The Effect of Capability-Seeking Investments on Competition in the Information Technology Services Industry: Coevolution of Capabilities and Corporate Scope

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Joydeep Chatterjee
DEDICATION

I dedicate this dissertation
To my family with gratitude and affection
To my parents whose unconditional love and encouragement
To my sister whose continuous support and enthusiasm
Made it possible for me to stay calm and complete this dissertation
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In conducting this research and throughout my doctoral student life at Wharton I have benefitted tremendously from the enthusiastic support, encouragement, and advice of several people. I shall remain ever grateful for their endorsement throughout this journey of realizing my goal of obtaining a PhD.

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ABSTRACT

THE EFFECT OF CAPABILITY-SEEKING INVESTMENTS ON COMPETITION IN
THE INFORMATION TECHNOLOGY SERVICES INDUSTRY: COEVOLUTION OF
CAPABILITIES AND CORPORATE SCOPE

Joydeep Chatterjee

Harbir Singh

This dissertation examines the evolution of firm capabilities and the resulting effect on competitive
dynamics within an industry. Specifically it examines how the development of new capabilities by
firms can result in expansion of firms’ corporate scope through vertical integration and ultimately
influence their competitiveness. In Chapter 2 an in-depth case study is presented to understand the
strategic intent, strategy formulation, and the actual process of dynamic capability development in a
leading multinational IT services corporation faced with stiff competition from foreign
multinationals in its home nation. In the next chapter using a unique sample of leading publicly listed
IT services firms from US and India, an event study is conducted to analyze the impact of various
capability-seeking investments made by these firms on their own as well as rivals’ stock market
performance. A number of propositions related to the effect of competitive actions of firms and
their rivals on their stock market performance are developed and tested. Finally Chapter 4 analyzes
how firms acquire complementary capabilities by making various internal investments and then
examines the impact of these decisions on performance. Overall this dissertation provides a rich
theoretical description of the co-evolution of capabilities and corporate scope and its eventual impact
on firm competitiveness. It thus contributes to the literature on firm evolution by bringing together
insights from the capabilities-based view, as well as competitive and corporate strategy. In addition
using proprietary project-level data, it provides large sample empirical evidence of the impact of
various internal capability-seeking investments on firm performance. Finally the dissertation traces
the evolution of capabilities within a leading firm in the information technology services industry to
understand the process of dynamic capability development and its consequences. Therefore this thesis contributes to the literature on the antecedents and consequences of dynamic capability development and more broadly to the technology strategy and knowledge based view of the firm.
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CHAPTER 1: INTRODUCTION

Overview

How firms develop capabilities and evolve over time is a central question in strategy research. Building on the evolutionary perspective (Nelson and Winter, 1982; Klepper and Simons, 2000), strategy research has placed considerable emphasis on the ways in which firm strategy and capabilities change over time. One stream of literature has studied how firms develop and acquire new capabilities (Nonaka, 1994; Zollo and Winter, 2002; Zollo and Singh, 2004), respond to innovation and technological change (Anderson and Tushman, 1990; Henderson and Clark, 1990; Christensen and Bower, 1996; Tripsas, 1997; Tripsas and Gavetti, 2000), balance the dual necessities of exploration and exploitation (March 1991; Levinthal and March, 1993; Gibson and Birkinshaw, 2004), recombine existing knowledge and capabilities (Kogut and Zander, 1992; Fleming, 2001; Hitt, Harrison, and Ireland, 2001), in order to stay competitive. Actually a firm’s ability to adapt to these transformative environmental forces and thrive – termed as its dynamic capability (Teece, Pisano, and Shuen, 1997; Eisenhardt and Martin, 2000; Winter, 2003; Helfat et al, 2007) has received a lot of attention from strategy scholars and become an important stream of literature by itself. A second stream of literature has examined the antecedents and consequences of corporate scope, i.e. the portfolio of businesses a firm operates in. The theoretical justification for diversification was to benefit from economies of scope from intangible, indivisible, and non-tradable assets (Penrose, 1959; Teece, 1982; Montgomery and Wernerfelt, 1988). Later scholars investigated the factors such as market conditions (Balakrishnan and Wernerfelt, 1986), firms’ existing resource base (Anand and Singh, 1997; Levinthal and Wu, 2010), and acquisitions (Chatterjee, 1986; Iyer and Miller, 2008; Seth, 1990) that lead firms to enter (Chatterjee and Wernerfelt, 1991; Chang, 1996; Villalonga, 2004; Miller, 2004) and exit (Duhaime and Grant, 1984; Bergh, 1995; Schlingemann, Stulz and Walkling, 2002; Berry, 2009) businesses. A third stream of literature has focused on industry competitive dynamics dealing with the causes (Cool and Dierickx, 1993; Chen, 1996; Smith, Grimm, Young, and Wally,
1997; Yu and Cannella, 2007; Yu, Subramaniam, and Cannella, 2009; Markman, Gianiodis, and Buchholtz, 2009), retaliatory responses (Chen and MacMillan, 1992; Chen, Smith, and Grimm, 1992; Chen, Su, and Tsai, 2007), and consequences (Karnani and Wernerfelt, 1985; Porac, Thomas, and Baden-Fuller, 1989; Porac, Thomas, Wilson, Paton, and Kanfer, 1995) of industry rivalry between firms and different strategic groups (Caves and Porter, 1977).

The above three streams of literature examine how firms evolve over time and compete. This dissertation lies at the intersection of these three streams of research. Specifically, it studies the dynamic relationship between competition, capability development/acquisition, and corporate scope, i.e. it examines how competitive pressures lead firms to invest in development of superior capabilities, how firms develop dynamic capabilities, and the eventual impact of these capability development initiatives on firm performance and scope. In this attempt, the dissertation draws upon existing research on competition, evolution of capabilities, the evolution of scope, and more generally on the knowledge based view of the firm to develop a richer understanding of the co-evolution of industry competition, firm capabilities, and scope in the global information technology services industry.

A more comprehensive understanding of the dynamic relationship between competition, capability evolution, and firm scope is important for several reasons. First, while studying these separately yields important insights, appreciation of the relationship between competition, development of capabilities, and expansion of corporate scope is essential to gain a thorough understanding of firm evolution. Theoretically speaking, understanding the linkages between competition, capability development, and scope is critical for the study of dynamic capabilities, since firms can sustain competitive advantage by simultaneously developing superior capabilities and enhancing their corporate scope by creating, extending, and modifying their resources (Helfat et al, 2007). For practitioners, studying these issues jointly is vital to making capability-seeking investment decisions when faced with competitive pressures, since the decisions regarding development of new
capabilities and scope expansion are fundamentally intertwined. Second, a better understanding of the relationship between competition, capability development, and corporate scope would inform the extant literatures on competitive strategy, dynamic capabilities, as well as corporate scope. If competitive pressures cause firms to develop superior capabilities and expand scope, then understanding the linkages (and the factors that lead firms to make capability-seeking investments, and the process of capability development) is important to helping enhance a firm’s performance and competitive advantage. Similarly knowledge of the performance implications of various capability-seeking investments and eventual effect on scope is critical to making informed decisions on a firm’s future strategic direction.

Past strategy scholars have studied the co-evolution of capabilities and scope. Wernerfelt (1984) theorized how firms use resources developed in one market to enter a new market, which in turn creates new resources. More recently, Jacobides and Winter (2005) explain the dynamic evolution of capabilities and transaction costs through two contrasting case studies of the U.S. mortgage banking industry, which went from vertically integrated to disintegrated production, and the Swiss watch-manufacturing industry, which went from disintegration to vertical integration. Other scholars have suggested a co-adaptive relationship between capability development and corporate scope, where the creation of new capabilities lead to changes in scope, which in turn influences the development of new capabilities to sustain competitive advantage (Brown and Eisenhardt, 1998; Helfat and Raubitschek, 2000; Helfat and Eisenhardt, 2004).

However, there are a number of gaps in the literature regarding our understanding of the relationship between competition, capability, development, and changes in firm scope. Firstly, the extant research says little about the specific investment decisions underlying the development of new capabilities and does not explore the impact of competition on these capability-seeking investments. Second, there is very little examination of firm’s own investments combined with rival firms’ investments (see Chatterjee, 1986; and Oxley, Sampson, and Silverman, 2009 for notable exceptions),
which accounts for the competitive effects on capability development activities. There is also scant research on the effect of technological competition on a firm’s capability development initiatives, even though rival firm capabilities could alter the relative value of a firm’s technological capabilities (Henderson and Mitchell, 1997).

Third, on the empirical side, this dissertation uses large sample project-level empirical data to develop very fine grained measures of two different types of capabilities (technological, and customer oriented) and examines their linkages to performance. Such studies are very rare in the literature primarily due to the difficulty in obtaining proprietary firm specific project-level data. Ethiraj et al (2005) presents an interesting study showing the impact of project management capabilities on performance using large sample project-level data from the global IT services industry, however their study ignores the contribution of a firm’s human capital (its employees) towards the development of those capabilities and uses operational measures of capabilities instead. Using a similar industry context, this dissertation combines operational measures with very fine grained data on training, certification examinations, and employee work experience to demonstrate the impact of capabilities on performance. Huckman, Staats, and Upton (2009) also use large sample detailed project-level data from a single firm in the IT services industry to investigate the relevance of team familiarity on project operational performance – again this study does not examine the effect of knowledge capital of employees on financial performance of projects.

This dissertation attempts to bridge these gaps, thereby developing a more comprehensive understanding of the linkage between competition and the coevolution of capabilities and corporate scope. In addition, it is one of the first studies to provide empirical evidence (using large sample project-level data) of internal development of dynamic capabilities by a firm utilizing its existing human capital. In doing so, it contributes to the dynamic capabilities literature and more broadly to the knowledge based view of the firm.
Finally, the dissertation describes the process of dynamic capability development within a leading multinational IT services firm using an in-depth case study. While the strategy literature has several case studies of capability evolution processes in a variety of industries, e.g. American Bookselling (Raff, 2000), Mainframe Computers (Rosenbloom, 2000), Pharmaceutical (Henderson and Cockburn, 1994; Cockburn, Henderson and Stern, 2000), Hollywood Film Studios (Miller and Shamsie, 1996), Italian Packaging Machine industry (Lorenzoni and Lipparini, 1999), NCR’s entry into the computer industry (Iansiti and Khanna, 1995), Smith Corona’s failed attempt to develop new products after the gradual obsolescence of its electronic typewriters (Danneels, 2010), emergence of fibre optic technology at Corning (Cattani, 2006), there is hardly any in-depth case study on the evolution process of dynamic capabilities in the software services industry. Arora et al (2001) present an excellent history of the evolution of the Indian software industry without getting into the details of firm capability development processes. Athreye (2005) presents an exposition on dynamic capability development in the Indian software industry however this study emphasizes the role of a tight labour market, and entrepreneurial experimentation in evolving a business model suited to Indian conditions, without delving deep into firm specific factors, deliberate investments, and processes that enable the development of dynamic capabilities and strategy implementation, especially in response to competition from established foreign multinationals.

The IT services industry context is an important test-bed for dynamic capability studies for a number of reasons. Firstly this knowledge intensive software services industry has experienced phenomenal growth over the past decade even after two major recessions (2001 dot.com bust, and 2008 mortgage-lending crisis) and is currently valued at USD 589 Billion\(^1\). Secondly, there has been an interesting trend of capability convergence among the globally leading firms in this industry – wherein several leading firms have made various investments to develop/acquire different capabilities and offer a full range of services (spanning the entire software services industry value

\(^1\) IDC 2010 Worldwide IT Services Spending report
chain) to their customers\(^2\). This presents a very interesting natural setting to study the impact of competition on capability development activities of firms, and their eventual effect on corporate scope. Third, the IT services industry is vital to the growth and survival of most other industries, as it enables business processes for them by the efficient use IT systems – thus firms in this industry essentially function as value-shops (Stabell and Fjeldstad, 1998) unlocking value by helping clients achieve their business objectives. Therefore it is important to identify and study the capability evolution in this industry due to its significant impact on the broader global economy.

**Structure of the dissertation**

The dissertation attempts to address the theoretical and empirical gaps by presenting three chapters that each address some aspect of the dynamic relationship between competition, capability development, and corporate scope. The first chapter conducts an in-depth case study of the actual process of dynamic capability development inside a leading global IT services firm by the judicious use of managerial incentives, inspiring leadership, and enabling mechanisms to earn the support of various stakeholders and implement strategic renewal and change through the skill upgrade of its human capital. The second chapter examines one set of decisions related to corporate scope – the decision to acquire, or deliberately invest to develop capabilities when faced with foreign competition – and examines the consequences of these decisions on firms’ and rivals’ stock market performance. The third chapter builds off the first two chapters and presents an empirical examination (using large sample project-level data) of the internal capability seeking investments within a leading global IT services firm to understand the performance implications of dynamic capability development enabled by upgrading the skills of its human capital. Each of the three chapters is a separate piece of research but connected through a common theoretical lens as well as a common industry context. While the first chapter depicts the strategic renewal efforts of a leading IT services multinational by developing

\(^2\) The software services industry value chain and graphical description of capability convergence in the IT services industry is explained in more detail in Chapter 2.
dynamic capabilities internally in response to competitive pressures from more established foreign rivals, the second chapter examines the competitive dynamics between Indian and US firms in the IT services industry through an event study using stock market performance of firms. The third chapter complements the first two chapters by empirically examining the performance outcomes of firm specific investments made by a leading firm in the global IT services industry using detailed internal project-level data. Thus the dissertation studies the same phenomenon using there different methodologies – an in-depth case study based on archival data and interviews of employees at all levels within the firm, an event study using stock market reactions, and an empirical study using detailed large sample internal project-level data. In doing so, the dissertation develops a comprehensive understanding of the phenomenon of global competition in the IT services industry and firm capability development through investment in human capital. In the following paragraphs I present each chapter in some detail before considering the overall contributions of my dissertation.

Study 1 – *Case Study depicting the Change Management Practices and Mechanism of Capability Development at Infosys Technologies – a leading global IT services firm*

I begin by examining the actual process of capability development inside a firm through an in-depth case study. The motivation for this study is the recognition that capabilities are context dependent and therefore a true appreciation of the origins and process of capability development is possible only by close inspection of the managerial decisions, internal investments, and operations of a firm.

The case describes the human capital development initiatives undertaken at Infosys Technologies. Being a high technology firm, human capital is at the core of its capability and therefore its strategic flexibility and competitiveness are heavily dependent on the outcome of the deliberate investments made by the firm in enhancing the quality and skill level of its employees.
Over the past decade this firm has graduated from delivering low-end software application maintenance (production support, migration, Y2K etc.) type of projects to successfully executing high end software development, and IT architecture design projects. Since 2004, the firm has set up its own consulting division to offer business consulting services to its customers. In order to meet the talent requirements for these types of services, senior management has embarked on a firm-wide initiative to upgrade the skills and knowledge base of its employees in various new technologies and customer business domains by preparing focused training programs, and administering mandatory certification exams.

Study 2 – Consequences of Complementary Capability-seeking Investments: US vs. Indian Firms

The second chapter analyzes the stock market impact of firms’ own and rivals’ capability seeking investment decisions. It is argued that when firms make investments to seek high-value added capabilities (those requiring high levels of tacit and socially complex knowledge), they will face greater challenges compared to firms making investments to access low-value added capabilities (those requiring more operational and cost efficiency). This is primarily due to the difficulty in building relationships with various stakeholders, and absorbing and incorporating the tacit socially complex knowledge into routines that enables a firm to offer high value added services. The stock market understands these challenges and differentially penalizes firms upon making these investment announcements. Firms already possessing high value added capabilities have advantage over firms that do not.

Results from an event study using investment announcements made by all US and Indian firms ($100M plus in revenue) in the global IT services industry provide support for these arguments. It is found that investment announcements by firms accessing high value added capabilities have significantly higher negative impact on all rivals that do not possess such capabilities compared to
other rivals that are endowed with such capabilities. Similarly investment announcements by firms accessing low value added capabilities are found to have significantly higher negative impact on rivals that already possess such low value added capabilities compared to rivals that are endowed with high value added capabilities. Overall the results suggest that firms face significant challenges while developing high value added capabilities that are subject to time compression diseconomies and require major investments of capital, effort, and managerial oversight. These results are consistent with a complementary and co-adaptive relationship between capabilities and scope and contribute to our understanding of firm evolution with internal and acquisition-led growth following similar investments by rivals. The findings also emphasize the importance of stock market performance as signals of firms’ competitive advantage. More generally the study traces the evolution of an industry through convergence of firm capabilities among the participants.

Study 3 – *Strategy, Customer Oriented Capability, & Performance*

The second chapter builds off the first two to examine the performance impact of a firm’s internal investments aimed at developing capabilities with the ultimate strategic intent of competing with established foreign rivals. At a theoretical level, it draws upon the knowledge based view of the firm to argue that firm capabilities are a combination of individual employees’ capabilities which are manifested in the form of performance at the operational levels where the real action takes place. It further draws upon evolutionary theory and the capabilities literature to assert that certain capabilities that are more operational in nature contribute towards technical fitness, while others that have more of a customer value addition flavor contribute towards evolutionary fitness of the firm. The customer oriented capabilities have the superior potential to impart ecological fitness because they enable the firm to gain in-depth knowledge of one of its primary stakeholders – the customer, which allows the firm to offer high value added services and adapt to the market as well as extract more business in future.
Using detailed project-level operational, financial, and human capital data from a leading multinational firm in the global IT services industry, this study finds that deliberate and focused investments in improving human capital helps in developing superior capabilities, which enables the firm to offer higher value added services to its customers, thus expanding its corporate portfolio. Specifically, it identifies two capabilities (technological and customer oriented) that are essential for success in this industry and examines their marginal returns to performance. Results suggest that customer oriented capabilities provide higher marginal returns to the firm compared to technological capabilities in this high technology services setting. The study thus suggests that the returns from capabilities that provide evolutionary fitness are higher than those of operational capabilities. By shifting the focus from whether capabilities matter to which capabilities matter more to firm performance, this paper expands our understanding of the performance implications of investing in different types of capabilities. It also adds to a more fine grained understanding of capability evolution within a firm and its impact on scope. From a methodological perspective, it introduces hitherto unexplored human capital variables to measure dynamic capabilities.

While many firms upgrade their capabilities by acquiring other firms, or hiring new talent, this firm exemplifies a novel method of enhancing capabilities through internal enterprise by improving the skills and competencies of its current employees through a diverse set of incentives and enablers. Besides this study fits very well with the previous two studies both in terms of theory and industry context – while the first study allows me to understand how those capabilities are actually developed from scratch using various resources available to the managers, the second study examines industry dynamics and convergence of capabilities in the industry using external stock-market based measures, and this third study assesses the performance implications of internal capability seeking investments at the operational level within a firm.
Integration

Overall this dissertation examines two key aspects of the firm – the strategic intent (both its own and rivals) and the investments made to achieve those strategic objectives and the consequent reaction of the stock market (on both own and rival’s stock) – and provides fresh perspective on the differential impact on rival stock prices based on their current capability portfolio. It also highlights the challenges faced by firms in acquiring high-end capabilities with the strategic objective to rise up the value chain and provide a wider array of services to customers. Secondly, this thesis closely examines the origins and mechanism of capability development within firms and the performance as well as strategic implications of different types of capabilities. It furthers our understanding of how firms evolve and adapt their product market scope to changing conditions, while also identifying the performance implications of various capability seeking investments. While firms’ product market competitive actions (pricing, new product launch, etc.), or platform based competition (investment in standards, technology standard wars etc. a la Gawer and Cusumano, 2002) are visible to customers and academics, investments in acquiring capabilities are less visible to outsiders and therefore it is essential to examine such mechanisms and illuminate this domain. This dissertation attempts to shed light on this invisible territory using the context of the global IT services industry.
CHAPTER 2: DYNAMIC CAPABILITY DEVELOPMENT THROUGH HUMAN CAPITAL UPGRADING AT INFOSYS TECHNOLOGIES

How firms adapt to external environment by upgrading their bundle of capabilities is a topic of central interest for strategy scholars. Such a phenomenon is often referred to as strategic renewal (Agarwal and Helfat, 2009; Floyd and Lane 2000; Huff et al, 1992) and has the potential to affect an organization’s long-term prospects significantly. While renewal initiatives are undertaken in response to decay of resources and capabilities, these efforts assume a strategic importance when environmental triggers engender such actions, because they define the repertoire of future choice and have a critical influence on their success or failure (Agarwal and Helfat, 2009). Renewal initiatives often reveal new insights and interconnections between different activities of a firm and lead to development of new products, services, and ways of conducting business as evidenced in the cases of Intel (Burgleman, 1994, 1996; Gawer and Cusumano, 2002), Liz Claiborne (Siggelkow, 2001, 2002), Corning (Cattani, 2006), IBM (Agarwal and Helfat, 2009), Smith Corona (Danneels, 2010), and several others. This chapter illustrates the strategic renewal initiatives undertaken by Infosys Technologies Limited as it endeavoured to develop superior business consulting capabilities by upgrading the technical and business skills of its employees through focused internal investments with the ultimate goal of offering high value added services to its customers. Very often renewal efforts are undertaken by firms in distress (especially weak financial performance) as evidenced by the above examples, however the present case illustrates the journey of a firm undertaking a major effort in developing new capabilities to offer superior value to its customers, even when their market performance (in terms of profitability, share price) was among the best in the industry. The risk of failure was high since the firm attempted to enter an unfamiliar line of business through internal development. The choice of entry mode into a new line of business was also unusual since prevailing wisdom suggests that a firm should buy or ally when entering new markets or businesses to minimize risk and avoid uncertainty.
Most of the leading Indian IT service firms were mainly technology focused and chose to develop superior business consulting capabilities by inorganic methods (M&A, Alliances, JVs) as they felt that such skills were beyond their reach to learn and develop internally. Infosys was more ambitious and risk-seeking and decided to develop those capabilities internally and this case illustrates their attempt and shows that they achieved a fair degree of success at least in the near term. Two factors stand out in this case – first this shows how a successful firm proactively attempted to enter new line of business by developing dynamic capabilities instead of waiting for a crisis to engender such an effort, and second it shows how a successful firm decided to develop those new capabilities internally instead of adopting inorganic means (alliances, JV, acquisitions), which is contrary to popular expectation. This also shows their long-term orientation since internal capability development typically takes longer to accomplish. While external modes of capability development (alliances, acquisitions, joint ventures) are widely published in news outlets, internal capability development methods are specially interesting as it is very difficult to obtain information about them without special access inside a firm.

Previous research has described capability development endeavours in a variety of settings e.g. American Bookselling (Raff, 2000), Mainframe Computers (Rosenbloom, 2000), Pharmaceutical (Cockburn, Henderson and Stern, 2000), Hollywood Film Studios (Miller and Shamsie, 1996), Italian Packaging Machine industry (Lorenzoni and Lipparini, 1999), NCR’s entry into the computer industry (Iansiti and Khanna, 1995), Smith Corona’s failed attempt to develop new products after the gradual obsolescence of its electronic typewriters (Danneels, 2010), there is hardly any in-depth case study on the evolution process of dynamic capabilities in the software services industry. Arora et al (2001) present an excellent history of the evolution of the Indian software industry without getting into the details of firm capability development processes. Athreye (2005) presents an exposition on dynamic capability development in the Indian software industry however this study emphasizes the role of a tight labour market, and entrepreneurial experimentation in evolving a business model suited to Indian conditions, without delving deep into firm specific factors, deliberate investments,
and processes that enable the development of dynamic capabilities and strategy implementation, especially in response to competition from established foreign multinationals. While the above studies describe capability evolution through internal development, a number of studies demonstrate the process of capability development through learning via external methods such as acquisitions (Zollo and Singh, 2004 - acquisitions in the US Banking industry), alliances (Kale, Dyer, and Singh, 2002; Kale and Singh, 2007 – alliances of US based firms). This case demonstrates the capability evolution process thorough internal learning mechanisms at Infosys Technologies – a global information technology services provider.

The IT services industry context is an important test-bed for dynamic capability studies for a number of reasons. Firstly this knowledge intensive software services industry has experienced phenomenal growth over the past decade even after two major recessions (2001 dot.com bust, and 2008 mortgage-lending crisis) and is currently valued at USD 589 Billion\(^3\). Secondly, there has been an interesting trend of capability convergence among the globally leading firms in this industry – wherein several leading firms have made various investments to develop/acquire different capabilities and offer a full range of services (spanning the entire software services industry value chain) to their customers\(^4\). This presents a very interesting natural setting to study the impact of competition on capability development activities of firms, and their eventual effect on corporate scope. Third, the IT services industry is vital to the growth and survival of most other industries, as it enables business processes for them by the efficient use IT systems – thus firms in this industry essentially function as value-shops (Stabell and Fjeldstad, 1998) by helping clients achieve their business objectives and unlocking value. Therefore it is important to identify and study the capability evolution in this industry due to its significant impact on the broader global economy.

While empirical studies (Chapters 2 and 3) have tested the impact of the larger industry-wide competitive forces that precipitated this change management effort, as well as the effectiveness of

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\(^3\) IDC 2010 Worldwide IT Services Spending report

\(^4\) The software services industry value chain and graphical description of capability convergence in the IT services industry is explained in more detail in Chapter 2.
this internal capability development initiative, the case study attempts to unravel the actual process by which Infosys went about developing dynamic capabilities by obtaining the necessary buy-in and support of various stakeholders (board of directors, senior management, customers, and employees). The aim of Infosys senior management was to enhance its bundle of capabilities, by investing in its employees’ skill upgrade through focused training, and internal certifications, and thereby offer high value added services to its global customers. The capability development initiative by investing in its human resources was engendered by a number of factors such as global competition from more established western multinationals (such as IBM Global Services, HP, Accenture), strong customer feedback complaining of inadequate software development capabilities, as well as the continuous need to enhance skills amidst rapid changes in software technologies, and software development methodologies.

This chapter contributes more broadly to the technology strategy literature beyond discussing the theoretical issues about strategic renewal through dynamic capability development. It illustrates how a leading firm in software technology development and implementation services sector upgraded its capabilities and migrated from offering lower value added software services to offering high value added services such as software architectural and business consulting – an entirely new line of business, through internal development. It also shows how a firm can refashion its HR systems and incentivize its employees to pursue self-learning and upgrade their individual skills for offering integrated business and software consulting services to its current customers as well as for meeting future business challenges. Strategic renewal initiatives consist of process, content, and outcomes (Agarwal and Helfat, 2009) and the following sections will elaborate on the research design followed by a discourse on each of these aspects in greater detail along with some background discussion on Infosys and the Indian IT services industry.

Research Methodology
The case presentation is based on a 3 month field study of a leading Indian IT services multinational firm headquartered in Bangalore. Background research involved interviews (face to face, and telephonic) with 72 senior executives from 25 leading IT services firms (Indian, US, and some European firms) between 2007-2009 as well as analyses of publicly available materials on Infosys and the 100 leading global IT services firms (based on annual revenue) to understand the industry evolution, competitive dynamics, strategic choices made by various players, strengths, and weaknesses of various firms. This formed the basis of information that was used to approach some of the largest players for access to their firm, detailed interviews of senior most leaders, access to employees at all levels within the firm, and detailed qualitative data related to the strategic initiatives within the firm. During April 2010, detailed face-to-face interviews were conducted inside the premises of the world headquarters of Infosys Technologies Limited in Bangalore over a period of five days, with several senior leaders, directors, board members as well as employees at all levels within the firm. The plan was to understand the process, content, and outcomes of the strategic renewal efforts of Infosys. These background interviews and field study formed the basis of the in-depth case study presented below.

Introduction

*A knowledge company can only prosper by investing in its employees.* – N.R. Narayana Murthy, founder of Infosys Technologies Limited

Founder Narayana Murthy’s statement sums up the guiding principle behind the development of human capital at Infosys Technologies Limited (Infosys), the Indian information technology (IT) firm that had grown on the strength of its capabilities for defining, designing, and delivering technology-enabled business transformation solutions for large corporations. In the first few years of its founding, Infosys invested 5 percent of its profits in training its workforce—in recent years this number increased to over 7 percent. Infosys also followed a statement of corporate values
known as C-LIFE—customer delight, leadership by example, integrity and transparency, fairness, and the pursuit of excellence. To pursue its strategy of developing superior capabilities in software engineering and competing more on quality instead of cost while also upholding these values, Infosys chose a goal of upgrading the competencies of its existing employees.

The certification initiative was the primary initiative for meeting this goal; it was initiated in 2005 in order to create a learning organization in which knowledge was increasingly relevant to meeting client needs. In 2010, with over 50,000 employees taking semiannual certification exams, Infosys top leadership remained convinced that their strategy of upgrading the capabilities of its workforce was vital to achieving its targets of higher growth and profitability. Perhaps, more importantly, Infosys was counting on this strategy to win more business transformational deals and provide higher value-added services to its customers. However, employees from lower levels of the organization questioned whether the certification exams were accomplishing their purpose effectively or simply imposing an additional burden on them. Regardless, some of these employees left Infosys despite the high level of investment in their skills. As the founding leaders of Infosys began to step aside and make way for younger successors, those involved in designing and implementing the certification initiative felt it was a good time to take stock of the company’s goals, achievements, and future challenges.

History of Infosys

The 1990’s saw explosive growth in demand for customized, outsourced software services worldwide. Several Indian firms seized this opportunity and expanded very quickly, exploiting the now famous global software delivery model (GDM) which utilizes inexpensive Indian software talent to provide services to western clients.

Infosys was a company that utilized this model. Founded by a group of seven entrepreneurs in 1981, it had become the darling of investors worldwide (see Exhibits 1, 2, and 3). Throughout the
1990s, Infosys serviced mostly software maintenance contracts—long-term agreements that required it to keep the legacy applications of various customers in different industries in working condition and provide periodic, minor enhancements. Toward the end of 1990’s, Infosys benefited from the huge demand for outsourced assistance with Y2K projects in order to fix the millennium date problem.\(^5\)

\(^5\) The year 2000 problem was a problem for both digital (computer-related) and non-digital documentation and data storage situations which resulted from the practice of abbreviating a four-digit year to two digits. In computer programs, the practice of representing the year with two digits became problematic with logical error(s) arising upon rollover from x99 to x00. This caused some date-related processing to operate incorrectly for dates and times on and after January 1, 2000. Companies and organizations worldwide checked, fixed, and upgraded their computer systems. “Year 2000 problem,” Wikipedia, http://en.wikipedia.org/wiki/Year_2000_problem (accessed December 2, 2010).
Figure 1: Infosys Technologies Limited - Revenue (US$ Millions), 2000-2010

Source: Infosys Technologies Limited Annual Reports.

Figure 2: Infosys Technologies Limited - Net Income (US$ Millions), 2000-2010

Source: Infosys Technologies Limited Annual Reports.
Figure 3: Infosys Technologies Limited - Growth, 1999-2009

Source: Infosys Technologies Limited.
By early 2000, the success of Infosys with Y2K projects generated large profits, and the company built a strong reputation among customers worldwide. However, with the end of the Y2K era, Infosys needed to identify new lines of business and seek new assignments from customers, such as the development of software solutions, e-business systems, enterprise resource planning (ERP) systems, and business process reengineering. However, some client executives doubted whether Infosys had the capability to provide high value-added services to them.

For Infosys leadership, it was time to make a decision—the company had come to a crossroad in its journey. The company could have continued to provide the same services it had been offering over the past two decades and remain content in being a regional leader servicing global customers from India by exploiting the GDM. Alternatively, it could have competed head on with global IT service providers that were several times larger and offered a wider range of services from software development to IT/business architecture design and consulting. If executed successfully, the company could bring in new customers and elevate its status to that of a truly global leader in IT services delivery. But, in order to compete with global giants such as International Business Machines Corporation (IBM), Accenture Plc (Accenture), Hewlett-Packard Company (HP), Dell Incorporated (Dell) (which acquired Perot Systems Corporation in 2009 and ventured into software services), Computer Sciences Corporation (CSC), and Cap Gemini SA (Cap Gemini), Infosys leadership realized that the company needed to invest in the capabilities of its employees.

**IT Industry in India**

The Indian IT software and services industry was estimated to account for US$63.7 billion in revenues in 2010. During this period, direct employment was expected to reach 2.3 million. As a proportion of gross domestic product (GDP), the IT sector revenues had grown from 1.2 percent in 1998 to an estimated 6.1 percent in 2010. The growth of the Indian software services industry had

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been a phenomenal success when measured against standard indicators such as growth in sales, employment, and exports. This growth was driven by a small number of pioneering firms, such as Infosys, Tata Consultancy Services Limited (TCS), Wipro Limited (Wipro), Satyam Computer Services Limited (Satyam), HCL Technologies Limited, and Patni Computer Systems Limited, which were able to transform the programming skills of their employees into firm-specific capabilities and pose a significant competitive threat to globally established rivals in the outsourced software services market.

This offshoring business model pioneered by these Indian firms expanded through software application development to virtually any data management service (e.g., financial and legal services, medical transcription, and academic tutorials) that could be accomplished remotely over high-speed telecommunication networks. Major corporations in the U.S. and Europe started outsourcing their back-office operations (e.g., employee payroll, data entry, and voice calling for back-end activities) to India, primarily to save costs. Collectively, these activities of offshoring specific business functions and processes are referred to as business process outsourcing (BPO).

Over time, more high-end services requiring in-depth business domain knowledge, advanced analytical skills, and sector-specific experience began to be outsourced to Indian companies. These services, collectively known as knowledge process outsourcing (KPO), require distinctly different capabilities. While BPO requires large-scale, rule-based operations that are essentially process driven, KPO is more complex and judgment-based and requires qualified and experienced professionals [e.g., engineers, MBAs, PhDs, lawyers, and certified public accountants (CPAs)] to accomplish tasks. While BPO is driven by size, volume, and efficiency concerns for clients interested in reducing cost per transaction, KPO is focused on creating value for clients by developing new knowledge by synthesizing enormous amounts of data. This synthesizing and integrative work requires industry-specific knowledge as well as an overall understanding of how business works.

In order to offer high value-added services to its customers, several top Indian IT services firms sought to augment their domain- and function-specific offerings. While some firms, such as Wipro, Cognizant Technology Solutions, and Satyam, went the acquisitions route by acquiring boutique business consulting firms, Infosys and TCS chose the path of organic growth by setting up business consulting divisions within their firms. These firms also started hiring MBA graduates from business schools in the U.S. and Europe to enhance their staff with business expertise. Infosys set up a wholly-owned subsidiary, Infosys Consulting Inc. (Infosys Consulting), in the U.S. in April 2004 and hired a few partners from reputed consulting firms, such as Deloitte Consulting LLP, Ernst & Young Global Limited, and IBM Global Services. The idea was to engage the client with a front-end business consulting service and then do the downstream implementation work, including KPO and BPO, offshore in order to be a complete service provider of software solutions (see Exhibit 4).
Note: Arrows indicate flow of work from one phase to the next. The typical IT services value chain begins with IT strategy/business process consulting and continues through process modeling, customized software application development, implementation, and post-delivery maintenance, including BPO. ERP, KPO, SI, IVS, and infrastructure tasks are separate add-on services offered by vendors.

8 Source: This flowchart was developed by the author after consulting with 72 senior executives from 25 firms (mainly U.S., Indian, and some European IT services firms). The goal of the interviews was to understand the type of services offered by the firms and the logical flow of work starting from understanding a client’s business problem to developing a solution and then implementing the solution using IT systems (various combinations of hardware and software) and after sales maintenance and support.
The challenge uppermost in the minds of senior management was to create differentiation from industry rivals through human capital investment and competency development and then to sustain that differentiation.

The competitive context: Precipitating circumstances that led Infosys to undertake corporate learning and capability development initiatives

Beginning 2000 several western IT services multinationals recognized the power of offshoring and decided to adopt the low-cost global service delivery model pioneered and perfected by the Indian IT services firms over the 1990s. Slowly they began investing in India and set up offshore service delivery centers in several locations to harness the highly-skilled talent pool of software engineers graduating from Indian engineering institutes. There were several reasons that made India an attractive destination for offshoring software services, such as availability of a large highly skilled English-speaking and cheap workforce, opportunity to exploit time-zone efficiencies⁹, favourable host government regulations and tariff regimes (Askari and Chatterjee, 2003) and over time these factors led most leading western IT vendors to build a significant presence in India. Some of these foreign investments are described in the following table.

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⁹ Time-zone efficiencies arise due to distributed project teams across several time zones. Enabled by modern information technologies and seamless electronic connectivity, teams can essentially work round the clock and speed up project delivery times resulting in significant increases in productivity.
Table 1: Inward Foreign Investments by Western IT services multinationals in India

<table>
<thead>
<tr>
<th>Firm</th>
<th>Initiative/Investment to access offshore software development and delivery expertise with the intent to offer end-to-end services to global customers</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unisys Corporation</td>
<td>Announced plans to invest $180 million over 5 years to set up software development center in Bangalore, India</td>
<td>2004</td>
</tr>
<tr>
<td>Keane Inc.</td>
<td>Acquired SignalTree solutions for $62 million to develop offshore software delivery capability in India</td>
<td>2002</td>
</tr>
<tr>
<td>Affiliated Computer Services</td>
<td>Opened its first shared software services center in Bangalore, India</td>
<td>2002</td>
</tr>
<tr>
<td>IBM Global Services</td>
<td>Invested $100 million to be spent over 3 years in software development laboratory in Bangalore, India</td>
<td>2001</td>
</tr>
<tr>
<td>Accenture</td>
<td>Launched offshore software development unit in Mumbai, India</td>
<td>2001</td>
</tr>
<tr>
<td>Cap Gemini</td>
<td>Launched software application management center in Mumbai, India</td>
<td>2001</td>
</tr>
<tr>
<td>Computer Sciences Corporation</td>
<td>Acquired Policy Management Systems India Pvt. Ltd. (PMSI) – a leading software vendor serving the insurance industry</td>
<td>2001</td>
</tr>
<tr>
<td>Deloitte Consulting</td>
<td>Announced joint venture (JV) with Mastek Limited to offer India-based software services and solutions to global customers</td>
<td>2001</td>
</tr>
<tr>
<td>EDS Corporation</td>
<td>Opened new software development facility at Tidel Park, Chennai, India</td>
<td>2001</td>
</tr>
<tr>
<td>Sapient Corporation</td>
<td>Announced global expansion with launch of new software development center in India</td>
<td>2000</td>
</tr>
</tbody>
</table>
As more and more western IT firms entered India, these inward investments were perceived as a threat by the leading Indian IT services vendors as they competed for similar IT services assignments from a similar set of global customers. Therefore they decided to enhance their capabilities to offer higher value added services to their customers and gain more control over their market. There was however wide variance in the actual mode of capability development. While Infosys was developing high value added capabilities, through internal certifications, other Indian IT services firms were also making various investments to acquire client-business domain expertise and rise up the industry value-chain. Wipro, HCL, Cognizant, and TCS also started their own in-house training programs to upgrade the skills of its employees. Some of them required employees to take certifications on a case-by-case basis as needed by their job-requirements. However their initiatives were not as comprehensive or regimented as that of Infosys. As a separate initiative Infosys also launched Infosys Consulting in Texas, USA, a wholly owned subsidiary of Infosys in 2004 to offer business consulting services to its clients (see Exhibit showing press release for this event). Most firms decided to buy small boutique business consulting firms to access the client-business domain knowledge and offer business consulting services to their clients. Some of the initiatives taken by rival firms are mentioned in the following table. The next section describes the process of internal capability development through investment in skill building of software engineers and managers by Infosys.
Table 2: Capability Development Initiatives by other Indian IT Services Firms

<table>
<thead>
<tr>
<th>Firm</th>
<th>Initiative/Investment to access business domain expertise with the intent to offer end-to-end services to customers</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognizant Technology Solutions</td>
<td>Acquired Market RX to enhance their capabilities in the Pharma/Life Sciences industry vertical</td>
<td>2007</td>
</tr>
<tr>
<td>HCL Technologies</td>
<td>Launched Enterprise transformation services to offer business transformation services to clients</td>
<td>2006</td>
</tr>
<tr>
<td>Satyam Computer Services</td>
<td>Acquired Citisoft to enhance their capabilities in the Financial services industry vertical</td>
<td>2005</td>
</tr>
<tr>
<td>Patni Computer Systems</td>
<td>Acquired USA based reference Inc. to enhance its capability in the Financial Services industry</td>
<td>2003</td>
</tr>
<tr>
<td>Polaris Software Labs</td>
<td>Acquired Orbitech Solutions to enhance its capability in the Financial Services industry</td>
<td>2002</td>
</tr>
<tr>
<td>Tata Consultancy Services</td>
<td>Launched Business Strategy Consulting practice to provide business consulting services to its clients</td>
<td>2000</td>
</tr>
</tbody>
</table>

Cognizant Technology Solutions is actually headquartered in Teaneck, New Jersey, USA, however over 90% of its offices and workforce is based in India and its capabilities are similar to other leading Indian IT services firms. Cognizant invested in acquiring business domain expertise through acquisitions. It is therefore considered a domestic rival of Infosys in contrast to foreign rivals such as Accenture, IBM Global Services, HP and others.
Human Capital Investment and Human Resource Systems at Infosys

Infosys provided customized software solutions to various clients in different industries (e.g., banking, insurance, telecommunications, retail, transport, manufacturing, and pharmaceutical). Providing high-quality solutions required employees with mastery of generic software technology platforms (e.g., Java, DotNet, and Mainframe) as well as a deep knowledge of the client’s industry and business imperatives. In addition, employees also needed to have expertise in different software development methodologies [e.g., capability maturity model (CMM)] for efficient operations. It was also essential that employees possess the required behavioral skills to work productively in teams involving employees from different countries and organizational cultures and be able to interact effectively with the client.

Infosys decided to build a world-class infrastructure and invest in its employees to set an example in the industry. As the software industry grew, Infosys expanded its employee strength manyfold (see Exhibit 3). During the 1980s and early 1990s, Infosys recruited the best software talent from the Indian Institutes of Technologies (IIT), the top tier technical institute with five locations in India, but now, to keep up with industry growth, they started recruiting both computer science and non-computer science graduates from other engineering colleges in order to meet the business requirement for talent. This necessitated the creation of the Education and Research (E&R) division to train its huge employee base of over 50,000 on the latest software technologies and raise their competencies to world class levels.

Until the early 2000s, Infosys operated on a grade-based structure in which every employee’s responsibility was assigned according to his experience; training was offered through a training calendar as well as when a project required new skills. So, there was not a standardized training program for all employees as well as no way to measure whether employees were learning new competencies through the training they received. Some Infosys leaders felt that many senior project managers were too occupied in managing customer relationships and had thus lost touch with the latest technologies. By being less involved in the technological aspects of a software development
project, these project managers had, therefore, lost their technical edge which was considered vital for maintaining industry leadership.

Before 2002, promotions at the firm were based on experience in a given job grade, and employees came to expect a promotion after a certain number of years of service. Thereafter, senior managers decided to emphasize competency over experience, and promotions gradually shifted from being experience- and grade-based to expertise- and role-based. The job description for each position within the firm was documented, and employees were evaluated by their supervisors based on expertise in their particular role. When promotions became role- and expertise-based, there was a need for enhancing the competencies of employees to meet the ongoing requirements and demands of different roles. This led to the advent of role-based training programs. Sometimes, individualized training programs were introduced for employees assigned to special tasks (e.g. customer-facing roles). However, one drawback of this training program was that there was no evaluation of the program or of the employees attending these training sessions. Employees often attended these training sessions with an attitude similar to that of students auditing a class—they were not necessarily internalizing what was taught as there was no test or exam at the end of the session to evaluate their absorption of the delivered knowledge.

Meanwhile, several western multinationals, notably IBM, Accenture, HP, CSC, Dell, and Cap Gemini, had set up large software development facilities in India and started servicing their customers similar to the way in which the Indian firms had been doing over the past decade. In other words, they had imitated the GDM that was pioneered by Infosys and other Indian firms and were competing for the same talent pool of skilled software engineers from the Indian engineering colleges. Faced with such a competitive threat in its home country, Infosys decided to upgrade its capabilities, especially in the delivery of high-end services tailored to its clients’ business requirements, with a desire to bridge the capability gap between itself and the established foreign multinationals.
History of the Certification Initiative

By the mid-2000s, Infosys was completing a period of exponential growth—net income and profit after tax grew by over 30 percent in 2006. It also faced new challenges of keeping employees motivated with proper incentives and providing regular training to ensure that their technical skills were up to date with the market requirements. Meanwhile, client surveys conducted by Infosys revealed several gaps in its capabilities that needed to be filled in order to keep customers satisfied and stay ahead of industry peers. One revelation from the surveys was that customers viewed Infosys software engineers as lacking adequate knowledge of their businesses as well as deep knowledge of the technologies used to develop their software. The immediate need was to deepen employee competencies in both technologies and business domains.

After receiving this feedback, senior management started thinking of ways to address these shortcomings. At several brainstorming sessions many ideas were debated and discussed, such as hiring talented individuals from top institutes and buying smaller firms with high-end technical and business architecture capabilities. S. D. Shibulal, one of the founders and then director and group head of Worldwide Sales and Customer Delivery at Infosys, came up with the idea of training and evaluating employees regularly through internal certification examinations. The purpose was to enable employees to gain expertise in different technologies through focused training and experience and, finally, to evaluate them through certified examinations. In order to incentivize employees to put in more effort and learn the topics covered in the various training sessions, the firm’s senior management came up with the idea of mandatory certification exams in 2005 that linked certifications to promotions and the career growth of employees.

It was decided that, initially, this certification scheme would be rolled out to the most senior employees, and then, over time, it would gradually include employees at the lower levels. The idea behind this top-down approach was that, if senior executives at the firm bought into the new scheme

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and saw its value through their commitment and personal participation, then mid-level managers would more readily accept this and ensure effective implementation at the lower levels.

Despite this strategy for change, the mandatory certification initiative faced a lot of stiff resistance from the employees, first and foremost from senior management. Several senior managers felt that these exams were unnecessary at this stage of their careers since they had graduated into management roles and were no longer directly involved in writing software code. Many employees at the lower levels felt that, as long as they were performing well in their current role and keeping their customers satisfied, they did not need to prove their competence by taking certification exams. Other employees thought that the content of the certification exams was not appropriate for teaching them the practical programming skills necessary for writing high-quality software code, believing that the knowledge gained by taking these mandatory exams was mostly theoretical.

However, the senior leaders of Infosys stood steadfastly behind this initiative and pushed it forward. Initially, the certification exams were offered in different technological platforms (e.g., Java, DotNet, C++, and Mainframe) with certifications in newer technologies introduced gradually. Between 2006 and 2007, domain-specific certification exams were introduced to augment the industry domain knowledge of employees working with customers in different industry verticals (e.g., banking, healthcare, telecommunications, retail, and energy and utilities). Later, certification exams in different process areas, such as quality of software delivered, project planning and estimation, and auditing, were also introduced.

Infosys senior management decided to roll out these exams in 2005, starting from the senior most managers followed by their direct reports and then to other managers in a top-down fashion. By 2006, when the exams were administered to all employees, it was mandated that each employee would have to pass two exams per year in order to be considered for a promotion. Furthermore, exam performance was also linked to their annual appraisals. This hard link to performance was expected to create sufficient incentives for employees to take the exams seriously and do well. Sanjay Purohit, head of Strategy at Infosys, remarked:
“Training often became procedural and employees did not always internalize the knowledge gathered. However, with certifications, life changed overnight … as there were consequences.”

Human Resources (HR) along with E&R conducted several awareness and information sessions with all employees explaining the benefits of these certification exams as well as educating them about the resources and study materials available to them before taking the tests. These sessions explained that the certification exams were an opportunity for employees to learn new technologies and broaden their horizons as well as strengthen their skills. It was not only important to perform well in their current role, but they also needed to prepare for future demands by developing a broader set of technological skills.

Apart from ongoing training, Infosys also had an elaborate training infrastructure for coaching its new recruits from engineering colleges. This was an essential part of the initial induction program which enabled the fresh graduates to be staffed on live client projects after successful completion of their foundational training. At Mysore Infosys built a beautiful 270 acre campus that housed one of the world’s largest training centers capable of training 13,500 students every day. There were residential facilities for over 4,500 students in this campus. Each fresh graduate recruit at Infosys had to go through a mandatory 23 week induction training program at Mysore before being employed into actual project work for clients. Over this time, new recruits received intensive classroom training in various software engineering topics, as well as programming languages such as Mainframe, Java, DotNet, Unix etc. They had to sit for several exams during this period and received a final assessment score upon completion of training. Students had to secure a score of 4 or higher out of a maximum of 5 points in order to continue their careers within Infosys.

This foundation training program was an ideal learning ground for future Infosys employees and provided the raw material for staffing hundreds of IT service projects taken on by the company. In contrast the certification initiative was aimed at continuing education beyond the foundational training in order to avoid obsolescence due to the rapid change in software technologies. The
following section describes the content of the strategic renewal efforts of Infosys by depicting the composition and rules of engagement of the certification exam initiative.

**Organizing the Certification Initiative**

Infosys senior management formulated a set of rules and guiding principles for this initiative:

1. Competency development would be jointly-owned by the individual and the organization.
2. Competencies would be linked to roles.
3. Competency development would be linked to individual performance rating and career progression.
4. Competency development would follow a framework of four dimensions of competency with three levels of certification for each dimension.

The four dimensions along which employees needed to develop and deepen competencies were technology, business domain, software development process, and behavioral. In each dimension, certification courses and examinations would have been developed for three levels of competencies—proficiency, competency, and expert levels (see Exhibits 5, 6, 7, 8, and 9).
Figure 5: Competency Dimensions

Source: Infosys Technologies Limited.

Figure 6: Competency Levels

Source: Infosys Technologies Limited.
Figure 7: Competency & Certification Levels in Technology

Source: Infosys Technologies Limited.
Figure 8: Competency & Certification Levels in Business Domain

Source: Infosys Technologies Limited.

Figure 9: The Virtuous People Life Cycle at Infosys Technologies Limited

Source: Infosys Technologies Limited.
Competency development planning followed a defined process. The senior leaders of every business unit identified certification requirements for each role in different competencies (technology, business domain, and process) in their specific unit. This was essential as the requirements of one business unit differed from another. For example, while the Enterprise Solutions business unit focused on ERP technology and consulting skills, the Independent Validation Services unit focused on testing technologies. As a next step, the Competency Council was set up to perform due diligence on the unit certification plan before approving it. The Competency Council consisted of a few senior leaders in the organization who had in-depth knowledge of the capability requirements for Infosys and understood the business requirements. The entire process was monitored by the competency anchor of each unit who was the go-to person for all competency-related concerns for the specific unit.

Each employee was expected to take and pass at least two certification exams per year for their role. It was mandated that every employee take at least one technology exam per year and could choose, for the second, either a domain or process exam after approval from his manager. Employees were encouraged to take the basic certification exam for the succeeding role only after completing all the required certifications for their current role. The objective was to ensure that competencies on multiple dimensions applicable for a role were acquired during the time an employee spent in that role. Through these certifications, the three dimensions of competencies—technology, business domain, and software development process—were addressed.

The fourth dimension of behavioral competencies was addressed through training workshops that enabled employees to work efficiently in diverse teams and manage the various pressures and expectations that arose during their project work for multinational customers. However, there were no exams for behavioral competencies and only technical, business domain, and process exams counted toward meeting certification requirements.
For each exam, special training materials, e-learning modules, and programs were available at the library and training centers as well as in online knowledge repositories. A certification exam was mandatory for all employees who were working in client projects at all locations worldwide. Onsite training was also made available for employees posted at client locations overseas. The exams were administered online through an external vendor. Each exam was typically composed of 50 multiple choice questions to be completed within 1 hour.

Managing the Certification Initiative

At the beginning of each year, employees consulted with their manager to develop a certification plan; the plans were based on the certification guidelines and roadmaps provided by the E&R division. Through this plan, the employee chose, and made a commitment to take, the two mandatory certifications for the year. The message from E&R was that capabilities were at the center of strategic change at Infosys, and therefore, it was imperative for employees to continuously upgrade their skills in different dimensions of their work. Due to the rapid rate of change in technologies, new versions of software become available every year; so, it was essential for employees to master new technologies quickly so that they could write high-quality software for customers.

According to Purohit:

“[Certification exams were] simply a mechanism to enable employees to develop a habit of continuously gaining new knowledge on technologies and business domains and validating that learning as part of their ongoing work at Infosys.”

The certification exams were designed such that an employee needed no more than 10 days to prepare for them. Time for exam preparation was not allocated, but employees were paid for the time they took to take the exam. These competencies were always related to an employee’s current role in the organization, and in order to advance to higher positions, employees had to take bridge
certification exams to cover the gap in competencies between the different roles. According to Chandrashekar Kakal, global head of the Enterprise Solutions division at Infosys,

“With business domain certification, employees could develop a deeper strategic understanding of their client’s business, and this will enable Infosys to get into a new space … of business consulting. Some employees could actually move to Infosys Consulting at a later point and add value.”

The certification cycle was aligned to the annual, year-end appraisal cycle; therefore, in order to be considered for a promotion, employees were expected to complete their certifications before the end of the year. Employees were given three tries to pass each exam. Passing each exam was required to fulfill their obligation; exam score was not used to differentiate between employees. For experienced employees who had joined the firm laterally, bridge certifications were made available to them to accelerate their competency development and enable them to stay on par with their peers within the organization.

The certification initiative gradually gained momentum as employees who did not take exams were not considered for promotions during year-end appraisals. Therefore, by 2007, through a combination of incentives, enablers such as training programs and study materials, and the top-down approach to implementation, Infosys was able to institutionalize this company-wide certification initiative to cover all of its 50,000 plus employees whose work involved various technology, domain, and process areas.

**Impact on Employees: Views of Exam Takers**

Infosys was able to implement the certifications firm-wide by creating a direct link to promotions and annual appraisals. However, this decision to create such strong incentives with significant consequences for failing to achieve certification had an effect on the morale of a large number of low-level employees. Some employees viewed the exams as a means of enhancing their knowledge. Others merely considered these exams as a means to fulfill the requirements for getting promoted instead of an opportunity to enhance their software development skills through continuous learning.
Each of the technology, process, and business domain exams led to different reactions among the employees. Employees found the technology exams very challenging, and they needed a lot of preparation during non-work hours in order to pass them. The business domain exams, on the other hand, were more popular, as most employees felt that the domain certifications improved their knowledge base of the relevant industry and enabled them to develop better quality solutions for clients. Passing these exams gave them a sense of achievement, and they felt more confident while talking to clients. Employees also considered the process exams useful in enhancing their productivity by helping them detect and resolve coding defects early in the software development cycle, thereby reducing rework.

Despite all of the learning benefits, certain employees resented the certification initiative because of the way it was imposed on them. They felt that exams were not appropriate mechanisms for judging an employee’s performance. One employee remarked: “Why do I need to establish my credibility by taking exams? When I am already doing good project work and keeping my client delighted …why is the company forcing me to take exams? I would instead prefer to do certifications when I want to.”

Some employees found that the content of the exams was not very closely linked to their daily job tasks. One employee said, “We use some of it, but most of the content is outside of my job responsibility; so, I am not very eager to learn those extra chapters for the certification exams.”

In response to these criticisms, E&R’s position was that the certifications were not simply meant to develop knowledge for their current job assignment but were expected to help prepare them for more demanding roles in the future.

**Operational Challenges**

Due to the global recession, customers were cutting their IT expenditures; this had an effect on Infosys’s revenues—employees felt additional pressure on the job. The exams were, therefore,
seen as something unpleasant that had to be completed in order to advance to higher roles with more responsibility. Furthermore, there were logistical issues that added to the frustrations of employees. Initially, when the exams were rolled out, every employee was expected to complete two certifications per year, and most of them kept avoiding them until the end of the year when there was a very high demand for scheduling exams. In a company with over 50,000 exam-taking employees, each responsible for taking two exams per year, this year-end rush led to major operational challenges with servers crashing, and many employees were not able to schedule and take the exams when they wanted to. In order to reduce this problem, E&R changed the rules and mandated that employees take one certification every six months. This resulted in two semiannual peaks and eased the operational challenges somewhat.

**Impact on Retention Rate of Employees**

There was a nagging fear among some senior executives that, by investing in employees, Infosys was augmenting its market value and hence, making it a more attractive target for poaching by industry rivals, such as Accenture and IBM. This could have potentially had serious consequences. Nandita Gurjar, head of HR at Infosys, took a different position. She explained:

“I tell employees who plan to quit after taking a few certifications: ‘These certifications offered by Infosys are like stock options that continuously enhance your skills and hence, your market value. The decision to cash out by quitting and joining another firm for higher pay is entirely up to you. But you should bear in mind that the competitor firms are unlikely to make the same investments in building your skills; so, once you leave Infosys, you may no longer have the same opportunity to build your future competencies and earning potential.’

Arguably, rival firms had to pay a premium in order to hire an Infosys employee with several certifications which would have adversely affected their cost structure and might have somewhat mitigated the risk of poaching. However, Kris Gopalakrishnan, CEO of Infosys, felt that if certain employees chose to quit after taking a series of certification exams, he considered it as a contribution to the IT industry that would also enhance the Infosys brand among peers and customers.
Performance Outcomes of the Certification Initiative

Once the certification initiative was fully implemented, Infosys evaluated the results in several ways. Using metrics, Infosys found that employees were indeed developing new skills in the four dimensions. Customer surveys found positive perceptions about Infosys employees being more productive and delivering higher quality software. Infosys also found that revenue rose due to high value-added assignments, and the number of business transformation deals also increased. At the level of an individual project, the certification exam scores of project team members had a positive correlation with project-level performance, especially for the business domain certifications.

Gopalakrishnan suggested that the certifications could provide a competitive advantage for Infosys going forward. Since there was no training at the industry level and thus, no mechanism to assure clients of the quality of software written by vendors, he expected that competency certifications would become the industry standard. In selecting a vendor, he believed that all clients would ask vendors to demonstrate that all of the programmers staffed to a software development or maintenance project were suitably certified. He also believed that when this happened, Infosys would have a big head start over competitor firms as they had already instituted this internally. He summarized this vision by stating:

“If standards become mandated at the level of the IT industry, every firm will be forced to achieve them, and our competitors will have to follow us … the strategic leverage we can get beyond project execution is by going back to the clients and suggesting … you must insist that you have the right people to staff your projects. If this becomes prevalent in the industry as a standard, then we are the first … because we have done it. That is how we can gain advantage…”

Assessment of the Certification Initiative

Infosys initiated the capability upgrade initiative with three stakeholders in mind – the firm (Infosys), the customers (clients), and the employees (the thousands of software engineers working in
the firm). It was important to keep the aspirations of these three stakeholders in mind while initiating any strategic program. At the time of initiation of the certifications, Infosys received client feedback that their employees were falling short in technical knowledge as well as industry domain skills – this was a serious problem that had to be addressed. Furthermore, as a firm, Infosys had aspirations of rising up the industry value chain and offering end-to-end services to its clients (from business consulting to BPO, see Exhibit 4). Finally it became clear that the training that was being offered to all employees, was not producing the intended learning effect it was expected to, since employees did not take training seriously. Often employees deferred training till the last week before the annual appraisal and then took whatever training that was being offered at the time they were available, so the training was not given to employees in a systematic manner. This reduced the efficacy of the training programs – therefore a thorough re-design of the training was necessary with adequate incentives to ensure that employees took training seriously.

The objective of this capability upgrade was to upgrade the skill levels of its software engineers in various areas (technologies, business domains, software development process, soft skills) such that they would be able to offer high quality services to clients and delight customers. This would bring in repeat business and higher profits, enhance the employees’ career progress and compensation, and ultimately satisfy all the stakeholders. Another reason for introducing the certifications and tying it to annual appraisals and promotions was to provide sufficient incentives to employees to get the necessary training and enhance their knowledge in different areas related to their actual work – this would over time build a culture of continuous learning that was necessary for a knowledge company such as Infosys.

Therefore Infosys decided to measure the effectiveness of the certification initiative by measuring the impact of this initiative on each of these three stakeholders. Firstly, the client satisfaction ratings showed a marked improvement over the years (see exhibit showing improvement in client satisfaction ratings). Several clients reacted positively to Infosys’s capability upgrade initiative and expressed their high satisfaction in the improved level of service they received from Infosys.
project team members. Customers recognized that Infosys was able to provide high quality service by virtue of their deep knowledge of various technologies, customer business domain, and software development process areas. Secondly the breadth of services offered by Infosys increased over time and they were able to offer more high value added services to their clients. The percentage of revenue generated from application development and maintenance was reduced over time, and newer services with higher component of business transformational tasks were being executed by Infosys.

Finally, from the employees’ perspective, there was some discontent regarding the composition of these exams and their relevance to their job, as well as the direct link to their yearly bonus. The reaction of employees at different levels within the firm could be summarized in the following manner –

Top management favoured this method of internal capability development as they were unsure of adopting external modes (Alliance, JV, Acquisition) due to the high incidence of failure among peer firms. The mid-level managers were dissatisfied because they perceived these mandatory exams as demeaning and were also worried about risks of failing the assessments since they were out of touch with the latest technologies. The junior employees had mixed reactions – while one set of employees viewed these as an opportunity to upgrade their skills and enhance their careers, others viewed this as a useless exercise that they had to undergo to abide by the rules because they were not actually hired to take exams. Senior leaders of Infosys had to devise a concrete plan to manage these tensions and reduce the discontent among the workforce.

In order to meet the aspirations of their employees Infosys top management decided focus on three aspects of the certification initiative, e.g. Relevance, Flexibility, and Brand. To address relevance, the E&R team focused on the exams and made several changes to ensure that the test questions were close to the actual work being done by project teams. Clearly, this would happen over a period of time since there were over 500 unique assessments and over 220,000 tests were taken in 2010 in 30 different countries where Infosys employees were based. To address the issue of flexibility, Infosys decided to remove this direct link with yearly bonus and just maintain the direct
link of certification exams to role change (promotions). That way, employees would receive their full yearly bonus irrespective of their performance in certification exams. Since promotions were still contingent upon clearing the mandatory certifications, employees essentially had more time to take the exams at their own pace before they came up for promotions every 3-5 years. These measures brought-in some flexibility and achieved sufficient acceptance among employees. To address the concern regarding the branding of internal certifications that Infosys offered, the company decided to recognize external exams as fulfilling the certification requirements. For those employees who wanted to take certifications from outside agencies, e.g. CISCO certified network professionals, LOMA, SUN-JAVA certification, etc. Infosys agreed to provide free training to employees, but asked the employees to pay for the outside certifications. Internal certifications continued to be offered for free and the external certifications were also counted as meeting the requirements for the mandatory annual certifications.

Challenges for the Future

The founders of Infosys had an idealistic and values-based desire to contribute to the industry by raising the quality of the available workforce through the certification initiative, but they also possessed a broad strategic vision for how Infosys would gain competitive advantage. They led by example by going through the certification process themselves and displayed a sophisticated sense for how to implement the initiative so that it would upgrade the human capital of their 50,000 plus workforce of software engineers in a relatively short period of time.

However, several challenges lay ahead as the worldwide competitive landscape evolved amidst a growing recession in western nations that were the primary source of clientele for Infosys. It was also essential to take stock of what Infosys had achieved so far with its certification initiative and what new competencies were needed for the future. Senior management needed to answer questions such as: Did the certification initiative achieve its stated objectives? To what extent was it successful? Were there any negative consequences? Was there a situation of diminishing returns from
certification courses and examinations? What alternative means of upgrading capabilities could Infosys consider? These questions can be addressed by conducting a longitudinal study with detailed empirical data collected at different points in the capability development life cycle spanning over a decade (2001-2010). Future research could also evaluate various creative ways to keep employees motivated amidst growing competition and the continuous need to upgrade individual skills and capabilities in order to stay competitive and relevant to the firm and customer. One aspect of this issue is the need for Infosys (senior leaders, E&R, and HR) to reduce attrition of skilled employees whose many competencies, certified by Infosys, made them highly attractive to competitors. Focusing on the factors that caused dissent among employees would enable Infosys to address this issue. For example, Infosys could make the certification exams more relevant to the actual work being done by project teams. The E&R division could try to improve the balance between breadth and depth of subject matter, as well as the timeliness of knowledge imparted by the training and study materials. These steps could reduce the dissatisfaction of its employees who felt that they were being force-fed with irrelevant knowledge.

In response to employee discontent revealed in the annual satisfaction surveys, Infosys senior management introduced specific changes in the certification initiative. Employees were unhappy about the composition of these exams, their relevance to their job, as well as the direct link to their yearly bonus. In order to meet the aspirations of their employees, Infosys top management decided to focus on three aspects of the certification initiative, e.g., Relevance, Flexibility, and Brand. To address relevance, the E&R team focused on the exams and made several changes to ensure that the test questions were close to the actual work being done by project teams. Clearly, this would happen over a period of time since there were over 500 unique assessments and over 220,000 tests were taken in 2010 in 30 different countries where Infosys employees were based. To address the issue of flexibility, Infosys decided to remove this direct link with yearly bonus and just maintain the direct link of certification exams to role change (promotions). That way, employees would receive their full yearly bonus irrespective of their performance in certification exams. Since promotions were still
contingent upon clearing the mandatory certifications, employees essentially had more time to take the exams at their own pace before they came up for promotions every 3-5 years. These measures brought-in some flexibility and achieved sufficient acceptance among employees. To address the concern regarding the branding of internal certifications that Infosys offered, the company decided to recognize external exams as fulfilling the certification requirements. For those employees who wanted to take certifications from outside agencies, e.g. CISCO certified network professionals, LOMA, SUN-JAVA certification, etc. Infosys agreed to provide free training to employees, but asked the employees to pay for the outside certifications. Internal certifications continued to be offered for free and the external certifications were also counted as meeting the requirements for the mandatory annual certifications.

Infosys also embarked on some new initiatives to improve the capabilities of its current employees and fresh college graduates. Among them the ‘Campus Connect’ program and enhancement of business acumen of employees were noteworthy.

Launched by Infosys in May 2004, the Campus Connect program was a unique academia-industry initiative to “architect the education experience”. Oftentimes managers at IT firms complained that fresh engineering recruits did not have the necessary skills to do the programming jobs, i.e. they were not ‘industry ready’. The Campus Connect program was designed specifically to address this knowledge gap among fresh engineering graduates. Their goal was to build a sustainable partnership with engineering education institutions in India and abroad for mutual benefit, producing “industry ready” recruits. Their plan was to train the faculty and students at various second and third tier engineering colleges in India to enhance their competence in various software technologies such that they could be employable when they graduated. Over three hundred engineering colleges were signed on into this program and the numbers of new colleges enrolling in this program increased steadily. Infosys top management believed that this program would help meet the growing IT needs of Infosys as well as other companies in the Indian sub-continent in the future years.
Enhancement of Business Acumen of employees was the new strategic learning direction taken on by the top management at Infosys Technologies. The idea was to change the mindset of the employees from being just a technology coding expert into an expert business solution provider. As Infosys Technologies attempted to scale up the industry value chain by providing more and more business transformational services to its clients, this strategic learning initiative was seen as a critical component of upgrading the capabilities of its workforce. In order to achieve this, Infosys formulated a plan to offer intensive classroom-based business training to its employees in its Mysore facility. They planned to bring in outside faculty from various leading business schools all over the world to offer specific business courses in different management disciplines such as finance, accounting, marketing, human resource management, strategic management, entrepreneurial management. This would also address the issue of attrition of employees to other firms, as employees would feel a sense of achievement by going through this capability upgrade initiative that Infosys offered for free. Some employees contemplating leaving Infosys for higher degrees such as MBA would probably decide to stay with Infosys after gaining the business knowledge from this intense 6 month program at Mysore.

Conclusion

The case study set out to depict the strategic renewal efforts undertaken by Infosys in response to competitive pressures from more established western multinationals that had successfully copied their powerful global service delivery model and thereby eroded some of their comparative advantage. It portrays dynamic capability development at Infosys Technologies and examines the actual process by which Infosys implemented their strategy of rising up the industry value-chain by developing superior business and technology consulting capabilities through skill enhancement of its employees. This major change management initiative involved the alignment of their business strategy with various internal support systems, notably its human resources system (recruitment, training, continuous evaluation, compensation, and career progression of software engineers). The
case discusses the challenges faced by senior management in institutionalizing the certification exams and the eventual short-term outcomes in terms of superior customer feedback, increased proportion of high-end services including business transformational assignments executed for clients, as well as enhanced project-level financial performance.

Overall this case study describes how Infosys developed dynamic capabilities by creating, extending, and modifying its resource base (Helfat et al, 2007) – its thousands of software engineer employees in response to environmental triggers such as stiff competition from established global rivals, and critical customer feedback. First, by offering induction training to its new recruits, Infosys created a skilled employee base that was competent enough to be staffed on client projects. Then by developing focused ongoing training programs, study materials, and certification examinations in various software technologies, and client business domains, Infosys was able to extend and modify the skills of its employees. Finally Infosys was able to create the right set of enablers and incentives and align its business strategy with human resources system to motivate its employees and elicit support of its stakeholders to implement this initiative. Together these processes enabled Infosys to meet the expectations of its customers and offer top quality software solutions to its clients. The dynamic nature of this capability development initiative is obvious from the continuous evolution of its training programs, study materials, as well as creation of newer certification assessments (in different software technologies and client business domains) every year. This was necessary due to the rapid changes in technological frontier as well as newer demands of its customers who wanted customized solutions to meet their idiosyncratic business objectives. The Education and Research division administered these certifications repeatedly to all employees every year to enhance their knowledge, which provides further evidence of the development of dynamic capabilities by Infosys.

The study suggests that business competence can be developed by codifying certain aspects of industry-specific business knowledge and disseminating the codified knowledge among thousands of employees engaged in customer projects. The case illustrates how a firm was able to transform specialized knowledge stored in the minds of a few internal experts within the firm into study
materials that were then taught to employees through training sessions to upgrade their skills. It further shows how the firm managed the process of evaluating the knowledge gained through training and self-study by administering mandatory certification exams to its large workforce spread all over the world. More broadly this case demonstrates how a successful firm responded to customer feedback by proactively embarking on such a major change management effort to develop superior capabilities, instead of waiting for a crisis to precipitate such a drastic measure. Since internal capability development takes much longer to achieve compared to external modes (alliances, JVs, M&As), the case suggests that firms that are proactive and start early, have the latitude and flexibility to experiment with internal development efforts to achieve business objectives. Besides external modes of capability development are also fraught with integration risks that often defeat the original purpose, so starting early has its advantages in terms of more flexibility as well as fewer integration problems.

How dynamic capabilities develop is an important area of research for strategy scholars and this case study contributes to that research by describing the process of dynamic capability development. Perhaps more importantly, this case study shows the critical role of senior management in this process (Chapter 4 in Helfat et al, 2007). Infosys senior management thought well in advance that they needed to upgrade their capabilities in order to compete with the best firms in the industry and allocated their time and substantial resources to achieve that objective. In order to obtain buy-in from junior employees they instituted the certification exam initiative in a top-down manner by first taking the exams themselves and leading by example. This type of strategically motivated behavior clearly shows how top management affects a firm’s ability to create, extend, and modify its resource base, paying special attention to environmental contexts to determine which type of capabilities are necessary to achieve evolutionary fitness (Chapter 1 in Helfat et al, 2007).

Finally a word about the sustainability of this strategy of developing superior capabilities through continuous learning mechanisms is important to assess the efficacy of such internal capability development methods. Since the strategy formulation by board members and senior
management, it took Infosys 3 years (2005-2007) to roll out the certifications to all of its employees. By 2010, Infosys had developed over 500 unique certification assessments and over 220,000 assessments were taken by its employees based in 30 different countries worldwide. These figures are quite astounding even for a company of over 120,000 employees with annual revenues of USD 6.04 Billion\textsuperscript{12}. This massive investment in continuous training and skill building of employees could potentially act as a credible signaling mechanism to its present and future customers and raise the status of Infosys within the industry leading to more business. This was a phenomenal corporate learning initiative that Infosys embarked upon and has the potential to impart competitive advantage over rivals. It is not impossible for competitors to replicate such a corporate learning mechanism however it will entail a massive investment of resources and time (at least 3-4 years) since such change management efforts require the support of multiple stake-holders who must be motivated and incentivized appropriately, aside from the mustering of massive resources (capital, technical expertise and managerial talent, know-how). This time advantage will enable Infosys to maintain its lead over industry peers by developing even newer and superior capabilities through focused learning processes. Following recent scholarly work on temporary advantage (D’Aveni, Dagnino, and Smith, 2010), this lead time advantage is bound to give Infosys sufficient opportunity to further enhance their competitive position vis-à-vis their domestic as well as foreign rivals.

Table 2 described some of the high value added capability development initiatives by other Indian firms. Majority of such initiatives are M&A because most Indian firms found it challenging to develop such business consulting capabilities in-house as it was very different from the technology consulting that they were familiar with. Business consulting required very different sets of skills and human resources than technology consulting, so they determined that such expertise was best developed inorganically through acquisitions. Theoretically this type of investment makes sense as firms generally move into new types of services (requiring novel skills and capabilities) through

\textsuperscript{12} This figure is based on March 2011 Infosys annual report. http://www.infosys.com/investors/investor-services/Pages/FAQs.aspx
external development modes. A few firms such as TCS, HCL Technologies, and Infosys launched in-house business consulting divisions and recruited talent from outside to staff them.

Barney (1986) suggested that firms should look inward to determine what their valuable resources are and then decide on exploiting a strategic opportunity which is ‘often a matter of serendipity and access of relevant idiosyncratic resources’ (Denrell, Fang, and Winter, 2003). Firms generally understand their situation better than outsiders and therefore Infosys was perhaps correct in choosing the organic route instead of acquiring business consulting capabilities through external means. They had access to a large pool of skilled employees whose capabilities could be enhanced through sustained training and evaluations. They decided to access business consulting expertise by hiring away talented and experienced individuals from other top consulting firms and creating a small core group of consultants that were assigned to set up Infosys Consulting in 2004. Over time they embarked on the internal certification initiative and created a wide body of training materials and assessments with the help of internal and external experts in different technologies, business domains, and software engineering process areas. Infosys considered this more efficient than buying a business consulting company at a premium and then trying to integrate it with the rest of the firm. Acquisitions often fail to deliver the expected value unless there are obvious synergies. Infosys was in the market for talented individual experts who could be trained to deliver value and not really in the market for buying business consulting firms that would entail paying a high price for the scarcity value of the resource.

Even so, this Infosys case exemplifies an alternative mode of high value added capability development than what is typically expected or observed. Infosys was foremost among them and went as far as creating an academic environment inside the firm by providing regular training sessions to its employees and evaluating them through mandatory annual certifications. The outcome of this organic capability development initiative as evidenced by improved customer feedback, increased proportion of higher value added offerings, and improved project-level performance clearly speaks volumes. Contrary to the predictions of extant theory and popular wisdom, Infosys decided to
develop high value added business consulting capabilities internally. This apparent anomaly with prevailing theory opens up a several avenues for further inquiry into the nature of these capabilities and outcomes of such capability-seeking investments. Firms seeking high value added business consulting capabilities could take much longer to achieve their objectives as such capabilities are based on tacit, socially complex, knowledge and involve trust-based relationship building with customers. Infosys and other Indian IT services vendors were trying to develop these high-end capabilities which were scarce and subject to time compression diseconomies (Dierickx and Cool, 1989) therefore they were facing a greater difficulty compared to their western counterparts who were setting up software development centers in India to access the many locational advantages of India (Askari and Chatterjee, 2003). The learning from the case study leads to the following questions: First, what are the origins of firm capabilities and how do firms with more generic capabilities build dynamic capabilities through internal development? Second, what is the impact of these capability-seeking investments on a firm’s internal financial performance, as well as its external stock market performance? Third what is the implication of these capability development initiatives on industry competitive dynamics?

It is therefore important to investigate some of the more general properties of this phenomenon involving investments by firms and counter-investments by rivals to acquire superior capabilities and sustain their competitive advantage. The following chapter attempts to address these questions by examining complementary investments made by firms to acquire different types of capabilities along the industry value chain. Chapter 4 addresses the questions of how individual knowledge aggregates to form organizational capabilities and the internal financial impact of a firm's capability development initiatives.
Chapter 3: COMPLEMENTARY CAPABILITY-SEEKING INVESTMENTS AND STOCK MARKET IMPACT

Competition between firms is a central phenomenon of interest to strategy scholars, and past scholars have documented the characteristics (e.g., VRIN resources, Barney, 1991; Peteraf, 1993) that enable firms to remain relatively immune to competitive forces over long durations.

Firms often try to diversify into multiple related businesses and enhance their market power in an attempt to sustain their advantage over industry rivals (Karnani and Wernerfelt, 1985). The literature on competition mostly deals with the causes (Cool and Dierickx, 1993), and consequences (Karnani and Wernerfelt, 1985; Porac, Thomas, and Baden-Fuller, 1989; Porac, Thomas, Wilson, Paton, and Kanfer, 1995) of industry rivalry between firms and different strategic groups (Caves and Porter, 1977). Retaliatory actions of firms facing competitive threat depend on their internal capabilities and the level of effort required for strategic implementation (Chen, Smith and Grimm, 1992). Strategic group membership determines how firms’ managers think about competitors, how they position themselves in the industry, and the frequency of their competitive moves (Smith, Grimm, Wally, and Young, 1997). However, there is little research on the impact of competition on firms’ strategic decisions, such as foreign direct investments (FDI), and their eventual impact on market performance and firm scope.

Balakrishnan and Wernerfelt (1986) suggest that economic uncertainty causes firms to vertically integrate but that technological uncertainty works in the opposite direction. Jacobides and Winter (2005) explain the dynamic evolution of capabilities and transaction costs through two contrasting case studies of the U.S. mortgage banking industry, which went from vertically integrated to disintegrated production, and the Swiss watch-manufacturing industry, which went from disintegration to vertical integration. This study uses event study methods to empirically explore the competitive moves of firms from different strategic groups within the global software services sector and examines their impact on the stock-market performance of the firms and their rivals.
THEORY & HYPOTHESES

Capability-seeking FDI and Cumulative Abnormal Returns (CAR)

Different research traditions have developed various theories about the causes and goals of FDI. Analyzing the nature and causes of foreign investment, Hymer (1960) concluded that direct investments are capital movements associated with international operations of firms, whose goal is to maintain control of production. Such control allows firms to either suppress competition or appropriate rents derived from advantages like skilled labor, cheap raw materials and access to capital markets or technology. Firms sometimes engage in capability-seeking FDI to avoid being left behind their rivals in the race for competitive advantage (Knickerbocker, 1973). The high levels of uncertainty inherent in establishing foreign operations tend to encourage isomorphic behavior in an effort to avoid letting close rivals go unchecked in foreign countries from which they may derive various capabilities, low-cost services, or cash from profits that fuel their competitive advantage in their home country or elsewhere (Karnani and Wernerfelt, 1985; van Witteloosuijn and van Wegberg, 1992).

The resource-based view (RBV) and capabilities view has some interesting findings on FDI. FDI has led to significant positive returns on the stock price of announcing firms when they engage in Joint Ventures (Park and Kim, 1997); core-related greenfield investments (Doukas and Lang, 2003); or cross-border acquisitions (Doukas and Travlos, 1988; Harris and Ravenscraft, 1991; Markides and Ittner, 1994). Firms announcing outsourcing of e-business projects realized significant positive abnormal returns, indicating that markets react favorably to outsourcing that reflects efficient project execution and potential future cost savings (Agrawal, Kishore, and Raghav Rao, 2006). These studies suggest that stock markets reflect the judgment of likely payoffs from the entrepreneurial decisions of firms. Therefore, FDI announcements of firms with intent to seek different capabilities related to their current service portfolio and enhance their competitive position
are also entrepreneurial decisions that have potential to reap future profits, and as such they should affect stock market returns positively. Therefore it is expected that –

*Hypothesis 1: Announcements of capability-seeking foreign direct investments by firms will generate significant positive abnormal returns on their own stock.*

**Impact of capability-seeking FDI on competitors**

Chen, Smith, and Grimm (1992) define competitive actions as “specific and detectable competitive moves initiated by a firm to improve or defend its relative competitive position.” In order to protect their competitive positions, firms must respond to rivals’ actions, which often involve decisions to acquire new resources and capabilities (Galbraith and Kazanjian, 1986). The impact of firms’ FDI announcements on non-announcing rival firms has also been studied by a few scholars (Shahrur, 2005; Slovin et al, 1991; Szewczyk, 1992), and they have documented systematic abnormal price performance in the shares of both announcing and non-announcing firms. These studies suggest that the strategic decisions of one firm in an industry can cause shifts in abnormal returns of its competitors. Therefore, when firms take strategic decisions such as capability seeking FDI to enhance their competitive position, such news is also likely to have a negative impact on the stock prices of their competitors (both domestic and international). From Porter’s (1975) structural analysis of industries, we know that rivalry increases when more firms enter the industry, as competition for the same set of production factors (resources) underlying the capabilities increases. Rivalry presents a challenge to firms: On the one hand, there are strong pressures to follow suit and imitate leading firms that have been successful in acquiring superior resources and capabilities (DiMaggio and Powell, 1983; Hannan and Freeman, 1977); on the other hand, pressures exist for maintaining relative uniqueness by differentiating themselves from peers to sustain competitive advantage (Porter, 1980). These studies suggest that even within a given industry firms are
heterogeneous with respect to the resources they possess and capabilities they develop over time – this happens due to various path-dependent evolutionary processes (Nelson and Winter, 1982).

The vertical scope of a firm is dynamically determined by the co-evolution of capabilities and by transaction costs as it attempts to reshape the transactional environment to increase profit and market share (Jacobides and Winter, 2005). Changes in vertical scope affect the capability development process, i.e., the manner in which firms invest and enhance their capabilities over time, which in turn reshapes the capability composition of the industry. Due to this heterogeneity of capabilities, the impact of competitive moves will affect firms differently, and firms’ ability to respond to competitive threats will be different depending on their own capabilities and the efforts needed to make counter moves (Chen, Smith and Grimm, 1992). Specifically, if a value chain of capabilities in an industry is considered, ranging from high-value-added to low-value-added (similar to Porter’s value chain analysis, 1985), these capabilities are expected to be heterogeneously distributed among firms within an industry. Some firms are strong in certain parts of the capability value chain, while others are strong in other areas. For example, in the pharmaceutical industry, biotech firms are known to possess superior drug discovery capabilities (i.e., they are very good at inventing new drug molecules for different diseases), while large pharmaceutical firms are adept in testing, manufacturing and marketing. Similarly, in the building trade, some firms have expertise in architecture and design, while others may only engage in actual construction. Now, the reasons for choosing a specific industry niche can vary widely; they can include differences in initial conditions, founder imprint, path dependence, and resource endowments or capabilities. Firms possessing any one capability may attempt to acquire complementary capabilities in order to enhance their competitive position and survival potential. As described earlier, these attempts will meet varying levels of challenges depending on the type of capability a firm is trying to acquire.
Software Architectural and Implementation Capabilities

Kusunoki, Nonaka, and Nagata (1998) suggested that organizational knowledge has a multilayered structure and that different layers of knowledge form the matrix for different types of capabilities. Henderson & Cockburn (1994) defined architectural competence as a firm’s ability to make use of its component competencies (locally embedded skills and tacit knowledge necessary for day-to-day problem solving) and effectively integrate them in novel and flexible ways to create fresh component competences. Ross (2003) defined architectural competency in enterprise IT architecture as a firm’s ability to create a mutually reinforcing pattern of evolving, tightly aligned business strategy and IT capabilities. The concept of architectural capabilities is not novel and has been studied by scholars in various contexts. Generally, architectural capabilities are the skills necessary to design or prepare the blueprint of any product or service, upon which the various components of that product or service will fit to accomplish the activity or task. Similarly, implementation capabilities are the operational skills necessary to accomplish a task by following the design principles that have earlier been codified.

With this conceptualization, these two capabilities can be visualized as being part of a value chain or continuum of knowledge-flow, where architectural capabilities are followed by implementation capabilities. For example, in the management consulting industry, firms such as McKinsey & Company, Bain & Company and Boston Consulting Group are involved mainly in strategy consulting, while others such as Accenture, Booz Allen Hamilton and Deloitte Consulting, offer both strategy formulation and implementation services. These capabilities are heterogeneously distributed among firms within an industry, and firms possessing any one of these capabilities may try to acquire complementary capabilities from adjacent parts of the value chain. As described earlier, these attempts will meet varying levels of challenges depending on the type of capability a firm is trying to acquire. The population ecology literature (Hannan and Freeman, 1989) suggests that firms within an industry subject to the same environmental conditions acquire similar organizational forms
and compete with other firms in the same industry group (niche). The idea of niche-based competition as well as mutualism has been further empirically supported by later scholars (Baum and Singh, 1994; Hannan, Carroll, Dundon, and Torres, 1995; Dobrev, Kim, and Hannan, 2001; Dobrev, Kim, and Carroll, 2002) in various industry settings.

Caves and Porter (1977) explained how industry groups command specific market positions and hence power. They discussed how mobility barriers prevent firms in specific groups from achieving positions in different niche groups within an industry. Since capabilities based on tacit and socially complex knowledge are difficult to acquire relative to codified capabilities, it may reasonably be expected that firms trying to acquire primarily tacit knowledge-based capabilities will face significantly higher challenges than firms attempting to acquire primarily codified knowledge-based capabilities. Capabilities embedded in the customer’s business domain and based on customer relationships and tacit knowledge are difficult to imitate or transfer and therefore impart advantage to the owning firm. Fujimoto (2007) explains how Japanese automotive firms enjoy architecture-based competitive advantage over their international rivals. Firms possessing architectural capabilities have an expertise based on tacit knowledge and relationships that is more difficult and time consuming to develop or imitate. In other words, firms possessing architectural capabilities are able to defy imitation by rivals as their capabilities are rarer and subject to time compression diseconomies (Dierickx and Cool, 1989).

The strategy literature asserts that valuable, rare, non-imitable, non-substitutable resources and capabilities are chiefly responsible for inter-firm performance variation (Barney, 1991; Dosi, Nelson and Winter, 2000; Rumelt, 1984; Wernerfelt, 1984). Scholars suggest several characteristics of resources and capabilities which prevent their imitability and thus impart competitive advantage to firms (Dierickx and Cool, 1989; Peteraf, 1993). Following the knowledge-based view of the firm (Kogut and Zander, 1993, 2003), a firm should vertically integrate if it possesses superior capabilities than what is available in the market, and if those capabilities are based on knowledge which is tacit
and therefore difficult to transfer across organizational boundaries (Polanyi, 1958; Nelson and Winter, 1982; Kogut and Zander, 1992; Nonaka and Takeuchi, 1995; Zack, 1999). Therefore, it may be argued that capabilities based on tacit and socially complex knowledge are difficult to learn, develop, or acquire. Similarly, capabilities based on codifiable knowledge should be relatively easy to learn, develop, acquire, or transfer across firm boundaries. Within an industry different types of capabilities may be heterogeneously distributed among firms, i.e., some firms may possess codifiable capabilities; others may possess tacit knowledge-based and socially complex capabilities; and still others may possess both. Zott (2003) asserted that path dependencies cause heterogeneity in firm capabilities within an industry.

This implies that within the same industry firms differ in their capabilities and may be ranked (from high to low) based on their expertise along a capability continuum. These capabilities may in turn require varying levels of expertise and experience and different combinations of resources and skills. Some firms may be able to bundle various resources and technologies to offer certain types of services, while others possessing complementary capabilities offer complementary services. McEvily and Zaheer (1999) show that firms embedded in a network of ties to other firms and regional institutions gain preferential access to new information, ideas, and opportunities, thereby positioning them favorably to acquire competitive capabilities. More recent research by McEvily and Marcus (2005) predicts that joint problem-solving exercises with suppliers play a prominent role in transferring tacit knowledge that underlies competitive capabilities and can facilitate their acquisition by the focal firm. The more socially complex the underlying knowledge of the acquired firm’s capabilities, the harder it is to effectively implement the acquisition (Ranft and Lord, 2002). These papers suggest that competitive capabilities are based on tacit knowledge which is difficult to learn, codify and transfer. Firms that possess such superior and high-value-added capabilities are likely to enjoy advantage over competitors that do not.
The stock market incorporates this belief into the valuation of the firms’ stock and differentially evaluates these firms. Firms efficient in architectural capabilities have an advantage over firms primarily possessing codifiable (and hence more imitable) capabilities. The owners of such valuable, imperfectly imitable, socially complex, and primarily tacit-knowledge based capabilities will therefore enjoy competitive advantage over rivals that lack them. Such high-value-added capabilities are more difficult and costlier to acquire, so firms seeking high-value-added capabilities are at a disadvantage compared to those seeking low-value-added capabilities, and the stock market is expected to reflect this factor in the form of lower returns to announcements. Therefore it is expected that –

**Hypothesis 2a:** Firms’ announcements of foreign investments to access capabilities in the lower-value-added segment of the industry value chain will have a greater negative impact on the stock of competitors established in the lower-value-added segment than on the stock of competitors established in the higher-value-added segment.

**Hypothesis 2b:** Firms’ announcements of foreign investments to access capabilities in the higher-value-added segment of the industry value chain will have a greater negative impact on the stock of competitors established in the lower-value-added segment than on the stock of competitors established in the higher-value-added segment.

Let’s say that when a firm announces foreign investments to access capabilities in the lower-value-added segment of the industry value chain, the announcement impact on competitor firms established in the lower-value-added segment is $V_{LC,LVS}$. Let the impact of such an announcement on competitor firms established in the higher-value-added segment be $V_{LC,HVS}$. Similarly, let’s say that when a firm announces foreign investments to access capabilities in the higher-value-added segment of the industry value chain, the announcement impact on competitor firms established in the lower-value-added segment is $V_{HC,LVS}$. Let the impact of such an announcement on competitor firms established in the higher-value-added segment be $V_{HC,HVS}$ (Please see Table 3). Therefore,

- **H2a** suggests that $V_{LC,LVS} < V_{LC,HVS} < 0$ &
- **H2b** suggests that $V_{HC,LVS} < V_{HC,HVS} < 0$
(Note that the impact values are all negative.) Both hypotheses suggest that firms lacking high-value-added capabilities are penalized to a greater extent (compared to firms that lack low-value added-capabilities) by the stock market, when their competitors make investments to access complementary capabilities. These propositions are consistent with RBV, in that firms possessing valuable and rarer resources and capabilities will have an advantage over those that do not. The following section describes the industry setting with the arguments justifying the use of this context for testing the propositions.
Table 3:

Typology of CARs of focal firms in response to announcement by different types of competitors.

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<th>Announcement Impact on Firms due to Competitive Actions by Rivals established in different parts of Industry Value Chain</th>
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<td>CARs of Firms established in Lower-Value Segment</td>
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METHODS

Empirical Context: Information Technology Consulting Services

Information technology consulting (IT consulting or business and technology services) is a field that focuses on advising businesses on how to make the best use of IT to meet their business objectives. According to IDC, worldwide IT spending in services was 589 billion USD in 2009, and BPO spending was 112 billion USD. In addition to providing advice, IT consultancies often implement, deploy, administer, operate and maintain IT systems for businesses. Over time the boundary between pure technology consulting and business/management consulting has blurred. Often there are overlaps between the two fields, but IT consultants generally have degrees in computer science, engineering, technology or management of information systems, whereas management consultants generally have degrees in accounting, economics, finance or a generalized MBA (master of business administration). The nature of technology outsourcing has evolved in the last two decades in response to rapidly changing technological, corporate and regulatory environments. Earlier firms either outsourced their entire technology requirements or did so on a project-by-project basis; however, this arrangement engendered operational risks and coordination costs and often failed to realize the full potential for savings and efficiency benefits. To address these issues, firms have been adopting a more systematic approach to outsourcing, demanding that vendors provide specialized technology services; cost effective, industry-domain-specific solutions; and even outcome-based pricing options. Consulting firms provide a wide range of IT services, and all firms do not possess superior capabilities across the entire gamut of services. The client engagement life cycle (please see flowchart Fig. 10 below) typically begins with a client engaging a vendor to prepare a request for proposal (RFP) addressing some part of a client’s market challenges in product and production development. These challenges may include global cooperation, product complexity, process quality and flexibility, time to market and/or production cost. This stage is followed by business process modeling and redesign, which leads to the actual implementation of the

13 Source: IDC-NASSCOM Strategic Review 2010
project based on the newly defined business strategy. Finally, the IT service providers provide post-implementation management of operations and production support. This flowchart in Figure 10 was developed by the author after consulting with 72 senior executives from 25 firms (mainly U.S., Indian, and some European IT services firms) during field visits to their offices located in Bangalore, Hyderabad, Calcutta, and New Delhi. The interviews were loosely structured around a questionnaire that was developed in consultation with industry experts and software professionals. The goal of the interviews was to understand the type of services offered by the firms and the logical flow of work starting from understanding a client’s business problem to developing a solution and then implementing the solution using IT systems (various combinations of hardware and software) and after sales maintenance and support. The field research was complemented with publicly available data on these firms from their annual reports and NASSCOM\textsuperscript{14} (1998-2008). Arora et al (2001) alluded to the concept of value chain while emphasizing the efforts of Indian firms attempting to move up the value chain by acquiring better software project management capability and domain expertise. The following figure depicts the value chain of software services in the IT industry by positioning various value added activities along a flow-chart forming a continuum of capabilities.

\textsuperscript{14} National Association of Software and Services Companies is a consortium that serves as an interface to the Indian IT and ITES industry. For more details see \url{http://www.nasscom.in/} and \url{http://en.wikipedia.org/wiki/NASSCOM}
The average billing rates and revenue productivity (measured in USD per person months) figures for these different services were obtained from multiple IT services vendors and the categorization was validated e.g. high value added services commanded significantly higher rates compared to low value added services. The average billing rate of Low value added tasks was 0.5-0.65 times the average billing rate for High value added tasks.
The IT strategy, business consulting and process modeling engagements can be considered architectural capabilities, as they form the higher end of the client-engagement life cycle; the software implementation and production support can be considered implementation capabilities, as they occupy the lower end. Architectural projects involve formulating business strategy and preparing the process milestones necessary for achieving a client’s chosen objectives, whereas implementation projects involve the actual execution of the business strategy using various information systems. It is therefore evident that architectural projects will be rooted in a client’s specific industry domain and market, while implementation projects will involve various combinations of technical hardware and software skills. Billing rates are higher in the IT strategy and business consulting assignments compared to the application development and maintenance assignments. However, architectural projects are usually of shorter duration (2-3 months) and generate much lower total revenue compared to software implementation projects (typically 6 months-1 year to large multi-year engagements). While architectural projects are more profitable but much shorter in duration, the implementation projects are less profitable but longer in duration which reduces the uncertainty in earnings and maintains the necessary balance in the portfolio of offerings. Therefore there are obvious advantages for a firm offering both types of services.

A close look at the types of projects and their billing rates reveals that functional and domain knowledge commands a premium, while pure technical knowledge is available for a lesser price. Architectural projects are also influenced by client relationship aspects. Since these projects involve formulating business-level strategy for a client requiring close interaction with top management and access to sensitive strategic information, most clients generally consult reputed firms whom they can trust with their proprietary data. Often, clients seek the services of their longstanding consulting partner firms when making major strategic moves. Therefore, apart from domain-specific knowledge, these strategy consulting assignments are determined by client-relationship based factors that evolve over time.
The global IT services industry has evolved in a very spectacular manner over the past decade. During the 1990s several Indian software service providers started offering software consulting services to western multinational clients. Their business model was simple – they developed software solutions in India by employing Indian engineering graduates at good salaries (which were however an order of magnitude lower compared to their US counterparts) and earned revenue in U.S. dollars, thereby making above normal profits through this labour arbitrage. It look sometime for the U.S. software vendors to recognize the power of this business model, but very soon they realized that this was a unique strategic opportunity (Denrell, Fang, and Winter, 2003) made available due to the advent of information and communication technology which enabled such software services to be delivered remotely. In order to seize and exploit such a profitable opportunity, several leading U.S. based IT consulting firms set up offshore software development centers (ODC) in India (as well as some other countries) after year 2000 to rationalize their cost structure and improve their operating efficiency.

The leading Indian software vendors were quick to comprehend the strategic implications of such inward foreign investments by U.S. based software vendors and realized that they needed to bolster their capabilities in order to maintain their competitive position vis-à-vis their western rivals. Therefore, as a countermove, some of the leading Indian IT services firms started setting up business consulting units in the U.S. to interact closely with their (mostly U.S.-based) customers, develop industry expertise and offer complementary business consulting services. These trends may be looked upon as capability-seeking foreign investments by U.S. and Indian consulting firms (please see Figure 11 depicting the competitive dynamics in this industry). The objective of both Indian and U.S. firms was to access complementary capabilities and offer end-to-end consulting services to their clients. The resultant potential outcome is a convergence of the capability portfolios of both U.S. and Indian firms at some point in future. This study examines the market impact of such diversifying activities by firms attempting to augment their corporate scope. It explores this phenomenon in the context of
the global IT services industry among firms that specialize in the design, customization and implementation of commercial software.
This diagram has been developed by the author after analyzing investments made by U.S. and Indian IT services firms over the previous decade. A very preliminary version of a similar figure also appeared in a market research report prepared by Tom Kucharvy of Summit Strategies, Inc. in May 2006.
Distinction is made between skills involving assessment of the customer’s business and strategic imperatives and design of IT architecture, and skills involving implementation of the system in the customer’s corporate environment.

For illustration, these capabilities are labeled “software architecture” and “software implementation” (please see Figure 10), with the former entailing a deep knowledge on the part of the supplier of the client’s strategic and business needs, and the latter requiring mainly technological skills in developing, installing and maintaining software products in a timely and efficient manner. Firstly, the ranking of high- and low-value-added services was founded on the IT services industry value chain (please see Figure 10) based on closeness of the outsourced work to the customer’s core business processes. This value chain was developed after conducting exploratory interviews with 72 senior executives from 25 firms (mainly U.S., Indian and some European IT services firms). The goal of the interviews was to understand the types of services offered by the firms and the logical flow of work, from understanding a client’s business problem through developing a solution to implementing the solution and after-sales maintenance and support. Secondly, the categorization of the various tasks was based on the average vendor billing rates for these services. The average billing rates and revenue productivity (measured in USD per person months) figures for these different services were obtained from multiple IT services vendors, and the categorization was validated, i.e., high-value-added services (as described in the value chain of software services in the IT industry) commanded significantly higher rates compared to low-value-added services (The average billing rate of Low value added tasks was 0.5-0.65 times the average billing rate for High value added tasks).

After introducing these two types of capabilities pertinent in the focal industry, it is argued that a firm’s competitiveness depends (at least in part) on the type of capabilities (whether software architectural or software implementation) it currently possesses and how easily competitors can replicate them. The belief is that the two classes of competencies impart vastly different advantages for their owners. Software architectural competencies allow a supplier to customize the information
technology to meet the idiosyncratic needs and organizational complexities of clients such that the knowledge best serves their requirements. In contrast, clients often require the delivery and implementation of hardware and software infrastructure in a speedy, cost-effective manner, which has led to the gradual commoditization of this type of service.

Due to initial conditions and path dependency, some firms have gravitated toward software architectural skills and others have moved toward software implementation skills. Since software architectural capabilities command much higher profit margins, firms are motivated to integrate backward from software implementation to design. A strong incentive for forward integration into software implementation also exists for firms whose competitive advantage derives from software architectural capabilities. This is due to the large size of the software implementation contracts, both in terms of duration and total revenue, which can offer a more stable stream of cash flows to the firm.

Building on the research on firm capabilities (Collis, 1994; Teece et al, 1997; Eisenhardt & Martin, 2000) and interviews of project managers and senior executives in the IT services industry, this study broadly identifies two classes of firms in this industry – (1) those that possess superior levels of software architectural capability based on their years of experience in business consulting, client relationships and industry domain expertise, and (2) those that are very efficient in software implementation capabilities based on their years of experience working on software development, access to large pools of skilled labor, training facilities and superior management capabilities and deep experience in providing software solutions to global customers using the onsite-offshore global delivery model. The following section describes the data and empirical methodology adopted in this study.

Data and Empirical Approach
In order to test the hypotheses, a population of leading publicly listed IT services firms from India and U.S. with annual revenues over $100 million was selected from the entire universe of IT services firms (based on 4 digit SIC codes 7371, 7373, 7379) in the ORBIS database. Filtering based on the above two criteria produced a list of 121 firms (32 Indian and 89 U.S.) out of which 21 firms were removed as they were predominantly IT product focused with insignificant service offerings. The final sample comprised 100 firms. A conventional event study (Campbell et al, 1996) was performed using cumulative abnormal stock market returns of a set of 100 firms (69 U.S.-based and 31 India-based) listed on NASDAQ and India’s National Stock Exchange (NSE), on specific dates of investment announcements (i.e., entry into the respective foreign nation). After detailed searches on the companies’ websites, Factiva and LexisNexis, a total of 46 events announcing either a foreign investment in India by U.S. firms (first time setup of a software development facility in India) or a foreign investment in the U.S. by Indian firms (first time setup of a business consulting division in the U.S.) were found between January 1995 and December 2008\(^{17}\). This information about events (i.e., investment announcement dates) was further corroborated through informal interviews and email communications with several executives from the firms in the sample. These 46 events were composed of capability-seeking investments of 27 U.S. firms announcing entry into India to set up a software development facility, i.e., seeking software implementation capabilities and 19 Indian firms announcing entry into the U.S. to set up a business consulting division, i.e., seeking software architectural capabilities. Most of the entry modes of these firms were greenfield, however there were some acquisitive (inorganic) entry modes as well\(^{18}\). Entry of U.S.-based firms in India to set up offshore development centers (ODCs) is considered a competitive move to acquire software implementation capabilities while entry of India-based firms in U.S. to set up business consulting practices either through acquisitions, or through organic hiring of local talent is considered a

\(^{17}\) The rationale for choosing just the first capability seeking investment was that the later investments would just be escalation of a firm’s commitment in a particular strategy (either acquiring low-value-added capabilities or high-value-added capabilities) in a country, and the major market impact was expected to happen upon announcement of the first foreign direct investment.

\(^{18}\) For the purpose of this study we do not differentiate between inorganic and organic modes of FDI because our primary interest is the intent/objective of the investment.
competitive move to acquire software architectural capabilities. The intent of the FDI announcements of all firms was reasonably clear from the press releases and from interviews of senior executives from all the firms in the sample to justify such a categorization (please see Appendix 1 for sample press releases). The impact of the announcements was measured by the increase in the announcing firm’s stock market value following the announcement (a market-based measure of success of a capability-seeking foreign investment).  

Each entry was considered an event, and the cumulative abnormal return (CAR) was calculated in the following manner. The expected stock return for the event window was calculated using the market model by regressing the focal firm stock returns on the NASDAQ index, and using the corresponding intercept ($\alpha$) and slope ($\beta$ coefficient) to calculate the expected firm stock returns for each day during the event window. CRSP was the source of the firm and market returns (NASDAQ returns for U.S.-listed firms and NSE returns for India-listed firms) data. The use of two different stock market exchanges from different countries was a necessity, as all firms in the sample are not listed in any one stock market. However, for the purposes of this study, it does not pose any empirical problems, as standardized CARs are used, accounting for the differences in risk between markets. For the market model regression, stock returns are calculated going back 250 trading days (roughly one year of trading) starting from 30 days prior to the event. This 30-day interval was designed to remove the effect of foreign direct investment or takeover news that could already be incorporated in the market price of the focal firm. The following expression was used to calculate the expected stock returns: Expected stock return on a given day = $\alpha + \beta^*$(Market index return on that day). Haleblian and Finkelstein (1999) have used this method to assess whether acquirers learn from their experience. The expected stock return of the focal firm during the 7-day window (3 days before the announcement until 3 days after the announcement) was then subtracted from the actual

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19 Several studies have relied on this methodology to assess the performance of strategic alliance announcements (Kale, Dyer, and Singh, 2002; Anand and Khanna, 2000; Merchant and Schendel, 2000; Koh and Venkatraman, 1991).

20 This rule was not possible to follow strictly for all the firm-event pairs, as some firms started trading on NASDAQ in the middle of the 250-day interval used for calculating the $\alpha, \beta$ parameters.
observed stock return during that 7-day window. The 7 differences were then added to obtain the CAR for the focal firm for that event window. This was further divided by the standard deviation of the CARs calculated for each of the 250 days in the estimation period to obtain the standardized CAR for the 7-day window. The results for 3-, 5-, 9- and 11-day windows were also calculated and yielded highly similar (in sign and significance) CARs to those of the 7-day window.

A 46*100 matrix of firm-event pairs was generated, where the rows represented events (FDI announcements). The columns represented the effect (either positive or negative) on the stock (i.e., the CARs) of the announcing as well as non-announcing firms over the event window. Out of the 4,600 possible observations i.e. CARs there were 946 observations missing, as the rival firms were not yet publicly listed during the event window. This reduced the final sample to 3,654 observations (i.e., CARs). The possible sources of bias due to missing observations could be due to these missing CARs being from events clustered in a particular timeframe, or events announced by certain companies, or CARs of certain companies. All the missing observations were analyzed for the above three sources of bias and it was found that the missing observations (CARs) were distributed throughout the timeframe of the study (January 1995 and December 2008), and were caused due to both US and Indian firms not being publicly listed during the event windows of both Indian and US firms. The 946 missing observations were due to missing CARs of 45 US and 23 Indian firms, which is quite reflective of the proportion of US and Indian firms in the sample. Therefore it is reasonable to say that the results are not affected by any systematic bias caused due to these missing observations.

Out of the available CARs, 2,573 CARs are of U.S. firms on various event windows corresponding to investment announcements by either U.S. firms in India or by Indian firms in the U.S. There is another set of 1,042 CARs of Indian firms on various event windows corresponding to investment announcements by either U.S. firms in India or by Indian firms in the U.S. The remaining

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21 Eckbo (1983) used similar methods to calculate CARs of merging firms and their horizontal rivals to test the possibility of collusive and anticompetitive effects.
39 CARs are those of the focal firms during the event windows corresponding to their own investment announcements. Table 4 shows the breakdown of CARs by categories.
Table 4:

Breakdown of CARs into different categories.

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<tr>
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<th>FDI by U.S. Firms in India</th>
<th>FDI by Indian Firms in U.S.</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CARs of U.S. Firms</strong></td>
<td>1471/1836 CARs of U.S. Firms due to FDI by U.S. Firms</td>
<td>1102/1311 CARs of U.S. Firms due to FDI by Indian Firms</td>
<td>2573/3147</td>
</tr>
<tr>
<td><strong>CARs of Indian Firms</strong></td>
<td>605/837 CARs of Indian Firms due to FDI by U.S. Firms</td>
<td>437/570 CARs of Indian Firms due to FDI by Indian Firms</td>
<td>1042/1407</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>2076/2673</td>
<td>1539/1881</td>
<td>3615/4554</td>
</tr>
<tr>
<td>Own Firm CARs</td>
<td></td>
<td></td>
<td>39/46</td>
</tr>
<tr>
<td><strong>Total Observations</strong></td>
<td></td>
<td></td>
<td>3654/4600</td>
</tr>
</tbody>
</table>
A breakdown of the observations according to events by Indian or U.S. firms, presents 2,076 observations (CARs of either Indian or U.S. firms) on event dates corresponding to U.S. firms’ announcements of FDI in India. Similarly, 1,539 observations (CARs of either Indian or U.S. firms) are found on event dates corresponding to Indian firms’ announcements of FDI in the U.S.

TESTS AND RESULTS

Hypothesis 1 is about the 39 own-firm CARs, which are expected to be significantly positive since the capability-seeking foreign investments made by the firms were expected to enhance their competitive position and increase future cash flows. The result was indeed found to be significantly positive, as shown in Table 5.

\[22\text{ Out of the 46 possible own firm CARs, 7 CARs (4 Indian firms and 3 US firms) were missing as the firms were not publicly listed when they made the capability-seeking FDI announcement.}\]
Table 5:

1 sample $t$ test of CARs of 39 firms announcing capability-seeking FDI.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Observations</th>
<th>One-sample $t$ test</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1:</td>
<td>N = 39</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean = 0.81</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std Err = 0.49</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>H1: mean &gt; 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pr($T &gt; t$) = 0.05</td>
</tr>
</tbody>
</table>
The second set of hypotheses is about the four individual cells in the center of Table 4. H2a suggests that when a U.S. firm announces foreign investments in India the announcement will have greater negative impact on the CARs of competitor Indian firms than on the CARs of competitor U.S. firms. Similarly, Hypothesis 2b suggests that when an Indian firm engages in foreign investments in U.S., the announcement will have greater negative impact on the CARs of Indian competitor firms than on the CARs of U.S. competitor firms. Figure 12 depicts the phenomenon underlying these hypotheses. The results support these assertions, as the 605 CARs of Indian competitors are significantly more negative compared to the 1,471 CARs of U.S. competitors in response to foreign investment announcements by U.S. firms in India. Similarly, the 437 CARs of Indian competitors are significantly more negative compared to the 1,102 CARs of U.S. competitors in response to foreign investment announcements by Indian firms in U.S., as shown in Tables 6 and 7 below –

---

23 Out of the 837 possible Indian firm CARs in response to U.S. firm FDI, only 605 CARs could be estimated as remaining firms were not publicly listed at the time of the capability-seeking FDI announcement. Similarly out of the 1,836 possible U.S. firm CARs in response to U.S. firm FDI, only 1,471 CARs could be estimated as the remaining firms were not publicly listed at the time of the capability-seeking FDI announcement.

24 Out of the 570 possible Indian firm CARs in response to Indian firm FDI, only 437 CARs could be estimated as remaining firms were not publicly listed at the time of the capability-seeking FDI announcement. Similarly out of the 1,311 possible U.S. firm CARs in response to U.S. firm FDI, only 1,102 CARs could be estimated as the remaining firms were not publicly listed at the time of the capability-seeking FDI announcement.
Figure 12: FLOWCHART DESCRIBING THE PHENOMENON BEHIND HYPOTHESES 2A & 2B

- **ANNOUNCING FOREIGN DIRECT INVESTOR FIRM**
  - Firms investing to access capabilities in the lower value added segment of the industry value chain e.g. U.S. Firms

- **LOCATION OF FOREIGN DIRECT INVESTMENT**
  - India
    - Competitor Firms established in high-value added segment of the industry value chain e.g. U.S. Firms
      - Significantly more negative
    - Competitor Firms established in low-value added segment of the industry value chain e.g. Indian Firms
      - Significantly less negative
  - U.S.
    - Competitor Firms established in high-value added segment of the industry value chain e.g. U.S. Firms
      - Significantly less negative
    - Competitor Firms established in low-value added segment of the industry value chain e.g. Indian Firms
      - Significantly more negative

- **TYPE OF COMPETITOR FIRMS (Announcement Impact)**
  - Car on competitor firm's stock
    - H2A
    - H2B
Table 6:

Two-sample unpaired t test between 605 CARs of Indian firms and 1471 CARs of U.S. firms in response to capability seeking FDI announcements by competitor U.S. firms.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Observations</th>
<th>Two-sample t test with unequal variances</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2a:</td>
<td>x = 605</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean = -0.13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std Err = 0.12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>y = 1471</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean = 0.14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std Err = 0.06</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H2a: diff (x-y) &lt; 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pr(T &lt; t) = 0.02</td>
<td></td>
</tr>
</tbody>
</table>

Table 7:

Two-sample unpaired t test between 437 CARs of Indian firms and 1102 CARs of U.S. firms in response to capability seeking FDI announcements by competitor Indian firms.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Observations</th>
<th>Two-sample t test with unequal variances</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2b:</td>
<td>x = 437</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean = -0.32</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std Err = 0.13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>y = 1102</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean = -0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Std Err = 0.08</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H2b: diff (x-y) &lt; 0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pr(T &lt; t) = 0.03</td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION AND CONCLUSION

Overall, the results show that when U.S. or Indian firms make capability-seeking investments in each other’s country, the announcement impact on their stock price is significantly positive due to the potential for generating higher future margins as well as gaining increased market share. However, the stock price of their competitors is significantly negatively affected due to the possibility of stiffer competition for resources (chiefly talented software engineers, as well as crowding effects) in the host country. The negative impact on the stock price of Indian firms is significantly greater than the negative impact on the stock price of U.S. firms, due to the higher difficulty in acquiring software architectural capability (for Indian firms) compared to the effort required to acquire software implementation capability (for U.S. firms). Tables 8 and 9 present some additional evidence in this regard. The 1,042 CARs of Indian competitors are significantly more negative compared to the 2,573 CARs of U.S. competitors in response to foreign investment announcements by all rival firms (both Indian and U.S.). Similarly, 437 CARs of Indian competitors in response to announcements of capability-seeking FDI by Indian firms are significantly more negative compared to the 1,471 CARs of U.S. competitors in response to announcements of capability-seeking FDI by U.S. firms.
**Table 8:**

Two-sample unpaired t test between 1042 CARs of Indian firms and 2573 CARs of U.S. firms in response to capability seeking FDI announcements by all competitor firms.

<table>
<thead>
<tr>
<th>INDIAN FIRM CARs VS. U.S. FIRM CARs IN RESPONSE TO ANNOUNCEMENTS OF FDI BY ALL RIVALS</th>
<th>Observations</th>
<th>Two-sample t test with unequal variances</th>
</tr>
</thead>
<tbody>
<tr>
<td>x = 1042</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean = -0.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std Err = 0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>y = 2573</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean = 0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std Err = 0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diff (x-y) &lt; 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pr(T &lt; t) = 0.003</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 9:**

Two-sample unpaired t test between 437 CARs of Indian firms in response to competitor Indian firm capability seeking FDI announcements and 1471 CARs of U.S. firms in response to competitor U.S. firm capability seeking FDI announcements.

<table>
<thead>
<tr>
<th>INDIAN FIRM CARs IN RESPONSE TO INDIAN FIRM FDI VS. U.S. FIRM CARs IN RESPONSE TO U.S. FIRM FDI ANNOUNCEMENTS</th>
<th>Observations</th>
<th>Two-sample t test with unequal variances</th>
</tr>
</thead>
<tbody>
<tr>
<td>x = 437</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean = -0.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std Err = 0.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>y = 1471</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean = 0.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std Err = 0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diff (x-y) &lt; 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pr(T &lt; t) = 0.001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This implies that when firms efficient in architectural capabilities make FDIs to access implementation capabilities, the stock market differentially penalizes other competitors (those efficient in architectural capabilities are affected less than those efficient in implementation capabilities), as it perceives a higher competitive threat to firms efficient in implementation capabilities. This indicates that firms possessing architectural capabilities have an advantage over firms possessing implementation capabilities – something which scholars have termed the “architectural advantage” (Jacobides, Knudsen and Augier, 2006; Fujimoto, 2007).

Since it is comparatively easier to acquire implementation capabilities, the stock market imposes a lower penalty on firms possessing architectural capabilities during implementation capability-seeking FDI announcements by rival firms possessing architectural capabilities. This result indicates that firms with implementation capabilities are significantly disadvantaged compared to firms with architectural capabilities. This vindicates the mobility barrier (Caves and Porter, 1977) arguments made earlier – firms with implementation capabilities face several barriers as they attempt to access architectural capabilities. These barriers include difficulty in establishing credibility in successfully executing high-end assignments with clients, in recruiting top-quality talent, and in acquiring the domain-specific tacit knowledge necessary to accomplish high-end projects. For the India-based firms, domain knowledge and expertise is the chief mobility barrier that prevents them from successfully obtaining business consulting assignments from global clients. Another mobility barrier is their reputation as technology consulting firms rather than business strategy consulting firms. While this reputation effect helps them obtain high-revenue technology consulting projects, at the same time it restrains them from successfully seeking business consulting assignments from the same clients. The stock market adjusts for this information by penalizing the firms possessing implementation capabilities more than it does firms with architectural capabilities. The stock market does not significantly penalize firms possessing architectural capabilities in response to FDI decisions by rival firms.
Thus this analysis concludes that in the global IT services industry firms with architectural capabilities and firms with implementation capabilities belong to two separate groups, and those firms having implementation capabilities face significant challenges in moving upwards along the capability continuum to acquire architectural capabilities possessed by firms in their rival group. These challenges arise due to differences in credibility, reputation, of vendors and relationships between client and vendors. The firms possessing architectural capabilities have built up a level of credibility and reputation in performing high-end assignments for their clients over several years, and they maintain excellent relationships with C-level executives in their client companies. Firms with only implementation capabilities do not possess such relationships with their clients or the business domain expertise, as they have been working on technology-intensive projects and dealing mainly with project managers and technological leads. Indian firms have traditionally executed fairly mundane projects such as low-level programming, Y2K, and maintenance in the 1990s (Arora et al, 2001). After 2000 they slowly graduated to higher value added services such as Customized software application development, ERP, and System integration by developing better project management capability, deeper knowledge of customer business domains, and enhancing the quality of project deliverables through superior software development tools and methodologies. In contrast, western firms such as Accenture, IBM Global Services, and HP have decades of consulting experience, deep business domain expertise, and long-standing trusted client relationships that enable them to offer higher value added services.

Although these two groups consist of firms from two different countries (India and U.S.), it is important to note here that the difference is not based on the home country of the firms, so this is not necessarily a country effect on firm capabilities in this context. Instead the difference is based on firm competencies, which have evolved within the respective firms over time, due to several path

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25 Year 2000 projects consisted of fixing the Millenium Date bug (due to the double digit year field instead of four digits) that caused severe calculation problems due to the rollover from 1999 (x99) to 2000 (x00) in several corporate IT systems around the world prior to 2000. For more details see “Year 2000 problem,” Wikipedia, http://en.wikipedia.org/wiki/Year_2000_problem (accessed December 2, 2010).
dependent reasons including availability of resources and business opportunities. Therefore the findings may be generalized to situations where firms lacking high value added capabilities (from any nation) face significant negative reaction (compared to the negative reaction on other rival firms possessing high value added capabilities) from the stock market when rivals with superior capabilities invest in their home nation in order to access those capabilities in which they are strong. Even in the same nation this result is expected to hold as firms with different sets capabilities make complementary investments to acquire their rivals’ capabilities – so firms possessing high value added capabilities are expected to enjoy advantage over firms that do not.

Besides, the IT Services industry the results are generalizable in other industries that have similar features, e.g. Architecture Design firms that design buildings and homes are expected to enjoy advantage over the construction firms that actually develop the buildings once the design is ready. The main point is that closeness to the customer and knowledge of their needs is valuable for the firm. Software Architectural Capabilities entail a deep understanding of client’s industry and business requirements – this knowledge enables firms to offer top quality software solutions. Such software services command much higher premiums compared to generic software services that are not differentiated according to a customer’s requirement. Similarly in the pharmaceutical industry, specialized drugs command much higher prices compared to generics and made to order products are more expensive compared to generic off-the-shelf varieties. Thus the results of this study may be generalized to similar settings where the firm obtains customers specific requirements and goals during the initial design stage of the development of a product or service.

**Limitations and future research**

One limitation of this study is that the sample includes firms that have engaged in FDI either in India or U.S., which leaves out FDIs in other countries, and this may have a moderating effect on the relationships. Using abnormal stock market firm returns in response to FDI announcement
events may not be the ideal measure for challenges faced by firms attempting to move into adjacent positions in the industry value chain by acquiring new capabilities possessed by firms in the rival groups. It is necessary to devise more fine-grained performance-based measures to better analyze such a phenomenon. However, using the CAR measure (as opposed to accounting measures) to assess the market perception of such competitive moves by firms with different capability portfolios is justified since the conclusions are about market perceptions. Since this is a context-dependent study, the findings may not be generalizable to other industries; however, given the growing relevance of IT services in almost every type of business, the study assumes importance.

Future research could focus on other service industries with similar characteristics, wherein firms from different groups attempt to acquire capabilities possessed by rivals, e.g., the BPO industry, which initially started with setting up of call centers in offshore locations but has now upgraded its capabilities to include several high-value added services including business analysis, financial analysis, back-office operations, legal research, etc., collectively known as KPO (knowledge process outsourcing).

Conclusion, Relevance, and Importance

This study empirically explores the links between competitive moves of firms in different strategic groups within an industry and their impact on their stock market performance. Results suggest that the market rewards and penalizes firms differentially when they undertake capability seeking FDI, based on their prior capabilities. Firms possessing high value added capabilities (software architectural capabilities, in this study) have an advantage over firms that lack such superior capabilities. Firms trying to access such high-value added capabilities face significant challenges in the form of major investments in developing a superior knowledge base as well as forming trusted customer relationships. The findings resonate with the strategy literature on RBV and KBV. Firms find it easier to acquire capabilities in the lower-value added segment of the industry value chain than
to acquire capabilities in the higher-value added segment. This is due to the tacit, socially complex knowledge base underlying the high-value added capabilities, as well as time compression diseconomies (Diericks & Cool, 1989) inherent in building trust-based relationships, which makes them difficult to acquire, or develop, or imitate. The study shows that Indian firms are exploring new territory to develop business consulting capabilities which they unfamiliar with and therefore are finding it more challenging compared to the US firms that are just establishing global software development centers in India to improve their service delivery capabilities. Indian firms need to acquire scarce intellectual capital and financial resources to develop business consulting capabilities, while US firms need mostly physical capital to set up global software development centers in India. Since business consulting capabilities are developed over time by building trust with clients, therefore Indian firms are likely to face more severe time compression diseconomies (Diericks & Cool, 1989) compared to US firms that can use their financial capital to quickly acquire the necessary physical resources and set up India based software delivery centers.

Strategy scholars agree that knowledge is an important resource of the firm and a significant contributor to competitive advantage (Barney, 1986, 1991; Gupta and Govindarajan, 2000; Grant, 1996). This link between knowledge and competitive advantage, particularly the ability of firms to transfer tacit knowledge among individuals and develop firm-specific capabilities based on such hard-to-imitate knowledge is of great importance and warrants further research (Barney, Wright, and Ketchen, 2001; Harrison, Hitt, Hoskisson, and Ireland, 2001). Tacit knowledge with its focus on ‘know-how’ (Ambrosini and Bowman, 2001; Kogut and Zander, 1992) is therefore one of the most critical resources influencing the development and sustainability of competitive advantage (Grant, 1996; Nonaka, 1991; Spender 1993). Firms possessing capabilities that have a high component of tacit and socially complex knowledge can avoid imitation and enjoy durable advantage over rivals.

The above conclusions are based on an event-study where the external market reaction to capability-seeking investments of firms are measured and analyzed. In doing so it opens up multiple
new queries regarding the internal investments made by firms to access capabilities and their impact on performance. It is important to examine both external and internal performance to gain a comprehensive understanding of such competitive investments and their impact on a firm’s future. The next chapter attempts to address this through an empirical analysis of internal investments and detailed large sample project level data from a leading Indian IT services firm.
Chapter 4: STRATEGY, CUSTOMER ORIENTED CAPABILITIES, AND PERFORMANCE

Starting from Penrose (1959), strategy research has emphasized the value of developing organizational capabilities as a means to implement corporate strategies (Snow and Hrebiniak, 1980; Zott, 2003; Slater, Olson, and Hult, 2006). Yet surprisingly little empirical literature recounts the origins, mechanisms, and strategic implications of capability development (Newbert, 2007). There are a number of theoretical papers describing the characteristics of resources and capabilities that impart competitive advantage to firms (Barney, 1991) and what prevents their imitation (Dierickx and Cool, 1989; Peteraf, 1993) yet, the strategy literature has limited understanding of how they actually acquire, or develop such valuable resources and capabilities. There have been several papers with anecdotal evidence and case studies of small sample of firms demonstrating how firm capabilities are linked to performance (Iansiti and Khanna, 1995; Miller and Shamsie, 1996; Lorenzoni and Lipparini, 1999; Rosenbloom, 2000; Raff, 2000; Ethiraj et al, 2005). Comparatively little research has been conducted on how firms develop, manage, and utilize their human resources to build capabilities with a strategic intent. Recent Resource Based View (RBV) emphasizes the importance of deploying resources efficiently (rather than the absolute magnitude of resources) to achieve superior firm performance (DeSarbo et al, 2005). Therefore it is possible that some firms, even though smaller or less endowed with superior resources can eventually outcompete larger resourceful rivals by deploying resources strategically. This underscores the process by which resources are transformed into valuable outputs (Srivastava, Fahey, and Christensen, 2001; Collis and Montgomery, 1995).

Teece, Pisano, and Shuen (1997) suggested that a firm is constrained by its context and history and this path dependence leads to heterogeneity of capabilities, which further influences firm boundary choices i.e. what type of products and services it offers (Argyres, 1996; Argyres and Liebeskind, 1999). Firms’ internal capabilities and transaction costs also determine firm scope (Williamson, 1999) in a co-evolutionary manner (Jacobides and Winter, 2005) and investments in
complementary assets enables firms to develop newer capabilities to expand its corporate scope and adapt with the market (Jacobides, Knudsen, and Augier, 2006). Recent strategy research suggests that intelligent resource deployment (as opposed to the absolute magnitude of resources) accounts for differential firm performance (Makadok, 2001). These theoretical papers imply that within an industry value chain, certain types of capabilities may be more valuable and therefore more desirable compared to others, as they enable firms to appropriate greater returns. However they leave the following question unanswered – if certain capabilities are more valuable, what is their marginal impact on firm performance?

The role of customer or market knowledge is widely assumed to enhance the quality of new products and services; however few empirical studies show this effect because of the absence of a concrete definition of that knowledge (Li and Calantone, 1998). Mansfield et al (1971) emphasized the difference between the technological success of an innovation and success of a new product in the market. Firms often face a choice while allocating scarce resources between maximizing on technological dimensions of a product, and improving their marketing efforts to provide greater value to their customers by understanding their needs better. Several scholars (Hamel and Prahalad, 1994; Sinkula, 1994) have suggested that customer knowledge has the potential to enhance the quality of a product or service. They have acknowledged that marketing expertise improves firm performance (Hult, Ketchen, and Slater, 2005; Katsikeas, Samiee, and Theodosiou, 2006), however few papers empirically link firm strategy with marketing capabilities (Vorhies, Morgan, and Autry, 2009 is a notable exception). This study demonstrates that customer knowledge enables the development of superior capabilities with attendant benefits for performance.

This paper addresses the above gaps and makes a number of contributions to the strategy literature. First, this study investigates how two types of capabilities (technological and customer oriented) enable a firm to realize its strategic objectives. By shifting the focus from whether capabilities matter to which capabilities matter more to firm performance, this paper expands our
understanding of the performance implications of investing in different types of capabilities. To analyze the impact of these capabilities, we test how pure technological knowledge, and knowledge of the customer’s business influences firm performance differentially. Following Winter (1987), this study attempts to link the development of capabilities through acquisition of technological and customer oriented knowledge, and a firm’s ultimate strategic objective of providing high value added services to its customers. The results demonstrate that knowledge of customer’s business objectives and requirements enables firms to offer higher value than pure technological knowledge and has a greater impact on their performance. Customer oriented capabilities are relatively more idiosyncratic, socially complex, and tacit compared to pure technological capabilities, and hence they are found to be more valuable for the firm consistent with the resource based view (RBV). Second, we reveal the actual process by which a firm develops these capabilities internally through deliberate and focused investments in altering its resource base and strategically re-orienting itself before its customers. This paper also provides a non-ambiguous measure of organizational capabilities and empirically tests their link to performance. Third, we examine the role of knowledge type (tacit and explicit) on the performance implications of the different capability types. This paper contributes to our general understanding of how firms seek new capabilities in the face of environmental competitive pressures. It shows how deliberate learning, proper deployment, and management of human assets leads to superior capabilities and enables a firm to rise up the industry value chain to appropriate greater returns thereby enhancing competitive advantage. Overall this study adds to contemporary research on capabilities by informing academics of the origins of capability development and their link to firm strategy.

THEORETICAL FRAMEWORK

With the evolution of RBV, it has become evident that resource heterogeneity or superiority alone may not provide enduring sources of competitive advantage, rather proper resource
deployments could be more effective drivers of sustainable competitive advantage. Besides not all firms are uniformly able to utilize standard resources that are available to them. Firms often combine standard human resources with internal knowledge and processes to perform their day-to-day operations. Over time these activities generate new organizational knowledge (through learning by doing and customer interactions) that becomes embedded in firm capabilities. These capabilities are generally difficult to understand due to causal ambiguity (Lippman and Rumelt, 1982; Reed and Defillippi, 1990), or imitate primarily due to the tacit nature of the underlying knowledge and involvement of human resources, and offer competitive advantage (Teece et al., 1997; Kogut and Zander, 1992). While proper deployment of internal resources is essential, competitive advantage also depends on how an organization adapts to the external environment and responds to competitor reactions over time. The following sections draw upon the Knowledge Based View (KBV), Capabilities literature, and evolutionary theory to build the theoretical framework. This paper is about evolution of firm capabilities and how the infusion of new competences by firms can result in superior performance that in turn can ultimately influence their corporate scope and competitive position. It indicates how a firm can achieve its strategic goals by properly allocating resources and developing capabilities. It shows that deliberate investments in enhancing the quality of its available human resources leads to development of superior capabilities, which has a positive impact on performance.

Capabilities, Fitness, and Firm Strategy

Capabilities are distinctive firm specific competences (Snow and Hrebiniak, 1980; Hitt and Ireland, 1985; Prahalad and Hamel, 1990) or knowledge based assets that enable firms to deliver superior products/services and to differentiate themselves from competitors. Snow and Hrebiniak (1980) and Hambrick (1983) theorized that within an industry firms develop specific capabilities to achieve strategic objectives, which ultimately explains firm performance. More recent empirical
papers suggest that organizational strategy determines what types of capabilities it develops (DeSarbo et al., 2005; Vorhies et al., 2009). Therefore deliberate investments aimed at capability development indicate that senior managers of the firm have made important decisions regarding organizational objectives. Firms following the strategy of expanding their product or services portfolio will need to deploy resources, first to develop new products or services and then efficiently market those to targeted customers to earn higher profits. Firms will need two broad sets of capabilities to achieve this goal – capabilities to develop the differentiated products or services and then another set of capabilities to sell those to target customers with desired benefits (Noble, 1999). This study introduces two types of capabilities that are relevant to firms following a strategy of expanding their market scope.

First, technological capabilities enable a firm to develop a product or service in an efficient and cost effective manner. These reflect operational efficiency of a firm and denote how well it can perform a certain set of tasks and earn a living in the present. Drawing upon evolutionary theory, Helfat et al. (2007) define technical fitness as how effectively a capability performs its intended function (its quality) when normalized (divided by) its cost. These capabilities are process oriented and more codified especially when the process is technology intensive. Technological capability is similar to know-how (Garud, 1997) and represents knowledge of the process by which a new technology product or service can be developed. The output from these capabilities is a technology that is quite generic and has to be customized and used in multiple situations to achieve a variety of business goals for different buyers. Technological capabilities are more fungible across different customers, since these are operational in nature and not yet much differentiated.

Second, customer oriented capabilities enable a firm to tailor a generic technology to suit the idiosyncratic requirements of customers. In contrast to technological capabilities there are a set of tasks and routines that are required to customize a generic technology to make it usable by a given customer. Customer oriented capability is similar to know-why (Garud, 1997) and represents an
understanding of the principles (cause and effect relationships) underlying a phenomenon (in this case, customer’s business). Prior literature has rarely distinguished between a firm’s acquisition of a new technology and its subsequent ability to customize, internalize, and implement it in the market. Although a firm can purchase, or gain access to technology from external partners, such access does not guarantee that the firm can readily deploy the technology in the market (Leonard-Barton, 1988; Steensma and Corley, 2000). In order to remain competitive a firm needs to be good at both these capability dimensions. Technical fitness by itself does not guarantee above normal profits for a firm, because it is also important to ensure that the technical fitness is rewarded by the environment (or customers who buy the firm’s products and services). As long as the technical fitness is a desirable and scarce quality, it will be valued by the customer and command superior profits for the firm. However with the change of environment, some dimensions other than pure technical fitness may become more salient and begin to be valued by the customers, e.g. how well a technology enables them to achieve their desired objective. Customer or market knowledge is conceptualized as that which enables a firm to achieve ecological fitness (Helfat et al, 2007). This type of customer knowledge when utilized and incorporated with the technological knowledge develops into a set of higher-order routines and evolves into a dynamic capability that allows a firm to survive and prosper in a changing market. Without sufficient customization, the generic technology is unusable in the customer firm’s internal business environment.

Such a distinction between technical and ecological fitness is particularly relevant in high technology services industries, where a firm adopts new technologies to enhance its business processes (Weigelt, 2009). This is because the use of these technologies often involve information-systems applications that are customer facing and therefore they have to be incorporated in the firm’s ongoing business processes and systems (Purvis, Sambamurthy, and Zmud, 2001) as well as embraced by its customers (Meuter et al, 2005). One example is the customization of ERP technologies to suit the idiosyncratic requirements of a particular firm. ERP technologies are generic in nature and are licensed by the software manufacturer (e.g. Oracle, SAP), but they need extensive
customization in order to fit into the buyer’s existing systems for proper utilization and realization of expected business benefits. These customer oriented capabilities are not fungible across different businesses, since these services involve high level of tailoring with respect to the client’s business requirements and systems architecture and this is where vendor firms add value to the product or service and earn higher profits.

To summarize, technological capabilities and customer oriented capabilities enable a firm to develop new technologies and then modify the technology to fit into the idiosyncratic business environment of the customer to create value for them, which in turn earns profits for the firm. Both these capabilities are essential for successfully providing services to customers and therefore have rent generation potential.

**Internal Capability Development through Learning**

Learning is a powerful way to acquire intelligence and many organizations have invested time and resources to learn capabilities and the ability to learn is considered to be a unique source of sustainable competitive advantage (Burgleman, 1990; Senge, 1990; Lane, Salk, and Lyles, 2001; Zollo and Winter, 2002; Zollo and Singh, 2004; McEvily and Marcus, 2005). Scholars of Strategy have suggested that performance difference across firms can be attributed to knowledge asymmetries and differences in their ability to learn, which is expected to grant competitive advantage to firms (Conner and Prahalad, 1996; Nonaka, 1994; McGill and Slocum, 1994; Barabba and Zaltman, 1991; Senge, 1990). Levinthal and March (1993) examined learning processes as instruments of organizational intelligence. Such learning behaviors that enable a long term adaptive capability are referred to as ‘strategic learning’ (Kuwada, 1998). Past scholars have also asserted that organizations that can convert information into knowledge and wisdom will be the most successful (Davis and Botkin, 1994), especially those in high velocity environments (Eisenhardt and Martin, 2000;
Volberda, 1996). It follows that if an organization can internally create an environment of continuous learning through proper mechanisms (as described in more detail later) and provide adequate incentives, it will realize performance advantages over competitors. This study examines capability development through two types of learning mechanisms – Informal learning through on the job experience and Formal learning through classroom training and evaluation.

**Informal Learning (Experiential)**

Experiential Learning is referred to by cognitive psychologists as implicit learning, which is complex and takes place often without the learner’s awareness – therefore such knowledge is normally not reportable or teachable through formal mechanisms (Hayes and Broadbent, 1988; Green and Shanks, 1993). It is deeply embedded in action and involvement in a specific context and requires the active participation of the learner in a given situation. Long (1990) suggested that in order to learn from experience, a person has to undergo a certain experience and then reflect upon that to extrapolate wisdom and experience reinforces the tacit knowledge acquired through experimentation (Raelin, 1997). However firms can also develop capabilities over time through trial and error and learning by doing (Nelson and Winter, 1982). Research on acquisitions and internationalization further support the view that firms increase their proficiency in deploying knowledge resources and capabilities with experience (Haleblian and Finkelstein, 1999; Zahra, Ireland, and Hitt, 2000). Customer oriented capabilities, can be acquired over time through repeated interactions with customers while working on several projects over a period of time. Repeated client interaction enhances the relationship, helps build customer specific absorptive capacity (Cohen and Levinthal, 1990; Dyer and Singh, 1998) and enables employees to offer higher value added services to customers. So it can reasonably be expected that,

*Hypothesis 1: Development of customer oriented capabilities through experiential learning is positively related to firm performance.*
Extending the same logic to the technological capabilities, it is clear that through repeated work on a certain technology, employees develop expertise, and their efficiency increases. Greater experience with a technology is also associated with reduced errors, and hence less rework. Greater experience with a given technology also enables employees to develop superior quality output that can last longer and require less ongoing maintenance. This should translate into better quality, which leads to higher performance. Therefore it may be predicted that,

*Hypothesis 2: Development of technological capabilities through experiential learning is positively related to firm performance.*

**Formal Learning (Training)**

Although a substantial body of literature on training and development exists, most of it focuses on individual learning and transfer (Kozlowski et al., 2000) and overlooks training and evaluation as a mechanism of capability development. Following Pisano (1994, 1996) formal learning is similar to learning before doing, which teaches a person the cause and effect relationships underlying a problem and imparts theoretical knowledge. The role of experience accumulation, knowledge articulation, and highly deliberate investments in learning mechanisms such as knowledge codification (Zollo and Singh, 2004) in the evolution of dynamic and operational routines is well documented in the strategy literature (Zollo and Winter, 2002). Customer oriented capabilities involve a deep understanding of the customer’s requirements and preferences, which allows employees to tailor a given technology or service to meet the needs of their customer. Such knowledge can be gained through specialized training programs and courses designed for a given customer’s business segment. A deep knowledge about a customer’s business will enable employees to provide value added services, which is expected to improve performance. Therefore it can be predicted that,

*Hypothesis 3: Development of customer oriented capabilities through formal training and evaluation is positively related to firm performance.*
Similarly formal training programs in different technological disciplines are also useful in imparting the relevant knowledge to employees. Specialized courses in various technologies are offered by different institutes and they are very helpful in preparing the trainees for live projects on the job. With the rapid advancement of technologies, it has become essential for technical employees to retool themselves regularly for meeting specific job requirements. This retooling is often accomplished through specialized training and certification courses and aimed at enhancing performance. Therefore, it is reasonable to expect that,

*Hypothesis 4: Development of technological capabilities through formal training and evaluation is positively related to firm performance.*

It is likely that these two mechanisms will have pros and cons, as well as differential impact on capability development. For example on-the job learning over time is expected to take a long time, whereas formal training is generally completed in a few months after which trainees start working on projects. Training is also quite labour intensive and expensive (Salas and Cannon-Bowers, 2001), especially if employees are trained during work hours, while on the job learning is less expensive in comparison as employees gradually pick up skills through repeated trials and errors as they work. Besides core rigidities and competency traps might also reduce the value of technical experiential learning (Levitt and March, 1988; Leonard-Barton, 1992). Therefore it is evident that while different capabilities can be developed through both formal and informal mechanisms, each of these methods is conducive for acquiring a certain type of knowledge. The following flowchart shows how tacit and explicit knowledge learned by individuals using the proper mode lead to development of different capabilities, which ultimately improve firm performance.
The process of capability development and how it generates firm performance is described in greater detail in Chapter 2.
The four hypotheses derived from the interaction/interplay between two different organic modes of capability development (formal training & evaluation and experiential learning) and two different capabilities (technological capability and customer oriented capability) are summarized in the table below.
<table>
<thead>
<tr>
<th></th>
<th>Experiential Learning</th>
<th>Formal Training &amp; Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Oriented Capability</td>
<td>+ H1</td>
<td>+ H3</td>
</tr>
<tr>
<td>Technological Capability</td>
<td>+ H2</td>
<td>+ H4</td>
</tr>
</tbody>
</table>
Performance implications of Technological and Customer Oriented Capabilities

Having introduced and argued that the two types of capabilities create value for customer and the firm, I now theorize on whether they impact the firm differently. Since technological capabilities are generic in nature and involve primarily codified knowledge to deliver outputs, it is expected that they will provide a firm with normal profits. These capabilities do not require high levels of asset specific investments and therefore there is a limit to the benefits/returns generated from their endowment. Such operational capability development imparts technical fitness (Helfat et al, 2007) to a firm because it enables a firm to perform its usual day-to-day operations efficiently at a minimum cost. Evolutionary theory suggests that firms possess dynamic capabilities to change in response to environmental triggers (supply and demand trends, competition, governmental actions, economic cycles etc.), and these capabilities are domain specific requiring consistent investment and domain specific learning (Winter, 2003; Teece et al, 1997). Apart from high levels of technological skills, firms should also possess very good understanding of the customer’s industry in order to develop top quality technological applications that meet the client’s business objectives. A deep knowledge on the part of the vendor about the client’s strategic and business needs enables the firm to develop technology that fits in well with the customer’s existing business systems, organizational complexities and satisfies their integral requirements. For example, a software application designed to keep track of patient’s medical records in a hospital will be entirely different from an application to keep track of inventory in a retail chain, or an application handling customer billing for a telecom operator. Since customer oriented capabilities require modification of generic technologies for the client in order to meet their distinctive needs, there is a high component of contextual knowledge associated with this type of assignment. Such work involves pooled interdependence with various stake holders from the customer’s domain and hence requires development of socially complex routines, to accomplish the task. Given the tacitness of underlying knowledge and work complexity this type of capability is not fungible across industries or geographies. These capabilities impart ecological fitness (Helfat et al, 2007) to firms and they create, extend, or modify the existing resource
base to meet the demands of a changing external environment. With changing market and customer demands a firm has to re-orient itself and tailor its products/services to the requirements of its customers – this ability to change dynamically is in our view a high-end capability and provides greater value to a firm.

The resources necessary to offer such services are expected to be specific to the customer or at least the customer’s industry sector. Firms will need to make asset specific investments in order to generate such capabilities. Cattani (2006) depicts how Corning Inc. entered the fiber optics for telecommunications industry by deliberate investments and commitment to reconfiguring and pre-adapting its existing glass technologies – an interesting example of dynamic managerial capabilities. Since customer’s preferences and business goals change over time, firms will have to make asset specific investments at regular intervals to match their service offerings with the changing customer needs. Often firms have to make relationship specific investments to provide superior value added services. The capabilities associated with these services are therefore dynamic in nature and are difficult to develop or acquire and are expected to command a premium. They enable firms to earn relational rents (Dyer and Singh, 1998) above and beyond that earned through the utilization of technological capabilities.

For illustration purpose, let us take the example of the digital camera and its resolution power as given by the Megapixels. Once upon a time, megapixels were the big differentiator in cameras — because if you didn't have enough megapixels, you couldn't get a high enough resolution for good photo prints. So firms invested resources to increase the megapixel count and improve picture quality. This was also valued by customers, who wanted the clearer pictures and therefore were willing to pay higher prices for cameras with higher megapixels. However after a certain number of years this technology became so advanced that almost all cameras offered over 6 megapixels which was high enough for small and larger size prints. At this time further investment in improving the Megapixels was not helpful for the firms or the customers, because beyond a certain level of picture
clarity, the extra bit did not add much marginal value to the general customer. Therefore firms began to invest in adding other useful features, such as higher optical zoom, lighter weight, longer battery life, etc. to the cameras. Due to change in the environment, resulting from advances in technology as well as changes in customer preferences, the technical fitness no longer dominated the attributes valued by the customers, and hence did not act as a major differentiator to guarantee superior profits. At this time the other dimensions of the digital camera were more essential for differentiating a given model from others. It is the ecological fitness which became more important as the industry evolved. Following Helfat et al (2007), ecological fitness is influenced by technical fitness, competition, and market demand. Over a period of time, capabilities that are based on tacit knowledge have a more durable effect on firm performance (McEvily and Marcus, 2005; Martin and Salomon, 2003) compared to the impact of capabilities based on codified knowledge – because of the ease of imitability of codified knowledge. Based on the above discussion, Customer oriented capabilities are expected to have a higher marginal return on performance compared to technological capabilities.

Hypothesis 5: Customer oriented capabilities will have a greater positive impact on firm performance compared to the impact of Technological capabilities.

EMPIRICAL SETTING AND CONTEXT

The empirical setting is based on a field study conducted over 3 months at a large multinational software services firm headquartered in India. In the spirit of Bartel, Ichniowski, and Shaw (2004), this is a single firm study using detailed quantitative data at the project level to examine the key production processes by first identifying the production units (e.g. teams of employees) and then conducting econometric hypothesis testing to determine organizational specific determinants of
performance\textsuperscript{27}. The software services industry is particularly conducive for testing this type of theory as it is a high technology knowledge based industry where the chief resource is large numbers of talented and skilled software engineers that accounts for over 70\%\textsuperscript{28} of the costs of producing the service. This firm provides customized software solutions to various clients in different industries, e.g. Banking, Insurance, Telecom, Retail, Transport, Manufacturing, Pharmaceutical etc. In order to provide superior quality solutions, firms require a thorough knowledge of the various generic software technology platforms (Java, DotNet, Mainframe etc.) as well as a deep knowledge of the client’s industry and business imperatives. This particular Indian firm was faced with competitive challenge from foreign multinationals (e.g. ACCENTURE, IBM, HP, CSC, and several others) who had several decades of experience in providing customized IT services to clients across multiple industries. These foreign firms had now imitated some of the comparative cost advantages of the focal firm by setting up global software development centers in India and recruiting fresh graduates from Indian engineering schools at a fraction of the salary of their US based counterparts. Faced with such a competitive threat in its home country, this firm decided to upgrade its capabilities, especially in the delivery of high-end services tailored to its clients’ business requirements with a desire to bridge the capability gap between itself and the established foreign multinationals. With this goal in mind, the firm made huge investments in providing specialized training to its software engineers in different technology platforms and industry domains and then developed certification exams in those subjects to evaluate their learning and knowledge absorption. This capability development initiative is described in greater detail in Chapter 2.

Software services are normally rendered to clients through individual projects and therefore the hypotheses are tested using detailed operational, financial, and human capital data at the project level from a large sample of software development projects. Capabilities in this industry primarily

\textsuperscript{27} Ichniowski and Shaw (2003) use the term “Insider Econometrics” to describe such single firm studies using large sample of internal project-level data based on extensive field work.

\textsuperscript{28} The focal firm confirmed this 70\% figure for their cost of operations. Several interviews and discussions with industry professionals from multiple firms confirmed this rough figure for other Indian IT services firms as well. Earlier estimates by Lakha (1994) also suggest that labour costs accounted for about 70\% of all software costs in the early 1990s.
exist and evolve around software projects within firms therefore a software project was chosen as the appropriate level of analysis. Winter (2003) defined capabilities as high-level routines (or collection of routines) and since each project execution involves a combination of several different routines, our assumption is consistent with previous theory. Using a similar empirical setting, Ethiraj et al (2005) have demonstrated the positive performance impact of project management capabilities, while Huckman, Staats, and Upton (2009) have established the importance of team familiarity in high performing projects. Since the firm delivers service to customers by executing multiple projects with different customers, it may be assumed that firm performance is an aggregation of project team performance. Therefore, firm level inferences may be drawn from an analysis of a large sample of projects executed by a single large globally renowned company.

**METHODS AND DATA**

In the beginning several unstructured interviews of employees at different levels within a leading world class software services provider headquartered in India, were conducted to understand the software development process, the success factors, and the capability development initiatives undertaken by the firm. Then following Banerjee and Duflo (2000), detailed quantitative data at the project level was collected from this firm. Over 95% of its revenues are generated from export of customized software to foreign countries out of which over 60% comes from North American customers. The dataset includes information on revenues, project gross margin, human resource factor inputs, capability measures, and various project characteristics such as customer industry domain, team size, duration, technological platform, all recorded at the project level. The data consists of 465 software development projects completed by the firm over a 3 year period between April 2005 and March 2008. After dropping projects with missing data the sample was reduced to
427 projects\textsuperscript{29}. This sample size further fell to 347 projects after introducing the independent variables. Software development projects are often plagued with a variety of complexities and uncertainties due to rapidly changing technologies, client requirements, which cause schedule and cost overruns. The software development project level data consists of objective performance measures and controls that allows comparison across projects. In addition to the project level operational and financial data, human capital information was collected on 5,536 employees who worked in these projects. Data was collected on 21,502 certification examinations taken by these employees. Out of these 11,932 were technological exams and 9,570 were business domain exams. Using the exam scores aggregate team level competence measures were developed of each project team, for the two capabilities discussed earlier. The unit of analysis employed was a software development project executed by the firm for a given customer, and all variables were measured at the project-level to allow for proper estimation of the performance impact of the capabilities discussed earlier. The firm produces a single output, i.e. customized software using skilled manpower. Therefore project performance was regressed against the different capability variables and controlling for several project specific factors described below.

\section*{Measures}

\textit{Dependent variable}

\textit{Project Gross Profit}. The dependent variable is project gross profit (revenues minus direct costs). Direct costs include salaries for project team members, project related travel costs, and any software licenses required for the given project. As described earlier, the project costs consist almost entirely of skilled labour. All revenue numbers are in USD equivalents adjusted for currency fluctuations and recognized as of the day of the project delivery, i.e. end date. Project level gross

\textsuperscript{29} Projects with missing data did not vary substantially on the main variables compared to the projects with no missing data.
profit is an important outcome variable for a study on firm capabilities because the capabilities primarily exist around projects and are developed through repeated project execution for multiple customers over time. Firm profits may be assumed to be an aggregate of project profits, as the firm in this sample essentially executes different types of projects for customers, and does not have any other revenue generating service. Overhead costs were not included in the calculation of Project Gross Profit, as these were not related to the project-level capabilities that are measured. The dependent variable was logged and the year dummies in the regression account for any changes in overhead costs due to inflation over the 3 year time period30.

Independent variables

*Technological Capability.* Technological capability is measured by the level of technological expertise of the project team in the technology of a given project in which the team has been deployed. This variable was measured using exam scores of the team members in different technological exams administered by the firm to all employees. Several exams were developed in each technology stream (Java, DotNet, Mainframe, C++ etc.). The exams were offered in three different levels of increasing difficulty (level 1 being the lowest difficulty up to level 3 with the highest difficulty). Employees were allowed to take each exam after approval from their supervisors, and higher level exams could be taken only after clearing the lower levels. The firm provided specialized coursework and preparation material for each of these exams. These exams were mandatory and each employee had to take at least two such exams in a calendar year, the results of which were also tied to their annual performance appraisals. This rule ensured that these exams were taken seriously by the employees and they prepared well in advance to perform well and pass these exams.

For each project a technology competence score was developed by summing the exam scores of every employee that worked in the project. While calculating these scores the following

30 Entering the variables as levels does not change the results. Results are reported on logged variables for ease of interpretation.
principle was adopted – an exam score was included if the exam was in the same technology as the project technology, and if the exam was taken at least 90 days (3 months prior to the project completion date). Most of the projects in the sample ranged in duration between 3 months to 6 months, so this method ensured that the knowledge gained by the employee through taking the exam was adequately used in the project. This was also supported by several interviews that were conducted with senior managers and service delivery heads at the target firm. For exams with different levels a simple weighted score method was used by multiplying the exam score by 2 (for level 2 exams) and by 3 (for level 3 exams). The total exam score for a project was therefore the sum of the weighted exam scores of each employee involved in the project calculated after satisfying the above principles. The final score was then divided by the team size to arrive at the project technology competence score. This type of aggregation by calculating the mean team score follows from theoretical expositions on multilevel constructs by Chan (1998), and Klein and Kozlowski (2000). Higher value of the technology competence score should indicate higher technological expertise of the project team. This should ideally translate into higher productivity and hence reflect in higher gross profits. The expected sign on this variable is positive.

A second measure of technological capability was developed by aggregating the experience of all project team members in the particular technology of the project. For example if a project was using Java technology, then the total experience of all team members in the Java projects was added and averaged by the team size to arrive at the technological experience measure. The technological experience measure is in Months. Project teams with higher Technological experience are expected to develop better quality software that satisfies all the functional goals of the client as well as meet all technical requirements. Therefore such projects should also have higher efficiency and productivity, which should provide higher profits. The expected sign for this variable is positive.
**Customer Oriented Capability.** Customer Oriented Capability is measured by the level of client industry knowledge of the project team. A good understanding of the customer's industry allows a project team to develop higher quality software that meets the customer's business requirements. This expertise is different from pure technical expertise. Knowledge of a customer's business domain enables a team to appreciate the customer's business priorities. This knowledge helps in translating a customer's business requirements into technological specifications that is developed into a suitable product or service using various combinations of software and hardware.

Similar to the technical exams developed by the firm, several exams were also developed in different industry domains at three different levels with increasing difficulty. Following the same principles as the technological exams, a composite domain competence score was calculated for each project by summing the weighted scores (by the exam level) of each project team member and then normalizing that with the team size. Project teams with higher domain competence scores perform better while they develop software applications for customers and will translate into higher productivity and higher project gross profits. The expected sign for this variable is positive.

A second measure of customer oriented capability was developed by aggregating the experience of all project team members in the particular industry domain of the project client. For example if a project was from the Banking Domain, then the total experience of all team members in the banking projects was added and averaged by the team size to arrive at the domain experience measure. The domain experience measure is in months. Project teams with higher domain experience develop better quality software that satisfies all the business goals of the client. Therefore such projects have higher efficiency and productivity, which should provide higher profits. The expected sign for this variable is positive.

In summary the four capability measures employed here are measures of the knowledge capital of a team, and since capabilities reflect the deployment of resources (Makadok, 2001) it is expected that capability differences across projects within the same firm should be reflected in
productivity differences between them. Hence, increase in the knowledge capital of a project team is accompanied by increases in productivity of the knowledge resources (in this case human capital) over time.

**Control Variables**

Following past studies (Ethiraj et al, 2005; Huckman et al, 2009), a number of controls were used for different factors such as team size, project size and complexity (Function Point measure)\(^{31}\), total effort (person-hours), project duration (days), onsite-offshore effort ratio, customer industry, development platform technology, year, contract type, and critical defects that may impact project gross profit. They are described in the Appendix 2. Following the results of Ethiraj et al (2005), we also controlled for the three significant independent variables that they used for measuring project management capabilities, e.g. schedule slippage, in-process defects, and effort overrun. This was done to show the importance of capabilities over and above what was found in past studies. The models were estimated using fixed effects specification (Greene, 1997) because the customized software services output varies with clients and technologies, therefore it is essential to control for client specific effects by including dummies for the client industries. The coefficients of the fixed effect models are interpreted as the amount of variation of the dependent variable that is caused due to a unit change in the independent variable. Thus the regression analysis explains changes in project profit across different projects for a given customer in an industry by changes in the independent variables after controlling for various time invariant effects and project specific controls.

**RESULTS**

Table 11 presents the descriptive statistics and correlation matrix of the key variables used in this study. Table 12 presents the coefficient estimates from the fixed effects regression analysis. The

\(^{31}\) For more information on Function Points please see Jeffery, Low, & Barnes, 1993
second column mentions the predicted signs on the key independent variables used in the model. The column labeled Model 1 presents the base results with only the control variables in the model. The $R^2$ for this model is high and the controls account for 83 percent of the variance in the data. The signs on all the three independent variables used by Ethiraj et al (2005) are negative and significant thus validating previous results. In Model 2 the domain experience variable was introduced and as expected the sign is positive and this model continues to be highly significant with an $R^2$ of 85 percent. In Model 3 the business domain competence score was included to check for its impact on performance. Again this model is highly significant and the signs on the business domain experience and competence variables are positive and significant as expected. Next in Model 4 both the independent variables for business domain capability are included and the technology experience variable is added to check for its impact on project performance. Quite unexpectedly, the technological experience variable is found to be negative but not significant. Finally the technological competence score is added in Model 5 and although the sign is positive as expected, this does not have any significant impact on project performance. Using the full model (Model 5) to interpret the results, we find support for Hypotheses 1, 3, while Hypotheses 2 and 4 are not supported. Overall results show that Customer oriented capability has a positive impact on project performance, but Technological capability does not have any significant positive effect on project performance. Finally Hypothesis 5 is not supported as both the measures (domain experience and domain competence score) for customer oriented capability were found to have a positive and significant impact on project performance, however the technology capability measures (technology experience and technology competence score) did not have a positive and significant impact on performance. Therefore it may be safely concluded that the Customer Oriented Capability has significant impact on project performance while the Technological Capability does not.

In order to check whether other aggregation methods for certification exam scores might impact project performance, the same tests were conducted using the standard deviation of all the exam scores of a team, the standard deviation of the mean score of all team members, the median, and the
highest score obtained by any team member. This was done to check for any performance effects of
the dispersion of individual scores in a team, as well as to check if the median, the highest
performing member in a team could predict team performance regardless of the capabilities of the
other team members. In all the models these different scores were insignificant, except for the
standard deviation of the technology competence scores, which was found to have a marginally
significant negative impact (at 10% level) on project performance. In order to check for possible
effects of dispersion of employee experiences within a project team, similar tests were conducted for
the employee experiences by calculating the median, maximum, standard deviation, and variance of
the employee experiences (in both technologies and business domains). In all the models these
different measures of team experiences were insignificant. These results are consistent with the
results in Model 5 suggesting that the identified effects are robust to alternative explanations.
Possible interaction effects between the two experience variables and the two competence variables
were also tested but did not produce any significant results.

A variance inflation factor (VIF) test was conducted to check for multi-collinearity issues
and it was found that all the variables (independent as well as controls) had a VIF score that was
significantly less than 10\textsuperscript{32}. The mean VIF was 2.61.

\textsuperscript{32} A VIF of 10 is considered a threshold in many statistics text books, i.e. VIF over 10 signifies that there are serious multi-
collinearity problems in the sample. Majority of them were in the range of 1-5 and just one of the independent variables had
a VIF of 6.
Table 11: Descriptive statistics and correlation chart of variables (N=464)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>STDEV</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Gross Profit (1000s)</td>
<td>251.72</td>
<td>347.18</td>
<td>1</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>2 Team Size</td>
<td>11.98</td>
<td>10.11</td>
<td>0.707*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3 Size (Function Points)</td>
<td>1639.5</td>
<td>3280.58</td>
<td>0.534*</td>
<td>0.639*</td>
<td>1</td>
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<tr>
<td>4 Effort (Person hours)</td>
<td>10882.46</td>
<td>14892.25</td>
<td>0.793*</td>
<td>0.835*</td>
<td>0.713*</td>
<td>1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Project duration (days)</td>
<td>231.6</td>
<td>130.1</td>
<td>0.587*</td>
<td>0.468*</td>
<td>0.479*</td>
<td>0.609*</td>
<td>1</td>
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<td></td>
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</tr>
<tr>
<td>6 Onsite/Offshore ratio</td>
<td>0.36</td>
<td>1.24</td>
<td>-0.03</td>
<td>0.044</td>
<td>-0.002</td>
<td>-0.019</td>
<td>-0.048</td>
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</tr>
<tr>
<td>7 Critical In-process defects</td>
<td>0.023</td>
<td>0.049</td>
<td>0.009</td>
<td>0.024</td>
<td>-0.094*</td>
<td>0.026</td>
<td>-0.002</td>
<td>-0.033</td>
<td>1</td>
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</tr>
<tr>
<td>8 Effort Deviation</td>
<td>0.028</td>
<td>0.151</td>
<td>0.033</td>
<td>0.244*</td>
<td>0.209*</td>
<td>0.258*</td>
<td>0.127*</td>
<td>-0.018</td>
<td>0.01</td>
<td>1</td>
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</tr>
<tr>
<td>9 Schedule Slippage</td>
<td>0.061</td>
<td>0.227</td>
<td>0.008</td>
<td>0.07</td>
<td>0.066</td>
<td>0.087</td>
<td>0.222*</td>
<td>-0.0004</td>
<td>0.039</td>
<td>0.173*</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>10 Technology Competence Score</td>
<td>24.04</td>
<td>61.1</td>
<td>0.002</td>
<td>-0.123*</td>
<td>-0.13*</td>
<td>-0.074</td>
<td>-0.02</td>
<td>0.002</td>
<td>0.027</td>
<td>-0.15*</td>
<td>-0.105*</td>
<td>1</td>
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</tr>
<tr>
<td>11 Domain Competence Score</td>
<td>19.41</td>
<td>47.85</td>
<td>0.018</td>
<td>-0.089</td>
<td>-0.138*</td>
<td>-0.074</td>
<td>-0.04</td>
<td>0.026</td>
<td>0.06</td>
<td>-0.17*</td>
<td>-0.105*</td>
<td>0.656*</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Technology Experience</td>
<td>27.57</td>
<td>19.28</td>
<td>-0.034</td>
<td>-0.107*</td>
<td>-0.067</td>
<td>-0.041</td>
<td>0.01</td>
<td>0.017</td>
<td>0.041</td>
<td>-0.046</td>
<td>0.0167</td>
<td>0.073</td>
<td>0.05</td>
<td>1</td>
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</tr>
<tr>
<td>13 Domain Experience</td>
<td>42.75</td>
<td>30.63</td>
<td>0.078</td>
<td>-0.038</td>
<td>-0.032</td>
<td>0.029</td>
<td>0.19*</td>
<td>0.108*</td>
<td>-0.045</td>
<td>0.008</td>
<td>-0.01</td>
<td>0.158*</td>
<td>0.28*</td>
<td>0.31*</td>
<td>1</td>
</tr>
</tbody>
</table>

* Indicates coefficients significant at 0.05 level or lower
Table 12: Regression estimates

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Predicted Sign</th>
<th>Dependent Variable: log (Gross Profit)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td>Domain Experience</td>
<td>+</td>
<td>0.00227***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0009183)</td>
</tr>
<tr>
<td>Domain Competence Score</td>
<td>+</td>
<td>0.00255***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0008634)</td>
</tr>
<tr>
<td>Technology Experience</td>
<td>+</td>
<td>-0.0005052</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0016246)</td>
</tr>
<tr>
<td>Technology Competence Score</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effort Deviation</td>
<td>-</td>
<td>-1.354****</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.392)</td>
</tr>
<tr>
<td>Schedule Slippage</td>
<td>-</td>
<td>-0.265**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.123)</td>
</tr>
<tr>
<td>Critical In-Process Defects</td>
<td>-</td>
<td>-0.906**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.399)</td>
</tr>
<tr>
<td>Team Size(^a)</td>
<td></td>
<td>0.311****</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.068)</td>
</tr>
<tr>
<td>Project Size (FP)(^a)</td>
<td></td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.027)</td>
</tr>
<tr>
<td>Actual Effort (Person hours(^a))</td>
<td></td>
<td>0.628****</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.069)</td>
</tr>
<tr>
<td>Actual Project Duration(^a) (days)</td>
<td></td>
<td>0.273****</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.073)</td>
</tr>
<tr>
<td>Onsite/Offshore ratio</td>
<td>-</td>
<td>-0.048****</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.01)</td>
</tr>
<tr>
<td>Industry Domain</td>
<td>Sig</td>
<td>Sig</td>
</tr>
<tr>
<td>Technology Platform</td>
<td>Sig</td>
<td>Sig</td>
</tr>
<tr>
<td>Year</td>
<td>Sig</td>
<td>Sig</td>
</tr>
<tr>
<td>Contract Type</td>
<td>Sig</td>
<td>Sig</td>
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<tr>
<td>No Critical Defects</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No Domain Score</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No Technology Score</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.875****</td>
<td>-2.444****</td>
</tr>
<tr>
<td></td>
<td>(0.359)</td>
<td>(0.394)</td>
</tr>
<tr>
<td>R(^2)</td>
<td>0.8287</td>
<td>0.846</td>
</tr>
<tr>
<td>N</td>
<td>427</td>
<td>358</td>
</tr>
</tbody>
</table>

\(^a\) Variables are Logged. **** \(p \leq 0.001\); *** \(p \leq 0.01\); ** \(p \leq 0.05\); * \(p \leq 0.1\) Heteroskedasticity Robust Standard Errors reported in parentheses.
Evaluating Selection Bias

Selection bias is a possible concern when studying capabilities using large sample of project teams from a single firm. The selection bias could arise if team members are selected into projects based on their competence scores or experience in the firm, which were the key independent variables in my empirical model. This may happen if the project manager in conjunction with HR staff identifies the employees who scored very high on the certification exams and then selects the project team with the top scorers. This could also happen if the project manager selects teams with very high experience on the project technology or customer’s business domain. If this were true than any performance benefits resulting from the certification exam initiative or on the job learning might not be due to the formal or informal learning, but rather from selecting the smartest or most experienced employees into projects and avoiding employees with low scores or low experience. If the smartest or most experienced employees work in a project, it is expected to perform well compared to other projects, so the team competence scores are not capturing the knowledge gained from the training and certification exams. Similarly, it is probable that the employee experience variable is not capturing the knowledge gained through on the job learning. In order to evaluate these issues it is important to examine how software development projects are staffed. After detailed interviews with the executives at my focal firm it was discovered that the first step in project staffing is estimation of project size and complexity (function points), effort (person days), and schedule (duration) of a new project. The software industry is very competitive with several major multinationals (e.g. IBM, Accenture, HP, TCS, Infosys, Wipro, HCL, Cognizant, etc.) competing for customer projects. Therefore firms do not have too much latitude to add slack into the estimates as that might engender losing the project. The project manager is assigned to a project after a customer agrees to the effort and schedule estimates, which also provides detailed guidelines on the type of people who will work on the project (e.g. DotNet programmer with 5 years’ experience). The project manager does not select specific employees for projects. There is a staffing group that provides software engineers based on the required skills and experience detailed in the initial estimates.
guideline. Generally employees are engaged in one project at a time and after the project is complete all team members are released by the manager to work on any new opportunities that are available at that time. A project manager cannot hold on to his best software engineers indefinitely after the completion of a project, as the supply of software engineers has been constrained in the past few years and the utilization rate of engineers has to be maintained at a high level in order to meet margin requirements. If a software engineer is engaged in a client project, he is a billable resource that earns money for the firm, but if kept on bench, the firm still has to pay his salary. During several interviews with senior executives, project managers from the focal firm, the idea of selecting project teams based on their certification exam scores was categorically denied.

In order to check if certification examination performance or employee experience is used as a criterion for staffing projects, some tests were conducted to see if any of the certification exam competency scores and team experience measures are significantly related to a project’s original size, schedule, and effort estimates. As mentioned earlier, the original size, schedule, and effort estimates are made based on the complexity of the project after receiving the contract. Over the duration of the project, however the actual schedule and effort can deviate from the original estimates, thereby causing overruns and slippages, which are costly for the firm as evidenced by their negative impact on project performance in Model 1. A significant relationship could mean that the staffing executives had anticipated that the project would be complex and therefore they created a team with the best performers in the certification exams as well as the highly experienced employees. It could also mean that the estimates were determined based on the capability of the team as reflected by their performance in the certification exam performance and firm experience in different technologies and business domains.
Table 13: Regression estimates for addressing possible sample selection bias due to project team staffing based on exam scores and experience

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Predicted Sign</th>
<th>Dependent Variable (Domain Experience)</th>
<th>Dependent Variable (Domain competence score)</th>
<th>Dependent Variable (Technology Experience)</th>
<th>Dependent Variable (Technology competence score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Effort (person hours)</td>
<td>+</td>
<td>-0.00022 (0.00015)</td>
<td>0.000015 (0.00018)</td>
<td>-0.00002 (0.00011)</td>
<td>-0.0001 (0.00025)</td>
</tr>
<tr>
<td>Estimated Duration (days)</td>
<td>+</td>
<td>0.02 (0.027)</td>
<td>0.012 (0.029)</td>
<td>0.015 (0.019)</td>
<td>0.0135 (0.049)</td>
</tr>
<tr>
<td>Project Size (FP)*</td>
<td>+</td>
<td>0.566 (1.496)</td>
<td>0.068 (1.48)</td>
<td>-0.52 (1.37)</td>
<td>2.654 (1.737)</td>
</tr>
</tbody>
</table>

Controls

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Size</td>
<td>-11.198*** (3.659)</td>
<td>-17.81** (7.57)</td>
<td>-13.14**** (2.66)</td>
<td>-35.8**** (9.78)</td>
</tr>
<tr>
<td>Person hours*</td>
<td>4.114 (3.758)</td>
<td>11.11* (5.86)</td>
<td>7.76*** (2.73)</td>
<td>18.738** (8.07)</td>
</tr>
<tr>
<td>Project Duration*</td>
<td>5.469 (6.186)</td>
<td>-2.8 (8.2)</td>
<td>-2.147 (4.61)</td>
<td>3.403 (8.272)</td>
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<tr>
<td>Onsite/Offshore ratio</td>
<td>1.24 (0.889)</td>
<td>-0.188 (1.284)</td>
<td>0.173 (0.476)</td>
<td>0.0227 (1.955)</td>
</tr>
<tr>
<td>Domain Controls</td>
<td>Sig</td>
<td>Sig</td>
<td>Sig</td>
<td>Not Sig</td>
</tr>
<tr>
<td>Technology Platform Controls</td>
<td>Sig</td>
<td>Sig</td>
<td>Sig</td>
<td>Sig</td>
</tr>
<tr>
<td>Year</td>
<td>Sig</td>
<td>Sig</td>
<td>Sig</td>
<td>Sig</td>
</tr>
<tr>
<td>Contract Type</td>
<td>Not Sig</td>
<td>Sig</td>
<td>Not Sig</td>
<td>Sig</td>
</tr>
<tr>
<td>Constant</td>
<td>10.679</td>
<td>-45.118</td>
<td>-11.558</td>
<td>-126.5***</td>
</tr>
</tbody>
</table>

R² | 0.5121 | 0.5487 | 0.4067 | 0.5401 |
N | 359 | 411 | 365 | 411 |

* Variables are Logged. **** p ≤ 0.001 ; *** p ≤ 0.01 ; ** p ≤ 0.05 ; * p ≤ 0.1 Heteroskedasticity Robust Standard Errors reported in parentheses
Table 13 presents the regression results using the original size, effort, and schedule estimates as predictors and the two competency scores (technological and domain) and experience variables (technological and domain) as outcome variables. Four separate models were run for the four outcomes. All models were good fit, but none of the predictors had any significant impact on the two competency scores and the two experience variables. In order to account for unobserved ability of project team members, the final model 5 in Table 12 was re-run with project costs as an additional control and the results were unchanged (Please see Table 14). Project costs consist mainly of employee (project team members) salaries (over 70%) in this high-technology IT services industry and salaries are also correlated with unobserved ability of employees (the firm is highly meritocratic), therefore the project cost control maybe considered an effective control for the omitted variable which may impact both the outcome (gross profit) and the four independent variables (Domain & Technology Experience, and Domain and Technology Competence Scores).
Table 14: Regression estimates using project cost as control for addressing possible sample selection bias due to unobserved ability of project team members

<table>
<thead>
<tr>
<th>Independent Variables</th>
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<th>Dependent Variable: log (Gross Profit)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Model 6</td>
<td></td>
</tr>
<tr>
<td>Domain Experience</td>
<td>+</td>
<td>0.0016433* (0.0009315)</td>
</tr>
<tr>
<td>Domain Competence Score</td>
<td>+</td>
<td>0.0022886** (0.0010721)</td>
</tr>
<tr>
<td>Technology Experience</td>
<td>+</td>
<td>-0.0002901 (0.0016069)</td>
</tr>
<tr>
<td>Technology Competence Score</td>
<td>+</td>
<td>0.0005439 (0.0007039)</td>
</tr>
</tbody>
</table>

** Controls **

<table>
<thead>
<tr>
<th>Variables</th>
<th>Predicted Sign</th>
<th>Dependent Variable: log (Gross Profit)</th>
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</thead>
<tbody>
<tr>
<td>Effort Deviation</td>
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<td>-1.70975**** (0.4412494)</td>
</tr>
<tr>
<td>Schedule Slippage</td>
<td>-</td>
<td>-0.1556906 (0.1114155)</td>
</tr>
<tr>
<td>Critical In-Process Defects</td>
<td>-</td>
<td>-0.7667114* (0.4194901)</td>
</tr>
<tr>
<td>Project cost</td>
<td></td>
<td>0.0003493*** (0.0001269)</td>
</tr>
<tr>
<td>Team Size&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>0.3499554**** (0.0803404)</td>
</tr>
<tr>
<td>Project Size (FP)&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>0.0209032 (0.0299398)</td>
</tr>
<tr>
<td>Actual Effort (Person hours&lt;sup&gt;a&lt;/sup&gt;)</td>
<td></td>
<td>0.5693734**** (0.0757266)</td>
</tr>
<tr>
<td>Actual Project Duration&lt;sup&gt;a&lt;/sup&gt; (days)</td>
<td></td>
<td>0.1293379* (0.0745164)</td>
</tr>
<tr>
<td>Onsite/Offshore ratio</td>
<td></td>
<td>-0.066158**** (0.0120184)</td>
</tr>
<tr>
<td>Industry Domain</td>
<td>Sig</td>
<td></td>
</tr>
<tr>
<td>Technology Platform</td>
<td>Sig</td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Sig</td>
<td></td>
</tr>
<tr>
<td>Contract Type</td>
<td>Sig</td>
<td></td>
</tr>
<tr>
<td>No Critical Defects</td>
<td>Sig</td>
<td></td>
</tr>
<tr>
<td>No Domain Score</td>
<td>Sig</td>
<td></td>
</tr>
<tr>
<td>No Technology Score</td>
<td>Not Sig</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-2.114683**** (0.4632806)</td>
<td>0.8457 (347)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Variables are Logged. **** p ≤ 0.001 ; *** p ≤ 0.01 ; ** p ≤ 0.05 ; * p ≤ 0.1 Heteroskedasticity Robust Standard Errors reported in parentheses.
Finally the residuals of the four models in table 13 were saved and used separately as four new variables. Then the full model in table 12 was re-run using these four residual variables instead of the four independent variables. The results were similar in both sign and significance as the final model 5 in table 12, thus suggesting that the relationship between the independent variables and the dependent variable is not driven by selection. This result does not conclusively prove that there was random assignment of employees while staffing projects, however it gives us confidence that selection was not the main reason for the results in this paper.

DISCUSSION

Two related research questions were examined in this paper: How are capabilities developed and how do they impact firm performance? It was argued that capabilities are developed over time through various path dependent processes such as learning by doing, and deliberate sustained investments of capital and resources. It was proposed that capabilities are context-specific and therefore they must be conceptualized and studied at the operational level within firms. Two different capabilities that are critical for success in the global IT services industry were identified: customer oriented capability and technological capability. The focal firm made deliberate investments with the strategic intent to develop these capabilities and compete successfully with its established foreign rivals and these investments bore fruit. The results suggest that firms can develop such capabilities through formal modes such as specialized training and evaluation or informally overtime through work-based learning/experiential learning.

The interplay of these two capability development modes and the two capabilities led to the four hypotheses. The results supported the two customer oriented capability hypotheses. Since there was no technological discontinuity (Anderson and Tushman, 1990) in the software technologies used in the projects during this period, the negative sign on the experience variable cannot be attributed to such a phenomenon.
The significant positive effect of business domain competence on project performance shows that the investments made by the focal firm in training its employees and evaluating them through certification examinations in order to develop their customer knowledge paid off. A 1 unit increase in business domain competence score resulted in 0.24 percent increase in project profits. However the same investment in formal training and certification exam evaluation in order to develop technological knowledge did not pay off. Table 15 shows regression results with the technological capability variables entered independently and customer oriented capability variables added later. It is not surprising to find that the technological competence score has a positive and significant effect on project performance while the technological experience variable is insignificant. However, the significance of technological competence score vanishes when the domain competence score is added while the domain competence score has a positive and significant impact thus overshadowing the effect of technological competence on project performance. This suggests that the domain competence score is a more appropriate proxy for the capability of a team. This could also be attributed to the high correlation between technological and domain scores suggesting that teams that scored high on technological certifications also did well on the domain certifications.

33 For an average project this implies an increase of about $600 in gross profits for an increase of 1 point in average team score
Table 15: Regression estimates with Technology Capability variables added independently

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Predicted Sign</th>
<th>Dependent Variable: log (Gross Profit)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
</tr>
<tr>
<td>Technology Competence Score</td>
<td>+</td>
<td>0.00154*** (0.0005468)</td>
</tr>
<tr>
<td>Technology Experience</td>
<td>+</td>
<td>0.0006775 (0.0016474)</td>
</tr>
<tr>
<td>Domain Competence Score</td>
<td>+</td>
<td>0.002986*** (0.0011164)</td>
</tr>
<tr>
<td>Domain Experience</td>
<td>+</td>
<td>0.0018978** (0.0009335)</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effort Deviation</td>
<td>-</td>
<td>-1.354**** (0.392)</td>
</tr>
<tr>
<td>Schedule Slippage</td>
<td>-</td>
<td>-0.265** (0.123)</td>
</tr>
<tr>
<td>Critical In-Process Defects</td>
<td>-</td>
<td>-0.906** (0.399)</td>
</tr>
<tr>
<td>Team Size</td>
<td>0.311**** (0.068)</td>
<td>0.385111**** (0.0717931)</td>
</tr>
<tr>
<td>Project Size (FP)</td>
<td>0.015 (0.027)</td>
<td>0.0210705 (0.0293356)</td>
</tr>
<tr>
<td>Actual Effort (Person hours*)</td>
<td>0.628**** (0.069)</td>
<td>0.5917**** (0.0712214)</td>
</tr>
<tr>
<td>Actual Project Duration (days)</td>
<td>0.273**** (0.073)</td>
<td>0.2552**** (0.0691519)</td>
</tr>
<tr>
<td>Onsite/Offshore ratio</td>
<td>-0.048**** (0.01)</td>
<td>-0.0524**** (0.0117184)</td>
</tr>
<tr>
<td>Industry Domain</td>
<td>Sig</td>
<td>Sig</td>
</tr>
<tr>
<td>Technology Platform</td>
<td>Sig</td>
<td>Sig</td>
</tr>
<tr>
<td>Year</td>
<td>Sig</td>
<td>Sig</td>
</tr>
<tr>
<td>Contract Type</td>
<td>Sig</td>
<td>Sig</td>
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<tr>
<td>No Critical Defects</td>
<td>Sig</td>
<td>Sig</td>
</tr>
<tr>
<td>No Domain Score</td>
<td>-</td>
<td>Sig</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.875**** (0.359)</td>
<td>-2.8821**** (0.4235807)</td>
</tr>
</tbody>
</table>

R² 0.8287 0.8319 0.8397 0.843 0.8428
N 427 410 353 353 347

* Variables are Logged. "**** p ≤ 0.001 ; "*** p ≤ 0.01 ; "** p ≤ 0.05 ; "* p ≤ 0.1 Heteroskedasticity Robust Standard Errors reported in parentheses.
The final model results suggest that these technology certifications did enhance the knowledge of the employees however this knowledge did not translate itself into superior performance in developing better quality software applications. The theoretical rationale for this may be that technological knowledge is more codifiable and therefore once learned during the initial training after joining the firm, can be easily utilized in actual project work to enhance project performance. Extra training and certification exams in future years did not add much to employees’ technological expertise that could be readily utilized in actual project work. Domain knowledge being more subjective and tacit in nature is relatively difficult to codify. However once certain portions of domain knowledge are codified in the form of training manuals and certification exams they can now be translated into actual project work in a relatively straightforward manner and create value.

Another possible explanation for the non-significance of technological capability could be because technological capability is table-stakes, without which firms will be non-competitive and therefore not be able to participate in the market. A threshold level of technical expertise is necessary to bid for client assignments and deliver the services therefore all firms competing in this industry are expected to have that level of expertise. However this also suggests that inability to keep up with the latest technological advances could be very costly. Technological capability being table stakes, led to convergence in project performance while customer oriented capability caused variance in project performance. Customer orientation is therefore critical for a firm aiming to provide differentiated services to its clients.

These results indicate that the ability of the firm to codify various aspects of customer domain knowledge in the form of certification exam questions, and then administer them to its employees had a positive and significant impact on project performance. This finding is important because, past studies suggest that tacit knowledge is difficult to transfer and has the ability to impart competitive advantage to its owner, and this study shows one potential method of codifying tacit knowledge and transferring it to employees through mandatory certification exams with beneficial outcomes for the firm.
Similarly for increased customer business domain experience, the project performance increases as the business domain expertise is accumulated over several years of experience in the client’s industry and seems to be more valuable compared to technological experience. A 1 unit increase in business domain experience resulted in 0.19 percent increase in project profits. The employees with high levels of business domain experience adequately compensate for their increased salary by their superior contribution to the project performance. Therefore we find that while customer oriented capabilities can be developed through deliberate investments in acquiring the relevant expertise and knowledge, through focused coursework and certification evaluation examinations, technological capabilities do not seem to be developed by making similar investments. Instead technological capabilities can perhaps be developed through the initial training provided to the fresh graduates after induction.

It was argued that investment in building capabilities will lead to better project performance and showed that different types of capabilities yield different marginal contributions to performance. Finally some evidence of capability evolution over time as a result of the deliberate investments in acquiring technological and domain specific competence was also found. The certification examinations came into effect after the first year (2006) in the sample therefore their impact could be seen in the performance of projects in the later two years (2007-8). It was found that average gross contribution on projects increased from 65.9 percent in the first year to 69.3 percent in the later two years. Thus the investments in developing technological and customer oriented capabilities resulted in positive performance effects at the project level. Tighter control over interim project milestones, and better schedule estimation and management resulted in a reduction of average schedule slippage of projects by 64% in the last two years (2007 and 2008) compared to the first year (2006). This emphasizes the value of improving schedule estimation and sticking to them.

\[ \text{For an average project this implies an increase of about $480 in gross profits for an increase of 1 month in average team experience} \]
This study on firm capabilities brings forward several important issues in business strategy. Firstly, it shows that firms develop capabilities with some strategic intent and deliberate investments in different types of learning modes (formal instruction/evaluation and work-based experiential learning) are conducive to building different types of capabilities. The role of knowledge type (tacit and explicit) is emphasized in determining the mode of capability development through learning – while training and certification exams enable accumulation of codified knowledge, experiential learning allows employees to absorb tacit knowledge. To our knowledge there has not been any study linking capability development with knowledge type and measuring their performance impact. This result also shows that capabilities that are based on primarily tacit knowledge (business domain knowledge) generate significant value for the firm compared to capabilities based on already codified knowledge (technological knowledge). Technological capabilities are more generalized in nature compared to customer oriented capabilities which are specialized and not fungible across multiple industries. Such expertise is difficult to develop in the first place, as it requires asset specific investments (in this case specialized training materials, certification exams, etc.), but once such investments are made, those specialized capabilities create superior value for the firm and provide enduring advantage over competitors. As a logical follow-on from my findings, it is clear that specialized capabilities based on primarily tacit knowledge (in this case Customer Oriented capability) are subject to time compression diseconomies (Dierickx and Cool, 1989), therefore firms that already possess such capabilities may enjoy an advantage over those that do not.

Further, this study shows that firm capabilities can be identified, analyzed, and measured at the operational level in different industries and these should be contextually grounded in order for scholars to decompose their individual performance implications. Since every industry is driven by its own supply and demand economics, which changes over time, it is essential to account for these differences while identifying and measuring the impact of firm capabilities. Holding project inputs and other characteristics constant it was found that there are differences in the way a firm utilizes its resources over time and improvement in managing effort overrun and in-process defects leads to
better performance. Thus it is apparent that differential ability to productively deploy resources and develop capabilities is the cause of performance differences (Makadok, 2001).

The process of capability development in this industry through specific investments and change management efforts by firms’ senior management team was examined and it was empirically demonstrated that certain capability development modes are more suitable for certain capabilities (i.e. they have higher marginal impact on performance) than others in this industry. This will inform firm level managerial decisions on which type of capabilities they should invest in as well as when to invest in acquiring/developing such capabilities. It is possible that different firms will face different costs and benefits in acquiring different capabilities, due to various interdependencies with other organizational choices (Ethiraj and Levinthal, 2004). Therefore firms can decide to focus on those capabilities for which their marginal returns are higher. More generally, this study is about how a developing country firm was able to generate high end capabilities by making deliberate and focused investments to improve its human capital and create value. Given that this firm was faced with competitive threat form established foreign multinational firms who already possessed such high-end customer oriented capabilities by virtue of decades of experience, this study reveals an alternative method of narrowing the capability gap by making appropriate investments. Such initiatives also serve as credible signals of the firm’s ability to provide high value added services to its customers, and increase their willingness to grant them more high-end project contracts in future.

Capabilities have largely been researched in numerous industry settings with the use of aggregate firm performance as a dependent variable (Ray *et al*, 2004). Prior research has mostly focused on the relationship of numerous independent variables and aggregate firm performance (Newbert, 2007). Consistent with Ray *et al’s* (2004) call for more research attention to the selection of disaggregated dependent variables, project performance was chosen as the dependent variable to address this knowledge gap. Thus measuring capabilities using individual employee knowledge attributes at the micro operational levels seems to be a promising line of research since it allows
better estimation of their economic significance and also gives clear direction for scholars and practitioners on when and how to improve their capabilities by making appropriate investments. Capability measurement at the aggregate firm level does not shed light on the true foundations of the capabilities, and how exactly they can be built. Finally this study helps in enhancing scholarly understanding of what type of capabilities are important in a high technology services industry and how they may be developed. Contrary to popular belief, it was found that it is not pure technological expertise that matters, but knowledge of the customer’s business and the ability to apply technology to solve customer’s business problems that provides increasing returns and creates superior value for the firm.

Limitation and Directions for Future Research

Like most other studies this has some limitations. Firstly, this is a single firm study in one particular industry with its own economics and idiosyncrasies and therefore generalizability to other settings is unclear. However as asserted above that study of capabilities is context dependent (Winter, 2003; Teece et al, 1997) precisely due to this reason (that different industries have their own set of economics and peculiarities which change over time), the results assume significance. Capabilities that are generalizable across several industries may be rather abstract and less meaningful for scholars as well as practitioners in assisting decision making. Ideally it would have been better to include projects from multiple firms, but it is extremely difficult to obtain such a rich set of detailed operational data, as well as performance data at the same operational level from a large number of firms. Keeping this data gathering challenge in mind this study assumes greater significance. Since the target firm is among the top five in the Indian IT services industry on several dimensions such as growth, profitability, reputation (as well as among the leading global IT services firms), the results hold promise in terms of generalizability within the industry. Also, the findings will be applicable to any firm which develops a technology that is used by a variety of customers with different
requirements such that customization of the technology is necessary to realize their goals. Value addition will happen with customization and firms will earn superior returns. It also gives me confidence regarding the strategy-capabilities-performance relationship. The insight that knowledge type (tacit and explicit) plays a role in capability development activities is probably generalizable across other industries. It is reasonable to expect that capabilities based on primarily codified knowledge can be relatively quickly developed through specialized training programs, however those that are more tacit in nature need to be developed over time through on the job learning, and hence are subject to time compression diseconomies (Dierickx and Cool, 1989). The idea of narrowing the capability gap between a firm and its established competitors through alternative investments in a firms’ human capital, and customer signaling can also be ported to other industry settings. In conclusion, this paper made an attempt to establish the link between firm strategy and capability development. It identified two different capabilities and pointed out the convenient modes of developing those capabilities that will result in demonstrated performance enhancement. Hopefully this study will encourage future papers that develop contextually grounded capability measures and tease out the marginal impact of capabilities in different industries. This will further our understanding of what types of capabilities are important to achieve success in different industries, how to develop them, and how they relate to firm strategy, impact performance, and ultimately result in performance differences among firms.
CHAPTER 5: CONCLUSION

As discussed in the introduction, the three essays in this dissertation address the dynamic relationship between competition, capability development, and corporate scope. The first chapter conducts an in-depth case study to trace the journey of a firm as it attempted to evolve from being a leading global information technology services provider to a leading business solutions provider. Chapter 2 showed that it was absolutely important for top management to put in place the correct incentives such as the link of annual certification assessments with career progress within the firm, to bring about such a change within the firm. Other factors that proved to be crucial were inspirational leadership that led by example by rolling out the initiative in a top-down manner, as well as availability of enablers such as focused training, study materials, and online knowledge repositories to facilitate employee learning.

Chapter 3 empirically examines the phenomenon of competition between U.S. and Indian IT services firms and their complementary capability-seeking investments to expand their corporate scope. By conducting an event study of the competitive actions of these firms, the second chapter examines one set of decisions related to corporate scope – the decision to acquire, or deliberately invest to develop capabilities when faced with foreign competition – and examines the consequences of these decisions on firms’ and rivals’ stock market performance. It develops a theoretical model of the relationship between capability-seeking investments and their impact on firms’ stock suggesting that when firms make investments to seek high-value added capabilities (those requiring high levels of tacit and socially complex knowledge), they will face greater challenges compared to firms making investments to access low-value added capabilities (those requiring more operational and cost efficiency). This is primarily due to the difficulty in building relationships with various stakeholders, and absorbing and incorporating the tacit socially complex knowledge into routines that enables a firm to offer high value added services. The stock market understands these challenges and
differentially penalizes firms upon making these investment announcements. Firms already possessing high value added capabilities have advantage over firms that do not.

Finally Chapter 4 examines the specific investments made by a leading Indian IT services firm to develop high-value added capabilities through organic methods (internal development) with the ultimate strategic intent of competing with established foreign rivals. At a theoretical level, it draws upon the knowledge based view of the firm to argue that firm capabilities are a combination of individual employees’ capabilities which are manifested in the form of performance at the operational levels where the real action takes place. It further draws upon evolutionary theory and the capabilities literature to assert that certain capabilities that are more operational in nature contribute towards technical fitness, while others that have more of a customer value addition flavor contribute towards evolutionary fitness of the firm. The customer oriented capabilities have the superior potential to impart ecological fitness because they enable the firm to gain in-depth knowledge of one of its primary stakeholders – the customer, which allows the firm to offer high value added services and adapt to the market as well as extract more business in future. Using detailed project-level operational, financial, and human capital data from a leading multinational firm in the global IT services industry, this chapter shows that deliberate and focused investments in improving human capital helps in developing superior capabilities, which enables the firm to offer higher value added services to its customers, thus expanding its corporate portfolio. The empirical results show that customer oriented capabilities provide more significant marginal returns to the firm compared to technological capabilities in this high technology services setting thus suggesting that the returns from capabilities that provide evolutionary fitness are more significant than those of operational capabilities. This study adds to a more fine grained understanding of capability evolution within a firm and its impact on scope and from a methodological perspective, introduces previously unexplored human capital variables to measure capabilities. More importantly, this study shows that customer oriented capabilities that are based on business domain knowledge that is more tacit in nature and client relationships that are socially complex, can in fact be developed through deliberate
investments in training and certification assessments. Most rivals of this firm have adopted the inorganic route for accessing these capabilities by buying business consulting firms with several years of experience in this domain. However, the oft-held notion that such capabilities are simply a function of time and can be developed only through experience was overturned as the firm exemplified the process through which primarily tacit-knowledge based capabilities (e.g. customer oriented capabilities) could actually be developed through focused training and codification by preparing and administering mandatory certification exams to employees.

Overall this dissertation makes both a theoretical and an empirical contribution to the strategy literature on firm evolution. On the theoretical side the dissertation enriches our theoretical understanding of the dynamic relationship between competition, deliberate capability-seeking investments, and corporate scope. While existing work theorizes about the dynamic co-adaptive relationship between capability development and corporate scope (Penrose, 1959; Wernerfelt, 1984; Jacobides and Winter, 2005; Brown and Eisenhardt, 1998; Helfat and Raubitschek, 2000; Helfat and Eisenhardt, 2004), it says little about the specific investment decisions underlying the development of new capabilities, and does not explore the impact of competition on such initiatives. Also there is scant examination of the impact of rival firms’ investments on firm’s capability development activities (Chatterjee, 1986; and Oxley, Sampson, and Silverman, 2009 are notable exceptions) since rival firms’ capabilities could in fact alter the relative value of a firm’s own technological capabilities (Henderson and Mitchell, 1997). The dissertation identifies factors both internal (deliberate internal capability-seeking investments) and external (rival investments) to the firm that impact the evolution of new capabilities and the emergence of an expanded corporate scope. In doing so, it provides additional insights on the internal capability development processes that underlies firm evolution as well as the performance implications of such investments. By analyzing the impact of rival investments on firm’s stock performance, the dissertation goes beyond existing models of technology-scope and thereby extends the literature on the effect of competition on capabilities (Henderson and Mitchell, 1997) by showing how the capability effects of competition cause the
emergence of a new corporate scope. More generally, by combining insights from the competitive and corporate strategy literatures, this dissertation provides a more comprehensive understanding of firm evolution that combines the effect of capability-seeking investments of rivals on firm’s own capability evolution process and the eventual outcomes on performance and scope.

On the empirical side, this dissertation is among the first to provide robust large sample quantitative evidence for the development of dynamic capabilities within a firm by creating, extending and modifying its existing resource-base (Helfat et al, 2007) to develop superior capabilities and meet competitive challenge from established global firms. This validates prior work in this area that has mostly been limited to qualitative and case-based papers. A number of fine grained measures of technological and customer oriented capabilities were introduced using individual certification exam scores and work experience aggregated at the team level. This was an improvement over previous work that has generally used patents, and accounting measures (such as advertising and R&D expenditures) as proxies for similar capabilities. In Chapter 3, the dissertation makes a methodological contribution by combining both own-firm and rival firm announcement impacts to study the stock market effect on capability-seeking investments. While Eckbo (1983) and Oxley et al (2009) have done similar treatments of firms and their horizontal rivals, they did not analyze the stock market impact of both announcing and non-announcing firms, which is a unique contribution to the literature. More broadly, the methodology employed in Chapter 3 can be applied far beyond the analysis of capability-seeking investments of firms and rivals to other important events with competitive implications such as strategic and policy decisions, including M&A, patent filings and races, lawsuits, market entry and expansion, top management turnover, and exogenous factors such as government regulations. By analyzing the effect of one firm’s strategic actions on the market value of its rivals, this methodology can inspire future research on such competitive behavior.

The dissertation has implications for both research and practice. On the research side this thesis not only contributes to work on firm evolution, but also has relevance for both competitive
and corporate strategy as it illuminates the relationship between competition, capability development and emergence of a new corporate scope. In particular this research is relevant for the literature on dynamic capability since the co-adaptation of capabilities and corporate scope is essential for an examination of the manner in which firms re-invent themselves and reallocate their resources to stay competitive (Helfat et al, 2007; Augier and Teece, 2009). This dissertation emphasizes the role played by rival firms’ capability seeking investments in dampening the focal firms’ stock performance, and therefore is relevant to the work on competitive interaction more generally (Cool and Dierickx, 1993; Chen, 1996; Smith, Grimm, Wally, and Young, 1997; Chen and MacMillan, 1992; Chen, Smith, and Grimm, 1992; Chen, Su, and Tsai, 2007). Moreover this dissertation relates the phenomenon of convergence in the global IT services industry, where most leading firms are making serious investments to offer end-to-end services spanning business consulting and technology consulting. This points to a specific strategic rationale – firms seem to have realized that there are sufficient synergies at the capabilities level to justify such massive investments and therefore they are racing to build the most inimitable sources of competitive advantage by adopting such a strategy.

Chapters 2 and 4 demonstrate the tenacity of management effort in upgrading the skills of employees through specialized training and certification evaluation with the ultimate strategic objective of developing superior organizational capabilities to meet the competitive challenge from established rivals. The dissertation clearly shows that capabilities that are socially complex, contextual and non-fungible across customer domains, and primarily based on tacit knowledge can be developed internally through strategic learning initiatives. This type of strategically motivated deliberate investment is exemplary in the management literature and has implications for firm capability development in the IT and other knowledge services contexts. In summary the results of Chapter 4 are indicative (being a single firm study) rather than definitive, they provide a provocative challenge to the prevailing view that tacit knowledge based business consulting capabilities can only be developed through external mechanisms such as M&A or experientially.
This thesis is also relevant for practitioners of strategy. By combining competitive and corporate strategy literatures this mirrors the viewpoint of managers who need to make decisions on corporate scope and capability development/acquisition decisions in tandem with the competitive landscape. The dissertation’s focus on rival firms’ investments and stock market impact also adds to managerial relevance since it emphasizes the need for managers to think about the stock market performance of own firm’s as well as rivals’ while making decisions on capability-seeking investments. Past literature has provided limited guidance to managers on the various modes of developing capabilities which are primarily tacit knowledge based – the predominant logic was to develop such capabilities through experience over long time periods, or through acquisition of other firms that are already experienced. However this dissertation points to an alternative mode of developing such capabilities through focused training and codification of certain portions of tacit knowledge by preparing and administering mandatory certification exam assessments to employees. Finally by conducting in-depth case study on a leading firm in the global IT services industry, this dissertation provides managers with a more nuanced and comprehensive understanding of firm evolution in this context. Learning from Infosys’s experience managers in other firms can think more globally (involving rivals actions and stock market performances) while making corporate strategic investments as well as improve their capability development mechanisms. Also following Winter’s (1995) suggestion about profitability arising from replication of successful routines, this type of capability development initiative points to a novel routine that can now be replicated by the firm continuously to create value.

Avenues for future research

While this dissertation contributes to the existing literature in myriad ways, it also opens up a number of additional questions for further study. Therefore this work represents the first step in a larger research program around firm evolution and the dynamics of competition and scope. In
concluding the dissertation it is important therefore to draw attention to some areas for future research as suggested by the findings in the chapters.

Firstly, an interesting area for future research is to examine the impact of capability seeking investments by firms and rivals, on internal performance measures (such as financial performance, future corporate scope in terms of diversity of services offered) of firms. In combination with the stock market performance, these internal performance measures will provide a more comprehensive understanding of how firms own and rivals competitive actions affect its performance. The outcome of such heroic capability development efforts can also be assessed by recording the evolution of market share of firms in different types of software services (e.g. IT/Business Architecture Design, ERP, System Integration, Application Development, Maintenance, BPO etc.) over a span of 10-15 years (say 1995-2010). If the market share of high-value added services offered by the firm improves over time, then it may be reasonably concluded that the capability development initiatives have been successful. A temporal analysis of the evolution of services mix can also reveal changing trends in the industry such as obsolescence of certain types of services and introduction of new services.

Another potentially interesting area for future research is to expand the set of companies to include IT services firms from Europe and other regions (apart from US and Indian) in the sample that was used in Chapter 3. While the results of chapter 3 suggest that Indian firms are at a disadvantage compared to U.S. firms due to their lower levels of software architectural capability, it will be interesting to see the impact of capability-seeking investments on the stock of firms form other regions of the world. This will reveal the relative strengths and weaknesses of firms from Europe and other regions vis-à-vis US and Indian firms.

Second, future research could examine a firm’s internal capability-seeking investments over time using similar large sample project-level data from multiple time periods separated by distinct investment regimes (or treatments), and then analyze their impact on performance and show the evolution of capabilities. This will unambiguously demonstrate the role of deliberate investments in
building dynamic capabilities in the IT services context. Another interesting study could inspect the effect of dispersion of individual capabilities (both technological and customer oriented) within a project team on project performance. These results could point to an optimal distribution of knowledge and experience within a team that produces higher performance. Additionally, subject to availability of data, future studies could conduct a similar analysis of dynamic capabilities using large sample project-level data from multiple firms from the same industry. This will validate the findings of chapter 4 as well as reveal interesting differences between firms attempting to develop similar capabilities. The results can contribute to the literature on sources of firm heterogeneity and dynamic capabilities more generally.

Finally future research could study other inorganic modes (alliances, JVs, M&A) of accessing high value added capabilities and compare the outcomes with that of Infosys Technologies that chose to develop such capabilities internally. The comparison of different modes of developing similar capabilities by accounting for various antecedents of such initiatives as well as path dependence of firms promises to be an interesting study that can contribute to the literature on corporate development as well as firm evolution.

In conclusion this dissertation contributes to the literature on firm evolution by extending existing theory around the dynamics of competition, firm capabilities, and corporate scope. It provides empirical and anecdotal evidence of the co-adaptive relationship between competitive imperatives, capability seeking investments, and their eventual effect on corporate scope. Additionally it suggests avenues of future research that can help us better understand how firms adapt and evolve over time.
APPENDICES

APPENDIX 1: CAPABILITY-SEEKING INVESTMENT ANNOUNCEMENTS

Example of an Indian firm investing in U.S. to acquire Software Architectural Capabilities –

Infosys

PRESS RELEASE

Top American Consultants take own advice and join Indian Firm

Senior leaders from top consulting firms join Infosys to build a new generation consulting firm.

Bangalore - April 8, 2004: An ensemble of consulting leaders have left their posts at the industry's top strategy and technology firms to team with Infosys Technologies Limited (NASDAQ: INFY) in launching a new business consulting firm that specializes in making companies more competitive.

The new firm, Infosys Consulting, Inc., was incorporated in Texas and is a wholly owned subsidiary of Infosys Technologies Limited.

“We have taken a somewhat unconventional approach to build our consulting capabilities. Having witnessed numerous failed mergers and acquisitions in this industry, we are instead assembling a dream team of top consultants from all the major firms and focus on building capabilities because we see our mission as helping companies to build a new generation consulting firm. While our beginnings may be modest, our vision is ambitious,” said S. Gopalakrishnan, Chairperson, Infosys Consulting, Inc.

“This represents an important step in the evolution of Infosys. We believe this is a more prudent and lower risk approach,” said Nandan M. Nilekani, CEO, Infosys Technologies Limited. “Infosys Consulting will be hiring aggressively in the United States and expects to provide a platform for top consulting talent.”

The founding officers include Stephen Pratt, one of the Top 25 consultants in the world by Consulting Magazine (2003); Ramesh Bahl, former leader of EDS’ 5000-person consulting practice; Paul Cole, former leader of global operations at CGI, and Raj Joshi, former CEO of Deloitte Offshore. (Profiles of the founding officers are available at www.infosys.com)

“After years of advising clients on how to get more competitive, it’s high time the consulting industry took some of its own advice. This is a wake-up call to our industry: we will offer clients more competitively priced projects, practical ways to increase competitiveness, and a much higher return on their consulting dollar,” says Infosys Consulting CEO Stephen Pratt.

“We will combine top consulting talent with what I believe is the world’s best global delivery model. For clients currently using traditional consulting firms this offers a new alternative. For current Infosys clients, this presents an additional way to use the global delivery model to their full advantage. It makes complete sense for our industry – and no other consulting firm can offer this today. The global delivery model is baked into the Infosys DNA and I have personal experience that this model cannot be replicated by others within the foreseeable future,” says Pratt. “The role of business consultants is to maximize the value they create for clients. This simplifies a better way to do that.”

In addition to building a more competitive model for consulting, Infosys Consulting will focus on making clients more competitive. “The business world has largely forgotten, or at least underestimated, the impact of competitiveness, and we believe it is the dominant predictor of business performance – and shareholder value,” Pratt says.

The company will introduce a host of new services to the traditional consulting mix: up-front competitive edge assessments; proprietary industry analyses; and projects structured around heating the competition,” said Pratt. It also will offer workshops and training designed to hone the competitive mindset of client organizations.

For a full presentation about the new firm, including profiles of its founding members, visit www.infosys.com.
Example of a U.S. firm investing in India to acquire Software Implementation Capabilities –

Accenture Opens New Offshore Development Facility in India

October 29, 2001

New Center in India, Bolsters Company’s Outsourcing, Software Development and Hosting Offerings

NEW YORK, Oct. 29, 2001 – Accenture today announced the opening of new technology-development facilities in India that will enable the company to broaden its offerings in outsourcing, software development and hosting services.

Located in Mumbai (formerly Bombay), the new facility complements Accenture’s existing offshore resources in the Philippines and Spain and are part of a global network of more than 20 Accenture Delivery Centers. These centers enable the company to provide a full range of technology-driven services, including business-process outsourcing, application development, management and hosting, and technology infrastructure development and outsourcing.

Combining High-Quality Service with Lower Delivery Costs

In particular, the addition of the new delivery center will help the company aggressively expand its core offerings in the area of business transformation outsourcing — restructuring and outsourcing entire business processes for enhanced business performance, cost management and growth. “The new facility in India will allow us to combine Accenture’s deep range of technology resources with lower cost of service delivery. This is a significant differentiator for us,” said James Hall, managing partner of Accenture’s Technology Business Solutions unit. “Our clients will benefit from a variety of new development options, a deeper pool of skilled resources and greater cost flexibility.”

India Center Staffs Up with High-Quality Talent Pool

The Mumbai Delivery Center, Accenture’s first development site in India, is currently staffed with software engineers with expertise in UNIX, Microsoft and SAP. The center is focusing initially on enterprise application development. “Our Mumbai Delivery Center will give us the flexibility to offer Accenture value at a new range of price points,” said Sid Khan, the Accenture partner who oversees business development at the Mumbai center. “The quality and size of the local talent pool will enable us to offer a wider array of offshore services to our clients while keeping a single-minded focus on delivering business value — not just software and technology.”

About Accenture

Accenture is the world’s leading provider of management and technology consulting services and solutions, with more than 75,000 people in 46 countries delivering a wide range of specialized capabilities and solutions to clients across all industries. Accenture operates globally with one common brand and business model designed to enable the company to serve its clients on a consistent basis around the world. Under its strategy, Accenture is building a network of businesses to meet the full range of any organization’s needs – consulting, technology, outsourcing, alliances and venture capital. Its home page is [http://www.accenture.com](http://www.accenture.com).
APPENDIX 2: Variable Descriptions

<table>
<thead>
<tr>
<th>Control Variable</th>
<th>Description</th>
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<tr>
<td><strong>Team Size</strong></td>
<td>Team size is expected to have an impact on project profitability. Profitability is expected to increase with team size if a small team does the entire project work and is overworked. Similarly profitability is expected to decrease with team size if a large team causes coordination problems leading to delay and inefficiency. Although the team size often varies during the different phases of a project, the peak team size is considered a good indicator of the total size of work delivered to the customer (This was validated by multiple interviews of project managers conducted onsite). This variable was logged to make the distribution normal and can be interpreted as elasticity with respect to project profitability.</td>
</tr>
<tr>
<td><strong>Project size and complexity</strong></td>
<td>Project size is expected to impact profitability. Below a minimum efficient scale, higher project size is expected to increase profitability and above a maximum efficient scale higher project size is expected to decrease profitability. The project size was measured using function points (FP) which gives a composite measure of project size and complexity. This FP measure (Albrecht and Gaffney, 1983) is an improved metric compared to kilo-lines of code used earlier which simply gives the magnitude of the software code written with no information about the complexity of the software delivered\textsuperscript{35}. This variable was logged to make the distribution normal and can be interpreted as elasticity with respect to project profitability.</td>
</tr>
<tr>
<td><strong>Effort (Person-hours)</strong></td>
<td>The team size measure is somewhat imperfect control of the amount of work delivered since there may be attrition during the project, or some team members may be working part time causing the team size measure to be overstated. Therefore person-hours of effort expended during the project is a more precise control of project size. This variable is also logged in the model to make the distribution normal and can be interpreted as elasticity with respect to profitability.</td>
</tr>
<tr>
<td><strong>Project duration</strong></td>
<td>Duration is an important control variable as longer projects often lead to cost overruns, employee attrition, and schedule slippage. Project duration is measured in actual days elapsed during the project execution (i.e. between the project start and end dates). This variable is also logged to make the distribution normal and may be interpreted as elasticity with respect to profitability.</td>
</tr>
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\textsuperscript{35} For more information on Function Points please see Jeffery, Low, & Barnes, 1993
<table>
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<th>Variable</th>
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<tr>
<td><strong>Onsite Offshore ratio</strong></td>
<td>The location of software development has an impact on the costs due to factor (resource inputs such as labour, materials, etc.) price differences in different countries, hence it is essential to control for these differences across projects. In some projects customers may request for more onsite personnel for trust building purposes, while in others they may ask for more offshore presence to seek a price reduction for the services delivered. This variable is measured as a ratio of the person hours of effort expended in onsite (i.e. client location) against the person hours of effort expended in offshore location (i.e. India). This variable is not logged and its impact can be interpreted directly as levels by taking exponents of the coefficient in the model.</td>
</tr>
<tr>
<td><strong>Customer Industry Domains</strong></td>
<td>The target firm executed projects for multiple customers in different industries. Project profitability is expected to vary by the customer’s industry as appropriability conditions may vary by industry, as well as the firm’s software development capability may also vary by industry. This capability may not be fungible across industry domains as domain knowledge is unique to a given industry. To control for these industry-specific differences dummy variables were included for Banking &amp; Financial Services, Insurance &amp; Healthcare, Retail, Manufacturing, Telecom Media &amp; Entertainment, and Energy &amp; Utilities industry groups. The omitted category was ‘other’.</td>
</tr>
<tr>
<td><strong>Development Platform Controls</strong></td>
<td>Project profitability can depend on the technological platform on which the software is developed. Older legacy applications are expected to incur lower costs compared to newer technologies which require substantial learning and start-up costs by software vendors. To control for these differences, dummy variables were introduced to distinguish between Java, DotNet, Mainframe/Cobol/JCL, Unix, C++, and Datawarehouse technologies. The omitted category was ‘other’.</td>
</tr>
<tr>
<td><strong>Year</strong></td>
<td>Year dummies were used in all models to control for time. The year dummies reflect the fiscal year in which each project was completed and delivered (There was no change in overall results when the project start year was used as dummy). This control captures the variance in the project profitability due to exchange rate fluctuations, inflation, changes in economic cycles, and supply/demand of software services over time.</td>
</tr>
<tr>
<td><strong>Contract type</strong></td>
<td>There were three types of contracts in the sample: Fixed price, time and material (T&amp;M), and Cap T&amp;M (time and material with a limit). Global service delivery capabilities may differ in these contracts. Profitability may also differ in different contract types as the terms of these contracts have an impact on the appropriability of returns as discussed earlier. Dummies were used for these contract types.</td>
</tr>
<tr>
<td>Control</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>No Critical Defects</strong></td>
<td>This control was used to distinguish between projects that had at least one critical in-process defect and those that had no critical in-process defects. This variable was used only in models where the critical in-process defect variable was included. A majority of projects did not have any critical in-process defect therefore this control was necessary to avoid any biases resulting from this.</td>
</tr>
<tr>
<td><strong>No Technology Competence Score</strong></td>
<td>This control was used to account for some projects where the technology exam scores were not available. These projects were mostly from the first year (2006), when the exams were taken mostly by senior management and not yet administered to all employees.</td>
</tr>
<tr>
<td><strong>No Domain Competence Score</strong></td>
<td>This control was used to account for some projects where the business domain exam scores were not available. These projects were mostly from the first year (2006), when the exams were taken mostly by senior management and not yet administered to all employees.</td>
</tr>
<tr>
<td><strong>Effort Deviation</strong></td>
<td>Ratio of (Actual Effort minus Estimated Effort) divided by Estimated Effort (person-hours).</td>
</tr>
<tr>
<td><strong>Schedule Slippage</strong></td>
<td>Ratio of (Actual Duration minus Estimated Duration) divided by Estimated Duration (days).</td>
</tr>
<tr>
<td><strong>Critical In-Process Defects</strong></td>
<td>Count of the number of Critical Defects that were encountered during project execution divided by size of the project (Function Point measure described above).</td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY –


Knickerbocker FT. 1973. Oligopolistic Reaction and Multinational Enterprise. Division of Research, Graduate School of Business Administration, Harvard University, Boston.


