andy driver
DESIGN ILLUSTRATION
ARTWORK RETOUCHING
M 07944 643920
E andy.driver@btopenworld.com

JOB No EE_0246_v2
CONTACT Andy Driver
DATE SENT 25.03.2009
BOOK TITLE
The Business Of Solutions
EDITOR Emma Dermott
PRODUCTION CONTROLLER Ilsa Williamson
ORDER No 37494
SPINE BULK 14mm
JACKET SIZE: Royal PPC 234mm x 156mm
COLOURS: CMYK

PLEASE NOTE:
Colours on the laser printed proof may differ slightly to those viewed on the PDF due to the nature of laser printing compared to the colour values seen on the screen.

The Business of Solutions

This book is the first to systematically explore the integrated systems business model.

The path towards the provision of solutions poses a number of challenges for manufacturers in terms of capabilities development and configuration: firms that offer solutions must shift from manufacturing to service capabilities, as they are required to provide services previously carried out by business users. Federica Ceci delves deeply into the nature, dimensions, and dynamics of this new business model, deploying research and analytical techniques from a variety of disciplines including the theory of the firm, operations management, strategic management, and innovation studies.

This enlightening book will be warmly welcomed by graduate students, scholars, consultants and practitioners in the fields of business strategy, technology strategy, operations management, management of information systems and technological change.

Federica Ceci is Assistant Professor of Innovation Management at DASTA – University G. D'Annunzio, Italy.

EDWARD ELGAR: A FAMILY BUSINESS IN INTERNATIONAL PUBLISHING

The Lypiatts, 15 Lansdown Road
Cheltenham, Glos, GL50 2JA, UK
Tel: +44 (0) 1242 226934 Fax: +44 (0) 1242 262111
Email: info@e-elgar.co.uk

William Pratt House, 9 Dewey Court
Northampton, MA 01060, USA
Tel: +1 413 584 5551 Fax: +1 413 584 9933
Email: elgarinfo@e-elgar.com

www.e-elgar.com

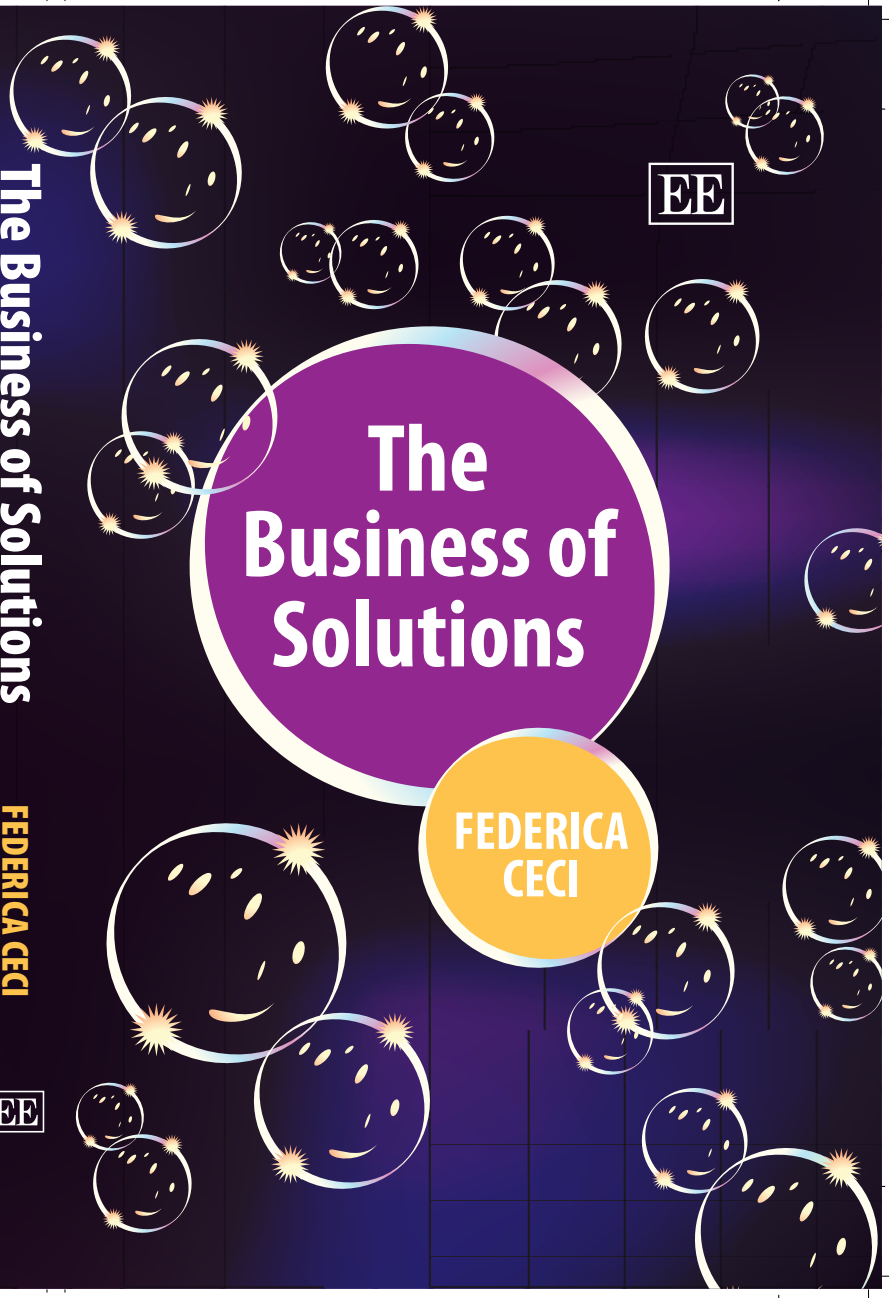
ISBN 978-1-84844-185-9

9 781848 441859

The Business of Solutions

FEDERICA CECI

EE



The Business of Solutions

The Business of Solutions

Federica Ceci
Assistant Professor of Innovation Manangement, DASTA
University G.d'Annunzio, Italy

Edward Elgar
Cheltenham, UK • Northampton, MA, USA

Published by
Edward Elgar Publishing Limited
The Lypiatts
15 Lansdown Road
Cheltenham
Glos GL50 2JA
UK

Edward Elgar Publishing, Inc.
William Pratt House
9 Dewey Court
Northampton
Massachusetts 01060
USA

A catalogue record for this book
is available from the British Library

Library of Congress Control Number: 2009928608

ISBN 978 1 84844 185 9

Contents

Figures and Tables

FIGURES

TABLES

Preface

The Business of Solutions is a pioneering book about the emergence of a new model for the 21st century business organization.

The historical turning point arrived in 1993 when IBM, under the leadership of Louis Gerstner, began to focus on the provision of information technology, products and services as high-value integrated solutions to each customer's needs. Demand for solutions emanated from IBM's customers – large business and government organizations. They wanted suppliers to develop an intimate understanding of their pressing IT-related business problems and provide solutions that integrated technology and products from a variety of firms. IBM was one of the first companies to respond to this opportunity by radically changing its strategy, organization and core capabilities – a long process which is ongoing. This integrated solutions business model spread rapidly to other firms in the IT industry and was soon embraced by practically all capital goods industries such as telecommunications, aerospace, railways, energy and construction.

The provision of solutions is difficult for managers and firms that remain tied to a production-centric world concerned with the pursuit of excellence in technology, product development and production – creating new things and improving how these things are made. In contrast to this concern with upstream production capabilities, the provision of solutions focuses our attention downstream on developing the customer-centric capabilities needed to acquire an in-depth understanding of a customer's changing needs, expectations and fears and provides a range of services to match. Integrated solutions may be market-led, but they require many new technological innovations to support a product during its operational life, such as embedded software systems to monitor and control operational performance and

modular systems made of reconfigurable and easy-to-maintain components.

The discipline of economics can be defined as the allocation of scarce resources in the pursuit of ends. Production-centric businesses take the ends as a given and focus their efforts almost entirely on the means – launching new products and reducing costs. Customer-centric businesses are more concerned with the end, rather than the means. The resources and capabilities of these solutions providers are focused intensely on the value a product provides for a customer over time. For example, if the ultimate end is to ensure that aircraft engines are extremely efficient and reliable, it makes sense to redesign the whole production system rather than just produce new aircraft engines. This is what Rolls-Royce did when it developed its 'power-by-the-hour' offering, which uses embedded software, live satellite feeds and three global operation centers to provide airlines with 24/7 real-time support and maintenance.

Integrated solutions are becoming attractive to large US and European companies and industries that face increasing global competition in high-volume consumer goods and standardized production activities. As the source of competitive advantage shifts to high-value added services and solutions, more firms will be faced with the challenge that this new business model poses for firm strategy, capabilities and organization.

The Business of Solutions by Federica Ceci contributes greatly to our understanding of this problem through an in-depth and comprehensive study of firms in the IT sector – the industry that continues to be at the forefront of change in integrated solutions. Ceci draws upon an impressive range of theoretical lenses to frame, analyze and interpret her empirical findings, including the resource-based view of the firm, contingency theory, new institutional economics and transaction cost economics. The book provides a thorough review of the literature on integrated solutions, including journal articles, books, PhD theses, working papers and consultancy reports covering a variety of disciplines such as innovation studies, organizational science, economics, strategic management and marketing.

One of the major contributions of this book is to guard against what institutional theorists call isomorphism: the tendency for organizations within an industry to become more similar to each other over time. Ceci is careful to

recognize the variety of approaches to integrated solutions provision that firms can pursue. A taxonomy of integrated solutions capabilities helps to identify the diverse capabilities that IT firms have developed. A structure–environment model accounts for the different decisions that prospective integrated solutions providers must make as they seek to achieve a good 'fit' between the capabilities of the firm and its external environment. A framework for analyzing insourcing and outsourcing decisions contributes to our understanding of the boundary of the integrated solution firm. Finally, Ceci recognizes one push towards homogenization: the importance of 'systems integration' as the core capability that all integrated solutions must have to bring together diverse knowledge bases in a vertically-disintegrated supply chain.

The book has an important message for the field of innovation studies. While technology-based innovation in an increasingly open and global supply chain continues to attract a great deal of scholarly attention, more research needs to be undertaken to understand the downstream dynamics of market-facing innovation in services and solutions.

Studies of integrated solutions have recently appeared in the leading management and business practitioner journals and efforts by IBM and HP to promote university curriculum on 'services science' suggests that interest in this subject is likely to increase significantly in the coming years. Federica Ceci's book will provide an important reference point for all future research that seeks to improve our understanding on the long-term journey into integrated solutions over the next decade.

Dr Andrew Davies
Reader in Innovation Management
Imperial College Business School
London

Acknowledgements

This book is the result of the interaction I had with all the people that I've been so lucky to be in contact with; without the encouragement, the support and the friendship of these people, I daresay, the book would not have been possible. The most important is undoubtedly Andrea Prencipe (University G.d'Annnunzio) who has always been present, providing important comments on my work, pushing and encouraging me.

I want also to express my sincere gratitude to other researchers and professors who showed interest in my work: Angelo Cichelli (University G.d'Annnunzio), Andrew Davies (Imperial College), Andrea Masini (London Business School), Michael Hobday and Tim Brady (University of Brighton). I would also like to take this opportunity to acknowledge the precious help of Lynn Hand, who corrected and edited the whole manuscript, Francine O'Sullivan, Jennifer Wilcox, Emma Dermott (Edward Elgar Publishing) and all those managers and engineers who dedicated their precious time to sharing their knowledge and experience with me: their names cannot be disclosed, to preserve confidentiality.

On a final note, I want to acknowledge my friends around Europe and my colleagues in Pescara who shared their time with me discussing academia, research, economics, innovation and life. A very special thanks goes to the people that I love most: my parents for their unconditioned love and my brother who, with his sarcasm, always makes me laugh. Without the endless patience and encouragement of Alessandro I would not have survived and I want to thank him for being the special person he is.

Chapter 2 is based on the paper published in *Industry & Innovation*, **15**(3) and reprinted with the kind permission of Taylor & Francis.

Federica Ceci

1. Introduction

The provision of integrated bundles of products and services has gained strategic importance across a variety of industrial sectors (Davies et al. 2006). Scholars have labelled this trend 'integrated solutions' (Wise and Baumgartner 1999). The emergence of the integrated solution business model suggests that added value resides in supplying bundled systems rather than individual subsystems. Aircraft engine manufacturers, for instance, do not sell engines to airlines; rather, through innovative contracts – such as the Rolls-Royce 'power-by-the-hour' – they offer a supply of continuous power matched to the effective usage of the airline. Aircraft manufacturers provide an integrated solution so that the customer airline pays a fixed rate that includes both capital and operating costs. A similar example is found in the information technology (IT) sector, in which ERP (Enterprise Resource Planning) systems comprising hardware, software, and technical support and assistance are increasingly offered as turnkey solutions. The IT clients do not buy single components from different firms. Instead, they purchase a complete ERP system from a single supplier that provides software and hardware as well as consultancy services, post-sales assistance, system customization, and hardware maintenance. In some situations it is also possible to outsource the management of the complete IT system to the external provider, that charges a fixed rate for the storage, management, and processing of data and information.

Three types of factors underpin the integrated solutions business model. First, there are 'economic factors': services have longer life cycles and generate larger revenues than products. 'Market factors' are also involved, because integrated solutions enable firms to satisfy increasing customer demand for services. Finally, 'competitive factors' underlie the integrated

solutions model as well. Services are more difficult to replicate, and a competitive advantage based on service thus is more defensible.

The path toward the provision of integrated solutions poses a number of challenges for manufacturers in terms of capabilities development and configuration. Firms that offer integrated solutions must shift from manufacturing to service capabilities, as they are required to provide services previously carried out by business users (for example, after-sales support, maintenance, training, operations, financing, consultancy, and service provision). They must also develop both the coordinative capabilities required to manage new types of long-term relationships with suppliers and customers and the embedded service technologies required to support the provision of integrated solutions. These include maintenance-oriented control technologies (mainly based on digital electronics), remote diagnostics, system operations, and so on. Firms are reinventing themselves as systems integrators that are able to provide integrated solutions for their customers, thereby changing their position in the value stream (Prencipe et al. 2003; Wise and Baumgartner 1999).

This book systematically explores the business model of integrated solutions. It delves deeply into the nature, dimensions, and dynamics of this new business model, deploying research and analytical techniques from a variety of disciplines including the theory of the firm, operations management, strategic management, and innovation studies. This work provides deep insights into the solutions business model, supported by an abundance of empirical evidence.

OUTLINE OF THE BOOK

The book is organized into two main parts. The first part focuses on the importance to firms of having adequate capabilities to offer integrated solutions. I discuss the different configurations of capabilities that integrated solutions providers adopt and how those configurations must be matched with the external environment to achieve superior performance. The second part of the book describes the relationships between systems integration and

integrated solutions, paying special attention to the impact of the integrated solutions business model on firms' boundaries.

Part One A Capabilities Approach to Solutions

Chapter 2 Paths towards integrated solutions

The most important challenge that firms face when moving into the business of integrated solutions is the development of appropriate capabilities. To embrace this new business model, firms must change their position in the value stream so as to become able to manage bundles of products and services. Based on qualitative data, Chapter 2 is exploratory in nature. In it I use empirical evidence collected in the IT sector to illustrate the capabilities required for firms to offer integrated solutions, and I impose a taxonomy upon these capabilities. Since the firms do not all develop and manage the same set of capabilities, the taxonomy represents a fundamental starting point from which to further analyze the capabilities configuration decision and its determining factors.

Chapter 3 Integrated solutions and capabilities configuration: coexistence of diverse approaches

In the previous chapter I discussed the importance of developing or reconfiguring existing capabilities when firms move into the new competitive space of integrated solutions, the third chapter identifies various strategic choices adopted by integrated solutions providers and examines whether these choices provide specific advantages in different environments. Drawing upon the resource-based view and contingency theory, I propose a model of fit between the environmental requirements of the firm and the types of integrated solutions capabilities developed. I then test this model by applying a clustering algorithm to empirical data from a sample of European IT providers. The results suggest the existence of four different configurations, that is, four different approaches to the offering of integrated solutions. The analysis of clusters shows that differences in fit between environmental variables and strategic choices partially account for performance differences.

Chapter 4 Further exploration of capabilities configuration: the importance of fit with the environment

The structure–environment approach suggests that the selection of coherent combinations of organizational capabilities and operational environments has performance implications. Research in the area of operations management has sought to determine how firms can best align their competitive capabilities and process-specialization level to their operating strategy. A pioneer in this area, Skinner (1974) pointed out the importance of focusing on a few, narrowly defined core activities in order to be competitive. The so-called 'focused factory' is proposed as the antithesis of the conventional factory, which tries to achieve multiple objectives without focusing and, as a result, loses competitive advantage. Multiple capabilities are not free, and firms should choose to develop new capabilities only if the environment supports it. In Chapter 4 I discuss the value of specialized capabilities, analyzing their fit with the operational environment. My results show that providers that possess specialized capabilities obtain greater benefits when they operate in homogeneous environments.

Part Two Systems Integration and Solutions

Chapter 5 Outsourcing dynamics in the business of solutions

The adoption of the new business model requires changes in firms' boundaries through extensive interfirm collaboration and/or the creation of a network of suppliers. Researchers in New Institutional/Transaction Cost economics have explained how firms may choose their boundaries (Williamson 1985). These and other theoretical contributions from eminent scholars lay the theoretical groundwork for the development of an understanding of outsourcing dynamics in the integrated solutions context. In Chapter 5 I explore the rationales behind outsourcing/insourcing decisions, investigating diverse aspects of outsourcing processes such as the characteristics of activities externalized, the relevance of outsourcing for the core business, and relationships with suppliers.

Chapter 6 Systems integration and integrated solutions

The multiple capabilities configurations that firms adopt when moving into the integrated solutions business model pose questions regarding how best to integrate diverse activities and knowledge bases. The disintegration of activities and their dispersion in a network of multiple suppliers presents challenges to firms needing to integrate the various subsystems created by different firms. The observed evolution of sectors desegregates activities among specialized actors and pushes integrated solutions providers to act as systems integrators. In Chapter 6 I analyze the ways that firms coordinate dispersed capabilities. The importance of systems integration capabilities is illustrated using empirical evidence from IT providers in Europe. I argue that systems integration capabilities play a paramount role in enabling the integration of activities diffused throughout the value chain.

THE SOLUTIONS BUSINESS MODEL IN PRACTICE: SUCCESSFUL APPLICATIONS

Since the aim of the book is to provide a systematic understanding of the managerial issues related to the integrated solutions business model, the remainder of this chapter reports cases from diverse business sectors. As discussed before, the solutions' business model is adopted in a variety of industrial sectors and assumes diverse configurations according to the specificities of the context. Such cases are based on empirical evidence from information technology, aerospace and defence, electronic systems and automotive (Davies et al. 2006, 2007; Kapletia 2003; Prencipe 1997). They provide empirical grounding and noteworthy examples to initiate the reader to the practice of the solutions, offering success cases of diverse and complementary ways to intend and implement the business of solutions.

The IT Sector and ERP Solutions: IBM Global Services[1]

The International Business Machines Corporation, now known as IBM, was founded in the US at the beginning of the twentieth century. The entrepreneurial idea was the brainchild of Thomas J. Watson Sr, who united a variety of small companies in the creation of IBM. At the beginning of its story, technological products, some highly heterogeneous, constituted IBM's

core business. An important shift in IBM's strategy occurred in the 1960s, however, when IT technologies became pervasive in the economy. Thomas J. Watson Jr, the son of the founder, concentrated all of IBM's activities in a new line of products, the System/360, and with this move the firm entered the digital sector.

IBM's offer was highly innovative compared to those of its competitors, and this very innovation allowed the firm to achieve a leadership position in the mainframes market. IBM correctly managed its first-mover advantage, securing an important market share until the 1980s. The mainframe business became the new core business for the company: all its diverse activities – hardware and software production, sales, and customer service – were driven by the needs of the mainframe market. Gerstner (2002) defines the IBM of those days as a 'mainframe company'.

In the early 1980s, IBM entered the personal computer market, another innovation in its business model. It created a large network of suppliers, small and medium-sized enterprises (SMEs) to which it outsourced the production of single components. IBM personal computers were not internally sourced but rather were the result of careful assembly and integration activities carried out by IBM. The decision to outsource the production of microprocessors to Intel and the production of operating systems to Microsoft forced IBM to give up control over certain essential components of the system, however. Intel and Microsoft entered into the market as independent producers, creating separate markets for single components beyond the market for the final product, the fully assembled personal computer.

In 1993 Louis V. Gerstner became the new CEO of IBM. His task was to introduce and implement radical changes in the company. IBM's failure appeared inevitable to many, but Gerstner worked hard to change IBM's competitive positioning, renewing its image and pushing toward the creation of a customer-oriented company. Gerstner transformed IBM from a mere machine assembler into an integrated solutions provider. By infusing a profound shift in the firm's culture, and with the collaboration of all of IBM's managers, Gerstner achieved an impressive turnaround and avoided the predicted failure. He did this by increasing the role of services in the

firm's overall offering, essentially shifting the core business downstream in the value chain. Gerstner's most important intuition was the understanding that competitive advantage was no longer to be found in the manufacturing of complex products, but rather in the integration and the functioning of those products. This integration is still present in the services offered by IBM (Gerstner, 2002). IBM Global Services is a service-dedicated structure comprising four divisions:

- IBM Business Consulting Services
- IBM Application Management Services
- IBM Integrated Technology Services
- IBM Strategic Outsourcing

IBM Business Consulting Services is IBM's business division that was created to support the client offering services of global consulting. These offerings include a wide range of solutions that integrate different technologies with a strategic analysis of the business. The activities of IBM Application Management Services focus on the offering of services aimed at the support, maintenance, management and development of any application for the whole application life cycle. This division largely relies on competencies already developed by IBM in past years and used to offer application management services within IBM itself. IBM Integrated Technology Services is a division created to manage services linked to infrastructures. Its offering comprises a variety of customizable solutions, designed to support the businesses of SMEs at varying levels of complexity. In this case, IBM uses advanced technologies integrated by consultants who specialize in understanding the needs of SMEs. IBM Strategic Outsourcing division is a delivery unit that handles the management of the entire IT system of the client. These IT systems are completely outsourced to the vendor. This type of contract is highly strategic for both parties, since it implies a long-term relationship between vendor and client.

Some years after the reorganization of the business, IBM continued along its path toward the integration of products and services, launching a business-on-demand offering. Business-on-demand can be seen as an extension of IBM's strategic outsourcing services. The idea is to provide the client with

customized services at the exact moment that these are needed. Servers and software are installed, as is any other infrastructure needed to assure the functioning of the system. The maintenance of the hard and soft components of the systems, networked connections, and secure access are managed by IBM itself, which remains the owner of the whole system. IBM 'lends' the system to the client but continues to oversee its functioning. A distinctive aspect of this offering is the complete separation between the client and the infrastructure it is using for its business. The client is not familiar with the functioning of the system; in many cases the firm does not even know its exact location. Rather, the client pays for the effective use of the system. In this case, the IT services are treated as utilities, for which the client pays a 'bill' computed on the basis of its actual usage. This new application revolutionizes the way IT services are viewed by the end user and, most importantly, the way IT service providers must structure their organizations. The adoption of this new type of offering requires a flexible and efficient organization that is able to manage the increasing complexity an IT firm faces.

IVECO: Successful Solutions in the Automotive Sector[2]

Iveco is an Italian manufacturer that specializes in industrial vehicles. Its range of products includes light, medium, and heavy commercial vehicles; buses; special vehicles; firefighting vehicles; and diesel engines. A subsidiary of the Fiat Group, it produces approximately 200 000 commercial vehicles annually. It is one of the world's largest producers of light commercial vehicles (vehicles with a maximum allowed mass of up to 3.5 tons).

Iveco was founded in 1975 and since that time its offerings have always been characterized by additional services, mainly financial. This is due to the nature of the sector: many of Iveco's clients are small entrepreneurial firms, and they highly appreciate these additional financial services. In fact, in many cases, these financial services are essential for the buyer to acquire the vehicle. A division of Fiat Group provides these services. This type of offering is a common strategy among industrial vehicle producers, since it is strictly linked with the characteristics of the product sold. At the beginning of 2000, Iveco began to heavily invest in services, increasing the role of its

customer service division. The Iveco 2007 official report shows a turnover of €11 billion, of which €1.2 billion were from the after-sales division. Iveco's 2007 profit was €800 million, of which the after-sales division's profit constituted half. Such data shows the importance of the service division for Iveco's overall business.

Services became central for the business because through them Iveco managed to offer real value-added to the customer. Research shows that an industrial vehicle used for business produces revenues for its owner only 20 days over 250 days of use. Thus, simply to break even – to cover costs such as the vehicle price, maintenance, insurance, taxes and other additional costs – the vehicle must be used 230 days per year. If the vehicle should have a breakdown or other failure that prevents its usage, every additional day or hour out of service dramatically decreases revenues for the owner. The resulting need to resolve vehicle problems or failures as soon as possible is the motivation that pushed the Iveco Customer Services department to adopt a series of measures to increase the speed and efficiency of its post-sales assistance. To fully protect its customers from any sort of damage or risk, Iveco launched its planned maintenance contract (PMC), a full solution that ensures timely vehicle servicing and, in accordance with customer requirements, partially or completely covers any necessary service operations. As of the beginning of 2008, Iveco was managing more than 40 000 PMC solutions that contribute significantly to the share of profits generated by services. The offering of PMC solutions has posed a number of challenges to Iveco, however, from a number of standpoints: (i) the development of appropriate technology; (ii) the adequacy of risk management; (iii) the hiring and retaining of qualified workers; and (iv) the redesign of processes.

The first key point in offering solutions is the development of appropriate technologies. PMC solutions guarantee real-time assistance for any breakdowns; thus, to be able to assist its clients, a firm must constantly monitor real-time diagnostics and maintain an efficient part-supply chain. The complexity of Iveco products has increased, while the number of electronic components has risen significantly: in the 1990s Iveco's vehicles did not contain any electrical devices, but by 2008 each vehicle had at least

40 electrical junction boxes. Moreover, the part-supply chain now must manage more than 160 000 part numbers. The performance of the usual diagnostic and assistance operations has thus become much more difficult. To facilitate real-time diagnostics and delivery of the required parts in a short period of time, Iveco uses the latest technologies available. This has been achieved via two important technological solutions: the EASY diagnostic platform and the Iveco Parts System.

The EASY platform is a diagnostic tool comprising a last-generation tablet PC developed in partnership with Panasonic, which is remotely connected to the Iveco Customer Support Centre. The custom-designed tablet PCs are based on Toughbook models and are resistant against water, dust, dirt, heat, humidity, and cold temperatures. Operators can connect their laptop with the central junction box of the truck and transmit data directly to the Iveco Customer Support Centre located in Turin, Italy. From that remote location experts carry out the diagnostics, operating as efficiently as if they were more locally situated. This technological solution allows workers to correctly diagnose a problem in vehicles that are characterized by increasing complexity.

The second technological solution is the Iveco Parts System, developed by Iveco in collaboration with Accenture. This system manages the flow of spare parts and information from suppliers to customers, managing five locations as a single virtual warehouse. The customer demand is fulfilled by the whole virtual warehouse stock and the total forecast is shared in proportion to local demand. The management of the five different warehouses as a unique virtual warehouse speeds up the delivery time and Iveco is able to deliver 90 percent of spare parts within 48 hours. This system maximizes the level of the service and minimizes purchase, logistics, and stock costs.

A second key aspect of the offering of full-coverage solutions is that it requires the careful management of costs generated by these contracts. While its clients pay fixed fees, Iveco must support costs that vary significantly among contracts, and these costs are difficult to estimate. For example, the likelihood of breakdowns is influenced not only by vehicle age and type but also by the material transported, the usual route (highway, gravel or unpaved

roads, and so on) and the preparation of the vehicle (refrigerated van, liquids transportation, and so on), along with any other factor that affects the overall condition of the vehicle. This yields a complex scenario that must be constantly monitored, because the failure to accurately predict costs generated by PMC solutions can cause significant financial losses for the company as a whole. To manage such a complex situation, Iveco, in collaboration with SAP, developed an IT system that calculates the contract fee to be quoted. The system is Web-based, and dealers can consult it immediately and remotely via a simple Internet connection. The possibility of decentralizing the process of quoting the contract is essential, since it is the dealers themselves that propose the PMC solution when the vehicle is sold to the customer. Moreover, thanks to the IT system, the financial risk of the PMC solutions can be constantly monitored: the profitability of each contract is evaluated daily, and the customer services department organizes weekly meetings with the sales personnel responsible for each market.

The presence of qualified people is the third aspect that merits attention when firms offer integrated solutions. Post-sales services are often provided through a call centre, which is the first interface between the client and the company. The importance of this interface is often neglected, and sometimes little attention is devoted to the strategic role of the employees working there. Iveco has followed a different approach: their call centre staff members are prepared to perform a preliminary diagnosis of the failure and to attempt to correctly identify the problem the client is facing. For this reason Iveco has heavily invested in the training of their call centre workers. Trained assistance in the early post-service phases helps to ensure a correct diagnosis of the failure, reduces cost and time to resolution, and increases customer satisfaction and loyalty. The investment in people made by Iveco is being repaid, since the turnover in their call centre is one of the lowest in the field for this type of job.

The last aspect crucial to the successful offering of integrated solutions is the redesign of processes. Specifically, this involves the modification of internal processes with a focus on the customers' needs. To offer a truly integrated solution, firms must change the internal workings of their organization and not simply add services to their existing product line. In line

with this reasoning, Iveco implemented important changes in their internal structure. According to Iveco manager Fabrizio Capello, this has been achieved through five steps: (a) the selection of raw materials, which must pass stiff quality controls to assure high performance; (b) accurate control over suppliers, to guarantee high-quality and certified processes; (c) strict testing of official spare parts, to ensure the excellence and reliability of the final products; (d) quality control assessment for every product or spare part entering the warehouse; and (e) the establishment of a network of professionals, trained to guarantee attention to customer needs while offering post-sales services for Iveco products. Iveco did not externalize the development of its IT systems. Despite the fact that IT systems are often viewed as a means of facilitating the offering of integrated solutions, such technologies are effective only if their implementation is controlled. For this reason Iveco developed and maintained certain IT competencies in-house. This is the rationale behind the firm's decision to found Eltrac in 2005. Eltrac's activities focus on the design of electronics and software applications for on-board electronics, production plants and customer service. For the latter, Eltrac developed the EASY diagnostic platform. Founding a new firm required a disinvestment of Iveco's resources from its core activities, but that decision allowed for the development of IT capabilities that are critical to the offering of integrated solutions.

By concentrating on the above four aspects (risk management, technology, people, and process), Iveco managed to successfully implement its integrated solutions offering. Besides increasing customer loyalty and customer satisfaction, Iveco added a new range of services characterized by high value-added, raising the competitiveness of its offer and the profitability of its business. In the future, Iveco is planning to reinforce its extensive service operations offering so as to better handle customer financing, contract hiring, full service maintenance and logistical support. Iveco realized that in tomorrow's truck and bus industry, customers will not want to wholly own a quickly depreciating asset; they will prefer to lease it, preferably only paying for it when it is actually on the road. Innovations such as per-kilometre contract hiring lead Iveco to continue to invest heavily in customer support, a strategy that has been highly successful in its implementation to date.

Rolls-Royce Solutions in Aerospace and Defence[3]

Henry Royce founded Rolls-Royce in 1884. In 1904, Henry Royce and Charles Rolls developed the first model of the Rolls-Royce automobile: the *Silver Ghost*, a limited edition series of cars. Just ten years later in 1914, with the beginning of World War I military operations, Rolls-Royce designed and produced its first airplane engine: the *Eagle*. The success of this product made possible the diversification of the business from the automotive to the aeronautics industry. In the 1950s, the core business of Rolls-Royce was in the civil aviation industry, and the core product line was the engines produced for Boeing airplanes. Now, at the beginning of the twenty-first century, Rolls-Royce is the second largest aeronautics engines producer, and it is the leader in the production of marine propulsion systems. Despite its long manufacturing tradition and the strong capabilities acquired in that area, recently Rolls-Royce modified its offering, increasing the number of services offered and including innovative sales contracts such as Power-By-The-Hour and Mission-Ready Management Solutions.

Power-By-The-Hour is a type of integrated solutions contract offered by Rolls-Royce to airplane producers and owners. In this relationship, the Rolls-Royce engine required for the airplanes is not actually sold; instead, firms pay a fixed rate for the use of the engine, which includes the cost of maintenance, usage, and repair. Rolls-Royce retains the ownership of the engine, effectively selling to the client the energy, or power, required for the proper functioning of the plane. The payment is calculated on the basis of the energy required by the engine and used by the client – thus the name 'Power-By-The-Hour'. As usually happens in offers of integrated solutions, clients are not in charge of the management and maintenance of the product; they buy from Rolls-Royce the propulsion service, the intangible component of the product itself. Advantages for clients from this type of program reside in the possibility of transforming fixed costs into variable costs and, even more importantly, the opportunity to outsource to a specialized provider all of the engines' maintenance operations. The clients' need for a high-quality, reliable propulsion system that runs the airplane is met by the turnkey solution proposed by Rolls-Royce.

In the United Kingdom, the 1998 Strategic Defence Review (SDR) sought

to transform the way in which the UK Ministry of Defence (MoD) acquires equipment from industry suppliers. The lack of life cycle thinking from 'product design and development' to 'in service' operational product support had resulted in higher than expected acquisition costs and poor linkages between designers and end users. Subsequent initiatives have focussed on reducing the MoD's costs of ownership associated with the complete process of procuring and supporting complex military equipment such as warships, transport vehicles, combat aircraft and helicopters. Rolls-Royce states that most engines currently in service will have operational lives of 25 years or more, which provides incredible scope for aftermarket services. The firm's response to defense market challenges led to the development of Mission Ready Management Solutions (MRMS) offerings. This offering has been deemed especially useful for defense industry clients, as it addresses the critical need to have engines that are able to function 24 hours per day. This can only be achieved through a careful planning of maintenance and support activities. The provision of MRMS involves taking on responsibility for managing and improving the client's availability of military engines. Drawing upon knowledge and capabilities developed over many years of activity in this sector, the complete portfolio of Rolls-Royce, typical services underpinning MRMS offerings include (i) off-wing support (for example, repair and overhaul, foreign object damage coverage); (ii) information management (for example, engine health monitoring); (iii) in-service support (for example, technical assistance and knowledge, spare parts); and (iv) inventory management (for example, logistics, stock management, engine transport). To achieve client value propositions to reduce costs of ownership and increase availability of engines, Rolls-Royce engineers maximum reliability in product design and integrates new life cycle information capabilities to ensure long-term good feedback (that is, engine health data) from the client's operations to the supplier's maintenance base. Rolls-Royce's ability to understand the functioning of the whole system allows for the extension of the services included in the solutions to the management and maintenance of related components. In the MRMS Rolls-Royce thus is able to include services involving the optimization of the supply chain and the management and control of defense systems mounted in the airplane, as well as other services not strictly linked with the propulsion system

Rolls-Royce has focussed chiefly on supporting its engine systems, working alongside other integrated solutions partners such as Lockheed Martin, Boeing and BAE Systems who seek to provide support and availability services for complete weapon systems. The Future Strategic Tanker Aircraft (FSTA) project is a leading edge example of shifting military equipment ownership entirely over to industry through a 27 year Private Finance Initiative (PFI) relationship. A consortium that includes European Aeronautic Defence and Space Company (EADS), Rolls-Royce, Cobham, VT Group and Thales UK provides a total air-to-air refuelling service to the Royal Air Force. During periods where the service is not required by the RAF, the consortium will seek out other clients who may benefit from their offering.

Rolls-Royce and its industry partners are developing more intimate relationships with the MoD, blurring the boundaries between the client and its supply base. The trust and confidence building that is derived from successfully providing services to the military is leading to greater exposure of what happens to equipment during training exercises and in actual military operations. In the future, suppliers may face the challenge of being measured against whether their contribution/offerings appropriately supported or affected the performance of specific military missions. This requires industry suppliers and defense organizations to work together seamlessly; and in particular, across individual integrated solutions contracts. Much like its close relationships with civilian airline clients, Rolls-Royce must understand its client's operating environment and key priorities (for example, costs of fuel and pollution in civil aerospace and operating in hot desert conditions in military). Future integrated solutions based value propositions provided by Rolls-Royce will depend on good foresight of client needs rather than new orders for engines and spare parts.

Opportunities for industry have opened up on a variety of levels, making it possible not only to migrate downstream to services but also to offer something more substantial to the customers in terms of adding value to their objectives, whether that is realized as greater efficiency or as improved combat effectiveness. The ability to integrate such factors into a solution and

thereby to add distinctive output value is quite possibly the newest source of unique and sustainable competitive advantage on which firms operating in any context should focus.

Loccioni: a Path Toward Turnkey Solutions and Durable Relationships[4]

Enrico Loccioni, an Italian entrepreneur, founded General Impianti in 1971. This firm's sole core business was the production of electronic systems for local clients. In 1980, Loccioni launched AEA (Advanced Electronic Applications), a firm that specialized in the production of test and control systems for the home appliances market. Exploiting similarities in technology, AEA also began working in the automotive sector, focusing on the production of test benches. Today, the Loccioni Group comprises three firms (Summa, AEA, General Impianti) and has 300 employees. Mr Loccioni remains the general manager of the group.

The Loccioni Group is characterized by a job-shop production process. Its core business focuses on the design and development of prototypes based on the requirements of individual clients. Loccioni has an extremely diversified range of operations: it develops solutions for distinct sectors including energy, home appliances, automotive, health care, textiles, agriculture and food. This firm operates in niche markets, and its clients tend to be large industrial groups that are looking for a specific solution. For example, Loccioni is the leader in the development and design of test benches for the automotive production processes; among its clients are Fiat, Ferrari, Bosh, Continental and Renault. Loccioni's solutions are characterized by the integration of different competencies. The complexity of the final systems is high, and solutions are difficult to imitate or to be substituted for, which assures a strong competitive advantage. In many cases, Loccioni is the leader in its niche. Systems developed by Loccioni must be carefully designed since, as in the case of production lines, they often must be operative 24 hours per day over many years, and any problem or failure will result in significant costs for the client. The importance of the correct integration of the products with the services, of the tangible and intangible aspects of the solution, is clearly apparent.

Loccioni is first and foremost a manufacturing firm and, until the year 2000, services were not considered as important as the design and development of the systems. When Loccioni began to offer services, the offerings in this area mainly involved post-sales assistance. The personnel devoted to these activities were dispersed throughout the firm, two or three per division. To increase the role played by the intangible component of the solution, a change in the organization was required, and a division dedicated to services was created. The services specialists, until that point dispersed in various divisions, were transferred to the newly created division. This organizational shift was not painless: the service division had to work hard to gain respect and credibility from the rest of the group. It was a major challenge for a manufacturing-oriented firm to create and maintain a service division that concentrated on project development, goal- and target-setting, and budget management.

Loccioni's service division does not provide only the typical post-sales activities. Its activities focus on three different aspects of service: pre-service, continuous service, and post-service. 'Pre-service' refers to the activities carried out to get in contact with new clients and to create a relationship with them. When establishing the first contact, Loccioni service teams seek to interact not only with the people that will be directly working with them but also with managers from other divisions. In this way, Loccioni can introduce itself and its work to the whole client group, to all the people working there. Pre-service has the qualitative objective of getting to know the customer, establishing the basis for a relationship and understanding the customer's needs. This facilitates the codevelopment of the system and enhances the possibility of obtaining repeat business with the customer in the future. 'Continuous service' refers to the activities from the order to the final test of the solution. Once the specifications and the requirements for the solution are set, the client is not left on its own, but instead a continuous contact is maintained. Loccioni's aim is to know as many aspects of the client firm as possible in order to foster the relationship through the creation of mutual trust and to, eventually, create space for new activities. The team is in charge of the relationship with the client during this period of continuous service, and they aim to connect the Loccioni activity with the activities of the client, to create new links, and to begin joint activities together (such as joint R&D or

other similar efforts). 'Post-service' activities include the typical post-sales technical assistance and, thanks to the relationship established in the first two phases, the investigation or development of possible future projects.

The three-fold structure of the service activities described above is the result of an evolution, of an emergent path followed by Loccioni since the creation of its services division. This path can be divided into five phases. The first phase directly followed the organizational changes that originated the service division. In this phase, the potentialities and preparation of personnel were enhanced with training, certification and specialization courses, both in Italy and abroad. This training phase was fundamental, enabling Loccioni to have workers who are able to provide the clients with high-quality services.

In the second phase, Loccioni started working on a contract basis. Before that, all the service activities were call-based: when clients experienced a problem or failure, they contacted the services division. When contracts were first launched, 90 percent of the service interactions were based on call-ins and the remaining 10 percent on contracts. However, strong marketing and communication activities rapidly increased the percentage of contracts, and now 70 percent of Loccioni's client contacts and 66 percent of its solutions volume are organized through contracts. The contract arrangement – in which Loccioni provides services to the clients only when failures occur – presents mutual advantages for the clients and for Loccioni. Work organization is facilitated for Loccioni, because contracts allow it to plan maintenance activities in advance. There are clear advantages for the client as well, specifically a reduction in the risk of failures and the mitigation of the risk of production stoppages.

Phase three focused on establishing a relationship with the clients and on creating trust. Loccioni employees began regularly visiting all the plants in which Loccioni systems were implemented. Such visits were not connected to maintenance activities or to the selling of new contracts/systems/solutions. The aim, rather, was to establish contact with the clients, to get to know them and, thanks to an increase in their mutual knowledge, to facilitate collaboration and information exchange. Although Loccioni has a contract with its clients, contracts alone do not guarantee full and reciprocal trust.

Through these client visits Loccioni achieved the double aim of overseeing the functioning of the systems and infusing trust into the client–vendor relationship.

The development of mutual trust and information exchanges between Loccioni and its clients changed the typical client–supplier relationship into a stronger collaboration. Loccioni is, in fact, a partner that understands the needs of its clients. The heterogeneity in the sectors it serves ensure a broad spectrum of different capabilities for Loccioni, and the corresponding range of solutions developed is also wide. In the fourth phase of the path towards the offering of turnkey solutions, Loccioni learned to foresee the possible future needs of its clients and to propose adequate solutions for these needs, developed using competencies acquired in other markets. For Loccioni this is a way to reapply capabilities already acquired, and its clients meanwhile have the ability to meet their existing needs with the help of a trusted partner.

In the fifth and final phase, the collaboration between Loccioni and its clients becomes much stronger. The clients trust in Loccioni's capabilities, and they branch out to collaborate with Loccioni in the development of other solutions based on new technologies. Such innovative, custom-designed solutions assume the form of a partnership or joint venture. Loccioni management strongly encourages the development of innovative solutions, even if they are far from the firm's core business, because this is an opportunity to diversify and to occupy a new niche. Cytocare, for instance, is the result of such a process. The first robotic system for the automatic dosing of cytostatic medicines, Cytocare originated from a specific request made by a Loccioni client, which was a hospital. A team of doctors explained to the Loccioni team the safety problems, the need to maximize resources and the need for control processes, and a Loccioni engineering team developed a specialized solution. The Cytocare solution provides immediate information management of the prescription, automated dose calculations, an automated compounding phase and a computer vision system for a final check. The benefits for the users, among others, are increased pharmacy staff safety, better use of pharmacy staff, optimization of drug use and automated dose calculations that eliminate or reduce human error. Loccioni was able to develop this very innovative system not only because it had the required

capabilities but also because of the trust it had established based on its relationship with the client.

Future objectives of Loccioni's service division include the creation of a virtual service community in which clients can autonomously manage post-sales services. The idea is that each client will be able to manage its contract, select its options and change them, using a custom-designed IT platform. The rationale is to be able to offer clients a more fluid solution management. Once a strong relationship is established, the client should be able to manage the solution by itself under the supervision of Loccioni's service division. This will help the clients to maintain in-house some of the competencies required to manage the system, while avoiding lock-in effects and retaining control of the systems. Such independence is incentivized by Loccioni: the vendor will still be present, but in a virtual way. The provision of client autonomy is the best way to ensure that the solution works without failure, allowing for the rapid solution of any problem and effectively meeting customer needs. This approach, innovative even within the integrated solutions business model, favours long-run benefits over short-term advantage. Mutual trust and strong relationships are the basis of the path that Loccioni continues to follow in the integrated solutions business.

NOTES

1. The IBM case history is based on the book by Louis Gerstner (2002) and on the author's private conversations with IBM managers.
2. The Iveco case history is based on the author's interviews with Iveco marketing managers Fabrizio Capello, Alberto Perfetto and Filomena Corradini.
3. The Rolls-Royce case history is based on the work of Andrea Prencipe (997; Prencipe et al., 2003), Dharm Kapletia (2003), and on public sources.
4. The Loccioni case history is based on the author's interviews with Loccioni managers Sergio Rotunno and Simonetta Piangerelli.

PART ONE

A Capabilities Approach to Solutions

2. Paths Towards Integrated Solutions

The most important challenge that firms face when moving into the business of integrated solutions is the development of appropriate capabilities. To embrace this new business model, firms must change their position in the value stream so as to become able to manage bundles of products and services. This aspect has been largely explored by the literature on integrated solutions, which has devoted much attention to the transition from product-based to service-based competition.

To offer integrated solutions, firms must restructure their organization around customers (Davies et al. 2007; Galbraith 2002a). From the firms' point of view, offering a solution means solving a customer's problem; from the customers' point of view, buying an integrated solution represents outsourcing some activity and thereby focusing their resources on their core business. Firms offering integrated solutions must therefore move downstream and provide services in addition to products. The introduction of services is a significant step, because the capabilities required to provide services differ from those needed for products (Windahl et al. 2004; Wise and Baumgartner 1999). The offering of services requires the development of organizational principles and organizational structures new to a product manufacturer. To achieve this, firms must divert financial and management resources from traditional areas. This process must be carefully managed to achieve a successful transition.

The aim of this chapter is to explore the capabilities required to offer integrated solutions in the information technology (IT) sector. By IT I refer to the science of managing information systems. These systems encompass all forms of technology used to create, store, exchange, and use information.

The IT sector includes all the businesses related to hardware and software that enable data collection, storage, and manipulation. I have chosen to focus on this sector because it is one of the largest and most important sectors in which the integrated solutions trend has taken hold (Cerasale 2004). After years of implementation, procedures and routines are now becoming standardized, and it is therefore possible to identify common paths in the capabilities managed by the firms. The rapid growth in the area of integrated IT solutions is due to the nature of products sold, which are characterized by numerous complementarities and which also require a high level of expertise to use (Spiller and Zelner 1997).

A CAPABILITIES APPROACH

The resource-based view (RBV) assigns central relevance to internal resources and capabilities as the sources of a firm's competitive advantage (Ansoff 1965; Barney 1999) and clarifies the nature and role of these variables in the provision of integrated solutions. Organizational capabilities are the outcome of a resource integration process that is enabled and supported by knowledge (Chandler 1990; Grant 1996, 2002). When they are valuable, rare, inimitable, and non substitutable, resources can guarantee the achievement of competitive advantage, especially if they are integrated into a unique set of capabilities.

Management scholars have also stressed that capabilities are not static and immutable, but rather dynamic (Teece and Pisano 1994; Zollo and Winter 2002). When competitive landscapes shift continuously, market boundaries are blurred, business models become unclear and the achievement of sustained competitive advantage is guaranteed only by the ability to continuously reorganize and reconfigure internal resources to match changes in the external environment. The dynamic nature of organizational capabilities creates path-dependency (Eisenhardt and Martin 2000), which further increases their stickiness. Organizations thus should not ignore the capabilities they already possess when they make strategic choices in the provision of integrated solutions. A software development company that

starts providing IT consulting services will never possess the same capabilities as an IT consulting firm that moves into software development. The two firms will choose different strategies for the provision of integrated solutions; they will target different markets, they will sell to different customers, and they will offer solutions with different technical characteristics.

Scholars have stressed that to be successful in the migration to integrated solutions offerings, firms must develop adequate capabilities (Galbraith 2002a; Wise and Baumgartner 1999). When offering integrated solutions, firms can move upstream and/or downstream. To embrace the new business model, therefore, a change in the existing set of capabilities is required.

While the general approach was a downstream movement, in line with Wise and Baumgartner's (1999) suggestion, some firms moved upstream. This is the case of consulting firms such as WS Atkins, which expanded from an engineering consulting company into an integrated solutions provider. This services-based firm moved toward the provision of integrated solutions by entering product manufacturing and therefore the development of systems integration capabilities (Davies 2004). Although the direction of the change can be different, the goal should be the same: be able to provide integrated products and services to the customers (Davies 2001, 2004).

In the transition towards integrated solutions, firms move base. This growth is successful if firms are able to use their experience to develop the capabilities required by the new business model. The capability building process implies explorative and exploitative learning, and it is required every time that firms move into a new market or technology (Brady and Davies 2004). As noted above, the direction of change can be up- or downstream. In both cases, successful growth requires the development of adequate 'core competencies' (Hamel and Prahalad 1994). In his pioneering work in this field, Davies (2001) identified the following four types of capabilities that should be managed by a solutions provider:

1. *Systems integration capabilities.* These are core capabilities required to manage integrated solutions. Integrated solution providers must able to put together different aspects of the solution in a system that works properly.

The integration of the different aspects of the solution (consulting services, physical goods, financing support) is a difficult task and one that is central to the success of the transition.

2. *Operational services capabilities*. These affect all the additional post sales services not already managed by the firm that are related to the full life-cycle of products. Examples of operational services include customer support services, training activities and maintenance services.
3. *Business consulting capabilities*. These are a very important set of capabilities for integrated solutions suppliers. In selling integrated solutions, firms must help their customers in the planning, building and maintenance of the systems. This requires them to spend time talking with the customers to find the right solution.
4. *Financing capabilities*. These refer to the ability to provide funds for the customers' activity. Because these capabilities are typically very distant from the core business of the integrated solutions provider, not all firms develop them. For this reason, the ability to assist customers with the arrangement of financing constitutes a competitive advantage for the firm.

A PRELIMINARY TAXONOMY OF INTEGRATED SOLUTIONS CAPABILITIES

In this section I report the evidence from a cross-case analysis of multiple case studies (see the methodological appendix at the end of this chapter). Following Grant's (1996) definition, I identify the constellation of activities that constitute each integrated solutions capability. Configurations of capabilities change across the firms, as seen in Table 2.1. Table 2.2 summarizes the characteristics of the analyzed sample.

Systems Integration Capabilities

Systems integration capabilities consist of the ability to integrate different products, services and technologies. Systems integration plays a central role in the provision of integrated solutions, because dissimilar technological platforms must communicate to assure a seamless flow of data and

Figure 2.1 Configurations of capabilities

	Alpha	Beta	Gamma	Delta	Epsilon	Zeta	Eta	Theta	Iota	Kappa	
1. Systems integration capabilities											
Integration of products and services	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100%
Integration of different technologies	✓	✓	✓							✓	40%
2. Consulting capabilities											
Business consulting	✓		✓	✓	✓	✓	✓	✓	✓		80%
Technology consulting	✓	✓	✓					✓	✓	✓	60%
3. Post-sales capabilities											
Hardware maintenance	✓	✓		✓	✓						40%
Software maintenance	✓	✓			✓		✓			✓	50%
Software problem solving	✓	✓		✓	✓	✓	✓	✓	✓		80%
Training of users	✓	✓		✓	✓	✓	✓	✓	✓		80%
4. Financial capabilities											
Financing assistance	✓					✓					20%
5. Production capabilities											
Hardware production	✓										10%
Software development	✓	✓	✓		✓		✓				50%
6. Delivering capabilities											
Software customization	✓	✓	✓	✓	✓	✓	✓	✓	✓		90%
Hardware delivery	✓	✓		✓	✓	✓	✓				60%
Internalization of capabilities	100%	85%	46%	54%	69%	54%	62%	46%	46%	30%	

Table 2.2 Structure of the sample

Firm	Size	Core business	Market	Complexity of customers' needs
Alpha	Large	Hardware producer	International	Medium/High
Beta	Small	Software house	Local	Low
Gamma	Medium	Consulting	National	Medium/High
Delta	Small	Consulting	Local	Low
Epsilon	Large	Software house	National	Low/Medium
Zeta	Large	Consulting	International	High
Eta	Small	Software house	Local	Low/Medium
Theta	Medium	Consulting	National	Medium
Iota	Large	Consulting	National	High
Kappa	Large	Hardware producer	National	High

information. Likewise, products, subsystems and services must also be fully integrated to address the increasing demand for speed and effectiveness that characterize the markets for IT applications. Empirical evidence shows that these are by far the most difficult capabilities to develop and are also a very critical component in the provision of integrated solutions (Brusoni et al. 2001; Prencipe et al. 2003).

Integration of products and services

Firms that provide integrated solutions are often project-based (Galbraith 2002a). Project activities usually focus on the integration of software, hardware and consulting services that enables the firm to develop an IT system satisfying the customers' requests. The core of the project is typically developed internally, but to provide an integrated solution it is often necessary to buy capabilities, services or products from outside the firm's boundaries. The ability to put together several pieces is defined as systems integration capability (Hobday et al. 2005). This represents the core

capability for firms providing integrated solutions.

Systems integration capability is usually managed in-house (this is the case for all the firms in this study), and the project manager in charge of the project carries out activities. The integration of different components is facilitated when each team member possesses both specialized knowledge about a specific component and general knowledge of the system. This two-level knowledge facilitates communication and interaction among team members. As the interviewee from company Gamma pointed out, 60 percent of the knowledge of consultants in his firm consists of common knowledge, while the remaining 40 percent is knowledge-specific to the position held (e.g., IT, software development or customization, organizational principles, industry processes or production systems). The common knowledge facilitates information sharing and integration of different capabilities.

Integration of different technologies

IT systems are composed of software and hardware based on different technologies that must be able to communicate with each other. The integration of such technologies is fundamental to the provision of effective solutions: if technologies are not properly integrated or if they are not appropriate for the needs of the customer, the firm risks building useless solutions. The role of the systems integrator is to combine together different technologies and to make these technologies work together. This activity also consists in making communication possible the between the experts and the client: if the solution is developed only by technicians without input from the customer, the result will be a system that in most cases will be too complicated for the users. The systems integration capabilities reside in the ability to adapt technologies to customers' actual needs. As explained by one interviewee:

> If the communication is only between technicians, the solution that will come out will be a 'cool' solution from a technical point of view but inadequate to meet the client's needs. The technicians will enjoy themselves in finding the more technologically advanced solution, but the risk is that they will not consider the real needs of the client. So the key to success does not reside in the possibility of offering a more technologically advanced solution but in understanding needs, proposing solutions and solving problems. A simple understanding of the

technologies does not entail the ability to develop good solutions. (Respondent from company Gamma)

Consulting Capabilities

Consulting capabilities represent the ability of an organization to understand the needs of its customers and to tailor solutions to those needs. Because integrated IT solutions must address customer needs from end to end, adequate consulting capabilities play a central role. Firms with inadequate consulting capabilities risk building useless solutions, which are both ineffective and expensive to maintain and upgrade (Slywotzky and Wise 2003).

Business consulting activities

As has been largely pointed out by the literature, the understanding of the customer's needs plays a central role in the business of integrated solutions. For this reason, the sample firms assign great importance to consulting capabilities. In this study, I distinguish between business and technology consultants: the typology of consulting varies according to the specificities of the solution to be installed, while business consulting refers to consulting activities focusing on organizational issues, communication/marketing, re-engineering of productive processes and so forth. The latter type of activity in particular is deeply linked with the nature of the product sold. According to the view of the interviewee from company Zeta, the selling of IT solutions is not the same as the selling of software: when installing an enterprise resource planning (ERP) program, it is often necessary to review and re-engineering internal processes. Such activity requires specialized, process-specific knowledge about the client's industry.

Empirical evidence indicates that integrated solutions providers often adopt a matrix organization, one of whose dimensions is represented by the industry in which the client operates. To ensure optimal business consulting, consultants with knowledge of the specific industry are required.

Technology consulting activities

The integration of different technologies is central to the development of an integrated solution, and in order to achieve this integration IS providers must be able to offer technology consulting. The understanding of clients' needs and the interpretation of these needs into a technological solution are crucial; in fact, 60 percent of the firms in the sample are involved in this activity. Two firms in the analyzed sample perform only technology consulting activities (and not business consulting). For these firms, the technology aspect of the solution appears to be more important than the business aspect. These companies have a similar core business that justifies their strategic positioning: both are engineering-based companies (a software house and a hardware producer) that moved downstream into services. Thus it is not surprising that they are more technology-oriented.

Among the analyzed firms, company Iota implements an interesting process that enables it to become aware of the latest technological novelty. This firm has a divisional structure organized by client industry, and every industry group has a dedicated R&D team in charge of exploring the market of technologies appropriate to its specific industry. This allows the firm to become aware of the latest innovations and to include them in their solutions.

Post-sales Capabilities

Post-sales capabilities include activities related to hardware maintenance, software assistance, software problem solving, and user training (Brady et al. 2005; Slywotzky and Wise 2003; Windahl et al. 2004). They are fundamental because of the very nature of the products sold: it is nearly impossible at the present time to sell software without post-sales assistance, especially in B2B environments. This is also one of the reasons that the IT sector pioneered the business of solutions.

Hardware maintenance activities

The first type of post-sales capability is the hardware maintenance that is usually guaranteed by the hardware producer. It is very rare for integrated solution providers to offer their own hardware maintenance; rather, the tendency is to outsource it, for two main reasons. First, this activity is not considered strategic, and therefore devoting resources to this area would require firms to divert resources from their strategic activities. Also, a

specialized workplace is required to carry out this service due to its high asset specificities. For the few firms that do offer post-sales hardware assistance, this constitutes a source of competitive advantage. These IS providers are able to sign special contracts with hardware producers, allowing them to offer assistance not only to their own customers but also to all the hardware owners in the area, and in this way they can make contact with potential new customers.

> Concerning HW [a hardware supplier], we are the official assistance point of our province. The machines in warranty in this area come here; we have a laboratory to repair them. This is a commercial channel because we often meet clients of HW. We provide simple repairs and sometimes we can also offer some services. This is a way to acquire new clients. (Respondent from company Eta)

Software problem solving and software maintenance

Software problem-solving and maintenance are two types of post-sales service assistance, typically provided in two phases. In the first phase, a call centre provides what is often called 'hot line service', in which the firm answers customers' questions and requests by phone. Every call is directed to a call centre, where an operator tries to solve the customer's problem if possible. I refer to this software post-sales assistance activity as 'software problem solving'.

If specific actions involving the product are required, the call centre may not be able to solve the customer's problem directly. These actions may include the need to install software, to modify some lines of code, to eliminate possible software bugs or to change software parameterizations. In such cases, calls are redirected to the appropriate division in charge of software maintenance activities. The process is managed differently by integrated solution providers depending upon how the firm acquired the software involved. If the solution provider developed the software internally, the request for assistance can be directed to the department that specializes in solving this type of problem. However, for firms that purchased the software from another provider, only the first phase of the software assistance (i.e., the call centre service) can be internalized. If the call centre is not able to solve a customer's problem, it must redirect the call to the software house that developed the software. No matter what firm produced the individual

software components, the integrated solution provider is held responsible for the provision of a turnkey solution.

An important relation exists between software post-sales services and the level of system customization. The implementation of highly customized systems requires firms to deal with systems that may differ greatly from each other, making each assistance request a difficult and expensive procedure. Post-sales support for customized systems requires specialized skills, and it is often necessary to contact the consultant who was involved in the specific project. This creates a tie-in effect in which single individuals possess specialized knowledge of the individual systems. For this reason, company Epsilon, a software house, does not offer customized solutions; standardized solutions allow the firm to achieve economies of scale in this area.

Company Iota, a consulting firm, has pursued a different strategy that allows it to mediate the trade-off between customization and standardization. This firm has two main large clients, and to fully satisfy their requests it structures its post-sales services according to special needs of these two customers. Iota offers two standard types of post-sales contracts, with conditions that are identical to those in the contracts signed by its two largest customers. When the firm prepares a new contract, it uses one of the two service-level agreements (SLAs) prepared for these customers. Iota builds its organization around those standards and replicates them with smaller clients. Based on the experience of company Iota, it is possible to identify the two following tendencies: (1) the larger the firm that offers the solutions, the more standardized will be the solution; and (2) the larger the customer, the more customized will be the solution.

User training

User training consists in teaching customers' employees how to use the new IT system. The broad representation of this activity in the analyzed sample is due to the nature of integrated solutions in the IT sector. In fact, it would not be surprising to find that in other sectors the importance of this activity will be lower, or in some cases such as aeronautics, nonexistent. In the sample firms the training is usually carried out by the youngest and least experienced members of the project team, since specialized skills are not required and it provides a good learning opportunity. Moreover, the cost of junior

consultants is lower. Thus, the rationale is also based on a cost/benefit evaluation.

This activity presents two critical challenges. The first involves the difficulty of estimating the amount of time that will be necessary for training. As an interviewee from company Epsilon pointed out:

> Theoretically, after the training period the employees should be able to use the new system correctly. The word 'theoretically' is important, because the period required for the appropriation of new technology by users is normally greater than the time required for the training phase. Learning how to use a tool and learning how to use it properly are two different things. (Respondent from company Epsilon)

The second problem, observed by the interviewee from company Zeta, is that the training phase is usually conducted during the last phase of software implementation and customization. This means that training is often carried out using software that is not the final version that users will utilize.

> It is difficult to decide at which point it is most appropriate to start the training. The training phase should be done with a stable version that is as similar as possible to the final version of the software, and it also must be done before the 'go-live' of the system, because the users have to be familiar with it when the production starts. What usually happens is that before the go-live we are still in the customization and the testing phase. So users are forced to learn on a not-yet-definitive system. (Respondent from company Zeta)

Financing Capabilities

Financial capabilities include all the activities through which integrated solution providers offer financial assistance to their customers, for example, the provision of leasing and flexible payment structures and the offering of competitive interest rates and/or buyout options (Brady et al. 2005). These services offer a high value-added to clients, who can count on a proper turnkey solution. However, they are also difficult to develop, because they require competences outside the core business of IT firms (Dierickx and Cool 1989; Sanchez 1995). For an integrated solution provider, the development of financial capabilities is an effective way to differentiate its offers from those of its competitors.

Financing assistance activities

The provision of financial services is a new practice among integrated solution providers. Financial services, often offered through collaboration with specialized partners (financing companies, banks and so on), allow integrated solution providers to offer high-value services to their customers. Moreover, being a new practice, this also permits firms to differentiate themselves from their competitors and obtain a competitive advantage. In the sample, only two firms (Alpha and Zeta) offer this service. These are large firms operating in international markets. As the local subsidiaries of multinational corporations, their financial situation allows them to offer such services. Obviously the ability of firms to offer financing assistance depends largely on the financial characteristics of the firm. Small firms may lack adequate financial means for this on their own, and thus for them the possibility of offering financing services depends on the building of partnerships with other, larger firms. For instance, hardware producers may offer zero-rate interest programmes or other financial promotions that smaller integrated solutions providers can include in their integrated solution offer.

Production Capabilities

Production capabilities are of two types: the ability to develop software (in other words the design, development and testing of software), and the ability to manufacture hardware and infrastructure, which includes the manufacturing and assembly of hardware products (computers, servers, workstations or other equipment) as well as other physical tasks associated with the installation of cables and networks (Ceci and Prencipe 2008; Davies 2004). These two sets of capabilities are distinguishing characteristics of integrated solution providers because they differentiate these providers from pure IT consultants.

Hardware production

Of all the activities that integrated solutions providers may offer, manufacturing activities yield the least value-added. For this reason, hardware production activities are the least broadly represented within the analyzed sample. The capabilities required for hardware production are

difficult to acquire, and the markets are characterized by high competitiveness, low margins and highly standardized products. Thus, only one sample firm manages this activity in-house. Alpha is a multinational company that moved into the integrated solution business without losing its capabilities. In the transition towards integrated solutions, Alpha followed an unusual path: it retained all its hardware production activities, controlling and managing all of them internally. The other former hardware producer, Kappa, made a different choice. Consistent with the theoretical perspective of Hamel and Prahalad (1990) on the value of core capabilities, Kappa outsourced all its noncore and nonstrategic activities, including hardware production.

Software development

Software development also requires the management of production capabilities. On the surface, it appears simple: it consists in writing code for a software product. Production processes, distribution and logistics typical of this activity, however, make it different from a 'pure' manufacturing activity, and it yields a value-added that is higher than that of hardware production. Some of the interviewed firms consider it both a core and strategic capability. In fact, all the former software houses retained this activity in-house while moving forward with their new business model. According to the interviewees, this capability represents an important competitive advantage for their firms.

The in-house production of software has remained a productive activity, in contrast to the transition toward off-shoring to lower-cost countries that hardware production has experienced in the last decades. Because this transition is still in its infancy, many firms are still investing in the resources and capability-building processes that will allow them to manage software production internally. The analysis of the empirical evidence collected in this study indicates that two firms in the sample have developed adequate capabilities to internalize their software development activity. One of these firms, Gamma, is a consulting firm that is moving upstream, integrating its previously managed consulting activities (typically service-based) with its software production activities.

Delivery Capabilities

Delivery capabilities comprise the ability to deliver hardware and software (including software customization). Software customization is a critical capability that needs to be managed by every solution provider (Ceci and Prencipe 2008; Davies 2004). It is particularly critical for firms offering complex packages, such as ERP, which need to be customized to fit the characteristics of the client.

Hardware delivery

This activity consists in delivering the hardware components of the solution, including both servers and user workstations. Offering an integrated solution means providing a turnkey system, and the installation of the hardware is part of this process. This activity features low complexity from a technical viewpoint, but it is strategic because it plays an important role in building the firm's relationship with its clients. For this reason, despite the low value-added of this activity, it is managed in-house by most of the firms in the sample. Moreover, it requires low asset specificity, so internalization is a viable strategy. The approach followed by Kappa illustrates the importance of this activity in building client relationships. The contractual agreement with the supplier performing hardware delivery requires that the supplier's employees, while working with Kappa's customers, must wear a uniform bearing the Kappa name. Kappa outsourced the activity because it is noncore and nonstrategic, but the uniform helps the customer to see that Kappa is overseeing the delivery of all aspects of the solution.

Software customization

The delivery of software consists in installing the software so that the client can use it. It can be installed in user terminals or in a server located in the client's site or in a remote location. Whatever the location, the software must be customized to fit the client's needs. This customization is central to the provision of integrated solutions in the IT sector, and for that reason nine out of ten firms in the sample offer this. It requires competences and skills similar to those for the delivery of hardware, because software must be customized and must work on a product developed outside the firm

boundaries or, if internally sourced, one developed in a different division. The product must match specific characteristics that are defined by the client and are not open to modification. For this reason an adaptation of the product is required. This activity is present in every integrated solution project.

INFLUENCE OF MARKET AND STRUCTURE IN THE PATH TOWARD INTEGRATED SOLUTIONS

Capabilities configurations vary across firms, as illustrated in Figure 2.1. In the first column I list the thirteen activities described earlier, grouped into the six capabilities: systems integration, consulting, post-sales, production, financing and delivery. For each macro-category, one or more specific capabilities have been identified. These thirteen capabilities are IT-sector-specific, and they represent the activities performed by the sample firms.

To explain why firms followed different paths and configured their capabilities differently, I adopt a contingency approach. Contingency theorists assume that a link exists among organizational context, structure, and performance (Drazin and Van De Ven 1985; Duncan 1972; Miles and Snow 1978; Venkatraman 1989). Each firm has a unique organizational context that has to be matched with the external environment (Miller 1988). The matching comes about as the result of natural selection, an evolutionary process of adaptation (Drazin and Van De Ven 1985). Firms make strategic decisions after analyzing both organizational and environmental factors, and their decisions must be coherent with these factors. Because each firm presents a unique configuration of factors, there is a lack of generalizability in strategies (Fredericks 2005). Hence, contingency scholars argue that no best strategy exists; rather, each strategy must be appropriate to the firm's unique mix of elements. Environmental and organizational factors co-evolve, and the formulation of strategy has to consider those interactions; moreover, capabilities must be configured in accordance with the chosen strategy. For surviving organizations, coherence between their strategic decisions and capabilities configuration should exist.

The identification of variables influencing firms' strategic decisions relies on the seminal paper by Ford and Slocum (1977), who argue that size, technology and the environment affect firm structure. Firms face different types of environments and must be able to cope with contextual diversity. The geographical location of the market, the type of clients, and the structure of the competition are just a few of the many factors that firms must take into account. I include in the present analysis both size and environment (market), and I investigate technology from two different points of view: an internal perspective, namely core business; and an external perspective, the complexity of customers' needs.

The market represents the first environmental variable in this analysis. Market characteristics differ with the changing geographical extension of the market itself. Local, national and international markets differ in terms of competition, roles, entry barriers and the relevance of territorial proximity (Grant 1998). The nature of the entry barriers differs across these markets: entry barriers in international markets consist in economies of scale, the importance of brand, and the use of advertising, while in smaller markets lower prices and customer loyalty play a major role in preserving competitive advantage (Rosenbaum and Lamort 1992). Territorial proximity is not as important in international markets as it is in smaller markets. In the latter case, face-to-face interaction with clients is crucial. In international or national markets, the location of the firm does not represent a competitive advantage, since the firm usually has branch offices in different places. As suggested by Grant (1998), the definition of market boundaries thus must take into account the geographical dimension in order to identify competitors. For these reasons, I use the geographical extension of the market as a proxy for environmental context.

The second environmental factor is the complexity of customers' needs. In an integrated solutions context, customer satisfaction is crucial (Wise and Baumgartner 1999): this is what differentiates a simple bundling of products and services from an integrated solution. The more complex the needs of the customers, the more complex will be the solution. The provision of a complex solution thus requires a certain level of technological capabilities (Davies and Brady 2000). In the investigation of the complexity of customer needs, I consider two distinct factors: the level of standardization of the

solution, and the level of sophistication of the client. These two factors are linked. Standardized solutions can be easily implemented and, more importantly, they allow firms to achieve economies of scale in post-sales activities such as systems maintenance and upgrading (Brady et al. 2005; Windahl et al. 2004). Consumer sophistication refers to the customer's level of training or experience in relation to the technologies comprising the solution. The higher the level of customer sophistication, the more complex will be the solution provided (Spiller and Zelner 1997). Customers with low levels of sophistication require simple, low-tech, standardized solutions that are easy to maintain and use. In contrast, highly sophisticated customers have more complex needs that generally require high-tech, customized solutions. Low standardization and high client sophistication entail solutions of high complexity.

The two organizational factors that I consider are a firm's size and its core business. Scholars in the field of contingency theory have argued that size significantly affects firm structure (Ford and Slocum 1977). Since the 1960s, contingency theorists have focused on firm size, because financial capabilities, possible economies of scale, organizational flexibility, and innovativeness are factors that are directly linked to this measure (Lawrence and Lorsch 1986; Woodward 1965). The strong correlations among those elements have led numerous researchers in this field to use firm size to analyze organizational characteristics (for example, Mealiea and Lee 1979). Another reason for the widespread use of this factor is the large amount of extant empirical evidence confirming the central role of size in the explanation of organizational characteristics (Penrose 1955; Pugh et al. 1969).

The second organizational factor on which I focus is the firm's core business before it transitioned into the provision of integrated solutions. This factor also represents the second specification of the concept of technology (Ford and Slocum 1977). To operate in a high-tech sector such as IT, knowledge of the relevant technologies is a necessary condition (Kogut and Zander 1992). Moreover, as pointed out by integrated solutions scholars (Davies et al. 2006; Wise and Baumgartner 1999), to enter into the new business, a movement in the value stream is required. The core business of

firms provides insight into the kind of technologies they manage, the capabilities they possess, and the types of processes they have implemented. Given the influence of path dependency (Teece et al. 1997) and organizational inertia (Hannah and Freeman 1984), I propose that a firm's core business will also affect its strategic choices. The firm's core business prior to its integrated solutions offering determines the type of capabilities already possessed and influences the development of new ones.

According to Grant (1996), a firm's strategy must be based on its resources and capabilities and must be determined in relation to its external opportunities. Our investigation of firms' strategic decisions is organized into three levels of analysis. The first level is represented by the configuration of capabilities. As explained before, I rely on the capabilities approach proposed by Grant (1996), in which I consider capabilities to be resources, integrated by distinctive knowledge, that allow a firm to perform selected activities. The configuration of capabilities has a central role in our model because firms must configure their capabilities properly in order to successfully implement a strategy.The second level of analysis examines the rationales that motivate the offering of integrated solutions. In other words, I analyze the external opportunities that firms exploit when entering the integrated solutions business. The literature on integrated solutions identifies various rationales that lead firms into this new business area (Oliva and Kallenberg 2003; Slywotzky 1996). Although the firms' goals are the same, their integrated solutions offers can be a response to different internal or external stimuli.

The third level of analysis investigates the role of integrated solutions in the overall firm offering. Integrated solutions can represent the new core business of the firm, or it can play a secondary role. In the next section I describe the method used to investigate the phenomenon and to test our analytical model.

CAPABILITIES CONFIGURATIONS

The objectives of this section are twofold: to identify how organizational/ market factors co-evolve with firms' strategy, and to investigate the

characteristics of strategic decisions according to three levels of analysis: capabilities configurations, rationales, and the role of integrated solutions in firms' overall offerings. Four groups of firms are identified. The number of firms within each group varies because certain factors and strategic choices are more common than others. A description of the four groups follows. For each group I discuss the relevant factors, strategic choices, capabilities configurations, rationales, and role of integrated solutions.

Group A is composed of two firms, Alpha and Epsilon. Each has a high percentage of activities managed in-house: 100 percent for Alpha and 75 percent for Epsilon. Although they operate in different markets (national for Epsilon, international for Alpha), these firms are both large, with more than 500 employees each. The most important characteristic that Alpha and Epsilon share is that they both moved downstream into services. Alpha's prior core business was hardware production, while for Epsilon it was software production. Because both were product-oriented firms, the offering of integrated solutions required a downstream movement.

For Group A firms, integrated solutions represents a new way to sell products, to know customers better and to forge a stronger link with them. In a sense, integrated solutions is more a new sales technique than a new vision for the entire firm. Although these firms have introduced certain organizational changes in order to provide integrated solutions, they have retained in-house all of the production, post-sales, and delivery capabilities they already possessed, as they continue to sell their own products (hardware for Alpha and software for Epsilon). Due to the large number of these in-house capabilities, Group A firms do not have any important suppliers; however, they do have many downstream partners that sell their products. The focus of their activity thus is still on production capabilities, and this represents a distinctive source of competitive advantage for them. Their capabilities configuration is a direct consequence of their decision to keep production capabilities in-house. In fact, these firms are the only ones in the sample that still have internalized production capabilities and pay significant attention to them. This group considers production, delivery, and post-sales capabilities as sources of competitive advantage.

Group B is composed of three firms: Beta, Delta and Eta. These three

firms operate in a local market only and have fewer than 50 employees each. Firms in this group are software houses or consulting firms, and their percentage of managed activities is fairly high: 85 percent for Beta, 54 percent for Delta, and 62 percent for Eta. The complexity of their solutions is low. For these firms, the offering of integrated solutions represents a movement both upstream and downstream and, from a strategic point of view, it represents a way to fulfil the needs of their customers. The decision to internalize many activities represents a way for Group B firms to conserve resources: due to their small size, these firms cannot achieve scale economies in either marketing or personnel, and they do not have enough resources to manage a network of suppliers. Therefore, these firms tend to perform many activities in-house. People that work in these firms are skilled in multiple technologies and usually are able to work in different functional areas (for example, workers may perform both marketing and delivery-related activities). They have broad knowledge about different aspects of the integrated solution but do not solve complex problems. Group B firms' post-sales and delivery capabilities represent the core of their offering, due to the characteristics of their market: their customers' sophistication is low, the customers require only simple systems to solve their problems and they are especially interested in post-sales assistance. What their customers require is what Group B firms offer.

Group C comprises four firms: Gamma, Zeta, Theta and Iota. These firms share the same core business, they are all consulting firms that began to offer integrated solutions. They operate in both national and international markets, and the level of sophistication of their customers and the complexity of the problems to be solved is high. The critical task for Group C firms is to find the right solution for their customers. The motivation for these firms to move into the integrated solutions business was the need to differentiate their offerings from those of their competitors. As observed by one interviewee, the combining of three or more distinct pieces into a solution increases the firm's opportunity to differentiate its offering and, as a consequence, the possibility of surviving in the market. The offering of integrated solutions, for Group C firms, is a way to create a niche in which to operate where competition is not as strong. Integrated solutions also represent a way to

provide a more comprehensive offering of consulting services for their customers.

The migration into the integrated solutions business required an upstream movement for Group C firms, and in doing so, they developed some product-related capabilities. Specifically, they acquired the capabilities necessary to offer additional products related to the consulting services already being provided. In many cases, the product-related activities were developed jointly with partners: three out of the four firms have strong relationships with product providers (that is hardware producers or software houses). Due to their size, they can achieve economies of scale and contractual advantages that make it profitable for them to outsource noncore activities. None of the firms manages its product-related capabilities in-house: the rationale for this decision is that these capabilities are not considered strategic.

Group D is composed of only one firm, Kappa. Kappa has more than 500 employees and operates solely in the national market. This firm is the only pure systems integrator in our sample. As such, its goal is to achieve technological and organizational synchronization within established product architectures (Brusoni and Prencipe, 2001), and that is precisely what this firm does. The solutions offered by this firm are very complex, customized to the specific requests of the customer, and with a high level of innovation in the use of technologies. Originally a hardware producer of infrastructure for the telecommunication industry, Kappa moved downstream into integrated solutions. The rationale behind this decision was the view that, according to the interviewee, only in the integration of products and services would it be possible to add value. When this firm started the transition towards integrated solutions, it outsourced to its partners all the activities that management considered nonstrategic. So Kappa now offers complete solutions and acts as a systems integrator of different components produced and delivered by a large network of suppliers. Kappa has devoted special attention to the development of its systems integration capabilities, providing its customers with an integrated bundle of different products and services available through its large network of supplier/partners.

Table 2.3 Strategies and capabilities configurations

Group	Core capabilities	Rationales	Role	*Strategy*
A	Production Delivery Operational	New way to sell existing products	Secondary to the previous offer	*Manufacturer*
B	Delivery Operational	Accomplish simple customer needs	As important as the previous offer	*Problem Solvers*
C	Consulting	Differentiation, creation of a niche	As important as the previous offer	*Solutions Providers*
D	Systems Integration	Add value to the offer	Central	*Systems Integrator*

In Table 2.3 I summarize the differences in the strategies pursued by the four clusters of firms. This table reflects firms' core capabilities, their rationales for pursuing integrated solutions, and the role assigned to the new business model, as highlighted in the above discussion.

CONCLUSIONS

In this chapter I have analyzed the capabilities configurations related to the offering of integrated solutions by a sample of firms in the IT sector. To successfully offer integrated solutions, firms must manage service-related as well as product-related capabilities. This implies a movement upstream for service-based firms and a movement downstream for product-based firms. According to contingency theory, environmental and organizational factors influence firms' strategies, which in turn have an impact on firms' capabilities configuration. I have aimed to identify and describe the relationships between environmental and organizational factors, strategies and capability configurations through a multiple case study in the IT sector (Drazin and Van De Ven 1985, Venkatraman 1989). Relying on previous studies (for example, Davies et al. 2006) and on empirical evidence from our

analysis, I have developed a taxonomy of capabilities that firms must manage in order to successfully offer integrated solutions in IT.

Using four contingency factors (size, core business, market and solution complexity), I have identified four groups of firms and have defined them by means of a hierarchical cluster analysis. Integrating the results of this analysis with previous analytical results in the literature, I have concluded that firms within the same group pursue similar strategies. This is consistent with the reasoning of contingency theory (see, for example, Drazin and Van De Ven 1985; Siggelkow 2002) in that, for our sample, similarities in organizational and environmental factors lead to similar strategic choices, and the varied importance attributed to different capabilities within each group is influenced both by external and organizational factors and by strategic choices. These findings are summarized in Table 2.4.

The literature (Davies et al. 2006) has stressed that systems integration capabilities are central to the offering of integrated solutions. The results of the present study illustrate that the importance of different capabilities varies across groups, and therefore there are different ways to offer integrated solutions. Specifically, the importance of firms' systems integration capabilities varies from medium to high (cf. Group D, and Tables 2.3 and 2.4). However, environmental and organizational factors also play an important role in shaping capabilities configurations. The fact that firms' responses may differ despite similar technological or market conditions is consistent with the evolutionary approach upon which I rely (Nelson 1991).

The empirical evidence also illustrates the factors that influence firms' strategic decisions in offering integrated solutions. The complexity of the solution is the most influential factor (Table 2.4), as it has an impact on each group. This is consistent with the observations that the offering of integrated solutions can be carried out in different ways and that the differences across integrated-solutions firms operating in the same sector may be quite large. Although each integrated solution in the IT sector may feature hardware, software, consulting, and post-sales assistance components, the specific needs of firms' customers vary in complexity, and the possibilities for a given firm to differentiate are many. Therefore, depending on the characteristics of the solutions offered, both the strategic decisions and the

Table 2.4 Factors, strategies and capabilities configurations

Group	Relevant factors	Strategy	Capabilities
A	Core business Size	*Manufacturers*	Production Delivery Operational
B	Market Complexity of solution	*Problem solvers*	Delivery Operational
C	Core business Complexity of solution	*Solutions providers*	Consulting
D	Complexity of solution	*Systems integrators*	Systems Integration

capabilities configurations can vary across firms. This is consistent with what has been stressed by scholars in previous studies: that in integrated solutions, the central role is assigned to the customers and, to satisfy their varied needs, firms may need to be able to configure their capabilities in very different ways.

METHODOLOGICAL APPENDIX

Two sources of data were used for the study: documents (including reports, journal articles, databases and firms' official websites) and personal interviews. The document analysis, which constituted the preliminary phase, enabled us to acquire an understanding of the specific characteristics of integrated solutions in the IT sector and to identify sample firms and people to interview. In the second phase, open-ended interviews served as our principal source of data. The length of the interviews was between 60 and 90 minutes. Interviews were conducted in Italy between May and July 2004 at the firm's site, or at the customer's site if the interviewee was working there.

All interviews were tape-recorded and fully transcribed in order to preserve the details of the conversations.

The interviews, which were exploratory in nature, consisted of questions about specific topics related to integrated solutions. The responses reflected the particular point of view of the interviewees (Oppenheim 2000). The questions are reported in Appendix A.

The questions were divided into three parts. The first part asked for a description of a typical project managed by the firm. For each phase of the project, the interviewees described the activities performed, the capabilities required, and the organizational form adopted. The second part focused on capabilities. I followed the taxonomy provided by Davies et al. (2006) in the development of the capabilities questions. Davies et al. identified four types of capabilities: systems integration, post-sales services, financing and business consulting capabilities. For each capability, I investigated the level of standardization/customization, the type of professionals required for the activities, the problems, and the critical features. The third part of the interview focused on the firm's boundaries, with specific questions on types of relationships the firm had with the suppliers of its products and services.

I adopted a multiple case study approach. Sample selection was carried out so as to ensure theoretical replicability – that is, so that the selected case studies could be reproduced either with results similar to those of the original framework or with contrasting results but for predictable reasons (Yin 2003). Through the sample selection I sought to capture a representative variety of experience among the sample firms. I first selected five cases, for which I wrote individual reports. After a preliminary analysis of the results, I selected an additional five firms to further increase the sample variety. Each of the sample firms contributes to the theory-building process by representing a unique and interesting approach to the integrated solutions challenge. sample comprises three firms operating in local markets, five firms operating in national markets, and two firms operating in international markets. Two firms are hardware producers, three are software houses, and five are consulting firms (Table 2.2). Firm names have been kept confidential.

APPENDIX A: INTERVIEW QUESTIONS

Introduction
- May I tape record the interview?
- When did you start working for this firm?
- What is your professional CV?

Projects
- Can you describe a typical integrated solutions project?
- Can you articulate it in different stages?
- What kinds of people work on the different stages of a project? (consultants, technicians…)
- How do they contribute to the overall scope of the project?
- How standardized and how customized is the solution prepared by the projects team?

Capabilities

Systems integration: Integration of products, services, technologies
- Is there room for standardization of procedures and routines at the firm level? Or does every single project team solve problems by itself?
- Can you describe how this activity is performed in your firm?
- How are project teams' procedures coordinated at the firm level?
- What kinds of professionals work in this activity?
- How important is this activity to achieve the goal of the project?
- What kinds of problems are related to this activity? How do you solve them? Could you give some examples?

Business consulting
- Are consulting services related to technological or to business aspects of the solution?
- Can you describe how this activity is performed in your firm?
- How are project teams' procedures coordinated at the firm level?
- What kinds of professionals work in this activity?
- How important is this activity to achieve the goal of the project?
- What kinds of problems are related to this activity? How do you solve them? Could you give some examples?

Post-sales services
- What kinds of post-sales services do you provide? (Post-sales services? Training activities? Maintenance services?)

- Can you describe how this activity is performed in your firm?
- How are project teams' procedures coordinated at the firm level?
- What kinds of professionals work in this activity?
- How important is this activity to achieve the goal of the project?
- What kinds of problems are related to this activity? How do you solve them? Could you give some examples?

Firm boundaries: Products

- Are products offered and used in the solutions sold by your firm?
- Are they included in the overall price of the solution, or do you charge for them separately?
- Do you have some kind of commercial or strategic relationship with your suppliers? What kinds of alliances do you have with the suppliers of the products that you use in the solutions? (contractual, preferred suppliers, joint venture…)
- Who is in charge of the post-sales assistance, maintenance and training for the users of these products?

Firm boundaries: Services

- Are services (consulting, assistance, post-sales…) offered by your firm, or do you have collaborations with external suppliers?
- If you have such collaborations, why?
- Do you have some kind of commercial or strategic relationship with your suppliers?
- What kinds of alliances do you have with the suppliers of the services that you include in the solutions? (contractual, preferred suppliers, joint venture…)
- If you work with external consultants, what kind of contract do they have?
- What kinds of services do the external consultants usually manage?

3. Integrated Solutions and Capabilities Configuration: Coexistence of Diverse Approaches

Integrated solutions are becoming prevalent in a large number of industries (Davies et al. 2006; Galbraith 2002a; Oliva and Kallenberg 2003). The diffusion of integrated solutions is particularly significant in the IT sector (Gager 2006; Gerstner 2002), where they are rapidly transforming the competitive landscape of the industry. In order to remain competitive in a sector where value creation is shifting from hardware manufacturing or software development to service-oriented activities (Dolbeck 2007), product and service providers face increasing pressure to supply bundled systems rather than individual subsystems (Tidd et al. 1997). These bundles, often linked by proprietary interfaces, tie customers into a solution with a single point of purchase and after-sales support, and guarantee higher margins than stand alone products or services (Wise and Baumgartner 1999).

Whilst economically appealing, the provision of bundled products and services poses a number of challenges for IT firms. In this new competitive environment, firms become integrators of components, resources, and services that are developed by external organizations (Brusoni et al. 2001). Supplying integrated solutions thus entails a change in the boundaries of the firm. It also requires a redesign of the firm's offers and the reconfiguration of its capabilities (Davies et al. 2006). Compared to firms focusing only on either products or services, integrated solutions providers must develop multiple capabilities to address a broader set of customer needs. They must also carefully evaluate the trade-off between the development of specialized and generic capabilities. In today's hypercompetitive markets, the

development of multiple capabilities may dilute the firm's core competences and, ultimately, erode its sources of competitive advantage.

Restructuring the organizational architecture of a firm, reconfiguring its internal capabilities, and developing new competences are challenging tasks that can be approached through different strategies. Firms in this industry have developed a variety of different capabilities and have historically followed different paths to become integrated solutions providers (Davies et al. 2006). However, none of the strategies adopted has yet emerged as generally superior (Davies et al. 2007; Windahl et al. 2004). For instance, firms originally specializing in manufacturing must integrate their manufacturing-oriented competences with service-oriented capabilities. However, the delivery of services requires organizational principles and structures that are almost completely new to a product manufacturer. By the same token, service companies that choose to offer bundles of products and services also need to acquire new competences.

The heterogeneity of the approaches followed by integrated solution providers suggest that there is uncertainty about the most appropriate ways to conceive, implement, and manage the provision of integrated solutions. They also indicate that the nature of the organizational capabilities required to succeed in this challenge is unclear too. The blurred picture on the practice side is symptomatic of a knowledge gap at the theoretical level as well. Previous studies on this topic have stressed that to become integrated solutions providers, firms must develop appropriate capabilities (Galbraith 2002a; Wise and Baumgartner 1999). Yet, the literature provides limited information on how firms should develop these new capabilities or reconfigure their existing ones. It also gives limited guidance regarding the shaping of integrated solutions offers and offers few insights into the factors that affect both the current structure and the future evolution of this industry. This chapter proposes and tests a conceptual model that links the capabilities developed by integrated solutions providers to the characteristics of the environments in which these firms operate. The model is used to achieve two related objectives and to make two main contributions. First, it is used to analyze the structure of the industry by uncovering configurations of integrated solutions providers in the IT sector. Specifically, I seek to determine whether firms in this industry organize themselves according to 'internally consistent combinations of strategy, organizational architecture and technology that provide superior performance in a given environment' (Tidd and Hull 2002). Recognizing the need for exploratory research in this field and following the increasing interest received by organizational gestalts (Aksin and Masini, 2008; Bensaou and Venkatraman 1995; Dennis and Meredith 2000; Meyer et al. 1993; Miller and Roth 1994), I follow a configurational approach. The establishment of configurations is a useful contribution to the emerging literature on integrated solutions and IT because 'taxonomies provide parsimonious descriptions which are useful in discussion, research and pedagogy' (Miller and Roth, 1994: p. 286).

As a second objective, the model is used to test the hypothesis that to generate value, integrated solution providers should develop capabilities that fit the requirements of the environment in which they operate. By examining performance differences among configurations and assessing the value of specialization in different environments, I shed light on the factors that influence the success of integrated solution projects and that ultimately shape the dynamics of this industry.

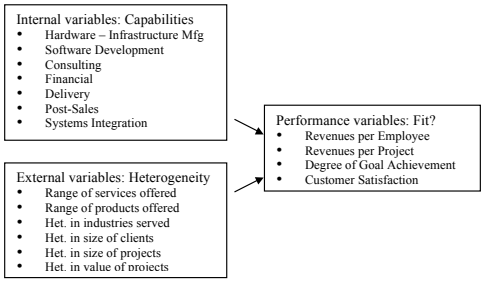
A CONCEPTUAL MODEL OF FIT TO INVESTIGATE THE SOLUTION BUSINESS

To shed light on the factors that affect the strategies and performance of integrated solutions providers, I use two main theoretical anchors: the resource-based view of the firm (RBV) and the contingency (or structure–environment) perspective. The structure–environment perspective offers a second theoretical lens for the analysis of integrated solutions. This theory posits that there is a link between environmental context, organizational structure, and performance (Drazin and Van De Ven 1985; Duncan 1972; Venkatraman 1989). Contingency scholars argue that a strategy is successful only if there is fit (that is, a degree of internal coherence) between existing capabilities and external environmental contingencies (Venkatraman 1989). This conceptualization of fit can be used to obtain configurations of different

contingencies, each having distinctive implications for organizational design (Child 1975).

A direct implication of the structure–environment perspective is that there is no such thing as a single best strategy in the provision of integrated solutions. Superior performance can be achieved only when organizational capabilities are combined coherently to match the characteristics of the competitive environment in which the firm operates. Building upon the literature contributions summarized above, and drawing upon the conceptualization of fit as gestalts, i.e. clusters of units that display coherence among a set of theoretical attributes (Miller 1981; Venkatraman 1989), I propose the conceptual model illustrated in Figure 3.1 and discussed in the next section.

Figure 3.1 Theoretical model



Capabilities for the Provision of Integrated Solutions

Organizational capabilities play a paramount role in the success of integrated IT solutions and offer a useful lens for the analysis of the strategies of their providers (Galbraith 2002a; Davies et al. 2006; Davies et al. 2007). As illustrated in the previous chapter, it is possible to identify six capabilities

required to offer integrated solutions. In the remainder of this chapter, I shall distinguish the production capabilities into: (i) software development capabilities include the design, development, and testing of software, and (ii) hardware and infrastructure manufacturing capabilities including the manufacturing and assembling of hardware products (computers, servers, workstations, or other electrical equipment), as well as other physical tasks associated with the installation of networks and cables. These two sets of capabilities are distinguishing characteristics of integrated solution providers because they differentiate these providers from pure IT consultants. Consulting capabilities represent the ability of an organization to understand the needs of its customers and to tailor solutions to those needs. Because integrated IT solutions must address customer needs from end to end, adequate consulting capabilities play a central role. Firms with inadequate consulting capabilities risk building useless solutions, which are both ineffective and expensive to maintain and upgrade (Slywotzky and Wise 2003).

Financial capabilities include all the activities through which integrated solution providers offer financial assistance to their customers, for example, the provision of leasing and flexible payment structures and the offering of competitive interest rates and/or buyout options (Brady et al. 2005). These services offer a high value-added to clients, who can count on a proper turnkey solution. However, they are also difficult to develop, because they require competences outside the core business of IT firms (Dierickx and Cool 1989; Sanchez 1995). For an integrated solution provider, the development of financial capabilities is an effective way to differentiate its offers from those of its competitors. Delivery capabilities include the capability to deliver hardware and software (including software customization). Software customization is a critical capability that needs to be managed by every solution provider (Ceci and Prencipe 2008; Davies 2004). It is particularly critical for firms offering complex packages, such as ERP, which need to be customized to fit the characteristics of the client. Post-sales capabilities include activities related to hardware maintenance, software assistance, software problem solving, and user training (Brady et al. 2005; Slywotzky and Wise 2003; Windahl et al. 2004). They are fundamental because of the

very nature of the products sold: it is nearly impossible at the present time to sell software without post-sales assistance, especially in B2B environments.

Systems integration capabilities consist of the ability to integrate products, services, and different technologies. Systems integration plays a central role in the provision of integrated solutions, because different technological platforms must communicate to assure a seamless flow of data and information. Likewise, products, subsystems and services must also be fully integrated to address the increasing demand for speed and effectiveness that characterize the markets for IT applications. Empirical evidence shows that these are by far the most difficult capabilities to develop and are also a very critical component in the provision of integrated solutions (Brusoni et al. 2001; Prencipe et al. 2003).

By selectively allocating resources to the different activities above, integrated solutions providers shape the nature of their offers and the characteristics of their capabilities. Firms that decide to develop specialized capabilities in a particular domain focus on a subset of the above activities (e.g., systems integration). Firms that choose to develop generic capabilities allocate resources more evenly among the various activities. Accordingly, I propose the following definition:

> *Definition 1:* Integrated solution providers display specialized capabilities when they concentrate their resources on a limited set of core activities. Integrated solution providers display generic capabilities when they spread their resources evenly among a wide range of activities.

Environmental Variables and Strategic Choices

Contingency theorists have analyzed several environmental characteristics with the objective of understanding how firms should adapt their organizational structures, strategies, or capabilities to different environments. A number of variables have been examined, including turbulence (Ansoff 1979), dynamism (Mintzberg 1979), speed (Eisenhardt 1989), uncertainty (Galbraith 2002b), and heterogeneity (Perrow 1967). Among these characteristics, heterogeneity plays a very central role in shaping organizational capabilities (Osborn and Hunt 1974; Pfeffer and Leblebici

1973). Integrated solutions providers can affect the degree of heterogeneity of their operational environment by making three types of choices: they can select the mix of products/services to deliver; they can choose the types of markets to target; and, finally, they can decide how to organize and manage the projects. These decisions create three specific types of heterogeneity: in the offers, in demand, and in the type of projects.

Heterogeneity in the offers accounts for the range of services as well as the range of products offered by the solution provider. Firms operating in service-oriented markets will require different capabilities than firms in product-oriented markets, because these markets have different characteristics (Easingwood 1986; Hill 1999). As integrated solutions include both products and services, the relative proportion of products and services in the offers effectively differentiates firms operating in niche markets from those operating in the mass market.

Heterogeneity in demand includes heterogeneity in the industries served and in the size of the clients, because both factors can affect the type of capabilities required to provide integrated solutions. Scholars have emphasized the role played by customer demand in determining performance, shaping innovation, and developing capabilities (Adner and Levinthal 2001; Adner and Zemsky 2006). With the increasing sophistication of customer requirements and the recent widespread diffusion of industry-specific IT products, 'one-size-fits-all' approaches to the provision of IT solutions are proving increasingly ineffective. Rather, IT providers need to develop industry-specific capabilities that can effectively address the needs of their clients in different industries.

Heterogeneity in projects takes into account heterogeneity in both the size and the value of the IT solutions provided. As IT solutions providers are project-based organizations, the characteristics of the projects they manage have a central role in shaping their operational environment (Davies 2004; Brady et al. 2005). The length and the value of a project significantly affect its complexity and its risk; in turn, complexity and risk have an impact on the type of capabilities and organizational structure that a solution provider needs to put into place to successfully manage the project (Davies and Hobday 2005; Hobday 2000). Based on the above characterization, I propose the

following definition:

> *Definition 2:* Integrated solution providers operate in heterogeneous environments when they offer a wide range of products and services, serve different customers, and develop projects of different sizes and values. Integrated solution providers operate in homogeneous environments when they offer a limited range of product and services, serve similar customers, and develop projects of similar size and value.

ANALYTICAL APPROACH

I operationalized the taxonomic variables that define heterogeneity as follows. Heterogeneity in the offer was operationalized by means of two indicators (RANGE_PROD and RANGE_SERV) reflecting the range of products and services included in the offer and developed internally. To allow us to compute the indicators, project managers were given a list of activities and asked to indicate whether and how the firm provided these activities. The list of activities (reported in the appendix) was based on the results of the analysis of the data collected in the exploratory phase of the research (Ceci and Prencipe 2008). The two indicators were then constructed as follows:

$$\text{RANGE\_PROD} = \Sigma_i (x_i * a_i)/\text{N} \quad (3.1)$$

$$\text{RANGE\_SERV} = \Sigma_i (x_i * b_i)/\text{N} \quad (3.2)$$

where x_i is the activity score reported in the questionnaire and coded according to the following key: 3 if the activity was included in the offer and managed in-house; 2 if included in the offer and managed both in-house and externally; 1 if included in the offer but managed by external providers only; and 0 if not included. a_i is the product-specific weight of activity i based on its product content. b_i is the service-specific weight of activity i based on its service content. N is the number of activities examined.

The heterogeneity of customers was measured using two Herfindahl-Hirschman concentration indices, one for the percentage of clients of different sizes (H_SIZECL), and one for clients operating in different industries (H_IND). The heterogeneity of projects was also measured by means of two Herfindahl-Hirschman indices applied to the length (H_SIZEPR) and the value (H_VALUEPR) of integrated solution projects. Low values for these indices indicate heterogeneous environments, whereas low values of the product and service range indices, in contrast, indicate homogeneous environments. A factor analysis on the six heterogeneity indices confirmed the existence of three factors representing the three types of heterogeneity.

The taxonomic variables defining the type of capabilities were measured using multi-item scales. For each of the seven activities, respondents were asked to assess through 5-point Likert scales its importance for the business; the frequency of provision of the activity; the involvement of external suppliers; and the percentage of work conducted internally. To operationalize the capability variables I first performed a factor analysis on the 28 items with varimax orthogonal rotation, which supported the retention of the seven factors suggested in the literature (Ceci and Prencipe 2008). The capability variables were then formed by aggregating the items tapping into each construct, weighted by their respective factor scores. I conducted several tests to assess the psychometric properties of the measures. Cronbach's alpha values varied from 0.84 to 0.96 for each measure, thus providing strong evidence of construct reliability. To establish convergent and discriminant validity, I performed a confirmatory factor analysis (Hair et al. 1998). I tested the measurement models through partial least squares (PLS), a structural modelling technique with small sample-size requirements (Wixcom and Watson 2001). The results provided strong evidence of convergent validity: the Average Variance Extracted (AVE) exceeded the recommended cutoff value of 0.50 for all scales. Factor loadings also exceeded the recommended cutoff value of 0.60. In addition, the results provide evidence of discriminant validity. The squared root of the AVE value of each construct was larger than the correlation between that construct and all other constructs. In Table 3.1 I report the factor loadings, Cronbach's alpha values, and AVE values for the seven capabilities.

I measured the two aggregated variables that assess environmental homogeneity and the degree of specialization of organizational capabilities as follows. The average degree of environmental homogeneity was measured by aggregating the factor scores obtained from the factor analysis of the six heterogeneity indices. The degree of specialization of capabilities was computed as the variance of the seven capability indices. Low levels of variance across the seven indices constitute evidence of firms with generic capabilities that allocate resources evenly among various activities. Conversely, high levels of variance are associated with specialization, as they indicate uneven resource allocation profiles across the seven capabilities. I also characterized the seven capabilities with respect to their degree of customizability to customer-specific needs. I calculated this variable by multiplying each capability index by its specific degree of customizability (measured via a dedicated 5-point Likert scale) and averaging these measures over the seven capabilities. Finally, to assess the fit between the capabilities and the environment, I computed a misfit variable as the squared difference between the standardized values of the homogeneity and specialization indices.

To assess the value generated by the different configurational arrangements, I used two productivity measures as dependent variables: revenue per employee (revenue from the integrated solutions business divided by the number of employees) and revenue per project. Furthermore, to reflect the customer's perspective I also assessed project performance by means of two variables: the degree of goal achievement and a customer satisfaction index calculated using a self-reported, 5-point Likert scale. Data to compute financial measures of performance were obtained from public databases (Amadeus). Other project-based performance measures were self-reported. For all the self-reported measures, I tested for common method variance (CMV) using Harman's single factor test (Podsakoff et al. 2003). Results showed no evidence of CMV.

To identify configurations of integrated solutions providers, I applied a clustering algorithm to the sample of 102 companies, using the six capabilities and seven heterogeneity indices in Figure 3.1 as taxonomic variables. Following the recommendations provided in Punj and Stewart (1983)

Table 3.1 Measurement scales for the seven capabilities

Construct and Questionnaire Items	Loading	*t*-stat.
Hardware and Infrastructure Mfg. (CR = 0.95; AVE = 0.82)		
Importance for the business	0.89	20.22
Frequency of provision	0.93	40.94
Involvement of external suppliers	0.94	55.33
Percentage of work done internally	0.88	21.30
Software Development (CR = 0.97; AVE = 0.89)		
Importance for the business	0.97	118.65
Frequency of provision	0.90	41.90
Involvement of external suppliers	0.95	84.02
Percentage of work done internally	0.96	74.38
Consulting (CR = 0.93; AVE = 0.78)		
Importance for the business	0.88	26.56
Frequency of provision	0.84	23.36
Involvement of external suppliers	0.89	42.13
Percentage of work done internally	0.91	45.85
Financial (CR = 0.97; AVE = 0.88)		
Importance for the business	0.94	52.97
Frequency of provision	0.95	57.96
Involvement of external suppliers	0.97	111.63
Percentage of work done internally	0.89	24.59
Delivery (CR = 0.89; AVE = 0.68)		
Importance for the business	0.83	17.83
Frequency of provision	0.77	12.23
Involvement of external suppliers	0.82	18.11
Percentage of work done internally	0.85	25.45
Post–sales (CR = 0.89; AVE = 0.69)		
Importance for the business	0.81	9.36
Frequency of provision	0.77	8.41
Involvement of external suppliers	0.82	25.84
Percentage of work done internally	0.89	39.89
Systems Integration (CR = 0.91; AVE = 0.71)		
Importance for the business	0.86	11.17
Frequency of provision	0.77	9.95
Involvement of external suppliers	0.85	26.46
Percentage of work done internally	0.90	35.71

and Ketchen and Shook (1996), I standardized the taxonomic variables to limit the spurious influence of different scales; I used the squared Euclidean distance as similarity measure; and I employed the Ward's minimum variance method to form clusters.

I used a two-stage clustering procedure to determine a final solution and to minimize the impact of outliers (Menor et al. 2001). In the first stage, I conducted a hierarchical clustering analysis using Ward's method and eliminated from the sample the 10 percent of the observations that had the largest multivariate distance from the others (i.e., potential outliers). Then, to identify the number of clusters, I looked for pronounced increases in the tightness of clusters as measured by the R^2, the Cubic Clustering Criterion, and the pseudo-F statistic (Milligan and Cooper 1985), and for managerial interpretability of the clusters (Ketchen and Shook 1996; Hair et al. 1998). The initial Ward's solution was used to identify the initial seeds for the second-stage analysis, in which I used an iterative K-means approach to search for improved solutions. The analysis, conducted with the CLUSTER and FASTCLUS procedures in SAS 9.1, generated a four-cluster solution containing 41, 15, 24 and 11 observations. The four clusters were named *off-the-shelf solution providers*, *resellers*, *industry specialists* and *technologists*.

I used several tests to assess the robustness and the validity of the solution. An overall multivariate test of significance using the Wilks' lambda criterion and the associated F statistic indicated that the null hypothesis that the four clusters were equal across all defining variables could be rejected with $p < 0.0001$ (Miller and Roth 1994). I also conducted a jackknife cross-validation analysis (Menor et al. 2001; Miller and Roth 1994), to assess whether the proposed classification criterion correctly classified future observations (Table 3.2). The analysis indicated a group-specific error-count estimate (proportion of misclassified observations) of around 10 percent, which is acceptable for this type of study (Menor et al. 2001). Finally, to test the statistical power of the configurations, I performed a series of one-way comparisons among the four clusters using the 13 taxons as discriminating variables.

To assess the external validity of the proposed configurations (Ketchen and Shook 1996) I compared clusters against the four performance variables

and also against the degrees of specialization and customization of their capabilities, the degree of environmental heterogeneity, and their degree of misfit. In addition, I also controlled for differences in age and size.

Table 3.2 Jackknife cross-validation of observations

	Assigned to cluster:				
From cluster:	1	2	3	4	Total
1 Off-the-shelf solution providers	**40 (98%)**	1 (2%)	0 (0%)	0 (0%)	41
2 Resellers	0 (0%)	**14 (93%)**	1 (7%)	0 (0%)	15
3 Industry specialists	2 (8%)	0 (0%)	**21 (88%)**	1 (4%)	24
4 Technologists	1 (9%)	1 (9%)	0 (0%)	**9 (81%)**	11
Misclassification rate	2%	7%	13%	18%	10%

CHARACTERISTICS OF THE FOUR CONFIGURATIONS

The four configurations can be characterized with respect to their respective group centroids (means) of the 13 taxonomic variables (Table 3.3). The results show that 9 of the 13 variables included in the model strongly discriminate among clusters (at $p < 0.05$ with a Scheffe contrast).

Off-the-Shelf Solution Providers

These providers comprise the largest cluster, representing 45 percent of the overall sample. These firms possess primarily delivery, post-sales, and consulting capabilities, whilst they do limited software development or hardware manufacturing. They either sell their own standardized packages or work in partnership with larger software firms for which they commercialize and install standard products after adding the minimum level of customization required. The presence of consulting capabilities is an indication

Table 3.3 Characteristics of the clusters

	Off-the-shelf solution providers (n = 41)		Resellers (n = 15)		Industry specialists (n = 24)		Technologists (n = 11)		F-value (probability)
Variables that define the type of capabilities [a]									
Hardware and infrastructure manufacturing capabilities									
Cluster mean	−0.38	(4)	−0.35	(4)	−0.24	(4)	**1.79**	(1,2,3)	49.73
St. dev.	0.18		0.26		0.52		1.31		< 0.001
Software development capabilities									
Cluster mean	−0.19	(3)	−0.02		**0.44**	(1)	0.03		2.18
St. dev.	1.08		1.03		0.78		0.75		0.09
Consulting capabilities									
Cluster mean	**0.40**	(3)	0.08	(3)	−0.68	(1,2,4)	0.33	(3)	8.19
St. dev.	0.50		0.83		1.41		0.33		< 0.001
Financial capabilities									
Cluster mean	−0.33	(2)	**0.85**	(1,3,4)	−0.39	(2)	0.06	(2)	10.41
St. dev.	0.46		1.44		0.07		1.14		< 0.001
Delivering capabilities									
Cluster mean	**0.33**	(2)	−1.37	(1,3,4)	0.28	(2)	0.08	(2)	22.65
St. dev.	0.47		1.46		0.41		0.42		< 0.001
Post – sales capabilities									
Cluster mean	**0.28**		−0.27		0.27		−0.38		3.67
St. dev.	0.58		1.09		0.49		1.28		0.01
Systems integration capabilities									
Cluster mean	0.06		**0.44**		0.11		−0.20		1.29
St. dev.	0.89		0.55		0.92		0.86		0.28

Table 3.3 Characteristics of the clusters (continued)

	Off-the-shelf solution providers (n = 41)		Resellers (n = 15)		Industry specialists (n = 24)		Technologists (n = 11)		F-value (probability)
Variables that define the heterogeneity of the environment [a]									
Range of services offered									
Cluster mean	−0.12		0.36		−0.18		**0.37**		1.75
St. dev.	0.94		0.88		1.03		0.93		0.16
Range of products offered									
Cluster mean	−0.06		−0.50	(4)	0.14		**0.57**	(2)	3.04
St. dev.	0.96		0.96		0.93		0.82		0.03
Heterogeneity in the industries served (reversed) [b]									
Cluster mean	−0.26	(3)	**−0.53**	(3)	0.50	(1,2)	0.08		5.10
St. dev.	0.90		0.83		0.98		0.90		0.01
Heterogeneity in the size of the clients (reversed) [b]									
Cluster mean	0.02		−0.29		0.29		**−0.57**		2.44
St. dev.	0.98		0.91		0.98		0.95		0.05
Heterogeneity in the size of the projects (reversed) [b]									
Cluster mean	**−0.56**	(2,3)	0.38	(1,3,4)	0.75	(1,4)	−0.50	(2,3)	16.61
St. dev.	0.66		1.02		0.84		0.79		< 0.0001
Heterogeneity in the value of the projects (reversed) [b]									
Cluster mean	**−0.70**	(2,3)	0.35	(1)	0.68	(1,4)	−0.19	(3)	18.92
St. dev.	0.52		1.08		0.93		0.50		< 0.0001

Notes

[a] Cluster means represent the average values of the taxonomic variables (standardized) for the four clusters. The numbers in parentheses indicate the cluster numbers from which the focal group was significantly different at the 0.05 level, as indicated by a Scheffe test. Numbers in bold represent the highest centroid for the variable.

[b] High values of the four Herfindahl heterogeneity indices indicate low levels of environmental heterogeneity.

that off-the-shelf solution providers have already worked with their customers before installing the product. They assess the business needs of their customers and help them select the most appropriate IT solution available on the market. They also deliver and install the solution, which is composed of standardized products often sourced from external suppliers. As their business does not require any industry-specific competence, they serve a large number of clients in different industries. The low customization of the solutions and the strong emphasis on consulting capabilities make this business model largely adopted by former consultancy companies.

Resellers

Firms in this group are small and relatively young companies characterized by specialized capabilities, mostly in finance and systems integration. They serve customers from different industries yet they focus on few typologies of products. Similar to off-the-shelf solution providers, resellers help their customers buy hardware and software from third parties, and do not produce in house. Yet, in contrast, they do not deliver or install the solution; they simply provide assistance to improve the compatibility among legacy systems that are not fully interoperable. Accordingly, they provide solutions tailored to customer needs (they have the second highest degree of customizability in their capabilities). Thus, they offer to their customers IT competencies that the latter are not able or not willing to develop.

Industry Specialists

These firms focus primarily on software development and, to a lesser extent, on delivery and post-sales activities. They are relatively small and newly established companies that operate with clients in a specific industry (for example, health care, transportation, publishing, or public administration). Although the solutions they deliver are not tailored to specific customer needs, they are highly industry-specific. This enables industry specialists to develop specific knowledge of the internal processes of their customers. In turn, this specific knowledge allows them to prepare ad hoc solutions for the idiosyncratic needs of the industry. Finally, as industry specialists are the

only ones possessing the specific product knowledge necessary to offer adequate post-sales services for the products they developed, they may use this knowledge to lock their customers into a long-term business relationship.

Technologists

This is the smallest cluster, representing 12 percent of the overall sample. Technologists are former hardware manufacturers and software vendors that have moved into the integrated solution business. They are large and well-established firms offering a wide range of customized products and services. They possess capabilities in software development and hardware manufacturing and pay little attention to delivery and post-sales activities. Similar to industry specialists, technologists focus on a restricted number of industries. Yet, in contrast to industry specialists, they occupy the upstream section of the industry value chain and delegate to other firms (for example, resellers) the task of implementing the solution. Whilst industry specialists sell standardized products and use their process knowledge to lock customers into their delivery and post-sales processes, technologists try to achieve the same objective by leveraging their technological skills to develop highly customized hardware and software products that cannot be easily substituted by other providers' solutions.

PERFORMANCE DIFFERENCES AMONG CONFIGURATIONS

In Table 3.4 I report differences in the variables used to validate the configurations. First, the results provide evidence of predictive validity, as I found significant differences among the four configurations with respect to most of the variables used to validate clusters. The data also provide partial support for hypothesis 1. Whilst the four groups display significant differences in the degree of specialization of their capabilities ($F = 15.20$, with $p < 0.0001$) and in the degree of homogeneity of the external environment ($F = 11.93$, with $p < 0.0001$), they do not display equally large differences in the degree of fit between these two variables ($F = 3.05$, with p

= 0.03). This suggests that integrated IT solutions providers tend to select products, markets, and customers in such a way that the resulting environmental heterogeneity is aligned with the degree of specialization of their capabilities. The results also indicate that firms that possess specialized capabilities can more easily customize their offers.

Performance differences can be also analyzed in light of the role of fit. Off-the-shelf solution providers and technologists, which have the highest degrees of fit, also display the best performance in terms of revenue per employee and revenue per project. These two groups represent different fit configurations. Off-the-shelf solution providers apply generic capabilities in a highly heterogeneous environment to sell a large volume of standardized solutions. Technologists, on the other hand, leverage specialized capabilities in a fairly homogeneous environment. This facilitates the development of highly customized solutions that can be priced at a higher level because they are not easily substitutable. It also creates economies of scale within the organization and reduces the effort required to customize the solution (hence the higher labour productivity figures). Superior revenue performance is consistent with the literature on integrated solutions. Previous studies have pointed out that the characteristic that differentiates an integrated solution from a simple bundle of products and services is the customization of the bundle to specific customer needs (Wise and Baumgartner 1999). It is worth stressing that resellers have the worst productivity results but the highest project performance. Lower productivity can be explained again by the fit argument (resellers have the second lowest degree of fit), as well as by the fact that these firms focus on low-value-added activities.

The choice to operate in heterogeneous environments makes it more difficult for these firms to develop highly customized loan packages for a large number of different customers and products. The nature of the work conducted by resellers also explains their higher customer satisfaction figures: they help companies finance projects developed and installed by other organizations (e.g., technologists), which are usually held responsible for the problems that eventually occur. The poor project performance of technologists can also be explained by the high degree of customization of their products. A high level of customization usually makes the solutions

more complex and more difficult to use. It also creates compatibility problems. As technologists provide hardly any post-sales assistance, they are usually blamed for their inability to provide adequate help when these problems occur.

Table 3.4 Analysis of predictive validity

	Off-the-shelf solution providers (n = 41)		Resellers (n = 15)		Industry specialists (n = 24)		Technologists (n = 11)		F-value (probability)
Revenue per employee									
Cluster mean	0.08	(4)	−0.37	(4)	−0.33	(4)	**0.94**	(1,2,3)	7.73
St.dev	1.02		0.41		0.46		1.85		< 0.001
Revenue per project									
Cluster mean	0.02		−0.31		−0.17		**0.44**		1.53
St.dev	0.81		0.33		0.81		1.74		0.21
Degree of goal achievement									
Cluster mean	−0.19	(3)	**0.42**		0.39	(1)	−0.38		3.58
St.dev	1.04		0.70		0.89		0.88		0.01
Customer satisfaction									
Cluster mean	−0.18	(2,3)	**0.57**	(1,4)	0.46	(1,4)	−0.69	(2,3)	7.46
St.dev	0.94		0.72		0.71		0.95		< 0.001
Homogeneity									
Cluster mean	−0.54		−0.17		**0.72**	(4)	−0.02	(3)	11.93
St.dev	0.79		0.86		0.82		0.88		< 0.001
Specialization									
Cluster mean	−0.60	(2,4)	**0.50**	(1,3)	−0.34	(2,4)	0.38	(1,3)	15.20
St.dev	0.50		0.69		0.69		0.80		< 0.001

Table 3.4 Analysis of predictive validity (continued)

	Off-the-shelf solution providers (n = 41)		Resellers (n = 15)		Industry specialists (n = 24)		Technologists (n = 11)		F-value (probability)
Customization									
Cluster mean	−0.20	(4)	0.39		−0.15		**0.61**	(1)	3.05
St.dev	0.94		0.94		0.82		1.32		0.03
Misfit									
Cluster mean	−0.36		0.15		**0.31**		−0.08		3.08
St.dev	0.77		0.90		1.17		0.82		0.03
Size									
Cluster mean	**0.28**	(3)	−0.29		−0.51	(1)	0.24		4.10
St.dev	1.10		0.96		0.51		1.04		0.01
Age									
Cluster mean	0.14		−0.52	(4)	−0.18	(2)	**0.41**		2.73
St.dev	1.00		1.04		0.94		0.68		0.05

Notes
Cluster means represent the average values of the variables (standardized) for the four clusters. Numbers in parentheses indicate the clusters from which the focal group was significantly different at the 0.05 level, as indicated by a Scheffe test. Numbers in bold represent the highest centroid for the variable. High values of fit variables indicate low levels of fit between environmental homogeneity and specialization.

Finally, it is interesting to note that the configurations with low degrees of customizability in their solutions (off-the-shelf solution providers and industry specialists) are the largest groups, accounting for more than 70 percent of the firms in the sample. This suggests the emergence of a trend towards standardized solutions – which is increasingly appreciated by customers, as they are then free to change IT providers without being locked into a specific business relationship. Projects based on standardized solutions

can be run on time and on budget, and with significant savings for the customer. They can generate economies of scale and scope that would be impossible to obtain when working with customized products and services.

CONCLUSIONS

Using primary data from 102 firms in the IT sector, this chapter sheds some light on the strategies of firms that offer integrated solutions. Our analysis identified four distinct configurations of IT providers that display fit between their organizational capabilities and their operational environment. It also indicated that integrated solutions providers that possess specialized capabilities tend to customize their offers and generate more value when they operate in homogeneous environments.

The present chapter provides an accurate description of the capabilities that IT firms can develop when they move into this business, which is quite new and still poorly understood. It also offers a detailed analysis of the actual competitive scenarios in the sector. The identification of the four strategic groups provides empirical proof that different strategic approaches to the provision of integrated solutions can indeed coexist in the same competitive environment (Davies et al. 2006).

A forward-looking interpretation of the results provides a related contribution to this literature and sheds light on the industry dynamics. The analysis suggests that, consistent with other industrial sectors, a trend toward more standardized solutions is emerging. As IT systems are becoming commoditized and no longer guarantee competitive advantages to their users, companies with simple IT needs prefer standardized solutions that do not lock them into exclusive relationships with their suppliers. The IT practitioners interviewed for this project agree that the emergence of standardized solutions will segment the market even further. An increasing number of firms with simple IT needs will opt for the standardized solutions provided by off-the-shelf solution providers and industry specialists. These providers will most likely increase their market share. Conversely, more complex requirements will still be addressed by technologists, but the need

for this type of services will become rarer and will cause a decrease in the market share of these firms. The identification of alternative strategies to integrated solutions, the analysis of performance differences, and the identification of future market trends offer useful insights. Managers and practitioners can use our results to verify whether the strategies implemented are consistent with the capabilities of their organizations. They can also use them to decide whether a shift in strategy is needed and how to manage this change coherently, given their internal resources. Moreover this chapter clarifies the nature of the capabilities for the provision of integrated IT solutions and it demonstrates that these theories are useful theoretical lenses to analyze this phenomenon. The analysis reinforces the concept of 'sticky' core capabilities: the differences among configurations suggest that firms are constrained in their strategic choices by the pool of capabilities they possess.

METHODOLOGIAL APPENDIX

The data for this study were obtained via a survey of a sample of integrated solution providers operating in the IT sector. In the first phase of data collection, extant literature and empirical evidence were used to generate valid items to measure the constructs in our theoretical model. The literature review focused on four topics: integrated solutions, systems integration, project-based organization and firm boundaries (Cerasale 2004; Davies and Hobday 2005; Prencipe et al. 2003; Williamson 1975). This review was then supplemented with a multiple case study analysis. Ten IT solutions firms operating in Italy were examined through an analysis of documentary and archival data and interviews with project managers, marketing directors and sales directors. Interviewees were asked to describe, for a typical integrated solution project, the phases, activities performed, capabilities required, organizational form adopted, level of standardization/ customization of the solution, and problems and criticalities, as well as the role played by external suppliers of products and services in the provision of the solution. Together with the analysis of the literature, this allowed for the establishment of a taxonomy of integrated solutions capabilities and the identification of items

describing the characteristics of these solutions (Ceci and Prencipe 2008).

In the second phase of data collection, the items were coded into a questionnaire and submitted to a sample of IT solution providers in Europe. To assure homogeneity in the sample, the survey was restricted to four countries that were representative of the overall population of IT solution providers in Europe and offered favourable opportunities for data collection: Italy, Spain, the United Kingdom and Sweden. To maximize the accuracy of responses, the questionnaire was prepared in the native language of the respondents (with the exception of Sweden, where English was used). The survey was written initially in English and was then translated into Spanish and Italian. The Italian and Spanish versions were then translated back into English by a second translator to check their accuracy and to eliminate inconsistencies (Bensaou and Venkatraman 1995). Each version of the questionnaire was pretested with industry representatives to ensure that the target informants understood the wording and that the Italian and Spanish versions were valid translations.

Table 3.5 Distribution of firms providing integrated solutions

No. of employees	% of firms offering integrated solution
20 to 99	47
100 to 499	50
500+	100

The sample selection was based on an ad hoc sampling procedure. As there was no extant database of integrated solution providers, I developed a procedure to estimate this population and from that population extracted a sampling frame. I used the Amadeus database of European Companies to construct the population of generic IT firms. Since firms that provide integrated solutions are former software houses, hardware producers, and consultancy firms, I considered the following NACE codes: 3001 and 3002 (manufacture of office machinery and computers) and 7210, 7221, 7222, 7230, 7240, 7250 and 7260 (computer and related activities). I then selected a random sample of 200 firms from the population and examined their websites to ascertain whether they provided integrated solutions. In this way, I

obtained the percentage of generic IT firms that moved into the integrated solution business, stratified by number of employees (Table 3.5), and computed the population of IT integrated solution providers. Finally, to select the sampling frame from this population of 3042 firms (Table 3.6), I randomly chose 40 firms from each country, yielding a final sampling frame of 160 firms. I obtained contacts for these firms from IT professional associations, alumni databases from business schools and universities, and distribution lists from specialized newspapers and from the House of Commerce.

Table 3.6 Population and sample characteristics

	Location	No. of employees			
		20 to 99	100 to 499	500+	Total
Firms operating in the IT sector (source: Amadeus database)	Italy	895	293	65	1253
	United Kingdom	1791	792	202	2785
	Sweden	610	131	29	770
	Spain	813	301	56	1170
	Total	**4109 (69%)**	**1517 (25%)**	**352 (6%)**	**5978**
Firms offering integrated solutions	Italy	421	147	65	632
	United Kingdom	842	396	202	1440
	Sweden	287	65	29	381
	Spain	382	150	56	588
	Total	**1932 (63%)**	**758 (25%)**	**352 (12%)**	**3042**
Sample	Italy	20	6	4	30
	United Kingdom	16	4	7	30
	Sweden	12	7	4	23
	Spain	11	5	3	19
	Total	**62 (61%)**	**23 (22%)**	**17 (17%)**	**102**

Because respondents needed to have a direct and personal involvement in an integrated solution project in order to answer the questionnaire, the ideal respondent was identified as a project manager who had completed at least one project with the firm. In order to guarantee that the data collected at the project level could be used as a reliable proxy for all of the firm's activities, project managers were asked to refer to a project that was highly representative of the activities of the company (that is within the class of projects that generated the largest proportion of revenue for the organization) (Subramaniam and Venkatraman 2001). To increase the response rate, I guaranteed that all the data would remain absolutely confidential and would be used only for academic purposes; I also promised to provide personalized feedback benchmarking the respondent's firm against a representative sample.

Telephone interviews were chosen as the preferred mode of data collection because they allowed the researcher to complement the data from the questionnaire with qualitative information that could be used to better characterize the firms. To set up interviews, a researcher first contacted the firms in the sampling frame via e-mail and made follow-up calls one week after the first message. In both cases the researcher briefly explained the aim of the research and the content of the questionnaire and asked to arrange a phone meeting with a project manager. This administration method yielded a 64 percent response rate, which is higher than other studies of this nature (Bensaou and Venkatraman 1995; Miller and Roth 1994). The final sample contained 102 firms (Table 3.6). Of the firms that participated in the survey, 75 percent completed the questionnaire during the phone interviews and 10 percent during face-to-face interviews. For the remaining 15 percent of firms, the survey was self-administered, with the researcher making follow-up calls to clarify the responses as needed. To maximize the accuracy of responses, the interviews were conducted in the native language of the interviewee (again with the exception of Sweden, where the interviews were conducted in English). A Wilcoxon signed-rank test on the firm size confirmed that the sample distribution was not significantly different from the population (p = 0.019).

4. Further Exploration of Capabilities Configuration: the Importance of Fit with the Environment

In actual competitive scenarios, the characteristics of the external environment facing firms are now changing dramatically faster. The pace of technological innovation is increasing, the evolution of consumer behaviour is following unexpected routes, and continuous change in market structure pushes firms to operate in ever larger and more global arenas. Management must be able to modify its internal capabilities to cope with this changing external environment. For this reason, an approach that does not take into account the interaction among those elements will be inadequate to describe present-day scenarios. Managerial scholars, in analyzing and studying firms' behaviour, must adopt an approach that allows them to take environmental characteristics into account in their explanations of the success and failure of firms.

The contingency approach is one way to analyze the phenomenon, as it considers the interaction between external variables (such as market characteristics, market dynamics and country-specific factors) and internal variables (such as organizational structure, routines, resources and capabilities). This approach suggests that the selection of coherent combinations of organizational capabilities and operational environments has performance implications (Drazin and Van De Ven 1985; Duncan 1972; Miles and Snow 1978; Venkatraman 1989). Organizational structure (internal variables) must be coherent with external variables, represented by the environmental context; strategies are the result of the interaction between these external and internal variables. Contingency scholars argue that one

best strategy does not exist, but rather a strategy will be successful to the degree that there is coherence between these two sets of variables (Venkatraman 1989). Research in the area of operations management has sought to determine how firms can best align their competitive capabilities and process-specialization level to their operating strategy. A pioneer in this area, Skinner (1974) pointed out the importance of focusing on a few narrowly defined core activities in order to be competitive. The so-called *focused factory* is proposed as the antithesis of the conventional factory, which tries to achieve multiple objectives without focusing and, as a result, loses competitive advantage. Multiple capabilities are not free, and firms should choose to develop new capabilities only if the environment supports them. In this chapter I discuss the value of specialized capabilities, analyzing their fit with the operational environment. Our results show that providers that possess specialized capabilities obtain greater benefits when they operate in homogeneous environments.

THE EVOLUTION OF THE CONTINGENCY APPROACH

The contingency approach has been applied in two major research streams: organizational research and the relationship approach. These research streams are not mutually exclusive alternatives, nor are they in opposition. Both of them, in fact, view the firm as a complex system operating in a dynamic and changing environment. The application of contingency principles to the study of organizational issues focuses on understanding the way that organizational structures combine the resources and capabilities of firms with other, external factors. The relationship approach, in contrast, analyzes the links existing among leadership styles, decision processes and situational factors. Both approaches, although having different theoretical points of departure, use the same methodologies, and, more importantly, reach the same conclusion: the centrality of the dynamic firm environment. In the remainder of this section, I review the main contributions and applications of the contingency approach in the area of organizational studies.

Applications in the Study of Organizations

The use of a contingency approach to study organizational phenomena was pioneered in the late 1960s. In this period, scholars analyzed interactions between different contingencies (or factors) as a reaction to the failure of the existent theories. Until this time, managerial scholars (following Weber and Taylor) explained reality with a bureaucratic approach. They developed a systematic view of the firm and explained the achievement of superior performance in terms of the identification of 'one best way', adequate for every firm, despite firms' unique characteristics and the unique characteristics (or contingencies) of their external environments. These studies aimed to obtain a solution adequate for every situation through the combination of different elements (economies of scale, pricing, organizational design, and so forth), paying no attention to the differences present in each firm. The failure of these studies to predict the one best way and to adequately explain the failure and the success of firms led to the development of an alternative approach.

The contingency approach was largely adopted in other research areas related to organizational studies (Miles and Snow 1978; Pugh et al. 1969), including those looking at environmental uncertainty (Duncan 1972), managerial practices (Siggelkow 2002) and leadership roles (Vroom and Yetton 1973). The first important contribution to this approach was by Burns and Stalker (1961), who analyzed the organizational structures and environmental context of English and Scottish firms. They demonstrated that a firm's structure was determined by the environmental and historic context in which it operated. Moreover, they showed that the firm's internal characteristics influenced the possibility of interaction with the external environment and therefore also the possibility of changes in their internal organization. Burns and Stalker's contribution is significant because they pointed out the importance of contingency factors in shaping the organization and also argued that it is not possible to design a successful organization without taking into account environmental contingencies.

Another important contribution came from Woodward (1965), who analyzed key factors and dynamics affecting firms' organizational structures. Woodward's major contribution resides in the identification of core elements,

that is, elements that play a central role in shaping the organizational and internal structure of the firms. The technology that a firm adopts is one such core element. In Woodward's approach, the decision-making process is a top-down one: he described all the aspects of the organization as departing from a single element. This approach thus follows a cause-and-effect path, useful for didactic purposes but not particularly effective in describing the reality facing the firm. In fact, it presents some obvious limitations due to the fact that the interrelationships among different elements and between internal and external elements are not considered. Observation of reality shows that it is not possible to identify in a univocal way the causes and effects of each factor. Recent approaches to contingency theory are more inclined to take into account each element's individual cause(s) and effect(s) in defining the evolution of the firm.

A milestone in this research stream is the work of Lawrence and Lorsch (1986). In their book *Organization and Environment* they focus on the way that characteristics of the external environment (for example turbulence or stability) determine different organizational decisions. Strategic decisions result from or are influenced by the production, commercial or technological needs of the firms. These needs in turn are strongly influenced by market structure and competitive dynamics. The competitive arena can be considered a causal factor as well as a consequence of the firm's system: the competitive arena influences and is influenced by the overall structure of the organization. The innovative aspect of this contribution resides not only in the identification of the external environment as a crucial factor, as important as the internal elements, but also in the development of a systemic view of the firm.

Early studies on organizational structure focused on the analysis of formalized configurations, including organizational units, decision processes, communication processes and hierarchical structure. Chandler's (1962) contributions have been integrated into later work on the influence on organizational structure of technologies (Woodward 1965), interdependence across different units (Thompson 1967), characteristics of communicational processes (Galbraith 1973) and static versus dynamic environmental characteristics (Burns and Stalker 1961; Lawrence and Lorsch 1986). In the

late 1980s and early 1990s researchers focused their attention on a new type of organizational structure that is organized not around formal elements such as the ones named above, but instead around processes and capabilities. The analysis of the evolution of these new organizational forms was largely based on the interaction of these elements with the environmental context.

Contingency Theory and the Evolutionary Dynamics of the Firm

The studies that have been reviewed thus far have focused their attention on the internal elements of firms and how these elements assume different configurations in relationships with external factors. Internal resources and external contingencies mutually interact to determine and shape the organizational design, information flows, hierarchical structure and decisional processes of a firm. The results of this research provide evidence of such an interaction, with different degrees of correlation. The development of this approach focuses on the analysis of the evolutionary dynamics of the firms, dynamics largely influenced by both external context and internal situation. The studies described so far have the limitation of being static, offering an analysis *a posteriori*. The approaches that I will describe in this section, however, present a dynamic dimension. Changes are studied in relationship with the elements that enabled them. The representation of the reality that follows has an important normative impact, with particular managerial and practitioner implications.

A dynamic approach provides an important cognitive advantage, but it also raises some concerns that scholars wishing to adopt the approach must be aware of. First of all, the identification of the elements considered central and the definition of the boundaries of the firms are difficult due to the lack of a clear and precise identification in the extant literature. Moreover, the nature of the phenomena studied does not allow for a precise and unequivocal measurement of the influence of the various elements. The situations analyzed cannot be replicated, and the opportunity to compare different situations is limited due to the complexity of the subject. While such a research stream is of unquestionable interest because of the possibilities for the application of the results, on the other hand its inner complexity makes the development of a formalized theory difficult.

An important question that has been addressed by contingency scholars is why firms choose one specific path toward a configuration rather than another. It is particularly interesting to identify the most influential environmental contingencies and the way that these determine the adoption of a given firm's configuration (Siggelkow 2001). Contingency scholars taking such an approach must be aware of its limitations. One pitfall is represented by the search for the one best fit. For obvious reasons, this position is subject to the same objections as have been raised for the one-best-way approach; although the premises in the literature are different, the problems arising are the same. The search for the one best fit does not take into account the complexity of the environment nor the specificity of the firm's characteristics. Another risk that researchers have to be aware of is represented by the converse of the one-best-fit search: the complexity of the context can lead to the formulation of a 'no model' in which the unique value of each situation leads not to any theoretical and generalizable model but only to an accurate description of many unique situations without any predictive application or practical implications. These represent two extremes of a continuum, and scholars would be wise to position their research in the middle, avoiding the pitfalls of both extremes. Another limitation to contingency theory is that it underestimates the role played by people within the organization. In describing the organizational forms at a macro level, the theory neglects the impact of the behaviour of individuals and their role in shaping the organization's characteristics.

A CONCEPTUAL MODEL OF FIT BETWEEN CAPABILITIES AND ENVIRONMENTAL VARIABLES IN THE SOLUTIONS BUSINESS

The structure–environment perspective offers a useful theoretical lens for the analysis of the strategic decisions of integrated solution providers. First, this theory suggests that under norms of administrative rationality a firm should match its internal organizational complexity with its environmental complexity (Thompson 1967). By choosing their markets, their target

customers, and the appropriate mix of products and services, integrated solutions providers affect the degree of heterogeneity of their operational environment. I suggest that rationally managed firms should frame their product/market/customer choices so that the resulting environmental heterogeneity is consistent with the organizational capabilities they possess. Integrated solutions providers that operate in a large number of different industrial sectors will tend to develop a wider range of capabilities than firms specializing in one industry. Likewise, companies that target customers of different sizes and manage different projects will tend to develop multiple capabilities and more flexible organizations than solutions providers that specialize in the provision of a specific solution.

The structure–environment theory also suggests that the selection of coherent combinations of organizational capabilities and operational environments should have performance implications. I expect that firms possessing specialized capabilities should obtain greater benefits when they operate in homogeneous environments. The possession of specific knowledge about a restricted number of customers in a given industry, as well as the development of dedicated products and services, should give these organizations a competitive advantage that cannot be easily matched by firms with generic capabilities. The specialized firms can customize their offers to match specific customers' needs and achieve greater economies of scale in doing so.

Integrated solutions providers may find heterogeneous environments more profitable, because these contexts offer greater opportunities to access new customers and markets. Heterogeneous environments also facilitate diversification, thereby decreasing the risk of being affected by changes in one particular market (Keats and Hitt 1988; Hitt et al. 1997). However heterogeneity requires multiple capabilities, because companies operating in these environments must address a broader set of customer needs. Firms with specialized capabilities should consider entry into heterogeneous markets with care, because the need to develop multiple generic capabilities does not facilitate customization, may dilute their core competences, and ultimately may expose them to the risk of being outperformed by more focused companies. Accordingly, I propose the following hypothesis:

> Hypothesis 1: Controlling for firm size and for the value and size of IT projects, the value of specialized capabilities increases with the degree of homogeneity of the firm's operational environment.

Drawing upon what has been discussed in the previous chapter, I adopt the following definitions in our investigation of the way that firms should align capabilities and markets to be successful in the solutions business. With respect to the range of capabilities developed, I affirm that integrated solutions providers display specialized capabilities when they concentrate their resources on a limited set of core activities. Integrated solutions providers display generic capabilities when they spread their resources evenly among a wide range of activities.

In regard to the variables that influence the external environment, consistent with our arguments in the previous chapter, I hold that heterogeneity plays a very central role in shaping organizational capabilities (Osborn and Hunt 1974; Pfeffer and Leblebici 1973). Integrated solutions providers can affect the degree of heterogeneity of their operational environment by making three types of choices: they can select the mix of products/services to deliver; they can choose the types of markets to target; and, finally, they can decide how to organize and manage the projects. These decisions create three specific types of heterogeneity: in offers, in demand, and in the type of projects undertaken. I therefore conclude that integrated solutions providers operate in heterogeneous environments when they offer a wide range of products and services, serve many different customers, and develop projects of different sizes and values. Integrated solutions providers operate in homogeneous environments when they offer a limited range of product and services, serve similar customers, and develop projects of similar size and value.

ANALYTICAL APPROACH

I measured the two aggregated variables that assess firms' environmental homogeneity and the degree of specialization of their organizational capabilities, as described in the previous chapter. (For details on the

operationalization of variables and the data collection method used, please refer to Chapter 3 and its methodological appendix.) To assess the value generated by the different configurational arrangements, I used two productivity measures as dependent variables: revenue per employee (revenue from the integrated solutions business divided by the number of employees) and revenue per project. Furthermore, to capture the customer's perspective I also assessed project performance by means of two variables: the degree of goal achievement, and a customer satisfaction index calculated using a self-reported, 5-point Likert scale. Data to compute financial measures of performance were obtained from public databases (Amadeus). Other project-based performance measures were self-reported. For all the self-reported measures, I tested for common method variance (CMV) using Harman's single factor test (Podsakoff et al. 2003). Results showed no evidence of CMV.

To determine the value of specialization I estimated the direct model (4.1) and the moderated model (4.2). The hypothesis was tested by assessing the significance of the coefficient β_5 and the significance of the increase in the adjusted R^2 between the direct and moderated models. The test was replicated for each of the four performance variables mentioned above. I estimated the models using OLS because evidence of neither multicollinearity nor heteroscedasticity was found: the largest correlation among regression variables was 0.34, while χ^2 values in a White test ranged between 20.22 and 29.71, with p between 0.78 and 0.28 for the four models tested.

$$\text{Performance} = \alpha + \beta_0\, \textit{firm size} + \beta_1\, \textit{project size} + \beta_2\, \textit{project value} + \beta_3\, \textit{homogeneity} + \beta_4\, \textit{specialization} + \varepsilon \quad (4.1)$$

$$\text{Performance} = \alpha + \beta_0\, \textit{firm size} + \beta_1\, \textit{project size} + \beta_2\, \textit{project value} + \beta_3\, \textit{homogeneity} + \beta_4\, \textit{specialization} + \beta_5\, \textit{specialization*homogeneity} + \varepsilon \quad (4.2)$$

Table 4.1 Moderated regression analysis

Dependent Variable: Revenue per employee	Direct model (4.1)			Moderated model (4.2)		
	Par. Est.		St. Error	Par. Est.		St. Error
Firm size	−0.07		0.11	−0.06		0.10
Project size	0.09		0.12	0.10		0.11
Project value	0.39	***	0.12	0.40	***	0.12
Homogeneity	0.14		0.11	−0.26		0.18
Specialization	0.22		0.14	0.26	**	0.13
Specialization* Homogeneity				0.69	***	0.25
R^2	0.18			0.25		
Model F	3.75	***		4.63	***	
ΔR^2				0.07		
Hierarchical F				8.97	***	
N	91			91		

Dependent Variable: Revenue per project	Direct model (4.1)			Moderated model (4.2)		
	Par. Est.		St. Error	Par. Est.		St. Error
Firm size	−0.12		0.08	−0.11		0.08
Project size	0.12		0.09	0.12		0.09
Project value	0.56	***	0.10	0.56	***	0.09
Homogeneity	0.08		0.08	−0.13		0.15
Specialization	0.09	*	0.11	0.12	*	0.11
Specialization* Homogeneity				0.34	*	0.20
R^2	0.37			0.39		
Model F	9.82	***		8.83	***	
ΔR^2				0.02		
Hierarchical F				3.34	***	
N	91			91		

Table 4.1 Moderated regression analysis (continued)

Dependent Variable: Degree of goal achievement						
	Direct model (4.1)			Moderated model (4.2)		
	Par. Est.		St. Error	Par. Est.		St. Error
Firm size	−0.03		0.10	−0.04		0.10
Project size	−0.01		0.12	−0.02		0.11
Project value	−0.12		0.12	−0.13		0.11
Homogeneity	0.25	**	0.11	0.61	***	0.18
Specialization	0.13		0.13	0.09		0.13
Specialization* Homogeneity				−0.61	**	0.25
R^2	0.09			0.15		
Model F	1.71			2.54	**	
ΔR^2				0.06		
Hierarchical F				7.25	***	
N	91			91		

Dependent Variable: Customer Satisfaction						
	Direct model (4.1)			Moderated model (4.2)		
	Par. Est.		St. Error	Par. Est.		St. Error
Firm size	−0.03		0.10	−0.04		0.10
Project size	0.01		0.11	0.00		0.11
Project value	−0.13		0.12	−0.14		0.11
Homogeneity	0.19	*	0.10	0.49	***	0.18
Specialization	0.15		0.13	0.12		0.13
Specialization* Homogeneity				−0.52	**	0.24
R^2	0.07			0.12		
Model F	1.31			1.89	*	
ΔR^2				0.05		
Hierarchical F				5.31	**	
N	91			91		

Notes
* Significant at the 0.1 level.
** Significant at the 0.05 level.
***Significant at the 0.01 level

FIT BETWEEN SPECIALIZATION AND HOMOGENEITY

The results of the moderated analysis provide support for hypothesis 1 (see Table 4.1). The first two series of models suggest that while specialization has only a moderately positive effect on labour and project productivity, this positive effect becomes significantly greater for firms that operate in homogeneous environments. The interaction term *Specialization* Homogeneity* has a positive and significant impact on both revenue per employee and revenue per project, and the increase in R^2 is also statistically significant in both models. Revenue per employee and revenue per project measure the performance of the firms in terms of labour productivity.

Consistent with what has been proposed by Skinner (1974), firms that have specialized their capabilities in a few narrowly defined core activities are better able to achieve competitive advantage. This explains the moderated but positive effects that specialization of capabilities has on labour and project productivity. The 'focused factory' approach gives the best performance because it forces firms to concentrate on just a few capabilities, externalizing or simply not offering those activities that are noncore. The positive effects of specialization are moderated by the impact of the homogeneity variable. Operation in homogeneous markets leads firms to develop a deeper understanding of clients' specific needs and to develop industry-specific tools and routines that increase labour and project productivity. From this it is possible to hypothesize the development of economies of experience that allow for cost reduction and an increase in efficiency.

The analysis of the two models with project-based performance variables provides a different picture. First, the results suggest that in homogeneous environments firms find it easier to achieve higher customer satisfaction and meet project objectives. Firms know their customers better, they have specific knowledge of the internal processes typical of the industry, and they know the types of problems that are frequently encountered and how to solve them. Moreover, given their deeper understanding of clients' characteristics, they are able to provide solutions that are tailored to customers' specific needs. They can exploit economies of scale, providing solutions developed

for the niche in which many of their clients operate.

However, in sharp contrast to the results of the productivity analysis, the benefits of specialization decrease with an increase in the degree of environmental homogeneity. A plausible interpretation of this effect is that homogeneous environments favour specialization and software customization. In turn, overly customized solutions may be too complex to use and may create compatibility problems with existing platforms, thereby dissatisfying clients. Solutions developed ad hoc may be difficult to manage, after-sales activities may become costly and ineffective, and in the development and delivery phases of the solution delays are likely to occur. Empirical evidence shows that firms trapped in these situations find it difficult to keep time and costs within budget, and this negatively affects customer satisfaction. On the other hand, firms working in heterogeneous markets offer comprehensive, highly standardized solutions. Generally, integrated solutions providers adopt the following strategy: they offer products and services that involve a defined core architecture that can be slightly customized to meet customer requests, with specific customization modules and options ready for implementation. This reduces implementation time and cost, allowing firms to stay within budgetary and schedule constraints, and increases customer satisfaction.

Altogether, the results suggest that the value generated by specialized capabilities increases with the degree of homogeneity of the firm's operational environment. But it does so for IT solution providers only: end customers are usually penalized by this choice, which produces complex and costly projects.

CONCLUSIONS

The aim of the present chapter has been to further explore the concept of fit in the context of integrated solutions offers. The importance of the exact match with the environment has been explored by a number of scholars adhering to the contingency approach research stream. They claimed that adequate fit between characteristics of the internal and external environment

allows firms to achieve superior competitive advantage. The contingency approach has been applied in different contexts to explore diverse business models, but the results reported in Chapter 3 highlight that this approach is particularly appropriate for the integrated solutions model studied in this book. The correct alignment of internal capabilities and external markets is more important in the business of integrated solutions than in other industries because of the central role played by customers in the offer. It is therefore important to explore how the contingency model can contribute to superior performance in a solutions business.

I have investigated the role of fit through an analysis of the interaction among internal and external variables and their impact on four performance indicators. Our results are consistent with those found by contingency scholars, since the moderated analysis presents a higher significance in every case. However the results only partially support hypothesis 1. Labour and project-productivity results are in line with hypothesis, while performance indicators based on customer satisfaction contrast with previous findings.

The data confirm that no one best fit exists. To avoid falling into the trap of seeking a single best fit, I have used different performance measures to distinguish among different optimal configurations that each contribute to the achievement of diverse results. Customer satisfaction can be guaranteed by focusing on standardized systems, which allow for greater control of time and costs, but labour and project productivity require different strategic decisions. From the latter viewpoint, the 'focused factory' appears to be a successful model for the solutions business. Obviously, the selection of the most appropriate performance indicator, one which will guarantee the success of the business model and the firm's survival in the competitive arena, is largely based on the beliefs and perceptions of the managers. The results of this study thus constitute support for the decision processes of managers and CEOs by shedding new light on the impact that different alignments of internal and external characteristics have on firms' performance. Moreover, the findings confirm the crucial importance of fit in assuring superior performance. Only the correct configuration of capabilities and the appropriate selection of markets can help firms to achieve their projected results.

PART TWO

Systems Integration and Solutions

5. Outsourcing Dynamics in the Business of Solutions

The adoption of the new integrated solutions business model requires changes in firms' boundaries through extensive interfirm collaboration and/or the creation of a network of suppliers. Researchers in new institutional/transaction cost economics have explained how firms may choose their boundaries (Williamson 1985). These and other theoretical contributions from eminent scholars lay the theoretical groundwork for the development of an understanding of outsourcing dynamics in the integrated solutions context. In this chapter we explore the rationales behind outsourcing decisions, investigating diverse aspects of outsourcing processes such as the type of activities externalized, the relevance of outsourcing for the core business, and firms' relationships with suppliers.

We have already noted that to offer an integrated solution a firm must bundle together different services and products, many of which are produced outside the firm's boundaries. The study of the strategic decisions that define the specific boundaries in the solutions context thus deserves serious exploration, due to the important implications that such decisions have for the solutions offered. The extant literature on this topic has highlighted two major drivers influencing such decisions: the transaction costs involved in the activity (Coase 1937; Williamson 1975, 1985) and the capabilities required (Argyres 1996; Barney 1999). Advocates of the former contribute to the large body of literature called transaction cost economics (TCE), while those who support the latter contribute to the literature on the resource-based view (RBV).

The transaction cost approach argues that firms internalize some phases of the production process when the cost of internalizing these operations is

lower than the cost of organizing and transacting with the market. The decision whether to internalize is influenced by the transaction costs that arise from underlying asset specificity, the frequency of the provision of the activity, and uncertainty (Coase 1937). Since the 1980s, the TCE approach has dominated research on firms' boundaries. For decades there was a flourish of empirical research that tested the role of asset specificity, uncertainty and frequency in explaining the vertical scope of the firm. More recently, however, TCE has begun to appear inadequate to explain the complex boundary decisions made by firms. To address this limitation, scholars have introduced the role of capabilities, identified as a major driver in outsourcing decisions by Walker and Weber (1984, 1987), Argyres (1996), and Poppo and Zenger (1998). Due to capabilities differences, firms that carry out the same activity can have different production costs (Demsetz 1988; Kogut and Zander 1992; Teece 1988). Departing from this assumption, Argyres (1996, p. 131) tested the proposition that, independent of the level of transaction costs involved, 'firms vertically integrate into those activities in which they have greater production or organizational capabilities, (…) except the cases where explicit long-run decisions are taken to incur the cost of developing in-house capabilities'. Empirical evidence suggests that in certain specific situations, capabilities are likely to matter more than asset specificity or any other transaction cost. This seminal contribution by Argyres opened a research stream that focuses on understanding the balance between capabilities development cost and transaction cost in outsourcing decisions.

The debate between TCE and the RBV remains open. However, scholars have converged on the idea that both capabilities and transaction costs matter. Capabilities have a direct impact on outsourcing decisions, and when firms explore the rationale for 'make or buy', both capabilities and transaction costs must be considered. The latter are short-run, while the former involve an evaluation of the comparative advantage of the firm (Foss 1993; Langlois 1992; Jacobides and Winter 2005; Madhok 2002). Moreover, the balance seems to be directly influenced by sector and context specificities, and generalizations appear difficult so far (Jacobides 2008; Mayer and Nickerson 2005; Wolter and Veloso 2008). An empirical analysis of the integrated solutions business context thus is called for.

The remainder of this chapter is organized as follows. In the next section we review significant contributions from the literature on TCE and the RBV and develop testable hypotheses. Then, using data from a sample of 102 IT solutions providers, we subject the hypotheses to empirical analysis to determine how the balance between transactions and resource is configured in the integrated solutions context. A description of our analytical approach follows, along with a discussion of the results. We conclude with a summary of the main contributions arising from the analysis.

OUTSOURCING DYNAMICS IN THE LITERATURE

The Capabilities Perspective

As resource-based theories have pointed out, firms are different because their capabilities mixes are heterogeneous (Penrose 1959). In this view, firms are a collection of productive resources developed over time. New capabilities cannot be built up quickly, and thus the path pursued by the firm dictates the actual accumulation of capabilities – that is, history matters (Dierickx and Cool 1989). Firms exhibit heterogeneity in their capabilities configurations, which arises from the specific contingencies that they are called to face (Siggelkow 2001). As Dierickx and Cool (1989) have pointed out, the difficulties of building and imitating capabilities largely depend on the stock of knowledge and capabilities. Even if firms are sufficiently aware of the required capabilities base to be able to be successful and survive in the market, path dependence and organizational inertia tend to lower their ability to perfectly adhere to the ideal configuration (Dierickx and Cool 1989; Freeman and Hannan 1984; Winter 1988). In line with this reasoning, firms that operate in the same business (for example, the integrated solutions business) follow different paths and exhibit heterogeneous capabilities configurations (see chapter 2 of this volume). Their offers are influenced by these configurations, which also affect their outsourcing dynamics.

Moreover, firms tend to specialize in activities in areas in which they have a comparative advantage (Jacobides and Winter 2005; Kogut and Zander 1992; Teece 1996). As pointed out by Hamel and Prahalad (1994), successful

growth requires the development of adequate core capabilities. By core capabilities we mean all the capabilities that are essential for the achievement of competitive advantage for the firm (Barney 1999; Leonard-Barton 1992; Patel and Pavitt 1997). Firms' core capabilities should allow access to a number of markets, contribute significantly and positively to the perception that the client has of the product, and be difficult to imitate. In this way, core capabilities provide strategic differentiation for the firm (Leonard-Barton 1992). Outsourcing decisions are influenced by the capabilities configuration of the firm because firms tend to retain in-house those activities that are core for their business. We therefore propose the following hypothesis:

> Hypothesis 1: If activities are considered core for the firm, this has a negative influence on the outsourcing decision.

The Transaction Costs Perspective

When Coase first developed the transaction cost approach in 1937, his contribution constituted a major departure from the dominant neoclassical economic orthodoxy. Infringing the assumption that every firm is characterized by the same production function, Coase argued that firms will internalize the activities of another only if the transaction cost savings are greater than any production costs. He superimposed transaction costs (the exchange dimension) onto production costs (the production dimension) (Madhok 2002). The emphasis of the TCE approach is on the transactions themselves: the opportunity to internalize or externalize an activity depends on the characteristics of a given transaction. TCE only marginally considers the capabilities and resources developed by firms (the production dimension). The TCE literature identifies three major sources of transaction costs, namely, uncertainty, frequency, and asset specificity. Greater levels of these costs raise the overall cost of an activity, which leads to an increase in firms' propensity to integrate the activity within their own boundaries (Williamson 1979).

As Joskow (1988) pointed out, one of the most important contributions of Williamson's work is its comparative perspective – that is, its recognition that a wide range of arrangements can be made to govern transactions. To minimize transaction costs, specific institutional arrangements can be made, blurring the boundaries between markets and firms. Markets and hierarchies roughly define the two extremes of the continuum of resource-allocation arrangements. But since a rigid separation between markets and hierarchies exists neither in practice nor in the literature, in the present chapter we investigate the propensity of firms to integrate or outsource an activity on the basis of the fundamental assumptions identified by TCE.

The first factor identified by TCE is the level of asset specificity required by a transaction. The expression 'asset specificity' refers to resources used and invested by the parties in a particular transaction. As investments become more specific to the buyer–seller relationship, firms move from simple, anonymous market contracting to more complex and long-term contractual arrangements in order to minimize transaction costs. Increases in complexity and asset specificity increase the cost of transacting because the risk of opportunistic behavior also grows. For this reason, in the presence of asset specificity either a long-term contract or internalization is preferred (Joskow 1988; Williamson 1975; 1985). From a coordination viewpoint, Klein et al. (1990) argue that coordination problems arising from specific investments will be less severe if the transaction is internalized.

Williamson (1983) discusses four types of relationship-specific investments that must be considered when investigating the level of asset specificity in a transaction. In the case of integrated solutions, we consider each activity included in a solution as a single transaction, since this constitutes the product/service unit to be sold to the customer. The relationship-specific investments are site specificity (for example, a natural resource available at a certain location and movable only at great cost); physical asset specificity (a specialized machine tool or complex computer system designed for a single purpose); human asset specificity (highly specialized human skills, developed in a learning-by-doing fashion); and dedicated assets (discrete investments that would not otherwise be made but for the prospect of selling a significant amount of products/services to a particular customer). In the solutions context, physical and human asset specificities are likely to occur, while site specificity and dedicated assets appear not to apply. TCE scholars have extensively explored the role of asset

specificity, and a variety of empirical evidence has been offered in support of Williamson's claim (Anderson and Schmittlein 1984; Dyer 1996; Masten 1984; Monteverde and Teece 1982). On this basis, we propose our second hypothesis:

> Hypothesis 2: Higher levels of asset specificity have a negative on the outsourcing decision.

The second factor that influences firms' decisions regarding the outsourcing of activities concerns the frequency of transactions. In particular, I highlight the relationship between the creation of a specialized governance structure and transaction frequency. The cost of a specialized governance structure is greater than that of an unspecialized structure, so the volume of transactions plays a central role in firms' decisions about which of these to adopt. Specialized governance structures are much easier to justify for recurrent transactions than for transactions that occur only occasionally. So, in the case of a one-time transaction, the use of the market would be preferred because it would be less expensive. This is the rationale underlying the decision to use the market whenever transactions are not frequent (Coase 1960; Williamson 1975, 1985). As noted by Williamson (1979), the frequency dimension refers strictly to buyer activity in the market.

> Hypothesis 3: The frequency of the provision of an activity has a negative influence on the outsourcing decision.

Uncertainty generally increases transaction costs because it can trigger contract updates and renegotiations. Even in the absence of opportunism or first-mover advantages, renegotiations can involve considerable costs (Conner and Prahalad 1996; Mayer and Argyres 2004; Williamson 1971). Thus, in principle, higher uncertainty will lead to higher degrees of vertical integration in an industry. Firms' internal organization mitigates these problems by allowing them to better cope with uncertainty through the use of adaptive sequential decisions (Masten 1984; Williamson 1975). Uncertainty as a construct can be decomposed in various ways, and firms face different aspects of uncertainty depending on their operational context. Two key

dimensions are technological uncertainty and demand uncertainty. Wolter and Veloso (2008, p. 589) clearly defined these two aspects of uncertainty from an innovation perspective as follows:

> We consider demand uncertainty . . . [to be the] uncertainty in market demand for a product due to factors other than the technology itself. Macroeconomic effects, regulatory uncertainty, and changes in consumer preferences fall under this category. By the same token, technological uncertainty includes a market demand component caused not only by (functionality- or quality-adjusted) product price (or production costs) achieved with the given technology but also by diffusion factors, such as network externalities and bandwagon effects.

Firms operating in a context of technological uncertainty benefit from disintegration, since they can then access the heterogeneity of technologies available more easily, without suffering from path dependency (Langlois 1992). Moreover, if the technological trajectories within a sector are still uncertain, interdependence among the components increases, requiring intense knowledge sharing with suppliers. On the other hand, to reduce the need for knowledge exchange between parties, and therefore transaction costs, the separation of components and the development of a standardized interface are helpful. Recent research on this topic shows that modularity decreases the influence of process control within alliances, lowers the need for interfirm knowledge sharing, and mitigates knowledge appropriation hazards (Tiwana 2008a, 2008b). Thus, the modularity of a system is directly linked to the level of technological uncertainty within transactions.

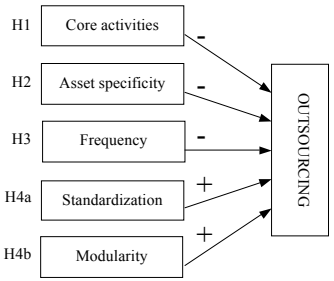
> Hypothesis 4a: The modularity of the products/services object of a transaction has a positive influence on the outsourcing decision.

Moreover, technological uncertainty also has implications at the production design level. Mintzberg (1979), a pioneer in this area, argued that uncertainty brings dynamism to the context, as it does not allow for process standardization; given uncertainty, the standardization of skills is more appropriate. On the other hand, in contexts characterized by low uncertainty, firms can standardize their production processes and thereby increase their

organizational efficiency. This has direct implications for firms' boundaries and transaction costs, and, not surprisingly, it has been studied in depth by TCE scholars. Grover et al. (1996, p. 96) provide the following example from the information systems context: 'Systems operations, which represents one of the earlier functions outsourced, is highly structured, and is commoditized. The second is the network management function, which reflects the trend toward standardization'. This trend is consistent with the observations of McFarlan and Nolan (1995), who note that standardized activities are generically attractive candidates for outsourcing. Hypotheses 1–4 are illustrated in Figure 5.1.

Hypothesis 4b: The standardization of the process/object of a transaction has a positive influence on the outsourcing decision.

Figure 5.1 Conceptual model



ANALYTICAL APPROACH

We investigate outsourcing dynamics using data obtained by means of a survey of 102 European firms in the IT industry, as described in previous

chapters. The survey instrument measures the outsourcing decisions for the activities included in a typical integrated solutions project carried out by the interviewed firms (for a detailed description of the collection of the data used for this study, please refer to the methodological appendix in chapter 3). The unit of analysis adopted in this chapter is the single activity. For each integrated solution project, we consider the activities involved in the solutions project, and our analysis is based on the outsourcing decision made for each activity. This allows us to test our hypotheses in the empirical context of integrated solutions.

The variable for asset specificity (ASSET) is measured via a 5-point Likert scales that investigates the need for dedicated assets, both physical and human, using the following items: 'Expensive equipment with no use for other activities has been required', and 'Highly specialized human skills have been required'. The individual items are constructed based on previous studies by Klein et al. (1990) and Zaheer and Venkatraman (1994). The variables indicating the frequency of provision (FREQ) and the importance of the activity for the firm's overall business (CORE) are also assessed using 5-point Likert scales. The measurement of the level of uncertainty of the activities/object of the transaction is based on two proxies: the level of modularity of the activity (MOD) and the level of standardization of the procedures (STN). These two proxies measure technological uncertainty, one of the two dimensions of uncertainty identified in the literature (Monteverde 1995; Williamson 1975).

The four control variables used in the models (firm size, client size, project length and project value) have been measured, respectively, as the firm's annual turnover (SIZE); the turnover of the solution's client (CL_SIZE); and the length (PR_LENGTH) and value (PR_VALUE) of the project selected by the interviewee as representative of the activity of the firm.

Finally, the model includes three dependent variables. The first, OUTSOURCING, measures whether the activity is provided in collaboration with (or exclusively by) external suppliers. It is measured as a dummy variable (0;1) that takes a value of 0 if the activity was internally sourced and a value of 1 if external suppliers were involved in the provision of the

activity. The second dependent variable, PERC_SUP, and the third, RELATION_SUP, capture the characteristics of the outsourcing decision made by the firm. PERC_SUP, which reflects the quantity of work externalized to the supplier, reflect the percentage of work done by outside contractors, and it expresses the role of the supplier from a quantitative viewpoint. The variable RELATION_SUP captures the firm's type of relationship with its supplier using a nominal scale (contractor, preferred supplier, strategic alliance, partnership, joint venture). This variable expresses the firm's relationship with its supplier from a qualitative viewpoint. We tested the data obtained from the respondents for common method variance (CMV) using Harman's single-factor test (Podsakoff et al. 2003) and found no evidence of CMV. The correlations are generally low, apart from the correlation (r = 0.58) between client size and project value. However, since the results are robust to the omission of either of the two variables, multicollinearity does not appear to constitute a problem for our sample.

We test the three hypotheses by fitting a linear logistic regression model (5.1). The dependent variable is binary (OUTSOURCING: 0;1). Analysis of the correlation matrix and of standardized residuals shows no sign of multicollinearity. The results for the Hosmer and Lemeshow goodness-of-fit test show that the fitted model is an adequate model (Hosmer-Lemeshow Goodness-of-Fit Test P>Chisq = 0.992) (Hosmer and Lemeshow, 2000). In Table 5.1 we report the results.

$$Y = \alpha + \beta_1\, asset + \beta_2\, frequency + \beta_3\, core + \beta_4\, modularity + \\ + \beta_5\, standardization + \beta_6\, client\ size + \beta_7\, firm\ size + \beta_8\, project\ value + \\ + \beta_9\, project\ length + \varepsilon \qquad (5.1)$$

While model (5.1) indicates whether an activity is outsourced, models (5.2) and (5.3) describe the quantity of work outsourced to external suppliers. The further exploration of outsourcing dynamics through these models also helps to explain certain results from model (5.1) that appear to contradict conventional wisdom about outsourcing decisions. Because the dependent variable PERC_SUP is constructed using a Likert scale, an ordered logit is

Table 5.1 Logit regression

Logit model (5.1) Dependent Variable: *OUTSOURCING*		
	Par. Est.	St. Error
Asset specificity	0.20**	0.10
Frequency	0.30**	0.12
Core	−0.23*	0.13
Modularity	−0.17	0.12
Standardization	0.29**	0.12
Firm size	−0.00***	0.00
Client size	−0.77***	0.16
Project value	0.50**	0.11
Project length	−0.19	0.15
Cox and Snell's pseudo R^2	0.10	
Nagelkerke's pseudo R^2	0.14	
AIC	584.69	
−2Log L	564.23	
N	467	

Notes
*Significant at the 0.10 level.
**Significant at the 0.05 level.
***Significant at the 0.01 level.

the most appropriate model. An interaction effect, ASSET*FREQ, has been added to model (5.3) to measure the reaction of the dependent variable to the combined effect of the two independent variables. Increases in the −2LogL measure [−2LogL = 620.348 for model (5.2) and 615.138 for model (5.3)] show that the interaction effect increases the fit of the model (Hosmer and Lemeshow 2002). We report the results in Table 5.2.

$$Y = \alpha + \beta_1\, asset + \beta_2\, frequency + \beta_3\, core + \beta_4\, modularity + \\ + \beta_5\, standardization + \beta_6\, client\ size + \beta_7\, firm\ size + \beta_8\, project\ value + \\ + \beta_9\, project\ length + \varepsilon \qquad (5.2)$$

$$Y = \alpha + \beta_1\, asset + \beta_2\, frequency + \beta_3\, core + \beta_4\, modularity + \\ + \beta_5\, standardization + \beta_6\, frequency{*}asset + \beta_7\, client\ size + \beta_8\, firm\ size + \\ + \beta_9\, project\ value + \beta_{10}\, project\ length + \varepsilon \qquad (5.3)$$

To investigate the firm's relationship with the suppliers involved in the transaction and to explain the results of the logit regression, we test the ability of the same independent variables to predict the governance mode selected for the firm's interaction with its suppliers. In contrast to the previous two models, which focus on the pure outsourcing decision and on a

Table 5.2 Ordered logit models 5.2 and 5.3

Ordered logit model				
Dependent variable: *Percentage of Work Outsourced*				
	Direct model (5.2)		Moderated model (5.3)	
	Par. Est.	St. Error	Par. Est.	St. Error
Asset specificity	0.09	0.12	1.324**	0.56
Frequency	−0.39***	0.15	0.31	0.34
Core	−0.39***	0.14	−0.32**	0.14
Standardization	0.33**	0.14	0.35**	0.15
Modularity	−0.09	0.13	−0.08	0.13
*Asset*Frequency*			−0.29**	0.13
Client size	0.11	0.18	0.12	0.18
Firm size	0.00***	0.00	0.00***	0.00
Project value	0.08	0.17	0.10	0.18
Project length	0.02	0.12	0.01	0.12
Cox and Snell's pseudo R^2	0.13		0.15	
Nagelkerke's pseudo R^2	0.14		0.16	
AIC	646.35		643.14	
−2Log L	620.35		615.14	
N	251		251	

Notes
*Significant at the 0.10 level.
**Significant at the 0.05 level.
***Significant at the 0.01 level.

Table 5.3 Ordered logit models 5.4 and 5.5

Ordered Logit Model				
Dependent Variable: *Relationship with Supplier*				
	Direct model (5.4)		Curvilinear model (5.5)	
	Par. Est.	St. Error	Par. Est.	St. Error
Asset specificity	−0.30**	0.11	−1.82***	0.53
Frequency	0.05	0.14	0.27***	0.09
Core	0.11	0.14	0.07	0.14
Standardization	−0.03	0.14	0.08	0.14
Modularity	0.37***	0.13	−0.12	0.14
*Asset*Asset*			0.40***	0.13
Client size	0.42**	0.18	0.46***	0.18
Firm size	0.00	0.00	0.00	0.00
Project value	−0.24	0.17	−0.15	0.17
Project length	−0.34***	0.12	−0.39***	0.12
Cox and Snell's pseudo R^2	0.13		0.16	
Nagelkerke's pseudo R^2	0.14		0.17	
AIC	696.08		688.98	
−2Log L	670.08		660.98	
N	251		251	

Notes
*Significant at the 0.10 level.
**Significant at the 0.05 level.
***Significant at the 0.01 level.

quantitative assessment of the outsourcing process, this analysis offers a qualitative evaluation of the firms' relationship with their suppliers. Due to the qualitative nature of the dependent variable *RELATION_SUP*, we use an ordered logit model (5.4). To increase the explanatory power of the regression, a quadratic effect is also added (5.5). Increases in the −2LogL measure [−2LogL = 670.085 for model (5.4) and 664.609 for model (5.5)] show that the quadratic effect better explains the dependent variable (Hosmer and Lemeshow 2002). In Table 5.3 we report the results.

$$Y = \alpha + \beta_1\, asset + \beta_2\, frequency + \beta_3\, core + \beta_4\, modularity + \\ + \beta_5\, standardization + \beta_6\, client\ size + \beta_7\, firm\ size + \beta_8\, project\ value + \\ + \beta_9\, project\ length + \varepsilon \quad (5.4)$$

$$Y = \alpha + \beta_1\, asset + \beta_2\, frequency + \beta_3\, core + \beta_4\, modularity + \\ + \beta_5\, standardization + \beta_6\, asset^2 + \beta_7\, client\ size + \beta_8\, firm\ size + \\ + \beta_9\, project\ value + \beta_{10}\, project\ length + \varepsilon \quad (5.5)$$

OUTSOURCING DYNAMICS IN THE BUSINESS OF SOLUTIONS

The analysis of the results of the logit regression (Table 5.1) yields three main results. First, the variable *Core* has a negative effect on the outsourcing decision (−0.23). This is in line with the literature on the RBV and fully supports hypothesis 1: if an activity is core for the company, the probability that a firm will outsource it decreases. Firms keep core activities in-house to control them, since those are the activities that confer competitive advantage. The second result is that the variable *Standardization* has a positive influence on the outsourcing decision (0.29, significant at the 0.05 level). This is consistent with previous results in the literature and provides support for hypothesis 4a. Standardized activities are easily outsourced, because the standardization of processes increases firms' ability to control the work of their supplier. An increase in control reduces the uncertainty of transactions, thereby reducing transaction costs and increasing the convenience of outsourcing the activity.

The third noteworthy result is the unexpected behavior of the variables *Asset specificity* and *Frequency*. Both of these variables have a positive impact on the probability of outsourcing (0.20 and 0.30 respectively, significant at the 0.05 level). Greater asset specificity and frequency of provision of an activity both increase the likelihood of outsourcing an activity. These findings do not support hypotheses 3 and 4. To explain these results, further investigation is required. However, such results are not completely unexpected. In fact, scholars of outsourcing dynamics have already pointed out that the effects of frequency, asset specificity, and uncertainty on outsourcing decisions are not linear, and the interactions among these elements are often more explicative than a direct model. This is the reason for our additional investigation using the four ordered logit models described above. These models explore the diverse characteristics of the outsourcing process, specifically, the quantity of work outsourced and the characteristics of the firm's relationship with its external suppliers.

The direct model (5.2) provides further support for hypotheses 1 and 4a. In particular, it shows that the variable *Core* negatively influences the dependent variable *Percentage of work outsourced* (−0.39, significant at the 0.01 level). This means that the more that an activity is considered to be a core activity, the less likely the work is to be outsourced to external suppliers. Further, when a firm decides to externalize a core activity, this is done only for a small part of the overall workload. The majority of the work is still retained in-house, consistent with hypothesis 1. The variable *Standardization* also has a positive influence on the percentage of work outsourced (0.33, significant at the 0.05 level). As noted previously, an increase in the standardization of work processes facilitates control over the suppliers' work, and therefore firms experience a reduction of transaction costs that favors an increase in the quantity of work outsourced.

The analysis of the results for the variable *Frequency* provide further evidence enabling us to better understand the boundary dynamics of firms in the specific context of integrated solutions. The frequency of the provision of an activity has a negative impact (−0.39, significant at the 0.01 level) on the percentage of work outsourced. This is partially consistent with hypothesis 3: the more often a solution is offered, the more likely the work is to be retained in-house. Firms choose massive outsourcing only for activities that are less frequent and for activities for which it is not convenient to develop a specialized governance structure internally. For one-time transactions, the market is preferred over internal development. These outsourcing dynamics can be better understood in view of the context: integrated solutions providers are project-based organizations, and their production processes are the job-shop type, organized around customers' requests. This entails difficulties in planning production and also the risk of high workload

variance due to external factors. Unpredictable seasonality pushes integrated solutions providers toward the adoption of a flexible organization structure and the significant use of external suppliers for to handle unexpected peaks in production activity. The internalization of such activities would result in a rigid organizational structure that is inadequate to meet changing demand. For this reason, firms do outsource frequent activities – despite the recommendation of TCE – but not *in toto*. This outsourcing mainly is targeted to handle seasonal peaks of labour.

Exploring further the dynamics of outsourcing, we see that the results for the interaction term *Frequency*Asset specificity* suggest other important findings. The interaction term reported in model (5.3) is negative and significant (−0.29, significant at the 0.05 level), indicating that firms tend to keep in-house the transactions that are more frequent and highly asset-specific. This provides evidence that high asset specificity leads to internalization only if it is also associated with high transaction frequency. If the client requires activities not usually offered by the firm and the solution provider knows that it will not be able to reuse that specific investment in the future, the market will be the preferred option. When the required activities are not included in the standard offer of the company and, due to their low frequency, in-house development is not cost-effective, outsourcing is the path of choice. Here, we see that, as suggested by TCE scholars, the findings from the direct models can be misleading, while the interactions between variables point to more relevant results.

The results from models (5.4) and (5.5) offer additional insight into the role of asset specificity in outsourcing dynamics. Model (5.5) identifies a curvilinear U-shaped relation between *Asset specificity* and *Relationship with the supplier*. A strong relationship with the supplier (for example, a joint venture or a partnership) can be found in presence of both low and high levels of asset specificity. The latter case provides support for hypothesis 2: in the presence of high asset specificity levels, transaction costs increase and hierarchies should be preferred to the market. Partnerships and joint ventures are two forms of contracting that provide the advantages of vertical integration (such as mitigation of opportunistic behaviour, long-term contracts, and a high level of trust) without increasing firms' size, assuring a highly flexible structure. With partnerships and joint ventures, solutions providers can obtain the advantages of hierarchies without increasing the complexity of their organizations. This is consistent with our observations related to the variable *Frequency* in model (5.2): a rigid organizational structure is not adequate in the face of the unpredictable demand that characterizes the integrated solutions context. For this reason, despite the recommendations of TCE, firms do outsource asset specific activities; however, they do this by adopting a contractual form more similar to hierarchies than to markets.

The curvilinear relation identified in model (5.5) indicates that a strong relationship with suppliers can also be found in the presence of low levels of asset specificity. Integrated solutions providers can develop strong relationships with their suppliers if the shared activities can be easily managed via an arm's-length relation. The explanation for this finding (in contrast with hypothesis 2) is based on the nature of the integrated solutions context. Integrated solutions are a bundle of products and systems combined into a single seamless offering. If transactions have low asset specificity, strong relationships with suppliers facilitate the integration of the firm's products and technologies. Also, although a market-based transaction might be more efficient in this case, a strong relationship facilitates the integration and coordination of dispersed activities. The curvilinear relation clearly shows the two diverse and coexistent approaches to outsourcing practiced by integrated solutions providers: the maintenance of a flexible organization, and the coordination and integration of activities dispersed throughout a network of suppliers.

Another relevant finding is the significance of the variable *Modularity* (0.37, significant at the 0.01 level). A high level of modularity is associated with a strong relationship with the supplier. This finding does not support hypothesis 4b and it is in contrast with the conclusions of previous literature about the role of modularity in the transaction cost equilibrium. Additional exploration of the role of modularity in the context of integrated solutions is needed. Further discussion of this topic can be found in chapter 6 of this volume.

CONCLUSIONS

The transition toward the integrated solutions business model requires firms to reorganize their internal capabilities and boundaries. While the first part of this book has focused on the former, in the present chapter we have analyzed the latter. Through an investigation of a number of aspects of outsourcing processes, such as the type of activities externalized, the relevance of outsourcing for the core business, and firms' relationships with suppliers, we have aimed to provide a comprehensive view of the rationales followed by solutions providers in the design of their boundaries. Contributions from the extant literature in TCE and the RBV have provided useful and sometimes contrasting theoretical lenses through which to analyze firms' strategic decisions. The debate between TCE and the RBV is still open: while TCE focuses on transaction costs, the RBV focuses on the analysis of internal capabilities and resources. However, recent contributions have converged on the idea that both transaction costs and capabilities matter – the former being short-run, the latter involving an evaluation of the comparative advantage of the firm (Foss 1993; Jacobides and Winter 2005; Langlois 1992; Madhok 2002). Moreover, the balance between these factors seems to be directly influenced by sector and context specificities (Jacobides 2008; Mayer and Nickerson 2005; Wolter and Veloso 2008). An empirical analysis of the context of the solutions business, consistent with the difficulties of generalization, yielded findings that only partially support our proposed hypotheses.

The contributions from our analysis are threefold. First, it emerges clearly that core activities are rarely outsourced by integrated solutions providers. This points toward the predominant role of resources and capabilities over transaction costs. Despite the efficiency that could be obtained by outsourcing specific activities, firms tend to evaluate their internal assets (their capabilities) and then design their boundaries accordingly, reinforcing their comparative advantage within the industry. This is in line with the conclusions of the emerging comparative advantage research stream, in which scholars argue that firms specialize in activities that grant them a comparative advantage over competitors (Jacobides and Winter 2005).

The second contribution lies in our finding that integrated solutions providers prefer organizational flexibility over production efficiency. This is due to the characteristics of the context and to the specifics of the business model. Integrated solutions providers are project-based organizations, and their production processes are job-shop in nature, organized around customers' requests. This can lead to difficulties in production planning as well as to an inconstant workload. For these reasons, integrated solutions providers prefer a flexible organization. The greater use of vertical integration does reduce costs and increase efficiency, but it also reduces flexibility, making it difficult to balance variations in workload. Firms adopting a solution business model operate in a dynamic environment in which flexibility and agility are preferred. Thus, they largely rely on an extensive network of suppliers, building strong relationships with them, such as partnerships and joint ventures. These relationships offer the advantages of hierarchies without increasing the complexity of the organization.

The third contribution arises from the analysis of the results of the interaction effects between *Asset specificity* and *Frequency*. We find that high asset specificity leads to vertical integration only if it is also associated with high transaction frequency. This is a result of the characteristics of the integrated solutions context, in which firms operate on a customer-demand base and their role is to fulfill customer-specific needs. This means that they are often asked to perform activities not usually offered as part of a solution. The internalization of such activities is not possible, because to do so the firm would incur a large investment with limited possibilities for reuse. Integrated solutions providers therefore generally decide to outsource asset-specific activities if they are required by only a single customer. In the case of such one-time transactions, firms prefer to make use of the market because the development of in-house capabilities would be too costly for the firm. This perspective highlights the two reasons for outsourcing identified by Fine (1998): capacity and knowledge. In the first case the firm has the capability to provide the product/service, but for reasons of money, space or management attention it chooses to outsource the production to external suppliers. In the second case, the firm lacks the appropriate knowledge or capabilities to produce the product or provide the service internally, and it is

less costly to outsource than to develop the knowledge or capability in-house.

From the discussion of our results it emerges that three major forces guide the boundaries dynamics in the solutions context. These forces are the need to retain a comparative advantage, to maintain flexibility and to fulfil customer needs. The role of context is also crucial, since the need for flexibility and the meeting of customer demand are typically context-driven requirements. Firms must not only analyze their internal assets, but also match them to the context – something that is difficult to accomplish, since demand is uncertain and changes are unpredictable. Moreover, heterogeneous capabilities configurations and the dispersion of activities throughout the value chain pose questions regarding coordination. The answers to such questions will be provided in Chapter 6, in which we explore the role of systems integration in the solutions business model.

6. Systems Integration and Integrated Solutions

The multiple capabilities configurations that firms adopt when moving into the integrated solutions business pose questions regarding how best to integrate diverse activities and knowledge bases. The disintegrated nature of activities and their dispersion in a network of multiple suppliers presents challenges to firms needing to combine and coordinate the various subsystems created by diverse firms. The dispersion of activities throughout the value chain results in a distribution of knowledge among different actors. This leads to a dynamic of knowledge integration, disintegration and recombination. Knowledge generation and integration are foundational aspects of industry architecture, and they are crucial to a better understanding of the effects that the adoption and diffusion of the integrated solution business model has on sector dynamics.

The existing literature provides an important theoretical lens through which to view this complex situation. In the previous chapter I have used contributions from scholars in transaction cost economics (TCE) and in resource-based view (RBV) to examine how firms may choose their boundaries. Studies of technological change, among others, have considered how organizations and technologies co-evolve over time (Abernathy and Utterback 1978; Klepper 1997). Yet only recently have an increasing number of scholars begun to understand what shapes the nature of the sectors, and what are the forces that explain why and how these sectors swing between integration and dis-integration (Jacobides and Winter 2005; Langlois 2003). Likewise, the link between the boundaries of organizations and the

knowledge bases in the sector has been shown to be important (Brusoni et al. 2001; Brusoni and Prencipe, 2006), and it is clear that these knowledge boundaries and organizational boundaries are not fully mapped onto each other. The observed evolution of sectors desegregates activities among specialized actors and forces integrated solutions providers to act as systems integrators, to recombine the dispersed knowledge into a fully integrated final product: a functioning solution.

In this chapter I aim to provide some answers to the question of how firms coordinate dispersed capabilities. Integrated solutions providers integrate dispersed and heterogeneous knowledge in order to deliver complex bundles of products and services. Thus, systems integration is the core capability required to specify, design and integrate the physical components of a solution, including the hardware and embedded software that form a functioning system such as a flight simulator or mobile communications network (Prencipe et al. 2003). Systems integrators ensure that the value of the system as a whole for the customer is greater than the sum of its component parts. These firms become leaders in the industry supply chain as they outsource an increasing amount of detailed design and production activities to a network of external manufacturers, while maintaining the capabilities in-house to coordinate complex projects and manage multifirm networks of suppliers and customers. In the remainder of this chapter, I use empirical evidence from IT solution providers in Europe to highlight the importance of systems integration capabilities. In the following section, I review the existing literature on systems integration. Then, on the basis of the theoretical contributions, I develop a framework for the analysis of integrated solutions and testable hypotheses. A description of methods follows, along with the presentation of the results and a discussion of empirical findings.

SYSTEMS INTEGRATION CAPABILITIES AND SYSTEMS-INTEGRATING FIRMS

The increased specialization of activities, the division of labour and outsourcing over the last decade have favoured the spread of systems

integration activities. Brusoni et al. (2001), pioneers in this area, have pointed out that systems integration – in the past considered merely a technical, operations-oriented task within the broader field of systems engineering – is today seen as a strategic task that pervades business management not only at the technical level but also at the levels of management and strategy. This activity has become a key factor in the operations, strategy and competitive advantage arenas in many industrial sectors (for example, computing, automotive, telecommunications, military systems and aerospace). Drivers underlying the diffusion of systems integration are many, including (i) the increasing complexity of products and systems, (ii) the rapid pace of technological change, and (iii) the increasing breadth of knowledge required to manufacture and deliver both consumer and capital goods. Also, using modular design strategies, firms operating in a large number of industrial sectors have begun to make extensive use of outsourcing to lower-tier suppliers so that they can move downstream to provide more lucrative services and solutions for their customers (Prencipe et al. 2003).

In one sense, systems integration is the 'other side of the coin', as it is the capability that underpins successful outsourcing. However, systems integration is not a mere counterpart to this process, but rather a method that allows the systems-integrating firm to gain the advantages of both outsourcing and vertical integration (Davies and Hobday 2005). It has been argued that systems integration performs a central function as the 'visible hand' of much modern industrial activity (Dosi et al. 2003). Systems-integrating firms are progressively replacing the large, established manufacturing firm, described by Penrose (1959) and Chandler (1962) as the major motor of technical change in advanced, high-wage countries. This shift reflects in part the unexpected difficulties faced by large industrial firms in exploiting new technological opportunities – unexpected because of wrong assumptions about the sources of entrepreneurial opportunities and the nature of science-based entrepreneurship. It also reflects the combined effects of advances in IT and globalization: the acceleration of offshore manufacturing, facilitated by improvements in monitoring and control, in modular interfaces, and in the transmission of codified skills; modularity, thick markets, and uneven technical change; and digitally based systems. Increasingly, systems

integration will extend from subsystems and components to specialized bodies of knowledge (Pavitt 2003).

The business of systems integration has fundamental implications for the capabilities of firms. In many cases, firms have made a transition from being vertically integrated – that is, doing nearly everything in-house – to being the integrator of another firm's activities. These changes, while building on trends of the past, have accelerated in recent years, posing new challenges not only to prime contractors and major systems integrators, but also to their networks of suppliers and partners in production and innovation.

More than a mere operational or technical task, systems integration capabilities have important implications for the competitive advantage of firms for two reasons. First, from a technological viewpoint, systems integration plays a central role in enabling new product development and market introduction, especially for complex products. Complex products are composed of different subsystems, and their design and production span organizational boundaries. As pointed out by Prencipe (1997), the evolution of new products derives from the interaction of a variety of diverse technological fields and the coordination of a dispersed network of suppliers. In such a situation, the ability to integrate dispersed technologies and knowledge represents the basis for the achievement of long-run competitive advantage.

Second, from a value-stream point of view, systems integration capabilities represent the ability of the firm to situate itself in the competitive arena and decide on competitors, collaborators and suppliers. Best (2003) cites the examples of Silicon Valley and Route 128 to show the importance of systems integrators. The principle of systems integration is manifested in the organizational capability of firms, individually and networked, to foster rapid technological change. The application of this principle to business organizations involves the integration of an ongoing technology management capability into a production system. The effect is a network or cluster of entrepreneurial firms in which design is decentralized from within the enterprise and diffused among other companies in their network.

HYPOTHESIS DEVELOPMENT

Heterogeneous Capabilities

According to resourced-based theories, the firm is a collection of heterogeneous capabilities (Penrose 1959). Capabilities represent the knowledge and experience of specific technologies and markets, and they emerge from the coordination of the firm's resources. They are developed and refined over time and, given their intangible nature, they can be deployed over a broad range of output (Ansoff 1965; Barney 1999; Chandler 1990; Grant 1998). New product complementarities constitute an opportunity for firms to deploy their heterogeneous capabilities in an integrated solutions business model. Thermo Electron Corporation, a firm that offers products and services for research laboratories, is a case in point. Thermo launched a project called 'The New Lab Initiative' that encompasses three types of offerings: product bundles, comprehensive solutions, and turnkey solutions. The product bundles are designed for specific lab types and specific applications such as microbiology, molecular biology, biochemistry, quality assurance and quality control. The key feature of this offering is that it takes advantage of Thermo's expertise in product selection, specification and installation. Customers can make a coordinated purchase of integrated training, service and support. When a researcher is responsible for setting up a new molecular biology lab, he or she can work with a single Thermo system specialist to choose from among a broad array of Thermo product lines. The benefits for the researchers are a single point of contact, a fully integrated and installed system, and a single service and maintenance arrangement (Studt 2003). Thermo illustrates how the mastery of heterogeneous capabilities enables a firm to offer integrated solutions and therefore to develop a new basis for its competitive advantage.

> Hypothesis 1a: The mastery of heterogeneous capabilities has a positive impact on the profitability of the integrated solutions offer.

To successfully offer integrated solutions, firms must build up the coordinative capabilities required to manage new types of long-term

relationships with suppliers and customers and must develop embedded service technologies, such as control technologies for maintenance, remote diagnostics and system operations (Davies et al. 2006). To manage this new range of activities, firms must be able to develop and implement systems integration capabilities. These capabilities consist of the ability to integrate products, services and different technologies. Empirical evidence shows that systems integration capabilities are by far the most difficult to develop and are also a very critical component in the provision of integrated solutions (Brusoni et al. 2001; Prencipe et al. 2003).

Hypothesis 1b: The development of systems integration capabilities positively moderates the impact of heterogeneous capabilities on the profitability of the integrated solutions offer.

Modular Solutions

Modularity is a general concept that refers to 'the degree to which a system's components can be separated and recombined' (Shilling 2000, p. 312). In a modular product, component interfaces are standardized, and each component is allocated a specific function to be performed with respect to the given interfaces. Modularity therefore enables units of production to work independently within such predefined interfaces (Baldwin and Clark 2000). Each component can be designed and improved independently, so modularity enables a greater division of labour across firms (Arora et al. 2002). By exploiting modularity, firms can achieve greater flexibility and the ability to offer quick answers to the market through the introduction of new products, the extension of their product lines, and rapid product upgrading.

Modularity enables firms to bundle products and services more easily. If the standard interfaces among components have been defined, firms can bundle these components in different ways. Baldwin and Clark (2000) note that this is particularly important in the computer industry, where the ability to exploit differential rates of technical advance is a crucial technological advantage. This is one explanation for Dell's success in the modern PC market – it is better at coordinating its component producers than are its rivals.

Hypothesis 2a: Product and organizational modularity have a positive impact on the profitability of the integrated solutions offer.

Modular product architecture allows for a more efficient division of labor among different units or different firms. However, this efficiency is not assured by the modularization of components per se; coordination problems also arise in organizations that have adopted modular design. Recent research on modularity points out that the coordination role is not effective if it involves an arms-length market relationship or if it is undertaken by the firm in an unconscious way. For firms to successfully coordinate and manage modular products, they must consciously act as systems integrators (Brusoni and Prencipe 2001, 2006). Systems integrators are not mere assemblers of physical components, but rather are directly involved in designing, developing and integrating the final product-service bundle (Hobday et al. 2005; Prencipe et al. 2003). Thus, the literature shows that the development of systems integration capabilities is fundamental to increased efficiency in the coordination of products and services included in the solution.

Hypothesis 2b: The development of systems integration capabilities positively moderates the impact of product and organizational modularity on the profitability of the integrated solutions offer.

Complementary Capabilities

Spiller and Zelner (1997, p. 563) have defined the complementarity of products as follows: 'A functional complementarity exists between two stand-alone products when these products are capable of being used together and, as a result, the demand for each product is greater in the presence of the other product than it would be in the other product's absence.' Changes in a firm's competitive environment can create new complementarities among its products. These external changes can relate to either technology or regulation. Technological change may render a product capable of being used in conjunction with others. For instance, compact disc players, which were initially utilized only as listening devices, started being used also as applications in the computer industry. Regulatory changes do not create

complementarities per se, but they allow firms to enter new markets that might yield product complementarities. This automatically enlarges firms' strategic options (Spiller and Zelner 1997). Product complementarities create new marketing opportunities that in turn may become the basis of new economic rents for firms. Firms can exploit these new complementarities by adopting an integrated solutions strategy. To successfully offer complementary products and services, adequate complementary capabilities are required (Milgrom and Roberts 1995; Moorman and Slotegraaf 1999).

For the successful implementation of an integrated solutions strategy, firms must consider the relationship between product complexity and the level of sophistication of the customer (Spiller and Zelner 1997). Product complexity 'refers to the level of training or experience necessary for a user to comprehend and exploit the full range of functions that a product can provide' (ibid., p. 6). In other words, it is the level of experience that a user needs in order to utilize all the functions of the product. Customer sophistication is 'the actual level of such experience that a product user has in relation to the products in question' (ibid., p. 6). The training and experience refer to the buyers' requirements for product performance and their knowledge of technical specifications. When product complexity is low or most customers are sophisticated, the offering of an integrated solution is not a viable strategy because the additional demand generated by complementarity manifests itself automatically. However, when product complexity is high and customers are unsophisticated, it is feasible to offer an integrated solution, since customers are not sufficiently competent to assemble such systems themselves.

> Hypothesis 3: When product complexity is high and customers are unsophisticated, the complementarity of capabilities will have a positive impact on the profitability of the integrated solutions offer.

ANALYTICAL APPROACH

As noted in previous chapters, the data for this study were obtained by means of a survey of 102 European firms operating in the IT industries. The survey

instrument measured, among other things, the systems integration capabilities of the participating firms. For a detailed description of how the data used for this study were collected, please refer to the methodological appendix of Chapter 3. The variable measuring heterogeneity was based on a Herfindahl-Hirschman concentration index of the firm's capabilities. To this end, I first assessed the capabilities possessed by the firms through multi-item scales. For each of the seven activities associated with the provision of integrated solutions (hardware and infrastructure manufacturing, software development, delivery, post-sales, consulting, financing and systems integration), respondents were asked to assess via 5-point Likert scales the importance of the activity for their business; the frequency of its provision; the involvement of external suppliers; and the percentage of related work conducted internally. A factor-analysis of the 28 items with varimax orthogonal rotation confirmed the seven factors' structure. Seven capability variables were then formed by aggregating the items tapping into each construct, weighted by their respective factor scores. A reliability analysis and a confirmatory factor analysis (Hair et al. 1998) conducted through partial least squares (PLS) confirmed the good psychometric properties of the capability measures (see Table 6.1). Cronbach's alpha values varied from 0.84 to 0.96 for each measure. The average variance extracted (AVE) exceeded the recommended cutoff value of 0.50 for all scales; factor loadings also exceeded the recommended cutoff value of 0.60, thus providing strong evidence of convergent validity. In addition, the square root of the AVE value of each construct was larger than the correlation between that construct and all other constructs, providing evidence of discriminant validity. I assessed the degree of heterogeneity of the firm's capabilities by computing a Herfindahl-Hirschman concentration index for six of the seven capabilities, excluding systems integration, which was used as a distinct capability measure.

The degree of modularity of the solutions was also operationalized through a multi-item scale. First, the level of modularity of each activity included in the solution was assessed via a dedicated 5-point Likert scale. The overall degree of modularity of the solution was then computed by averaging these values to obtain a scale with good psychometric properties (Cronbach's alpha = 0.84, AVE = 0.78).

Table 6.1 Measurement scales for the capabilities

Construct and Questionnaire Items	Loading	*t*-stat.
Hardware and Infrastructure Mfg. (CR = 0.95; AVE = 0.82)		
Importance for the business	0.89	20.22
Frequency of provision	0.93	40.94
Involvement of external suppliers	0.94	55.33
Percentage of work done internally	0.88	21.30
Software Development (CR = 0.97; AVE = 0.89)		
Importance for the business	0.97	118.65
Frequency of provision	0.90	41.90
Involvement of external suppliers	0.95	84.02
Percentage of work done internally	0.96	74.38
Consulting (CR = 0.93; AVE = 0.78)		
Importance for the business	0.88	26.56
Frequency of provision	0.84	23.36
Involvement of external suppliers	0.89	42.13
Percentage of work done internally	0.91	45.85
Financing (CR = 0.97; AVE = 0.88)		
Importance for the business	0.94	52.97
Frequency of provision	0.95	57.96
Involvement of external suppliers	0.97	111.63
Percentage of work done internally	0.89	24.59
Delivery (CR = 0.89; AVE = 0.68)		
Importance for the business	0.83	17.83
Frequency of provision	0.77	12.23
Involvement of external suppliers	0.82	18.11
Percentage of work done internally	0.85	25.45
Post Sales (CR = 0.89; AVE = 0.69)		
Importance for the business	0.81	9.36
Frequency of provision	0.77	8.41
Involvement of external suppliers	0.82	25.84
Percentage of work done internally	0.89	39.89

Table 6.1 Measurement scales for the capabilities (continued)

Construct and Questionnaire Items	Loading	*t*-stat.
Systems Integration (CR = 0.91; AVE = 0.71)		
Importance for the business	0.86	11.17
Frequency of provision	0.77	9.95
Involvement of external suppliers	0.85	26.46
Percentage of work done internally	0.90	35.71

The degree of complementarity among an organization's capabilities was computed by means of the following index: $complementarity_k = \Sigma_{i \neq j} \alpha_{ik} \alpha_{jk} \rho_{ij}$, where $complementarity_k$ is the degree of complementarity among firm k's activities, a_{ik} = [0,1] and a_{jk} = [0,1] are two dummy variables that indicate whether activities i or j are included in firm k's offer, and ρ_{ij} is the correlation coefficient between activities i and j. This operationalization follows Grant's (1996) description of the billing system of American Express as a constellation of complex and team-based productive activities that constitute an organizational capability.

The complexity of the solutions provided was calculated using two different dimensions of complexity, both measured via dedicated 5-point Likert scales: the complexity of the work required by the specific solution offered, and the degree of customization of the solution.

The degree of sophistication of the client was computed using a proxy based on the size of the client, as empirical evidence shows that the penetration rate of information technology is lower for smaller firms (Eurostat data – Information Society Statistics). A lower penetration rate is indicative of less familiarity and less experience with the products, and thus I use this rate to calculate the proxy for customer sophistication.

Three control variables were used in the models. These variables – firm size, client size and project value – were measured as the firm's annual turnover, the average turnover of the firm's clients, and the average value of the projects completed by the firm in the year of the analysis, respectively. Finally, the dependent variable, revenue per project, was measured as the revenue generated by the firm from the integrated solutions business divided

by the number of projects conducted by the firm in the year of the analysis. As the data to compute this measure of performance were obtained both from the respondents and from public databases (Amadeus), I tested for common method variance (CMV) using Harman's single factor test (Podsakoff et al. 2003). The test showed no evidence of CMV.

I tested the three hypotheses developed above via moderated regression analysis (MRA). To test hypotheses 1 and 2, I estimated the direct model (6.1) and the moderated model (6.2) below, and I assessed the significance of the coefficients β_7 and β_8 as well as the significance of the increase in the adjusted R^2 between model (6.1) and the moderated model (6.2).

$$Y = \alpha + \beta_1 \textit{ firm size} + \beta_2 \textit{ client size} + \beta_3 \textit{ project value} + \beta_4 \textit{ heterogeneity} + \\ + \beta_5 \textit{ modularity} + \beta_6 \textit{ SIC} + \varepsilon \quad (6.1)$$

$$Y = \alpha + \beta_1 \textit{ firm size} + \beta_2 \textit{ client size} + \beta_3 \textit{ project value} + \beta_4 \textit{ heterogeneity} + \\ + \beta_5 \textit{ modularity} + \beta_6 \textit{ SIC} + \beta_7 \textit{ SIC * heterogeneity} + \\ + \beta_8 \textit{ SIC * modularity} + \varepsilon \quad (6.2)$$

Likewise, to test hypothesis 3 I estimated the direct model (6.3) and the moderated model (6.4) below. The hypothesis was tested by assessing the significance of the coefficients β_7 and β_8 and the significance of the increase in the adjusted R^2 between model (6.3) and the moderated model (6.4).

$$Y = \alpha + \beta_1 \textit{ firm size} + \beta_2 \textit{ client size} + \beta_3 \textit{ project value} + \\ + \beta_4 \textit{ complementarity} + \beta_5 \textit{ complexity} + \beta_6 \textit{ sophistication} + \varepsilon \quad (6.3)$$

$$Y = \alpha + \beta_1 \textit{ firm size} + \beta_2 \textit{ client size} + \beta_3 \textit{ project value} + \\ + \beta_4 \textit{ complementarity} + \beta_5 \textit{ complexity} + \beta_6 \textit{ sophistication} + \\ + \beta_7 \textit{ complementarity * complexity} + \\ \beta_8 \textit{ complementarity * sophistication} + \varepsilon \quad (6.4)$$

After standardizing the variable, I estimated each of the four models using two different estimation methods. First, I used ordinary least squares (OLS); secondly, because a plot of the residuals suggested the presence of moderate

levels of heteroskedasticity, all models were re-estimated via weighted least squares (WLS), using the reciprocal of firm size as model weight. A White test confirmed that the approach satisfactorily corrected for heteroskedasticity (χ^2 values ranged between 32.04 and 48.59, with p between 0.22 and 0.84). As the presence of several missing values considerably reduced the size of the original sample, both estimation methods (OLS and WLS) were used to re-estimate the models on a second sample after I replaced the missing values for the dependent variable (further details on the procedure are available upon request). The results, reported in Tables 6.2 and 6.3, suggest that the estimates are consistent across samples (with and without missing values) and across estimation methods (OLS and WLS).

HETEROGENEOUS AND COMPLEMENTARY CAPABILITIES

Heterogeneity exerts a negative and significant impact on project performance, while the interaction term *heterogeneity * SIC* is positive and strongly significant (with $p < 0.01$ in all models). These results do not support hypothesis 1a, but they do offer support for hypothesis 1b, as they suggest that the presence of heterogeneous capabilities is a necessary but not sufficient condition for the offering of integrated solutions. Thus, heterogeneous capabilities alone do not guarantee superior performance to integrated solutions providers. Heterogeneous capabilities may point toward a strategy based on the offer of a wide range of products/services delivered to customers. However, this strategy can be ineffective and even dangerous unless it is accompanied by the development of systems integration capabilities that enable the solutions provider to integrate the various elements of its offers. The diverse activities required in an integrated solution can cause inefficiencies that reduce the profitability of the business. For firms to reduce such inefficiencies and effectively coordinate and integrate the different activities into a unique system, systems integration capabilities are necessary.

Table 6.2 Models 6.1 and 6.2 (continued)

	OLS - Dependent variable: Revenue per project Panel B. Complete Sample				WLS - Dependent variable: Revenue per project Panel B. Complete Sample			
	Direct model (6.1)		Moderated model (6.2)		Direct model (6.1)		Moderated model (6.2)	
	Par. Est.	St. Error	Par. Est.	St. Error	Par. Est.	St. Error	Par.Est.	St.Error
Heterogeneity	0.04	0.11	−2.27***	0.89	0.01	0.12	−2.43***	0.74
Modularity	−0.14	0.10	1.51*	0.92	−0.12	0.11	1.59**	0.73
SIC	−0.09	0.11	−3.60*	2.16	−0.08	0.10	−3.90**	1.77
*Heterogeneity *SIC*			6.31***	2.43			6.76***	2.05
*Modularity *SIC*			−2.16***	1.19			−2.25**	0.96
Turnover	0.37***	0.11	0.35***	0.11	0.39***	0.11	0.36***	0.11
Client size	−0.04	0.11	0.05	0.11	−0.13	0.12	0.00	0.11
Project value	0.33***	0.12	0.25**	0.12	0.39***	0.12	0.28**	0.12
R^2	0.34		0.42		0.36		0.47	
Model *F*	6.51***		6.59***		7.04***		8.09***	
DR^2			0.08***				0.11***	
N	83		83		83		83	

Note. The restricted sample excludes firms with missing values in the dependent variable.
*Significant at the 0.10 level. **Significant at the 0.05 level. ***Significant at the 0.01 level.

Table 6.2 Models 6.1 and 6.2

	OLS - Dependent variable: Revenue per project Panel A. Restricted Sample				WLS - Dependent variable: Revenue per project Panel A. Restricted Sample			
	Direct model (6.1)		Moderated model (6.2)		Direct model (6.1)		Moderated model (6.2)	
	Par. Est.	St. Error	Par. Est.	St. Error	Par. Est.	St. Error	Par.Est.	St.Error
Heterogeneity	0.01	0.15	−2.57 ***	0.71	−0.09	0.17	−2.73***	0.57
Modularity	0.05	0.12	1.13	0.71	0.09	0.13	1.14**	0.57
SIC	−0.21*	0.12	−5.87 ***	2.04	−0.20**	0.11	−6.36***	1.70
*Heterogeneity *SIC*			8.13 ***	2.21			8.69***	1.85
*Modularity *SIC*			−1.59	1.02			−1.59*	0.84
Turnover	−0.03	0.12	−0.05	0.11	0.00	0.12	−0.01	0.11
Client size	−0.12	0.12	−0.08	0.11	−0.26**	0.13	−0.15	0.11
Project value	0.67***	0.13	0.58	0.11	0.78***	0.14	0.64***	0.12
R^2	0.44		0.59		0.49		0.68	
Model *F*	5.65 ***		7.48***		6.81***		10.89***	
DR^2			0.15***				0.19***	
N	50		50		50		50	

Table 6.3 Models 6.3 and 6.4 (continued)

	OLS - Dependent variable: Revenue per project Panel A. Restricted Sample				WLS - Dependent variable: Revenue per project Panel A. Restricted Sample			
	Direct model (6.3)		Moderated model (6.4)		Direct model (6.3)		Moderated model (6.4)	
	Par. Est.	St. Error	Par. Est.	St. Error	Par. Est.	St. Error	Par.Est.	St.Error
Complementarity	0.12	0.10	1.19***	0.36	0.19***	0.07	1.06***	0.25
Complexity	−0.08	0.12	−0.65**	0.28	0.01	0.10	−0.53**	0.21
Sophistication	0.03	0.11	0.48*	0.26	−0.01	0.08	0.31*	0.18
*Complexity * complementarity*			1.00**	0.41			0.90***	0.31
*Sophistication * complementarity*			−0.66**	0.30			−0.42**	0.20
Turnover	0.10	0.12	0.08**	0.12	0.56	0.47	0.57	0.44
Client size	−0.01	0.12	−0.05	0.12	0.04	0.08	−0.02	0.08
Project value	0.48***	0.12	0.43***	0.12	0.40***	0.09	0.39***	0.08
R^2	0.23		0.33		0.33		0.43	
Model F	3.95***		4.67***		6.41***		7.23***	
DR^2			0.10***				0.10***	
N	85		85		85		85	

Note. The restricted sample excludes firms with missing values in the dependent variable.
*Significant at the 0.10 level. **Significant at the 0.05 level. ***Significant at the 0.01 level.

Table 6.3 Models 6.3 and 6.4

	OLS - Dependent variable: Revenue per project Panel A. Restricted Sample				WLS - Dependent variable: Revenue per project Panel A. Restricted Sample			
	Direct model (6.3)		Moderated model (6.4)		Direct model (6.3)		Moderated model (6.4)	
	Par. Est.	St. Error	Par. Est.	St. Error	Par. Est.	St. Error	Par.Est.	St.Error
Complementarity	0.14	0.12	1.28***	0.38	0.28***	0.11	1.31***	0.27
Complexity	−0.16	0.14	−0.74***	0.29	0.07	0.12	−0.52***	0.24
Sophistication	−0.06	0.13	0.51*	0.29	−0.07	0.11	0.45***	0.22
*Complexity * complementarity*			1.11***	0.46			1.12***	0.38
*Sophistication * complementarity*			−0.88***	0.36			−0.81***	0.26
Turnover	−0.67	1.62	0.13	1.51	0.29	8.17	2.31	7.03
Client size	−0.18	0.14	−0.23*	0.13	0.05***	0.11	−0.08	0.10
Project value	0.64***	0.13	0.58***	0.12	0.54	0.11	0.5***	0.10
R^2	0.36		0.50		0.45		0.63	
Model F	4.73***		5.89***		6.72***		10.28***	
DR^2			0.13***				0.19	
N	57		57		57		57	

In regard to hypotheses 2a and 2b, the results show that modularity exerts a positive and significant impact on project performance, while the interaction term *modularity * SIC* is negative and significant (with $p < 0.10$ in the restricted sample and $p < 0.05$ in the complete sample). This suggests that integrated solution providers can implement different strategies to achieve profitability in the integrated solutions business. Like manufacturing firms developing mass customization, they can introduce modularity at the product level. Obviously, this approach makes the development of system integration capabilities redundant, as customers can then select and assemble for themselves the bundle of modules that best satisfy their requirements without requiring specific assistance from the provider to integrate the systems. In this case the activities disintegration and recombination is done *ex*ante, before bringing the different modules to the market.

The analysis of results from the tests of hypotheses 1 and 2 highlights the coexistence of two different approaches to knowledge disintegration and recombination. Empirical evidence suggests that the integration of components into a system can be done either after or prior to selling of the solution. In the first case, by leveraging heterogeneous capabilities, ex post systems integration activities enable integrated solutions providers to recombine the diverse activities while implementing the solution. Solutions based on this strategy will be more customized, with less use of standardized modules or components. Firms implementing this strategy possess heterogeneous capabilities that allow them to control the production of products and the delivery services included in the solution, and the systems integration capabilities allow the recombination of those products and service into a seamless offering.

In the second case, one can observe that activities recombination is sometimes done ex ante. By 'ex ante' I refer to the design and development of the solution in different but fully interchangeable modules that must be able to interact and coordinate once the solution is installed and is operating. A solution developed following this approach will be more standardized because it is based on pre-existing modules, and this will facilitate post-sales assistance and maintenance. The analysis of the empirical evidence enlarges our understanding of systems integration activities in a modular environment.

The extant literature calls into question whether such firms consciously act as systems integrators (Brusoni and Prencipe 2006). Firms that organize their offer into modules do not need to manage systems integration capabilities, since the integration activities required ex post are compensated for by the ex ante standardization of modules; thus, for these firms, systems integration capabilities essentially become redundant.

The results reported in Table 6.4 provide strong support for hypothesis 3. The interaction term *complementarity * complexity* is positive and strongly significant (with $p < 0.01$ in most of the models), while the interaction term *complementarity x sophistication* is negative and also strongly significant (with $p < 0.01$ in most of the models). Focusing on the positive and significant value reported for the variable *complementarity*, results show us that the mastery of complementary capabilities is essential to the achievement of greater profitability. This is consistent with what has been found in previous studies such as those of Milgrom and Roberts (1995) and Moorman and Slotegraaf (1999), and it has important implications for integrated solutions providers. It shows that in the process of developing new capabilities, not only is quantity important, as demonstrated by hypotheses 1a and 1b, but so is quality (for example, typology). Moreover, the existence of new product and service complementarities is one of the conditions that enable the diffusion of the integrated solutions business model into new markets. For this reason, results confirm the central role played by complementary capabilities in the integrated solutions offerings. Superior performance is made possible by the development of complementary capabilities that allow firms to offer complementary products and services.

More important, results also demonstrate that when product complexity is high and customers are unsophisticated, capabilities complementarity increases the economic value of product bundling. It is interesting to note that while customer sophistication has a direct and positive impact on project performance, product complexity has a direct but negative impact. Targeting sophisticated (that is, more demanding) customers increases the revenue of integrated solutions providers regardless of other strategies adopted, probably because it enables firms to price their solutions higher. Conversely, the development of complex solutions is a viable strategy for increasing the

value of product bundling only when the provider possesses complementary capabilities that can be effectively used to handle the increased complexity.

Our results indicate that to obtain superior performance, firms should match the target market and typology of solutions with their internal capabilities. This is consistent with the message of the previous chapters. Due to the significant attention that integrated solutions providers have to pay to customer needs, a correct match between internal capabilities and customer characteristics appears to be important also for the analysis of the mechanism of knowledge coordination adopted by firms.

CONCLUSIONS

In the present chapter I have explored the issue of the coordination of the activities required to offer integrated solutions. Knowledge and capabilities are distributed both within and outside firms' boundaries, as shown in Chapter 5, and to be successful in their integrated solutions offerings, firms must be able to recombine dispersed activities. Drawing upon the recent contributions of scholars such as Prencipe, Brusoni and Hobday that explore the concept of systems integration capabilities, I have developed a number of hypotheses in order to further understand how firms integrate and coordinate dispersed knowledge and activities. Our aim has been to shed further light on the evolution of sectors, explaining how sectors swing between integration and dis-integration.

Contributions arising from our analysis of the results are threefold. First, I have highlighted the balance between the heterogeneity and complementarity of capabilities. These are not opposites, but rather two different aspects of the capabilities configuration adopted by firms. Heterogeneity implies a quantitative evaluation of the capabilities developed; for instance, firms managing few capabilities in-house have low heterogeneity. It has been argued that high levels of capability heterogeneity pose problems for integration and coordination. Such problems can be solved, however, with the development of adequate systems integration capabilities. Complementarity, in contrast, implies the qualitative assessment of the

capabilities developed, on the basis of the activities enabled by the capabilities themselves. It has been proven that the development of complementary capabilities leads to superior performance. Our results show that firms, while configuring their capabilities, have to pay attention to quantity, quality and the balance between them. Complementarity is important, but an increase in the capabilities managed may create problems for the coordination of dispersed knowledge.

The second contribution of this study is that it highlights the importance that the external environment plays in the definition and configuration of internal capabilities. This is in line with what has been previously stated in Chapters 3 and 4. The discussion of hypothesis 3 shows how the characteristics of the external environment, namely customer satisfaction and the complexity of the integrated solution, moderate positively the impact that the possession of complementary capabilities has on firms' performance. The development of adequate capabilities is important, but it is the correct matching of these capabilities with the needs of the customers that leads to greater efficiency and superior performance.

Third, and most important, I find that the coordination of knowledge and activities can effectively be done both ex ante and ex post. The choice of the appropriate strategy depends upon an analysis of the capabilities managed in-house. In fact, the implementation of ex-ante coordination is feasible only if the solution itself is organized into interoperable modules that can be matched and combined during solution implementation. Ex-ante coordination leads to the development of a standardized solution in which the necessary modules can easily be bought from external suppliers. In this case, the role of systems integration capabilities appears redundant: firms wanting to achieve better performance do not need systems integration capabilities if their strategy focuses on a modular solution.

In ex post coordination firms have the ability to coordinate and integrate different products, services and technologies. These are the abilities that constitute systems integration capabilities, as defined by Prencipe et al. (2003). Systems integration capabilities are fundamental to the coordination of heterogeneous capabilities managed by the firms. Empirical results show that firms that manage systems integration capabilities as well as

heterogeneous capabilities obtain better performance. Heterogeneous capabilities alone do not assure an effective integrated solution offering: such diverse capabilities need to be integrated and coordinated. Our results are consistent with the findings of the literature on systems integration and provide a more complete understanding of the mechanisms underlying such coordination, as they show that within a single business model two different approaches can coexist. While integration of knowledge and activities is central to the integrated solutions business model, and it is the only way to achieve superior performance, it can be accomplished in multiple distinct ways. This has relevant implications for practitioners and managers, since it shows clearly that special attention should be devoted to the effective integration of knowledge that is dispersed across various divisions of a firm. The division of labor is not sufficient: the divided labor must also be recombined if it is to offer a complete working solution and not constitute only separate pieces of a given solution. Empirical evidence shows that this recombination aspect has been partially neglected in current managerial practice.

7. Conclusions

This book has explored the business model of integrated solutions, analyzing its nature, dimensions and dynamics. In this study my aim has been to offer a comprehensive view of the phenomenon. I have used a variety of theoretical lenses (that is, the theory of the firm, operations management and strategic management) to investigate the solutions business and its implications for firms' capabilities configurations, boundaries dynamics, and organizational design. Based on original empirical evidence, the book has explored such themes as systems integration, fit and performance to provide a picture of this new business model. In so doing, it has provided a comprehensive understanding of the dynamics and characteristics of the solutions business and has advanced our knowledge of firm and industry evolution.

This study has focused on the role of capabilities in solutions offers. Special attention has been devoted to the discussion of the way that firms must match different configurations of capabilities with their external environment to achieve superior performance. To embrace this new business model, firms must change their position in the value stream so as to manage bundles of products and services and develop appropriate capabilities. In this book, I have also identified various strategic choices adopted by integrated solutions providers and have examined whether these choices provide specific advantages in different environments.

In this investigation I have analyzed the strategic decisions made by solutions providers to coordinate capabilities inside and outside their boundaries. I have explored the rationales behind outsourcing/insourcing decisions, examining diverse aspects of outsourcing processes such as the characteristics of activities externalized, the relevance of outsourcing for the core business, and firms' relationships with their suppliers. The results

highlight that the dis-integration of activities and their dispersion in a network of multiple suppliers pose challenges to firms, as they then need to integrate a variety of externally produced subsystems.

In the following section I examine the implications and contributions arising from this book. The principal research findings are organized around three themes: (i) the capabilities developed and required by the new business model, (ii) the organizational design of integrated solution providers, and (iii) an analysis of sector dynamics and the competitive scenario. A discussion of the theoretical implications of this study and its contributions for practitioners follows.

PRINCIPAL RESEARCH FINDINGS

Theme 1: Exploring Capabilities Configurations

One of the main theoretical approaches followed in this book is that of the resource-based view of the firm. Relying on this theory, I have extensively analyzed the solutions business model from the micro-level perspective of resources and capabilities. The results show that to successfully offer integrated solutions, firms must manage service-related as well as product-related capabilities. This requires a movement along the value chain, with an adequate capabilities development process (Davies et al. 2006). The contributions of this study are threefold.

First, this book proposes a taxonomy of the capabilities that firms must manage in order to successfully offer integrated solutions. The taxonomy comprises thirteen capabilities, grouped into six different types: (a) systems integration capabilities; (b) consulting capabilities; (c) post-sales capabilities; (d) financial capabilities; (e) production capabilities; and (f) delivery capabilities. These six macro-level categories extend Davies' (2001) framework and reflect the types of capabilities common to all firms that offer integrated solutions, irrespective of the sector in which they operate. For each macro-level category, one or more specific capabilities have been identified. These capabilities underpin the various activities performed by the analyzed firms. This taxonomy constitutes a useful benchmark for managers and practitioners against which to compare a firm's activities. It also represents a building block for future research on capabilities configurations, organizational design, and sector analysis.

Secondly, the book has also focused on the outsourcing decisions related to individual capabilities. It emerges that integrated solutions providers rarely outsource core activities. Despite the economies that could be obtained by outsourcing these activities, firms evaluate their internal capabilities and design their boundaries accordingly, with an eye to the reinforcement of their comparative advantage within the industry. Thus, in regard to the balance between resources and transaction costs in the shaping of organizational boundaries, my results suggest that resources and capabilities play the predominant role. This is in line with the findings of research in the field of comparative advantage: firms specialize in activities that grant them a comparative advantage against competitors.

Finally, in studying the optimal configuration of capabilities, I have focused also on the optimal balance among the number and type of capabilities to be developed. The results show that firms pay attention to both the quantity and type of capabilities, as well as the balance between these. The development of complementary capabilities leads to superior performance; on the other hand, an increase in the overall number of capabilities may create problems for the coordination of the firm's dispersed knowledge. The findings presented here also indicate that firms managing a high number of capabilities in-house may indeed encounter coordination problems unless they develop adequate systems integration capabilities. In summary, the results of this research demonstrate the importance of a harmonious balance between the number and type of capabilities developed.

Theme 2: Designing the Organization

The present study not only contributes to the definition of the solutions business model from a capabilities perspective but also describes the integration and combination of solutions components in organizational design. In so doing it offers insight into the fit between organizational characteristics and environmental contingencies; strategies informing boundaries design; and the coordination mechanisms adopted by firms when

coordinating dispersed activities.

According to contingency theory, both environmental and organizational factors influence firms' strategies, which in turn have an impact on firms' capabilities configurations. In this book I have aimed to identify and describe the relationships between these aspects of the solutions model. The empirical results indicate that similarities in organizational and environmental factors lead to similar strategic choices, and that the varied importance attributed to different capabilities within each group is influenced both by external and organizational factors and by strategic choices. This is consistent with the reasoning of contingency theory (see, for example, Drazin and Van De Ven 1985; Siggelkow 2002), and it sheds further light on firms' perceptions of the roles of their diverse capabilities. While previous literature has stressed that systems integration capabilities are central to the offering of integrated solutions (Davies et al. 2006), the results of the present study illustrate that the importance of different capabilities varies across groups, and therefore there are different ways to successfully offer integrated solutions. The fact that firms' responses may vary is consistent with the evolutionary approach (Nelson 1991).

When adopting the contingency approach, both practitioners and researchers can fall into the trap of searching for an ideal strategy that is the one 'best fit'. To avoid this potential pitfall, I have used a variety of performance measures to distinguish among various optimal configurations that lead to different results. The data confirm that no one best fit exists: customer satisfaction can be guaranteed by focusing on standardized systems, which allow for greater control of time and costs, but optimal labor and project productivity require different strategic decisions. This implies that it is not possible to identify a single best strategy for the offering of IT solutions; rather, the various possible strategies lead firms toward the achievement of different performance objectives. Firms thus can modify their strategic positioning in order to attain specific performance goals. This insight advances the knowledge of integrated solutions strategies by highlighting that managers must carefully align internal and external factors in order to achieve the expected performance results. Obviously, the selection of the most appropriate performance indicator is largely based on the beliefs

and perceptions of managers.

This study has also focused on boundaries dynamics, a crucial aspect of organizational design. The results show that integrated solutions providers, when establishing their boundaries, prefer flexibility to production efficiency. This is due to characteristics of the context and to specificities of the business model. Integrated solutions providers are project-based organizations, and their production processes are the job-shop type, organized around customers' requests. This leads to difficulties in production planning and exposes these firms to a constantly shifting workload. It is not surprising that integrated solutions providers show a preference for flexible organization: favoring the market over vertical integration on the one hand increases costs and decreases efficiency but, on the other, increases flexibility, facilitating the accommodation of workload variation. Integrated solutions firms largely rely on an extensive network of suppliers, building strong relations with them, such as partnerships and joint ventures.

The last contribution of this book in the area of organizational design is its exploration of coordination mechanisms. Firms' activities are made possible by specialized knowledge, and recent studies have pointed out the importance of the appropriate recombination of the knowledge dispersed within an organization or outside it in the suppliers' network (Brusoni et al. 2001; Jacobides and Winter 2005). The results of my study have shown that the coordination of knowledge can effectively be done either ex ante or ex post. In the specific case of solutions offerings, by 'ex ante' I refer to the design and development of the solutions in different but fully interchangeable modules that must be able to interact and coordinate once the solutions are installed and operating. By organizing the offer into modules, firms eliminate the need for systems integration capabilities, since the integration activities are essentially handled through the ex ante standardization of modules. Thus, for these firms, systems integration capabilities essentially become redundant. In ex-post integration, integrated solutions providers retain control of heterogeneous capabilities, recombining various activities during the solution implementation. Solutions based on this strategy will be more customized, with less use of standardized modules or components. Firms implementing this latter strategy leverage their systems integration

capabilities to recombine products and service into a seamless offering.

My findings are consistent with those of the literature on systems integration and provide a more complete understanding of the mechanisms underlying such coordination, as they show that within a single business model two different approaches coexist. The integration of knowledge and activities is central to the integrated solutions business model, and it can be accomplished in multiple distinct ways. The division of labor alone is not sufficient: the divided labor must also be recombined, especially if it is to offer a complete working solution.

Theme 3: Understanding Sector Dynamics

Sector dynamics are dominated by the centrality of the customer in the integrated solutions offer. Although the activities to be included in integrated solutions are similar across sectors, firms' offerings are differentiated on the basis of their clients' needs. The requirements of customers vary in complexity, and the possibilities for a given firm to differentiate are many. Such considerations have important implications for the analysis of the competitive scenario in the IT sector specifically and in the integrated solutions business in general. Solutions providers operate mainly on a customer-demand basis. They are often asked to perform activities not generally offered, and the internalization of such activities is not possible. This fosters the creation and diffusion of supplier networks and the birth of many SMEs that operate within the industry as second-tier suppliers of specialized components.

The analysis presented in this book suggests that, consistent with other industrial sectors, a trend toward more standardized solutions is emerging in IT. As IT systems are becoming commoditized and no longer guarantee competitive advantages to their users, companies with simple IT needs increasingly prefer standardized solutions that do not lock them into exclusive relationships with their suppliers. The IT practitioners interviewed in this study agree that the emergence of standardized solutions will segment the market even further: a growing number of firms with simple IT needs will opt for the standardized solutions, and providers offering such solutions will most likely increase their market share. While more complex requirements

will still be addressed, the need for that type of service will become rarer, and this will result in a decrease in market share for firms offering more customized solutions.

IMPLICATIONS FOR MANAGEMENT

The findings of this investigation offer implications for practitioners and policy makers, as the results yield a deeper understanding of sectoral dynamics and future market trends. First, based on empirical evidence and on the analysis of capabilities development processes described in previous studies, I conclude that the offering of integrated solutions is strongly influenced by the pool of capabilities a firm already possesses. A strong path dependency is found among the analyzed firms: a final offer is influenced by the characteristics of the firm's value-chain movement, that is, either up- or downstream.

Second, the identification of strategies that serve as alternatives to integrated solutions and the analysis of performance differences also yield useful insights. Managers and practitioners can use these results to verify whether the strategies implemented are consistent with the capabilities of their organizations. They can also use them to decide whether a shift in strategy is needed and, if so, how to manage this change consistently, given their internal resources.

Moreover, the analysis of firms' performance shows the importance of the correct alignment of resources, environment and performance. No one 'best fit' plan exists; rather, managers are called upon to clearly establish their objectives while developing their strategies. The results of this study indicate the existence of a trade-off between different performance indicators, specifically customer satisfaction and labor productivity. In the solutions business, customer satisfaction can be achieved by focusing on standardized systems, which allow for greater control of time and costs, but labor and project productivity require different strategic decisions, such as a focus on small markets and/or the development of high valued-added and customized solutions. Firms that operate in niche markets tend to privilege specialization

and software customization. However, the risk of this strategy is that overly customized solutions may be too complex to use and may create compatibility problems with existing platforms, thereby dissatisfying clients. Specialized solutions developed for a small number of clients may be difficult to manage, rendering after-sales activities costly and ineffective and causing delays in the development and delivery phases of the solution. Empirical evidence shows that firms trapped in these situations find it difficult to keep time and costs within budget, and this has a negative effect on customer satisfaction. On the other hand, firms working in heterogeneous markets offer comprehensive, highly standardized solutions, adopting the following strategy: they offer products and services that involve a defined core architecture that can be slightly customized to meet customer requests, with specific customization modules and options ready for implementation. This reduces implementation time and cost, allowing firms to stay within budgetary and schedule constraints, and increases customer satisfaction. The knowledge of such mechanisms can facilitate management and help firms align their capabilities and environment consistently with their objectives.

In line with previous studies on the topic, the results reported in this work highlight the crucial importance of developing a network of suppliers and partners. Because integrated solutions providers are project-based organizations, a flexible organization is preferable, and significant reliance on outside suppliers and partners to develop and deliver solutions is a recommended strategy.

The present research also casts further light on the role of modularity and the characteristics of systems integration in the solutions business. In Chapter 6 I describe two possible integration mechanisms adopted by integrated solutions providers, namely integration ex ante and ex post. My empirical results show the benefits of modular systems and enlarge our understanding of the importance of modularity for complex systems, consistent with previous literature, by identifying the two complementary coordination mechanisms of *ex* ante and *ex* post integration. This finding has important implications for managers, as it offers firms a concrete solution to a significant knowledge coordination issue.

To conclude, from the discussion of the results of this study I see that

three major objectives guide firms' strategy in the solutions context: to retain comparative advantage(s); to maintain flexibility; and to fulfil customers' needs. The role of the context is crucial in the decision among these objectives, because the need for flexibility and the need to meet customer demand are context-driven. Firms should begin with an analysis of their internal assets, then match these with the requirements of their context – requirements that may be difficult to satisfy, since demand is often uncertain and change is inherently unpredictable. Moreover, the heterogeneous nature of capabilities configurations and the dispersion of activities throughout the value chain pose challenges for coordination.

THEORETICAL IMPLICATIONS

This study has aimed to contribute to the theoretical debate regarding capabilities in areas of the theory of the firm, operations management, and strategic management. It has brought together insights from different perspectives on the implementation and management of the integrated solutions business model. In particular, it has analyzed the business model from a capabilities' viewpoint, offering empirical evidence that illustrates the strategic scenario of the integrated solutions competitive arena.

The theoretical implications of this study contribute to the research streams on strategic fit, boundaries dynamics, and coordination mechanisms. The first important theoretical finding pertains to the role of fit: consistent with the contingency literature, the results show that the appropriate configuration of capabilities and the careful selection of markets allow firms to achieve their performance objectives. This confirms the crucial importance of fit in assuring superior performance, and it advances our understanding of this concept. However, the type of fit – and thus its impact on performance – varies. The empirical evidence in this study shows that different types of fit lead to different performance results, and the various possible operational approaches thus allow for the achievement of firms' diverse strategic objectives.

This finding draws upon previous work by Siggelkow (2002) that

investigates 'the organizational consequences of having followed one developmental pattern rather than a different one' (p. 157). My study enlarges the understanding of the consequences of following different developmental paths toward fit (or misfit). The use of a variety of performance measures challenges the notion of a plurality of 'successful transitions' (ibid.). Such findings contribute to the debate about the existence of equifinality in organizational design, that is, the possibility of 'multiple, equally effective designs to support a given strategy' (Gresov and Dazin 1997, p. 404). Taking the definition by von Bertalanffy (1968, p. 58) as a point of departure, equifinality is said to be a general property of open systems such that 'as far as they attain a steady state, this state can be reached from different initial conditions and in different ways'. Recent research on this topic provides diverse and conflicting theoretical and empirical evidence on the role and the existence of equifinality (Payne 2006; Siggelkow and Rivkin 2005; Westerman et al. 2006). The results of the present investigation illustrate that the final operational state in the solutions business model can be achieved by following different paths and utilizing different fit configurations; the performance results differ based on firms' strategic choices. This enlarges our understanding of the role of equifinality in economic systems, by challenging its existence.

Second, this book has explored the coordination mechanisms adopted by integrated solutions providers. The solutions sector is characterized by significant dependence on supplier networks, which comprise SMEs operating as second-tier suppliers of specialized components. This fragmented scenario poses difficulties for the coordination of knowledge and the distribution of capabilities both within and outside firms' boundaries, as it requires firms to recombine dispersed knowledge. Drawing upon recent contributions exploring the link between the boundaries of organizations and the knowledge bases in a given sector, I have investigated the knowledge coordination activities of the solutions providers in order to further elucidate the ways that firms integrate dispersed capabilities. Brusoni et al. (2001), pioneers in this area, pointed out that systems integration is a strategic task that pervades business management. Systems integration is seen as the ability to integrate dispersed technologies and knowledge, and it represents the basis

for the achievement of long-run competitive advantage. My study contributes to the understanding of integration dynamics by highlighting the knowledge integration mechanisms followed by solutions providers (namely *ex* ante and *ex* post integration), each of which requires a different production process and solution design. My aim has been to shed further light on the evolution of sectors, explaining how sectors swing between integration and disintegration and how firms contribute to this process.

Finally, as solutions scholars have pointed out, the transition toward the integrated solution business model also requires the reorganization of firms' boundaries. Investigating diverse aspects of outsourcing processes, such as the type of activities externalized, the relevance of outsourcing for the core business, and firms' relationships with their suppliers, the book provides a comprehensive view of the underlying rationales followed by solution providers in designing their boundaries. The extant literature on this topic has highlighted two major drivers influencing such decisions: the transaction costs involved in the activity (Coase 1937; Williamson 1975, 1985) and the capabilities it requires (Argyres 1996; Barney 1999).

The debate between transaction cost economics and the resource-based view remains open. Empirical evidence suggests that in certain situations, capabilities are likely to matter more than asset specificity or any other transaction cost. Scholars have converged on the idea that both capabilities and transaction costs matter. Capabilities have a direct impact on outsourcing decisions, and when firms explore their rationale for 'make or buy', both capabilities and transaction costs must be considered. The latter are short-run, while the former involve an evaluation of the comparative advantage of the firm (Foss 1993; Jacobides and Winter 2005; Langlois 1992; Madhok 2002). Moreover, the balance seems to be directly influenced by sector and context specificities, and generalizations appear difficult so far (Jacobides 2008; Mayer and Nickerson 2005; Wolter and Veloso 2008). This book has contributed to this debate, showing in which situations short-term decisions are preferred to long-run ones and illustrating a series of context and sector-specific factors that directly influence firms' strategies in the solutions business model.

Bibliography

Abernathy, J. and J. Utterback (1978), 'Patterns of innovation', *Industry Technology Review*, **80**(7).

Adams, J. and W. Yellen (1976), 'Commodity bundling and the burden of monopoly', *The Quarterly Journal of Economics*, **90**(3), 475–98.

Adner, R. and D. Levinthal (2001), 'Demand heterogeneity and technology evolution: implications for products and process innovation', *Management Science*, **47**(5), 611–28.

Adner, R. and P. Zemsky (2006), 'A demand-based perspective on sustainable competitive advantage', *Strategic Management Journal*, **27**(3), 215–39.

Aksin, Z. and A. Masini (2008), 'Effective strategies for internal outsourcing and offshoring of business services: an empirical investigation', *Journal of Operations Management*, **26**(2).

Alchian, A. and H. Demsetz (1972), 'Production, information costs and economic organization', *American Economic Review*, **62**, 777–95.

Anand, B. and T. Khanna (1997), 'On the market valuation of inter–firm agreements: evidence from computers and telecommunications, 1990–1993', *Working Paper: Harvard Business School*.

Anderson, E. and C. Schmittlein (1984), 'Integration of the sales force: an empirical examination', *Rand Journal of Economics*, **15**, 385–95.

Ansoff, H. (1965), *Corporate Strategy: An Analytic Approach to Business Policy for Growth and Expansion*, New York: McGraw-Hill.

Ansoff, H. (1979), *Strategic Management*, London: Macmillan.

Araujo, L. and M. Spring (2006), 'Services, products, and the institutional structure of production', *Industrial Marketing Management*, **35**(7), 797–805.

Argyres, N. (1996), 'Evidence on the role of firms' capabilities in vertical integration decisions', *Strategic Management Journal*, **17**(2) 129–50.

Arora, A., A. Fosfuri and A. Gambardella (2002), *Markets for Technology*, Cambridge, MA and London: MIT Press.

Ashour, A. (1973), 'The contingency model of leadership effectiveness: an evaluation', *Organizational Behaviour and Human Decision Processes*, **9**(3), 339–55.

Bakos, Y. and E. Brynjolfsson (1999), 'Bundling information goods: pricing, profits, and efficiency', *Management Science*, **45**, 1613–30.

Baldwin, C. and K. Clark (2000), *Design Rules*, Cambridge, MA: MIT Press.

Barney, J. (1999), 'How a firm's capabilities affect boundary decisions', *Sloan Management Review*, **40**(3), 137–46.

Bensaou, M. and N. Venkatraman (1995), 'Configurations of inter-organizational relationships: a comparison', *Management Science*, **41**(9), 1471–92.

Best, M. (2003), 'The Geography of Systems Integration', in A. Prencipe, A. Davies and M. Hobday (eds), *The Business of Systems Integration*, Oxford: Oxford University Press.

Bourgeois, J. and K. Eisenhardt (1988), 'Strategic decision processes in high velocity environments: four cases in the microcomputer industry', *Management Science*, **34**(7), 816–35.

Brady, T. and A. Davies (2004), 'Building project capabilities: from exploratory to exploitative learning', *Organization Studies*, **25**(9), 1601–21.

Brady, T., A. Davies and D. Gann (2005), 'Creating value by delivering integrated solutions', *International Journal of Project Management*, **23**(5), 360–65.

Brusoni, S. and A. Prencipe (2001), 'Unpacking the black box of modularity, technologies, products and organizations', *Industrial and Corporate Change*, **10**(1), 179–205.

Brusoni, S. and A. Prencipe (2006), 'Making design rules: a multidomain perspective', *Organization Science*, **17**(2), 179–89.

Brusoni, S., A. Prencipe and K. Pavitt (2001), 'Knowledge specialization, organizational coupling, and the boundaries of the firm: why do firms know more than they make?', *Administrative Science Quarterly*, **46**(4), 597–621.

Burns, T. and G. Stalker (1961), *The Management of Innovation*, London: Tavistock.

Ceci, F. and A. Prencipe (2008), 'Configuring capabilities for integrated solutions: empirical evidences from the IT sector', *Industry & Innovation*, **15**(3), 277–96.

Cerasale, M. (2004), *Business Solutions on Demand*, London: Kogan Page.

Chandler, A. (1962), *Strategy and Structure: Chapters in the History of Industrial Enterprise*, Cambridge, MA: MIT Press.

Chandler, A. (1990), *Scale and Scope: The Dynamics of Industrial Capitalism*, Boston, MA: Harvard University Press.

Child, J. (1975), 'Managerial and organizational factors associated with company performance, part II: a contingency analysis', *Journal of Management Studies*,

12(1–2), 12–27.
Cleven, W. and F. Fielder (1956), 'Interpersonal perceptions of open hearth foremen and steel production', *Journal of Applied Psychology*, **40**, 312–14.
Coase, R. (1937), 'The nature of the firm', *Economica*, **4**, 386–405.
Coase, R. (1960), 'The problem of social cost', *Journal of Law and Economics*, **3**, 1–44.
Coase, R. (1988), 'The nature of the firm: meaning', *Journal of Law, Economics and Organizations*, **4**, 19–32
Conner, K. and C. Prahalad (1996), 'A resource-based theory of the firm: knowledge versus opportunism', *Organization Science*, **7**(5), 477–501.
Davies, A. (2004), 'Moving base into high-value integrated solutions: a value stream approach', *Industrial and Corporate Change*, **13**(5), 727–56.
Davies, A. and T. Brady (2000), 'Organizational capabilities and learning in complex product systems: towards repeatable solutions', *Research Policy*, **25** (9), 931–53.
Davies, A. and M. Hobday (2005), *The Business of Projects*, Cambridge: Cambridge University Press.
Davies, A., T. Brady and M. Hobday (2006), 'Charting a path toward integrated solutions', *MIT Sloan Management Review*, **47**(3), 39–48.
Davies, A., T. Brady and M. Hobday (2007), 'Organizing for solutions: systems seller vs. systems integrator', *Industrial Marketing Management*, **36**(2), 183–93.
Demsetz, H. (1968), 'The cost of transacting', *Quarterly Journal of Economics*, **82**, 33–53.
Demsetz, H. (1988), 'The theory of the firm revisited', *Journal of Law, Economics and Organization*, **4**(1), 141–61.
Dennis, D. and J. Meredith (2000), 'An empirical analysis of process industry transformation systems', *Management Science*, **46**(8), 1085–99.
Dierickx, I. and K. Cool (1989), 'Asset stock accumulation and sustainability of competitive advantage', *Management Science*, **35**(12), 1504–10.
Di Maggio, P. and W. Powell (1983), 'The iron cage revisited: institutional isomorphism and collective rationality in organizational fields', *American Sociological Review*, **48**, 147–60.
Dolbeck, A. (2007), 'Valuation of the custom software and IT services industry', *Weekly Corporate Growth Report*, **1438**, 1–4.
Dosi, G., M. Hobday, L. Marengo and A. Prencipe (2003), 'The economics of systems integration: towards an evolutionary interpretation', in A. Prencipe, A. Davies and M. Hobday (eds), *The Business of Systems Integration*, Oxford: Oxford University Press.
Drazin, R. and A. Van De Ven (1985), 'Alternative forms of fit in contingency theory', *Administrative Science Quarterly*, **30**, 514–39.

Drucker, P. (1988), 'The coming of new organization', *Harvard Business Review*, **66**(1), 45–53.
Duncan, R. (1972), 'Characteristics of organizational environments and perceived environmental uncertainty', *Administrative Science Quarterly*, **17**, 313–27.
Dyer, J. (1996), 'Does governance matter? Keiretsu alliances and asset specificity as sources of Japanese competitive advantage', *Organization Science*, **7**(6), 649–66.
Easingwood, C. (1986), 'New product development for service companies', *Journal of Product Innovation Management*, **3**(4), 264–75.
Eisenhardt, K. (1989), 'Agency theory: an assessment and review', *Academy of Management Review*, **14**(1), 57–74.
Eisenhardt, K. and J. Martin (2000), 'Dynamic capabilities: what are they?', *Strategic Management Journal*, **21**(10–11), 1105–21.
Eppen, G., W. Hanson and R. Martin (1991), 'Bundling new products, new markets, low risk', *MIT Sloan Management Review*, **32**(4), 7–15.
Estelami, H. (1999), 'Consumer savings in complementary product bundles', *Journal of Marketing Theory and Practice*, **7**(3), 107–15.
Fennel, M. (1980), 'The effects of environmental characteristics on the structure of hospital clusters', *Administrative Science Quarterly*, **25**, 485–510.
Fielder, F. (1967), *A Theory of Leadership Effectiveness*, New York: McGraw Hill.
Fielder, F. and M. Chemers (1976), *Improving Leadership Effectiveness: the Leader Match Concept*, Wiley.
Fine, C. (1998), *Clockspeed*, Reading, MA: Perseus Books.
Foote, N., J. Galbraith, Q. Hope and D. Miller (2001), 'Making solutions the answer', *McKinsey Quarterly*, **3**, 84–93.
Ford, J. and J. Slocum (1977), 'Size, technology, environment and the structure of organizations', *Academy of Management Review*, **2**(4), 561–75.
Foss, N. (1993), 'Theories of the firm: contractual and competence perspectives', *Journal of Evolutionary Economics*, **3**, 127–44.
Fredericks, E. (2005), 'Infusing flexibility into business-to-business firms: a contingency theory and resource-based view perspective and practical implications', *Industrial Marketing Management*, **34**(3), 555–65.
Freeman, J. and M. Hannan (1984), 'Structural inertia and organizational change', *American Sociological Review*, **49**(2), 149–64.
Gaeth, G., I. Levin, G. Chakraborty and A. Levin (1990), 'Consumer evaluation of multi-product bundles: an information integration analysis', *Marketing Letters*, **2**(1), 47–57.
Gager, R. (2006), 'Integration: the integrators' perspective', *Security Distributing and*

Marketing, **36**(6), 56–62.
Galbraith, J. (1973), *Designing Complex Innovations*, Reading, MA: Addison-Wesley.
Galbraith, J. (2002a), 'Organizing to deliver solutions', *Organizational Dynamics*, **31**(2), 194–207.
Galbraith, J. (2002b), *Designing Organizations: an Executive Guide to Strategy, Structure, and Process*, San Francisco, CA: Jossey-Bass, Wiley.
Geng, X., M. Stinchcombe and A. Whinston (2005), 'Bundling information goods of decreasing value', *Management Science*, **51**(4), 662–67.
Gerstner, L. (2002), *Who Says Elephants Can't Dance? Inside IBM's Historic Turnaround*, New York: HarperCollins.
Ginsberg, A. and N. Venkatraman (1985), 'Contingency perspective of organizational strategy: a critical review of the empirical research', *Academy of Management Review*, **10**(3), 421–34.
Goldsmith, P. (2001), 'Innovation, supply chain control and the welfare of farmers: the economics of genetically modified seeds', *The American Behavioural Scientist*, **44**(8), 1302–26.
Graen, G., K. Alvarez, J. Orris and J. Martella (1970), 'Contingency model of leadership effectiveness: antecedent and evidential results', *Psychological Bulletin*, **74**, 285–96.
Grandori, A. (1997), 'Governance structure, coordination mechanism and cognitive models', *Journal of Management and Governance*, **1**, 29–47.
Grandori, A. (2006), 'A relational approach to organization design', *Industry and Innovation*, **13**, 151–73.
Grant, R. (1996), 'Prospering in dynamically competitive environments: organizational capability as knowledge integration', *Organization Science*, **7**, 375–87.
Grant, R. (1998), *Contemporary Strategy Analysis*, Malden, MA: Blackwell.
Greenwood, R. and C. Hinings (1993), 'Understanding strategic change: the contribution of archetypes', *Academy of Management Journal*, **36**(5), 1052–81.
Gresov, C. and R. Dazin (1997), 'Equifinality: functional equivalence in organization design', *Academy of Management Review*, **22**(2), 403–28.
Grover, V., M.J. Cheon and T.C. Teng (1996), 'The effect of service quality and partnership on the outsourcing of information systems functions', *Journal of Management Information Systems*, **12**(4), 89–116.
Guiltinan, J. (1987), 'The price bundling of services: a normative framework', *Journal of Marketing*, **51**, 74–85.
Hair, J., R. Tatham, R. Anderson and W. Black (1998), *Multivariate Data Analysis*,

Upper Saddle River, NJ: Prentice Hall.
Hamel, G. and C. Prahalad (1994) *Competing for the Future*, Boston, MA: Harvard Business School Press
Hannaford, W. (1976), 'Systems selling: problems and benefits for buyers and sellers', *Industrial Marketing Management*, **2**, 139–45.
Hannah, M. and J. Freeman (1984), 'Structural inertia and organizational change', *American Sociological Review*, **49**, 149–64.
Hanson, W. and R. Martin (1990), 'Optimal bundle pricing', *Management Science*, **36**, 155–74.
Hax, A. and D. Wilde (1999), 'The delta model: adaptive management for a changing world', *Sloan Management Review*, **40**(2), 11–28.
Hayes R. and S. Wheelwright (1979), 'Link manufacturing process and product life cycle', *Harvard Business Review*, **57**(1), 133–40.
Herrmann, A., F. Huber and R. Coulter (1997), 'Product and service bundling decisions and their effects on purchase intention', *Pricing Strategy and Practice*, **5**(3), 99–107.
Hill, P. (1999), 'Tangibles, intangibles and services: a new taxonomy for the classification of output', *Canadian Journal of Economics*, **32**(2), 426–46.
Hitt, L. and P. Chen (2005), 'Bundling low-marginal-cost goods', *Management Science*, **51**(10), 1481–93.
Hitt, M., R. Hoskisson and H. Kim (1997), 'International diversification: effects on innovation and firm performance in product diversified firms', *Academy of Management Journal*, **40**(4), 767–98.
Hobday, M. (2000), 'The project based organization: an ideal form for managing complex products and systems?', *Research Policy*, **29**(7–8), 871–93.
Hobday M., A. Davies and A. Prencipe (2005), 'Systems integration: a core competence of modern corporation', *Industrial and Corporate Change*, **14**(6), 1109–43.
Hosmer, D. and S. Lemeshow (2000), *Applied Logistic Regression*, New York: John Wiley and Sons.
Jacobides, M. (2005), 'Industry change through vertical disintegration: how and why markets emerged in mortgage banking', *Academy of Management Journal*, **48**(3), 465–98.
Jacobides, M. (2008), 'A model of how transaction costs, capabilities and limits to growth drive vertical scope', *Organization Science*, **19**, 1–21.
Jacobides, M. and L. Hitt (2005), 'Losing sight of the forest for the trees? Productive capabilities and gains from trade as drivers of vertical scope', *Strategic Management Journal*, **26**(13), 1209–27.

Jacobides, M. and S. Winter (2005), 'The co-evolution of capability and transaction costs: explaining the institutional structure of production', *Strategic Management Journal*, **26** (5), 395–413.

Johansson, J., C. Krishnamurty and H. Schlissberg (2003), 'Solving the solution problem', *McKinsey Quarterly*, **6696**, 117–18.

Joskow, P. (1988), 'Asset specificity and the structure of vertical relationships: empirical evidence', *Journal of Law Economics and Organization*, **4**(1), 95–117.

Joskow, P. (1993), 'Asset specificity and the structure of vertical relationships: empirical evidence', in O. Williamson and S. Winter (eds), *The Nature of the Firm: Origins, Evolution, and Development*, New York and Oxford: Oxford University Press.

Kapletia, D. (2003), *The Solutions Battlefield: an Exploratory Study of Rolls Royce's Strategic Move into Mission Ready Solutions*, CoPS Working Paper, SPRU, University of Sussex.

Keats, B. and M. Hitt (1988), 'A causal model of linkages among environmental dimensions, macro organizational characteristics and performance', *Academy of Management Journal*, **31**(3), 570–98.

Ketchen, D. and C. Shook (1996), 'The application of cluster analysis in strategic management research: an analysis and critique', *Strategic Management Journal*, **17**(6), 441–59.

Klein, S., G. Frazier and V. Roth (1990), 'A transaction cost analysis model of channel integration in international markets', *Journal of Marketing Research*, **27**, 196–208.

Klepper, S. (1997), *Industry Life Cycles*, London: Oxford University Press.

Kogut, B. and U. Zander (1992), 'Knowledge of the firm, combinative capabilities, and the replication of technology', *Organization Science*, **3**, 383–97.

Langlois, R. (1992), 'Transaction-cost economics in real time', *Industrial and Corporate Change*, **1**, 99–127.

Langlois, R. (2002), 'Modularity in technology and organization', *Journal of Economic Behaviour and Organization*, **49**(1), 19–37.

Langlois, R. (2003), 'The vanishing hand: the changing dynamics of industrial capitalism', *Industrial and Corporate Change*, **12**(2) 351–85.

Langlois, R. and P. Robertson (1995), *Firms, Markets, and Economic Change: a Dynamic Theory of Business Institutions*, London: Routledge.

Langlois, R. and N. Foss (1999), 'Capabilities and governance: the rebirth of production in the theory of economic organization', *Kyklos*, **52**(2), 201–19.

Lawless, M. (1991), 'Commodity bundling for competitive advantage: strategic implications', *Journal of Management Studies*, **28**, 267–80.

Lawrence, P. and J. Lorsch (1986), *Organization and Environment: Managing Differentiation and Integration*, Cambridge, MA: Harvard Business School Press.

Leonard-Barton, D. (1992), 'Core capabilities and core rigidities: a paradox in managing new product development'. *Strategic Management Journal*, **13**(1), 111–125.

Madhok, A. (2002), 'Reassessing the fundamentals and beyond: Ronald Coase, the transaction cost and resource-based theories of the firm and the institutional structure of production', *Strategic Management Journal*, **23**, 535–50.

Masten, S. (1984), 'The organization of production: evidence from the aerospace industry', *Journal of Law and Economics*, October 1984, **27**(2), 403–17.

Mayer, K. and N. Argyres (2004), 'Learning to contract: evidence from the personal computer industry', *Organization Science*, **15**, 394–410.

Mayer, K. and J. Nickerson (2005), 'Antecedents and performance implications of contracting for knowledge workers: evidence from information technology services', *Organization Science*, **16**, 225–42.

McAfee, R., J. McMillan and M. Whinston (1989), 'Multiproduct monopoly, commodity bundling and correlation of values', *The Quarterly Journal of Economics*, **104**(2), 371–83.

McFarlan, F. and R. Nolan (1995), 'How to manage an IT outsourcing alliance', *Sloan Management Review*, **36**(2), 9–23.

Mealiea, L. and D. Lee (1979), 'An alternative to macro–micro contingency theories: an integrative model', *The Academy of Management Review*, **4**(3), 333–45.

Menor, L., A. Roth and C. Mason (2001), 'Agility in retail banking: a numerical taxonomy of strategic service groups', *Manufacturing and Service Operations Management*, **3**(4), 273–92.

Meyer, A., A. Tsui and C. Hinings (1993), 'Configurational approaches to organizational analysis', *Academy of Management Journal*, **36**, 1175–95.

Miles, R. and C. Snow (1978), *Organizational Strategy, Structure and Process*, New York: Mc Graw-Hill.

Milgrom, P. and J. Roberts (1995), 'Complementarities and fit strategy, structure, and organizational change in manufacturing', *Journal of Accounting and Economics*, **19**(2–3), 179–208

Miller, A. (1988), 'A taxonomy of technological settings with related strategies and performance levels', *Strategic Management Journal*, **9**, 239–54.

Miller, D. (1981), 'Toward a new contingency perspective: the search for organizational gestalts', *Journal of Management Studies*, **18**, 1–26.

Miller, J. and A. Roth (1988), 'Manufacturing strategies', *Operations Management Review*, **6**(1), 285–304.

Miller, J. and A. Roth (1994), 'A taxonomy of manufacturing strategies', *Management Science*, **40**(3), 285–304.
Milligan, G. and M. Cooper (1985), 'An examination of procedures for determining the number of clusters in a data set', *Psychometrika*, **50**(22), 159–79.
Mintzberg, H. (1979), *The Structuring of Organizations*, Englewood Cliffs, NJ: Prentice Hall.
Miyazaki, K. (1994), 'Search, learning and accumulation of technological competences; the case of optoelectronics', *Industrial and Corporate Change*, **3**(3), 631–54.
Monroe, K. (1990), *Pricing: Making Profitable Decisions*, New York: McGraw-Hill Publishing Company.
Monteverde, K. (1995), 'Technical dialog as an incentive for vertical integration in the semiconductor industries', *Management Science*, **41**, 1624–38.
Monteverde, K. and D. Teece (1982), 'Supplier switching costs and vertical integration in the automobile industry', *Bell Journal of Economics*, **13**(1), 206–13.
Moorman, C. and R. Slotegraaf (1999), 'The contingency value of complementary capabilities in product development', *Journal of Marketing Research*, **36**(2), 239–57.
Nambisan, S. (2001), 'Why service businesses are not product businesses', *MIT Sloan Management Review*, **42**(4), 72–80.
Nelson, R. (1991), 'Why firms differ and why it matters', *Strategic Management Journal*, **12**, 61–74.
Nelson, R. and S. Winter (1982), *An Evolutionary Theory of Economic Change*, Cambridge, MA: The Belknap Press of Harvard University Press.
Oliva, R. and R. Kallenberg (2003), 'Managing the transition from products to services', *International Journal of Service Industry Management*, **14**(2), 160–72.
Oppenheim, A. (2000), *Questionnaire Design, Interviewing and Attitude Measurement*, London: Pinter.
Osborn, R. and J. Hunt (1974), 'Environment and organizational effectiveness', *Administrative Science Quarterly*, **19**(2), 231–46.
Page, A. and M. Siemplenski (1983), 'Product systems marketing', *Industrial Marketing Management*, **12**(2), 89–99.
Paliwoda, S. and P. Thomson (1985), 'The practice of systems marketing in the French packaging industry', *Journal of Marketing Management*, **1**, 99–113.
Patel, P. and K. Pavitt (1997), 'The technological competencies of the world's largest firm: complex and path-dependent, but not much variety', *Research Policy*, **26**, 141–56.
Pavitt, K. (2003), 'Specialization and systems integration: where manufacture and services meet', in A. Prencipe, A. Davies and M. Hobday (eds), *The Business of Systems Integration*, Oxford: Oxford University Press.
Payne, T. (2006), 'Examining configurations and firm performance', *Organization Science*, **17**(6), 756–70.
Penrose, E. (1955), 'Limits to the growth and size of firms', *American Economic Review*, **45**, 531–43.
Penrose, E. (1959), *The Theory of the Growth of the Firm*, Oxford: Blackwell.
Perrow, C. (1967), 'A framework for the comparative analysis of organizations', *American Sociological Reviews*, **32**(2), 194–208.
Peters, L., D. Hartke and J. Pohlmann (1986), 'Fiedler's contingency theory of leadership: an application of the meta-analysis procedure of Schmidt and Hunter', *Psychological Bulletin*, **97**, 274–85.
Pfeffer J. and H. Leblebici (1973), 'The effect of competition on some dimensions of organizational structure', *Social Forces*, **52**(2), 268–79.
Podsakoff, P., S. MacKenzie, J. Lee and N. Podsakoff (2003), 'Common method biases in behavioural research: a critical review of the literature and recommended remedies', *Journal of Applied Psychology*, **88**(5), 879–903.
Poppo, L. and T. Zenger (1998), 'Testing alternative theories of the firm: transaction cost, knowledge based and measurement explanations for make or buy decisions in information services', *Strategic Management Journal*, **19**(9), 853–78.
Porter, M. (1985), *Competitive Advantage: Creating and Sustaining Superior Performance*, London: The Free Press.
Porter, M. (1996) 'What is strategy?', *Harvard Business Review*, **74**(6), 61–78.
Prahalad, C. and G. Hamel (1994), 'Strategy as a field study: why search for a new paradigm?' *Strategic Management Journal*, **15**(2), 5–16.
Prencipe, A. (1997), 'Technological capabilities and product evolutionary dynamics: a case study from the aero engine industry', *Research Policy*, **25**, 1261–76.
Prencipe, A., A. Davies and M. Hobday (eds) (2003), *The Business of Systems Integration*, Oxford: Oxford University Press.
Pugh, D., D. Hickson, C. Hinings and C. Turner (1969), 'The context of organization structure', *Administrative Science Quarterly*, **14**, 91–114.
Punj, G. and D. Stewart (1983), 'Cluster analysis in marketing research: review and suggestions for application', *Journal of Marketing Research*, **20**, 134–48.
Rivkin, J. and N. Siggelkov (2005), 'Speed and search: designing organizations for turbulence and complexity', *Organization Science*, **16**, 101–22.
Rogers, D. (2001), 'The future of software bundling after United States vs. Microsoft', *Intellectual Property and Technology Law Journal*, **13**(12), 1–11.
Rosenbaum, D. and F. Lamort (1992), 'Entry, barriers, exit, and sunk costs: an

analysis', *Applied Economics*, **24**(3), 297–304.
Sanchez, R. (1995), 'Strategic flexibility in product competition', *Strategic Management Journal*, **16**, 135–59.
Sanchez, R. and J. Mahoney (1996), 'Modularity, flexibility, and knowledge management in product and organization design', *Strategic Management Journal*, **17**, 63–76.
Sandberg, R. and A. Werr (2003), 'Corporate consulting in product innovation: overcoming the barriers to utilization', *European Journal of Innovation Management*, **6**(2), 101–10.
Schmalensee, R. (1984), 'Gaussian demand and commodity bundling', *Journal of Business*, **57**(1), 211–30.
Shilling, M. (2000), 'Toward a general modular system theory and its application to interfirm product modularity', *Academy of Management Review*, **25**(2), 312–34.
Siggelkow, N. (2001), 'Change in the presence of fit: the rise, the fall, and the renaissance of Liz Claiborne', *Academy of Management Journal*, **44**, 837–58.
Siggelkow, N. (2002), 'Evolution toward fit', *Administrative Science Quarterly*, **41**, 125–59.
Siggelkow, N. and J. Rivkin (2005), 'Designing organizations for turbulence and complexity', *Organization Science*, **16**(2), 101–22.
Skinner, W. (1974), 'The focused factory', *Harvard Business Review*, **52**(3), 113–21.
Slywotzky, A. (1996), *Value Migration: How to Think Several Moves Ahead of the Competition*, Boston, MA: Harvard Business School Press.
Slywotzky, A. and R. Wise (2003), 'The dangers of product-driven success: what's the next growth act?', *Journal of Business Strategy*, **24**(2), 16–26.
Smith T. and J. Reece (1999), 'The relationship of strategy, fit, productivity, and business performance in a service setting', *Journal of Operations Management*, **17**, 145–61.
Spiller, T. and B. Zelner (1997), 'Product complementarities, capabilities and governance: a dynamic transaction cost perspective', *Industrial and Corporate Change*, **6**, 561–94.
Stiegler, J. (1968), *A Note on Block Booking, Organization of Industry*, Irwin, IL: Homewood.
Stogill, M. (1948), 'Personal factors associated with leadership: a survey of the literature', *Journal of Psychology*, **25**, 35–64.
Stremersch, S. and G. Tellis (2002), 'Strategic bundling of products and prices: a new synthesis for marketing', *Journal of Marketing*, **66**(1), 55–72.
Strube M. and J. Garcia (1981), 'A meta-analytic investigation of Fiedler's contingency model of leadership effectiveness', *Psychological Bulletin*, **90**, 307.

Studt, T. (2003), 'New lab operating models', *R&D*, **45**(5), 42–43.
Subramaniam, M. and N. Venkatraman (2001), 'Product development capability: testing the influence of transferring and deploying tacit overseas knowledge', *Strategic Management Journal*, **22**, 359–78.
Teece, D. (1980), 'Economies of scope and the scope of the enterprise', *Journal of Economic Behaviour and Organization*, **1**, 223–47.
Teece, D. (1985), 'Transaction cost economics and the multinational enterprise: an assessment', *Journal of Economic Behaviour and Organization*, **7**, 21–45.
Teece, D. (1988), 'Technological Change and the Nature of the Firm', in G. Dosi, C. Freeman, R. Nelson, G. Silverberg and C. Soete (eds), *Technical Change and Economic Theory*, London: Pinter.
Teece, D. (1996), 'Firm organization, industrial structure, and technological innovation', *Journal of Economic Behaviour and Organization*, **31**, 193–224.
Teece, D. and G. Pisano (1994), 'The dynamic capabilities of firms: an introduction', *Industrial and Corporate Change*, **3**, 537–56.
Teece, D., G. Pisano and A. Shuen (1997), 'Dynamic capabilities and strategic management', *Strategic Management Journal*, **10**, 509–33.
Thompson, J. (1967), *Organizations in Action*, New York, McGraw-Hill.
Tidd, J. and F. Hull (2002), 'Organizing for service innovation: best-practice or configurations?', *SPRU Electronic Working Paper Series*, no. 77, University of Sussex, SPRU, Brighton, Sussex, UK.
Tidd, J., J. Bessant and K. Pavitt (1997), *Managing Innovation: Integrating Technological, Market and Organizational Change*, Chichester, Wiley.
Tiwana, A. (2008a), 'Does interfirm modularity complement ignorance? A field study of software outsourcing alliances', *Strategic Management Journal*, **29**(11), 1241–52.
Tiwana, A. (2008b), 'Does technological modularity substitute for control? A study of alliance performance in software outsourcing', *Strategic Management Journal*, **29**(7), 769–80.
Venkatraman, N. (1989), 'The concept of fit in strategy research: toward verbal and statistical correspondence', *Academy of Management Review*, **14**(3), 432–44.
Von Bertalanffy, L. (1968), *General System Theory: Foundations, Development, Applications,* New York: George Braziller
Vroom, V. and P. Yetton (1973), *Leadership and Decision Making*, Pittsburg: University of Pittsburgh.
Walker, G. and D. Weber (1984), 'A transaction cost approach to make or buy decisions', *Administrative Science Quarterly*, **29**(3), 373–92.
Walker, G. and D. Weber (1987), 'Supplier competition, uncertainty and make-or-buy

decisions', *Academy of Management Journal*, **30**, 589–96.
Westerman, G., W. McFarlan and M. Iansiti (2006), 'Organization design and effectiveness over the innovation life cycle', *Organization Science*, **17**(2), 230–38.
Whinston, N. (1990), 'Tying, foreclosure and exclusion', *American Economic Review*, **80(**4), 837–59.
Williamson, O. (1971), 'The vertical integration of production: market failure considerations', *American Economic Review*, **61**, 112–23.
Williamson, O. (1975), *Markets and Hierarchies: Analysis and Antitrust Implications*, New York: Free Press.
Williamson, O. (1979), 'Transaction-cost economics: the governance of contractual relations', *Journal of Law and Economics*, **22**(2), 233–61.
Williamson, O. (1983), 'Credible commitments: using hostages to support exchange', *American Economic Review*, **83**, 519–40.
Williamson, O. (1984), 'Corporate governance', *The Yale Law Journal*, **93**, 1197–219.
Williamson, O. (1985), *The Economic Institutions of Capitalism*, New York: Free Press.
Windahl, C. (2006), 'Suppliers in the privatised UK wastewater market and their possible moves towards integrated solutions', *Water Policy*, **8**(6), 559–72.
Windahl, C. and N. Lakemond (2006), 'Developing integrated solutions: the importance of relationships within the network', *Industrial Marketing Management*, **35**(7), 806–18.
Windahl, C., P. Andersson, C. Berggren and C. Nehler (2004), Manufacturing firms and integrated solutions: characteristics and implications', *European Journal of Innovation Management*, **7**(3), 218–28.
Winter, S. (1988), 'On Coase, competence, and the corporation', *Journal of Law Economics and Organization*, **4**, 163–80.
Wise, R. and P. Baumgartner (1999), 'Go downstream: the new profit imperative in manufacturing', *Harvard Business Review*, **77**(5), 133–41.
Wixcom, B. and H. Watson (2001), 'An empirical investigation of the factors affecting data warehousing success', *MIS Quarterly*, **25**(1), 17–42.
Wolter, C. and F. Veloso (2008), 'The effects of innovation on vertical structure: perspective on transaction costs and competences', *Academy of Management Review*, **33**(3), 586–605.
Woodward, J. (1965), *Industrial Organization: Theory and Practice*, London: Oxford University Press.
Yadav, M. (1994), 'How buyers evaluate product bundles: a model of anchoring and adjustment', *Journal of Consumer Research*, **21**(2), 342–54.

Yadav, M. (1995), 'Bundle evaluation in different market segments: the effects of discount framing on buyers' preference heterogeneity', *Academy of Marketing Science Journal*, **23**(3), 206–25.
Yadav, M. and K. Monroe (1993), 'How buyers perceive savings in a bundle price: an examination of a bundle's transaction value', *Journal of Marketing Research*, **30**, 350–58.
Yin, R. (2003), *Case Study Research: Design and Methods*, London and New Delhi: SAGE Publications.
Zaheer, A. and N. Venkatraman (1994), 'Determinants of electronic integration in the insurance industry: an empirical test', *Management Science*, **40**(5), 549–66.
Zollo, M. and S. Winter (2002), 'Deliberate learning and the evolution of dynamic capabilities', *Organization Science*, **13**(3), 339–51.