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Adoption of Open Business Models in the West and Innovation in India's Software Industry

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IDS RESEARCH REPORT 62

Adoption of Open Business Models in the West and Innovation in India's Software Industry

Rasmus Lema

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Cover photo: Chris Stowers

Photo caption: Bangalore, Karnataka, India. An IT professional talks on his mobile phone at a canteen in 'Electronics City', an industrial complex dedicated to the IT and electronics industries. The 'Electronics City' complex, located ten miles outside Bangalore, has been hugely successful in attracting foreign investment and it is home to several multinational companies.

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Rasmus Lema

Summary

Over the last three decades, outsourcing has had a big influence on the international division of labour. It is clear that it has been a major reason for the enormous build-up of production capabilities in the developing world, in particular in the export platforms of Asia. However, the influence of outsourcing on innovation capabilities is less clear. Recent literature shows that innovation capabilities have emerged in the software cluster of Bangalore in India. This report asks whether and how the adoption of open business models in OECD countries had an influence on the rise of innovative software services in Bangalore. This requires detailed research on both the demand side and the supply side of outsourced software services. On the demand side, this report compares three software buyer segments, exploring the relationship between business models and outsourcing patterns. The study shows that the adoption of open business models in OECD countries has a major influence on the 'space' for innovation that accrues to suppliers in the software industry in India. On the supply side, the study investigates the factors that determine whether the new spaces are filled and how advanced innovation capabilities are built. The key feature of this study is that it examines the interaction between demand- and supply-side dynamics. Most studies tend to focus on only one side, but the key is to see them in conjunction. The study shows that their co-evolution over time changes not only the scale of outsourcing but also the 'quality' of the contents and the division of labour.

Keywords: outsourcing; open business models; global value chains; ODIP; innovation; integrated innovation; problem framing; software; Bangalore; India.

Rasmus Lema is a collaborator in the IDS project *The Changing Knowledge Divide in the Global Economy*, coordinated by Hubert Schmitz of IDS jointly with Simone Strambach of the University of Marburg. Rasmus combined work on this project with doctoral research on outsourcing and the rise of innovative software services in India.

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This report is an output of the project *The Changing Knowledge Divide in the Global Economy*. The project examines how the organisational decomposition of the innovation process (ODIP) affects the global distribution of innovation activities. This report presents the findings on the software industry, concentrating on the interaction between organisational change in OECD countries, buying companies and the build-up of innovation capability in supplying enterprises in Bangalore, India.

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Acronyms

3PL	Third-party logistics
ASD	Agile software development
B/OSS	Billing and operations support solution
B2B	Business to business
BOT	Build-operate-transfer
BPI	Business process improvements
BPM	Business process management
BPSS	Business process software services
CAD	Custom application development
CEO	Chief executive officer
CIO	Chief information officer
CRM	Customer relationship management
DMS	Dealer management system
DSV	Dependent software vendor
EMS	Electronics manufacturing services

ERP	Enterprise resource planning
ESO	Engineering services outsourcing
ETF	Electronics and telecom firms
ETL	Extract transform and load
FEA	Finite element analysis
GSM	Global system for mobile communications
HBU	Horizontal business unit
HR	Human resources
IBU	Industry business unit
ICT	Information and communication technology
IEEE	Institute of Electrical and Electronic Engineers
IMS	Infrastructure management services
IP	Intellectual property
IS	Information Systems
ISV	Independent software vendor
IT	Information technology
ITD	IT department
ITS	Independent testing services
KIBS	Knowledge-intensive business services
KM	Knowledge management
LAN	Local area network
MAC	Media access control
MFI	Microfinance institution
MIP	Made in India products
MIS	Management information system
MNC	Multinational corporation
NASSCOM	National Association of Software and Services Companies
NGO	Non-governmental organisation
NIC	Network information centre
NMS	Network management system
NPD	New product development

ODC	Offshore development centre
ODIP	Organisational decomposition of the innovation process
ODPP	Organisational decomposition of the production process
OECD	Organisation for Economic Cooperation and Development
OEM	Original equipment manufacturer
OPD	Outsourced product development
OSS	Operations support solution
PC	Personal computer
PDSS	Product development software services
POC	Proof of concept
R&D	Research and development
SaaS	Software as a service
SAD	Software architecture document
SETLAB	Software engineering and technology lab
SIG	Special interest group
SME	Small/medium enterprise
SOA	Service-oriented architecture
UIL	Universal industry linkage
UML	Unified modelling language
UWB	Ultra wideband
VoIP	Voice over internet protocol
Y2K	Year 2000

Key concepts

This glossary presents the key concepts. The explanations provided here are brief; the main text elaborates these definitions.

Business model

A business model is the way a firm generates value and captures a share of this value.

Business model, open

Firms with open business models use the organisational decomposition of innovation activities to generate and capture value. They incorporate external resources into their own business model, and they place their own resources into the business models of others.

Capability leveraging

Capability leveraging refers to the exploitation of an existing stock of capabilities and its use in a new domain.

Innovation

An innovation is the introduction of a new or significantly improved product (including 'service product') or process.

Innovation activities

Innovation activities create knowledge and transform it into specifications and systems. These activities are undertaken in order to produce an innovation.

Innovation activities, decomposition of

The decomposition of innovation activities is the reconfiguration within and between firms (or other organisations) of innovative functions that have hitherto been performed in-house.

Innovation activities, integrated

Integrated innovation activities are bundled with production activities.

Innovation activities, standalone

Standalone innovation activities are 'de-linked' (in organisational terms) from downstream production activities.

Outsourcing

This refers to the externalisation of production and/or innovation activities to independent firms (in low-cost economies).

Problem framing

The term problem framing refers to the subset of innovation activities that define products/systems and their architectures.

Production activities

These are the knowledge-using (as opposed to knowledge-creating) activities concerned with the manufacturing/construction/provision of goods and services.

Software industry, primary

The primary software industry consists of firms that develop and sell software as their main business.

Software industry, secondary

The secondary software industry comprises software-producing organisations (e.g. IT departments) residing within firms whose main business is not software.

Software outsourcing industry

The software outsourcing industry comprises buyers and suppliers of outsourced software services as well as the related institutional environment.

Supply platform

A supply platform is an agglomeration of export-oriented firms in a low-cost economy.

Value-chain co-evolution

Mutually reinforced change in buyer and supplier organisations.

1 Introduction

The global economy is currently witnessing two remarkable phenomena that were largely unforeseen a decade ago. The first is the rapid transformation and upgrading of supply platforms in low-cost economies, such as China and India. There are ample indications that these hubs no longer just specialise in labour-intensive production of goods and services. In China and India, for example, the transition from productive capacity to innovation capabilities has begun and in certain sectors the availability of low-cost innovation is already apparent (Altenburg *et al.* 2008; Zeng and Williamson 2007).

The second phenomenon is a fundamental change in the business models of a large number of leading firms in OECD countries: these firms used to function with internally focused systems of value generation, but many have since migrated to business models that are substantially more open (Chesbrough 2006a; 2007). Firms are now outsourcing activities that they used to undertake in-house to key suppliers and providers of knowledge-intensive business services (KIBS). While this organisational decomposition of the innovation process (ODIP) is widely acknowledged, it is not clear whether it changes the global distribution of innovation activities (Schmitz and Strambach 2009).

This study aims to examine whether there is a link between the adoption of open business models in developed countries and the mounting transition from production to innovation in global supply platforms in developing countries. In the context of outsourcing, the study concentrates on the adoption of open business models in firms in developed countries and some of the key contingent factors that are central to the transformation of new opportunities into realities in global supply platforms. The overriding research question is: *(how) does the adoption of open business models influence the build-up of innovation capability in developing country supply bases?* In examining this link, the study concentrates on evidence from the global software industry and the supply platform in Bangalore. Recent research has shown that segments of the Bangalore software industry have made the difficult transition from production to innovation capability (Lema 2009b). This study is concerned with how and why this was possible. In particular, it provides empirical insights into whether and how the shift to open business models influenced the global distribution of innovation activities in the software outsourcing sector.

1.1 The received wisdom

It may be surprising that this study raises the issue of open business models in the context of software outsourcing to India. The existing literature has tended to emphasise (1) the role of core competence strategies in driving software outsourcing to India, (2) the strained opportunities for capability formation associated with this type of outsourcing and (3) the limited extent of innovative capability in the Indian supply base. These arguments constitute the essential backdrop for this study and are worth setting out in more detail.

1.1.1 Core competence strategy as the key driver of software outsourcing

The literature has shown that core competence strategies drove the boom in software outsourcing to India during the 1990s as this was a key way for customer firms to cut cost and focus on distinct capability fields (Arora *et al.* 2001; D'Costa 2003; Kobitzsch *et al.* 2001).

Pfannenstein and Tsai (2004: 72) found that lower labour costs were the primary driver of offshore IT outsourcing, 'but companies also want to focus on their core businesses and create value for their shareholders'. Similarly, Arora *et al.* argued that:

Firms outsource because they do not want to invest in in-house capability in areas outside their core competence (such as developing applications for old computing platforms) and to free their in-house IT staff from mundane maintenance tasks for more creative projects.
(Arora *et al.* 2001: 1276)

Lema (2009a) argues that such core competence strategies contributed to the shift from onsite services to the offshore model in the 1990s. The offshore model fulfilled several core competence objectives, such as vertical specialisation (focus on selected value-chain tasks), asset variability and increased organisational flexibility. However, most of the literature has tended to argue that this type of outsourcing limits the opportunities for capability formation in the Indian supply base. Outsourcing relationships do not provide proximity to tacit knowledge and domain expertise because customers are at a physical and social distance from India (Hoekstra 2006). Because lead firms keep core competences in-house, the formation of innovative capabilities is strained. 'Export services that are outsourced to India are likely to remain non-critical adjuncts to central functions' (D'Costa 2003: 214, 221; see also Lema 2009a). The core and strategically important innovative activities of OECD-based customers are typically perceived as 'non-globalised' and 'bound' to their home locations; they are dependent on localised and intricate linkages between firms and institutions in lead markets (see Wibe and Narula 2002: 243). Arora describes the division of labour in outsourced software services as follows:

At the risk of oversimplification, software-related activities generally fall into one of three categories: design, coding, or maintenance. Design, which translates approximately into R&D and product development, has the highest value added of the three activities. Coding and maintenance may be thought of as analogous to production in other industries and consequently entail

lower-end tasks... [M]ost of the functions offshored (especially to India) involve production, while design has tended to remain local. (Arora 2006: 400)

The popular business press is also sometimes an exponent of this view. A *Forbes* analyst provided the following assessment: 'India, for all its glory, is still the world's back office. India's tech industry is a "services" industry. The Indians don't do the thinking. The customers do. India executes' (Mitra 2008).

1.1.2 The main route to innovation capability: the local innovation system

Because of the consensus regarding the learning constraints associated with software outsourcing, the literature has searched for alternate routes to capability building. In particular, the majority of the literature seeks guidance implicitly or explicitly from some version of the innovation system approach (see for instance Balasubramanyam and Balasubramanyam 2000; Chaminade and Vang 2008a; Fromhold-Eisebith 1999; Kumar 2001; Kumar and Joseph 2005; NASSCOM 2006a; Parthasarathy and Aoyama 2006; Vijayabaskar and Krishnaswami 2003). This literature focuses mainly on inter-organisational relationships within the supply base and its supporting environment.¹

However, there is also widespread agreement that the local innovation system in Bangalore is generally weak (Krishnan 2007; Tschang 2005; Vang and Chaminade 2006; Vijayabaskar and Krishnaswami 2003). The National Association of Software and Services Companies (NASSCOM) expresses this view clearly when stating that there is no innovation system at all. Innovation systems may differ in nature, depending on the relative level of participation by different 'constituents' such as firms, investors, government bodies and research institutes, but not in India where 'all constituents are weak participants' (NASSCOM 2007b: 127). While most analysts agree with this conclusion, there is some debate over the strength and importance of particular linkages, such as those between domestic firms and multinationals (for contrasting views see Athreye 2004; Patibandla and Petersen 2002) and between enterprises and research institutions (for contrasting views see Basant and Chandra 2007; D'Costa 2008).

The conclusions regarding the deficiencies of the innovation system (against a usually unspecified ideal model) have meant that the prospects of developing innovation capability have appeared dim. For instance, Vang and Chaminade saw the level of cluster dynamism as insufficient for the development of innovation capabilities. They reached a similar conclusion about the role of the innovation

1 Unsurprisingly, much of the empirical research on the Indian software industry has focused on Bangalore, the most visible of the Indian software clusters. The importance of Bangalore's institutional endowment is undisputed. The city received large investments in defence and other public sectors in the post-independence period. There is widespread agreement that the technology and training centres established in earlier periods (for different purposes) contributed to the formation of a critical mass of skilled labour. In addition, Bangalore hosts premier institutions such as the Indian Institute of Science, and it was the first Indian city to have a software technology park in 1991. This marked the beginning of the software industry's take-off phase and Bangalore's firm establishment on the world economic map. Bangalore's institutional legacy has been described in detail by Heitzman (2004).

system by distinguishing between two phases. They argue that the ‘systemic propensity’ of the region was not necessary in the first phase, where the main challenge was to attract foreign investment and accumulate basic competences. ‘However, it becomes a crucial factor when the firms attempt to move up the value chain with activities that involve a higher degree of innovation’ (Vang and Chaminade 2006: 26). Software suppliers in the cluster are therefore unlikely to break out of lock-in unless they can exploit the benefits of local interactive learning in the regional system (Chaminade and Vang 2008b; Vang and Chaminade 2006).

1.1.3 The quality of capabilities in the Indian software supply base

The dominant argument about the ‘quality’ of capabilities is that Indian firms have become strong in production/execution capabilities but remain weak in innovation capability (Arora *et al.* 2008; Dossani 2006). The popular business press is also sometimes an exponent of this view. The emphasis on ‘productive’ capacity is particularly strong in the works of D’Costa (see, for example, D’Costa 2006; 2008).² He argues that the rootedness of India’s competitive advantage in low labour costs gave rise to ‘extensive growth’, the linear expansion of the workforce, without a corresponding increase in the deepening of skills. Indian firms tended to focus on the lower value-added stages of the software development cycle in which learning opportunities were limited (see also Tschang 2005).

However, some recent studies give a slightly different picture. Athreye (2005b) agrees that Indian firms focus on downstream execution tasks, but she highlights the formation of strong *process and organisational capabilities*. These capabilities did not change the division of labour between buyer and supplier, but they were necessary to exploit the opportunity that arose with offshore outsourcing (as distinct from onsite). NASSCOM reached the same conclusion in a major study on innovation. It found that innovation was ‘heavily skewed’, focused predominantly on improving inputs (human resources) and business processes to ‘sustain’ competitiveness, while neglecting ‘enhancing’ and ‘market-facing areas’ such as research and development (R&D) services, intellectual property (IP) creation and the development of ‘Indian standards’ for next-generation technologies (NASSCOM 2007b).³

With regard to future prospects, most analysts agree that India will continue doing some of the low-end work in the *immediate future*, but there is also increasing agreement that parts of the Indian software industry are likely to acquire stronger innovative capability in the *long haul* (see, for example, D’Costa and Sridharan 2004: 276). There is very limited agreement, however, with regard to the circumstances in which the transformation of capabilities may occur.

2 As will be discussed in Chapter 3, a certain phase in the software development life cycle is in a sense a manufacturing process.

3 The most optimistic scholarly assessment to date – and the view which diverges most from the conventional wisdom – is provided by Parthasarathy and Aoyama (2006). Based on interviews with 12 CEOs of Bangalore software firms, mainly those developing so-called embedded software, they conclude that the industry is moving ‘from providing low-skill software services to providing high-skill R&D services’. These authors do not provide direct evidence of this move, but they convey the perception of managers in the segment of embedded software.

1.2 Recent counterevidence from Bangalore

As mentioned, the existing literature has tended to be pessimistic with regard to the formation of innovative capability in the software supply base, acknowledging fast growth but emphasising that this contains very little innovation. However, recent doctoral research by this author (Lema 2009b) has shown that a segment of suppliers in Bangalore firms have moved over time towards increasingly innovative activities. This research examined what types of ‘peak capability’ a sample of leading firms have acquired and demonstrated after the turn of the millennium (2001–6).

Lema (2009b) concludes that some firms have not only acquired process and organisational innovation capabilities, but also customer-focused problem-solving and problem-framing innovative capability.⁴ Contrary to expectations, the study found that the deepening of capabilities in core services and product functions was just as pronounced as process and organisational capability in the creation of new innovative capability. The existence of problem-framing capability was particularly surprising given the prevailing view in the literature that advanced innovative activities remain located in OECD countries and that only basic and routine innovation is outsourced to suppliers in developing countries.

The identification of advanced (problem-framing) innovative capability suggests that a segment of suppliers have progressed to an unexpected stage of innovative service provision. It does not suggest, however, that India will abandon low-end work in the immediate future. The industry is likely to take the high road and the low road simultaneously. The recent findings support this conclusion by showing that production and innovation capabilities are rarely deployed separately. They tend to go hand in hand. A group of key firms have followed a progressive trajectory towards higher-value services, products and practices, but the low-cost service provision capability remains important. Even vanguard firms have not undergone a capability *transition* (in which production capabilities are replaced). Rather the trajectory is one of capability *expansion*, involving the strengthening of production capabilities alongside the acquisition of innovation capabilities. This means that suppliers are not ‘moving up the value chain’ in the normal sense, in which high-value activities are acquired and low-value activities are left behind. Rather they are stretching their value-chain thread into knowledge-creating activities.

1.3 Purpose and scope of the study

The purpose of this research report is to illuminate *how* and *why* the rise of innovative software services in Bangalore has occurred despite the prevalent pessimism. A number of factors need to be taken into account if one seeks to explain the build-up of innovative capability. This study gives particular attention to a factor that has received little in-depth attention in the literature: the adoption of open business models.

4 The term ‘problem framing’ refers to the subset of innovation activities that defines products/systems and their architectures. Problem-solving innovation is focused on more confined activities such as the design of new module or system components.

In order to do this, the study both draws on and contributes to recent work on the organisational decomposition of the innovation process (ODIP). In a recent article, Schmitz and Strambach (2009) ask whether and how ODIP may contribute to global dispersal or continuing concentration of innovation activities in OECD countries. They review theoretical arguments for and against big changes in the global distribution of innovative activities and lay out an agenda for empirical research.

Schmitz and Strambach (2009) emphasise that ODIP has an intra-firm as well as an inter-firm dimension. This study is particularly concerned with the inter-organisational dimensions: outsourcing to developing countries.⁵ In that context, this research report contributes to the ODIP agenda in four main ways.

First, it suggests that in order to understand ODIP, one needs to consider a broader change in company strategy. It provides evidence that suggests that this form of ODIP is rooted in the adoption of increasingly open business models by buyer firms in OECD countries. The adoption of open business models by pioneering firms renders obsolete some of the ingrained notions associated with the core competence perspective (Christensen 2006).

Second, it addresses explicitly the central proposition of Schmitz and Strambach (2009) that innovative capabilities may be 'dispersed' to new innovative regions, but the quality of these activities will be limited to non-strategic types. While there is no established way to define 'strategic', the authors suggest that one can borrow from the modularity and system integration literature and distinguish between problem framing and problem solving (Brusoni 2005). They argue that: 'Problem framing is exactly what the lead firms of global value chains do' (Schmitz and Strambach 2009: 242). This study provides evidence that runs contrary to the proposition and suggests that the adoption of open business models makes lead firm behaviour more unpredictable. It shows that some buyer firms in the software industry have begun to outsource not only routine problem-solving innovation but also advanced problem-framing innovation. Interestingly, this type of advanced innovation is rarely outsourced on a standalone basis. Rather it tends to be tightly connected (integrated) with routine tasks.

Third, the study provides insights into *how* the inter-organisational decomposition of innovative activities in global value chains takes place to also enhance innovative activities and capabilities in the low-cost supply base. It does not adopt a narrow focus on outsourcing *per se* (the 'demand side'), but also takes into account factors associated with supplier firms and their contexts (the 'supply side'). While outsourcing creates new spaces, the exploitation of these spaces is not automatic and the research shows how firms in India have mobilised resources – ideas, investment and knowledge – to capture new opportunities. By doing so, it examines the relevance of 'concentrated dispersion' (new clustered agglomerations of innovation), a phenomenon that is deemed particularly interesting for the ODIP agenda (Schmitz and Strambach 2009: 243). In other

5 Closely related issues have been discussed in the context of intra-corporate relationships within MNCs. However, there are currently few detailed empirical insights into ODIP in the context of non-hierarchy relationships between independent firms in global value chains.

words, this research examines the relevance of operating in a cluster for the capture of opportunities opened up by ODIP.

Fourth, the report examines empirically whether the causal relationship runs in both directions such that the emergence of enhanced innovative capabilities in India influences the demand-side propensity to decompose firm-level innovation processes over vast geographical distance. Schmitz and Strambach (2009: 237–8) put forward the proposition that supply-base actors may ‘develop a dynamic of their own’ and ‘change the landscape in which the large client firms operate’. So far, there is little empirical investigation of this proposition. Thus, we do not know much about how and through which mechanisms this ‘dynamic from below’ influences the division of labour in global outsourcing industries. The study addresses this issue and places the discussion of open business models in a co-evolutionary framework. It suggests that the adoption of open business models is a key *enabling factor* that has brought the co-evolution of demand-side outsourcing practices and supply-side capability into the realm of innovative activities.⁶

The research presented in this report is entirely exploratory. As a pioneering piece of empirical work on ODIP, it could draw on existing concepts only at a very general level. It was necessary to develop novel conceptual frameworks and methods of operationalisation. Furthermore, it depends almost entirely on data that (1) had to be derived from interviews at firms at both ends of the value chain, and (2) had to encompass a wide range of phenomena. It is therefore based on a relatively small sample of firms and innovation events. Consequently, the aim of the study is to explore the ODIP agenda in the context of software outsourcing, rather than to systematically test hypotheses about the relationship between open business models, ODIP and the build-up of innovation capability in the supply base.

1.4 The structure of the report

After this introduction, Chapter 2 sets out the theoretical framework and combines this with a review of the literature. It discusses the notion of the open business model and the relevance of this concept to the study of offshore outsourcing and the accumulation of innovative capability in supply platforms. Thus the chapter outlines a framework that can help to capture the relevance of open business models to the outsourcing world and the interactive dynamics between ‘innovation push’ (externalised by customers) and ‘innovation pull’ (attracted by suppliers). Based on this discussion the chapter concludes by specifying the research questions addressed in the empirical chapters of the study.

Chapter 3 seeks to operationalise the key concepts and explain the methodological approach of the study. It starts by providing operational conceptual distinctions for the empirical analysis of business models and software-outsourcing relationships. It defines ‘production’ and ‘innovation’ processes in software development and discusses how buyers and suppliers may divide the

6 It is not suggested that open business models themselves are (always) a central part of the co-evolutionary ‘loop’ such that the supply-side dynamic is a major overall force in the transformation of demand-side business models. This is explained in more detail in section 2.1 (see Figure 2.1) and the concluding chapter.

labour within and between these types of activity. It also sketches out frameworks for the analysis of the extent and the mechanisms of capability building in supplier firms. A key feature of the research is the focus on inter-firm relationships and the investigation of these relationships from both sides: buyers in OECD countries and suppliers in India. The chapter sets out the sampling strategy used to achieve this and it discusses related methodological issues.

Chapter 4 initiates the presentation of demand-side findings. It contrasts three buyer segments and presents a number of case studies in each segment. The purpose is to examine the relevance of open business models to the outsourcing of innovative activities. Chapter 5 proceeds by examining in more detail the type of organisational decomposition of innovation processes that occurs. This chapter also investigates the boundaries or 'upper limits' of innovation outsourcing. It shows that 'new spaces' for suppliers' innovative activities have arisen in the global software-outsourcing industry, this chapter also emphasises that these spaces vary by buyer segment.

Chapter 6 examines the inputs into supplier projects – projects that were 'learning events' in the sense that they were associated with the formation and demonstration of new levels of innovative capability. It thus examines the combination of sources in the process and discusses the role of competence leveraging across different knowledge domains and the role of these processes in the 'capturing' of new opportunities (spaces) for innovation. It also discusses how innovation capabilities on the supply side create an 'innovation pull' that reinforces the existing trend towards the deepening of outsourced activities. This formation of innovative capability changes the environment in which buyer firms compete, and the pull arises from direct and indirect feedback mechanisms from innovation outsourcing.

The concluding discussion in Chapter 7 provides a summary of the main findings with regard to open business models and their role in the transition from labour cost-based to innovation-based competitive advantage in global supply platforms. It pulls together the findings of the different analyses offered in this study. The chapter suggests that a co-evolutionary relationship exists between outsourcing on the demand side and capabilities on the supply side, and that this has driven successive phases of outsourcing in the context of changing business models. As always, however, there are shortcomings and limitations. The chapter concludes with a discussion of these limitations and their implications for the interpretation of the overall findings and it identifies issues for further research in this area.

2 Openness, outsourcing and formation of supplier capabilities

The key hypothesis driving this study is that the adoption of open business models has a major influence on the location and build-up of innovation capabilities in the world. Later chapters examine the empirical evidence. This chapter presents the conceptual framework for the research and combines this with a review of the relevant literature. This will then help to specify more precisely the research questions examined in this study.

Key to this endeavour is the bringing together of three sets of literature:

- That part of the innovation literature which focuses on openness and organisational decomposition of innovation (e.g. Chesbrough 2007; Cooke 2005);
- That part of the value-chain literature which focuses on the connections between global lead firms and local supply platforms (e.g. Ernst and Kim 2002; Gereffi *et al.* 2005; Schmitz 2007b; Schmitz and Strambach 2009);
- That part of the innovation literature which focuses on learning and accumulation of innovation capabilities in latecomer countries (e.g. Ariffin and Figueiredo 2006; Bell 2006; 2007).

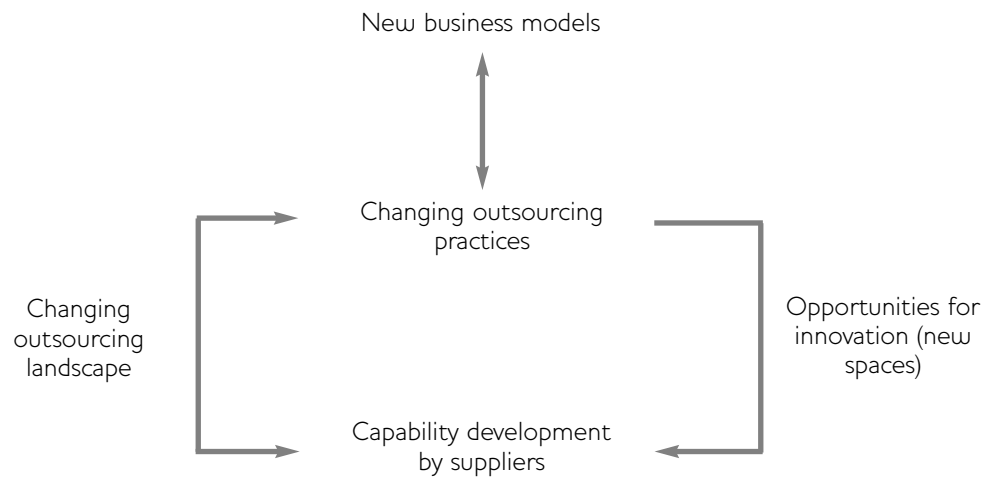
This chapter does not proceed by discussing these bodies of literature one by one, but draws on them where relevant in order to provide a conceptual basis for the empirical analysis. The chapter starts by setting out a framework for the analysis of how open business models may influence buyers and suppliers in outsourcing industries (Section 2.1). It continues by discussing the demand side (2.2) and the supply side (2.3), before specifying the questions for empirical analysis (2.4).

2.1 Business models and co-evolutionary outsourcing

Analysts agree that outsourcing is changing the global economy. Firms in OECD countries are increasingly using offshore outsourcing to maintain competitiveness and market shares. This has led to a much deeper integration of firms from developing countries into the global economy. These developments are frequently noted, and there is already a growing body of literature on offshore outsourcing. However, this literature tends to focus on either the demand side (e.g. Maskell *et al.* 2007) or the supply side (e.g. Hansen *et al.* 2007). The existing literature rarely examines the two sides in conjunction.

To be sure, the literature acknowledges that outsourcing is dyadic, with a reciprocal relationship between buyers and suppliers. The idea is most clearly expressed by Sturgeon and Lee (2005), who suggested that in certain conditions outsourcing is mutually reinforced. They observed a virtuous cycle between increased strategic outsourcing and the emergence of a global supply base in the electronics industry. Capability formation in the supply base was important to this process. 'Once new supplier competencies are in place, they can be used as a basis to develop relationships with other lead firms, and can influence future lead

Figure 2.1 **New business models and co-evolutionary dynamics in outsourcing**



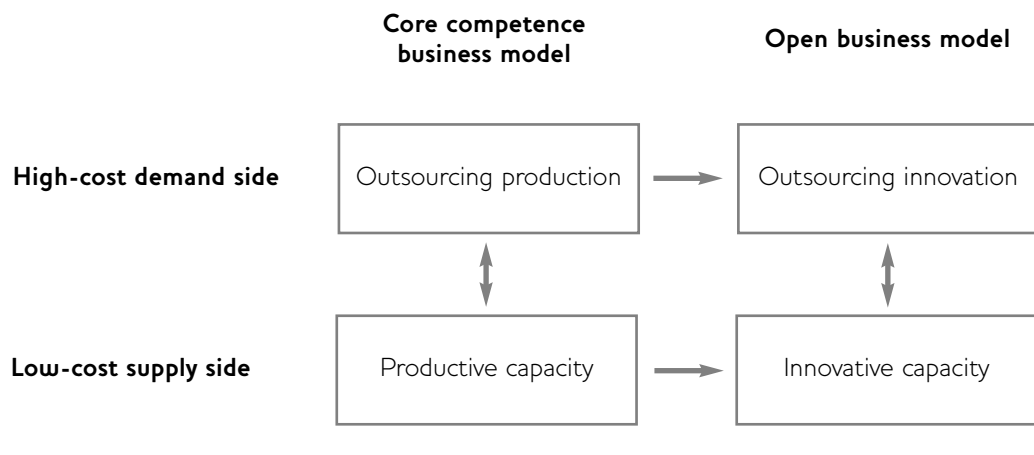
firm decision making regarding strategic outsourcing' (Sturgeon and Lee 2005: 36). In other words, the increase in scale and capacity of the supply base makes additional outsourcing attractive. Drawing on these authors, Memedovic sums up the argument:

Deepening of vertical specialisation and rising capabilities in developing countries are creating a self-reinforcing, co-evolutionary cycle that is driving global economic integration forward: fast and continuous changes in international division of labour drive the global engagement up; global engagement drives capabilities up; and rising capabilities tend to attract more investment and customers.

(Memedovic 2008: 229)

Building on this idea, the present study proposes that co-evolution in outsourcing is not only about *scale* but also about *direction and quality*. The potential deepening of outsourcing relationships may entail a qualitative transformation of outsourced activities and significant structural change on both sides. This type of evolution is central to the understanding of whether outsourcing leads to the build-up of innovation capabilities in the supply base. The transition from the 'core competence' business model to the 'open' business model is important to this process. Figure 2.1 shows the key steps in a co-evolutionary cycle that changes conditions on both sides.

Offshore outsourcing of production activities and routine services is an established phenomenon. This first wave of outsourcing was rooted in the organisational decomposition of the production process (ODPP). It reflected the shift from the closed, vertically integrated business model (Chandler 1977; Williamson 1981) to the core competence business model, in which 'non-core' activities were increasingly outsourced. Figure 2.2 proposes that the shift to open business models may be central to innovation outsourcing. This extension from production to innovation outsourcing on the buyer side is associated with the transformation of capabilities on the supplier side. This, in turn, expands the option for further innovation outsourcing from developing countries.

Figure 2.2 **Co-evolution – from production to innovation**

The dispersal of innovation activities to new supply platforms is not an autonomic outcome. On the contrary, the outsourcing of innovation activities, which follows the opening of business models, tends to be heavily concentrated in and between high-cost economies (Simard and West 2006). There are key mediating variables that determine whether the opportunities opened up by open business models transform into reality. The circumstances in which this can take place are not clear. A co-evolutionary pathway starting with the outsourcing of production has been sketched out. While the literature has noted the possibility of such a trajectory, it has not conceptualised this trajectory clearly, nor has it subjected it to empirical examination. This is what this study intends to do.

The remainder of the chapter uses this model to review the literature and construct a vocabulary for the empirical analysis. Under what circumstances does outsourcing lead to the build-up of innovation capabilities? This is the key question discussed in the chapter. It starts on the demand side with a discussion of corporate restructuring and changing outsourcing practices. It then turns to the supply side and discusses the build-up of capabilities in the supply base and how this changes the outsourcing landscape. The report deals here with circumstances on both sides one by one, but the key is to see them in conjunction.

2.2 The demand side

The existing literature on offshore outsourcing tends to assume that buyer firms adopt core competence strategies. This applies not only to those studies based on supply chain management/global value-chain approaches but also to those based on the innovation management literature. The starting point for this study is different – it focuses on the adoption of open business models. This section explains why it is important to unravel the dynamics that arise from open business models, addresses the implications for offshore outsourcing and discusses what spaces this may open up for developing country firms.

2.2.1 Corporate restructuring: from closed to open business models

In order to respond to the growing complexity of competition, lead firms in the developed world are continuously rethinking their corporate strategies and business models. A business model is the way a firm generates value and captures a share of this value (Chesbrough 2006a: 2). It is widely acknowledged that value arises in a series of activities that bring a product or service from its conception to its end use. This series of activities is the value chain. The capturing of value depends on a key asset, resource or position in the value chain that brings competitive advantage (Porter 1990). The key trend is towards vertical specialisation in the value chain. While a business model based on vertical specialisation is not a new phenomenon, lead firms are currently pushing much deeper into the value chain (Lynn and Salzman 2007; Sako 2005) and some have begun to open the business model itself (Chesbrough 2006a; 2007).

The shift from closed to open business models is a three-stage process. In the closed business model, the first stage, firms could systematise innovation across different business units in order to build competitive advantage in existing and new product markets. This depended on large R&D budgets and strong research capabilities. Firms took control over a long thread of activities in the value chain and became known as ‘vertically integrated firms’, in which economic activities were guided by a visible hand (Chandler 1977).

It became apparent during the 1990s that firms’ strategies were changing. In this second stage, firms were increasingly developing higher degrees of strategic focus, thereby concentrating on select core competences in the value chain. This was enforced as a way to achieve excellence, cut costs and maximise shareholder value. The core competence strategy depends on the development and recurrent deepening of distinct capabilities that allow for innovation rents.⁷ This is only possible when the business model is hard to imitate by incumbents. For this reason ‘there is an incentive (a) to outsource non-core activities; and (b) to avoid any leakage of core competence to suppliers’ (Altenburg 2006: 505). Innovation and the definition of products and services for specialised markets often became the key focus (Lazonick and O’Sullivan 2000; Prahalad and Hamel 1990). By contrast, firms increasingly outsourced production activities and other non-core functions to external providers. Core competence strategy and increased codification led to the organisational de-linking of innovation and production, with the former undertaken by lead firms and the latter by specialised supply bases concentrating on so-called ‘non-core functions’ (Sturgeon 2002).

In the third stage, the open business model, even the innovation process becomes organisationally decomposed. Lead firms reap savings in time and costs in the innovation processes by leveraging external development. The development of new products and systems involves multiple firms, with the different parties dividing the work of innovation. This division of innovative labour is central to the open business model:

An open business model uses this new division of innovation labor – both in the creation of value and in the capture of a portion of that value. Open

7 See Kaplinsky (2005: 62–84) for a thorough discussion of the concept of Schumpeterian innovation rents.

Table 2.1 **Business models**

	Closed business model	Core competence business model	Open business model
Corporate structure	Vertical integration – in-house production and innovation	Selective disintegration – retaining innovation activities in chosen competence field	Vertical disintegration – extending to some (formerly) ‘core’ areas
Managerial priorities	Internal economies of scale; minimising knowledge spillover to external organisations	Concentration on core capabilities; attracting and maintaining core capabilities in-house	Leveraging external (as well as internal) ideas, resources and knowledge assets. Risks and rewards are shared with select partners.
Innovation processes	Closed system, centralised in internal R&D department	Closed system, centralised in internal R&D department	Open system; decomposed innovation processes, internally and externally
Sourcing practice	No outsourcing	Outsourcing production	Outsourcing production and innovation
Literature	Chandler (1977)	Prahalad and Hamel (1990); Sturgeon (2002)	Chesbrough (2006a); Lazonick (2008)

Source: Lema (2009b) and sources cited in the text.

models create value by leveraging many more ideas, due to their inclusion of a variety of external concepts. Open models can also enable greater value capture, by using a key asset, resource, or position not only in the company’s own business model but also in other companies’ businesses. (Chesbrough 2006a: 2–3)

The organisational decomposition of the innovation process is associated with new corporate structures, managerial priorities and firm boundaries. Many firms have accepted, more or less voluntarily, that they cannot control all innovative activities in the value chain. Buyer firms put greater emphasis on the ‘dynamic/adaptive’ and ‘open/extrovert’ side of their competences than is normally associated with the core competency approach (Christensen 2006).

This study uses ‘openness’ as a term that encompasses open business models (corporate restructuring for new modes of value capture) and the associated changes in innovation management and strategy (ODIP).⁸ The shift towards openness has gone furthest in ‘high-tech’ industries such as computers, information

8 A closely related concept is that of ‘open innovation’. This refers to a new model of innovation, which is an antithesis of the vertical integration model where internal innovation activities result in internally developed products and services. In this new model firms increasingly draw on external innovation (Chesbrough 2006b: 1). This model is a result of the pressure on firms to reduce in-house research (basic and applied) in order to concentrate primarily on new product development, i.e. the realisation of architectures and systems (Chesbrough 2003c).

technology and pharmaceuticals – and mainly in large firms. Yet there are signs that it is now expanding to other industries and smaller companies (Chesbrough 2006b).

Table 2.1 shows the three phases of business model described above. These are ideal types; in reality, firms rarely fit neatly into one of the categories. The shift to openness is a gradual process rather than a sweeping change. As discussed in the next chapter, a particularly pertinent question is whether firms bring along elements of the core competence strategy into the open business model (Christensen 2006). The fundamental difference between the two business models is that in the core competence model, firms disintegrate only production activities – thereby de-linking production and innovation (Sturgeon 2002)⁹ – whereas in the open model, firms disintegrate elements of the innovation process itself. The next chapter defines the boundaries further.

2.2.2 Aspects of the business model and the unit of analysis for outsourcing

A business model has a buying side as well as a selling side (Sandulli and Chesbrough 2009). This distinction is useful for the identification of firms with (different degrees and types of) open business models. On the *selling side*, firms with open business models use their resources in the business models of other companies. On the *buying side*, they use external resources in the firm's own business model. The buying side is of most immediate importance to this study, but the key is the connection between the two sides.

Furthermore, business models can be identified at various levels. Small firms may have one coherent business model. However, large firms with several business units may have multiple business models, and the sub-firm (business unit) level may often be particularly salient (West *et al.* 2006). On the selling side, business units may cater for internal or external markets. On the buying side, they may have different strategies for the management of suppliers. The key is that one needs to focus on the *sponsor organisation* – the organisation that manages the contract(s) – in the analysis of changing business models and the implications for outsourcing strategy, at least in the first instance.

2.2.3 The geography of openness

Does openness contribute to global dispersal of innovative activities or does it reinforce the existing geographical concentration in OECD countries? Chesbrough notes that the discussion of open innovation 'has taken on greater saliency in light of the debate about globalization and the potential for the R&D function itself to become outsourced, as the manufacturing function was 20 years earlier' (Chesbrough 2006b). However, empirical research has mainly concentrated on openness that unfolds within (OECD) countries. Only a few industry-level case studies are concerned with 'global' open innovation processes and these have

9 Sturgeon (1997) described the organisational de-linking of production and innovation activities in the electronics industry. This notion continues in later work (2002), but more emphasis is given to the fact that turnkey suppliers undertake a whole range of activities, including new logistics tasks and some elements of design. Hence, this work seems to adopt a narrower definition of 'innovation activity' than the present study.

concentrated mainly on innovation processes ‘distributed’ between OECD countries (Christensen *et al.* 2005; Cooke 2005).¹⁰

The studies that are explicitly concerned with geography suggest that innovation is likely to be geographically concentrated within OECD countries and often within ‘knowledge regions’ in such countries: ‘Open Innovation benefits may be more readily achieved in regional clusters, since the effect of networks on innovation is magnified by geographic proximity’ (Simard and West 2006). In sum, the open innovation literature suggests that open business models increase the propensity to search for innovative solutions outside the firm, but they largely confine this search to the innovative regions in OECD countries.

Some of the work on global value chains arrives at the same conclusion. Authors writing within this tradition have highlighted that only certain stages of the value chain are outsourced to emerging market economies, mainly manufacturing and standardised services. Lead firms have different strategies for the control of the value chain, but one common characteristic is that innovation activities tend to be tied to so-called advanced economies (Mudambi 2008).

However, other authors come to a different conclusion. As mentioned, Schmitz and Strambach (2009) put the link between the ODIP and the global-scale geography of innovative activity centre stage. While using different terminology they share with the open innovation literature the notion that ‘a fundamental change is currently occurring in the way innovation is organised in developed countries’. While acknowledging the centripetal forces, they also highlight the dispersal of some innovation activities outside OECD countries. Outsourcing includes not just routine activities but increasingly also knowledge-intensive activities, including some R&D activities (Ernst 2008; Hansen *et al.* 2007). In other words, the impact of open innovation and the shift to new business models is now felt not only within OECD countries but also in so-called developing countries: ‘transformations in strategy and organisation have provoked fundamental changes in innovation management and enhanced the mobility of innovation’ (Ernst 2006). This perspective suggests that current trends of corporate restructuring have an important influence on the international division of labour. It may be time to qualify earlier claims that buyer firms only outsource production activities to low-cost destinations.¹¹ The present study explores this proposition by focusing on the software outsourcing industry.

2.2.4 The limits to innovation outsourcing

The key defining feature of the open business model is the purposeful inflow and outflow of innovative assets and activities (Leung 2007). In other words, elements of the innovation process are organisationally de-linked. Nevertheless, the disintegration process is not entirely open-ended. Even when conceiving outsourcing as a sequential learning path, this does not mean that there are no upper limits or constraining factors. For instance, some of the literature argues that innovation offshoring proceeds at rapid pace, but the dispersed innovation

10 These studies also focus on the ‘traditional’ open innovation industries, consumer electronics (digital amplifiers) and pharmaceuticals.

11 Other recent literature supports this view (Ernst 2008; UNCTAD 2005).

activities are of a second order. It follows the practice of MNCs that tend to distribute their innovation activities hierarchically, 'with advanced technology being confined to advanced industrialised countries while more routine low-end innovation is decentralised in a few developing countries' (Chen 2008: 622).

This suggests that there are strategic and non-strategic innovation activities. Schmitz (2007b) argues that strategic innovation activities are 'problem framing'. He draws on the modularity literature which shows that firms in most industries seek to avoid the effective loss of system integration capabilities (Brusoni 2005; Brusoni *et al.* 2001; Pavitt 2005). This system integration activity is a critical step in the innovation processes, even where the systems integrator (buyer) itself is a subsystem supplier in intermediate markets. This is often important for firms with open business models. The failure to retain the system-integrating step in the innovation process could result in a situation where the buying firm no longer possesses the capabilities to incorporate new knowledge and components effectively into its systems (Chesbrough 2003c: 191). For this reason, lead firms are much more readily prepared to outsource 'problem-solving' innovation such as the design and engineering activities associated with the development of a system component. The situation that arises is that buyer firms keep problem-framing activities in-house (or close to home) and only disperse problem-solving activities to lower-cost suppliers in new economic regions (Schmitz and Strambach 2009).¹² Thus, new spaces arise for the supply base, but these are limited to problem-solving activities. The empirical part of this study explores this proposition.

2.3 The supply side

Changing outsourcing practices may open new spaces, i.e. opportunities for innovation created by the demand of the customer. However, taking advantage of the spaces to satisfy the new types of demand is not something that occurs automatically. Understanding how suppliers do this is a key task. What is needed is an analysis of the dynamic interaction between increased outsourcing – or rather the outsourcing of new types of activities – and the suppliers' formation capabilities within new spaces.

2.3.1 *The formation of new capabilities in the supply base*

As mentioned, the relevance of the co-evolutionary lens to the analysis of outsourcing is evident in the research on the electronics industry undertaken by Sturgeon (2002) and Sturgeon and Lee (2005). In this industry, the shift from vertically integrated firms to core competence firms was associated with the emergence of a new global supply base for so-called 'manufacturing services'. The strategy of disintegration and the ability to codify transactions in this industry was central to large-scale outsourcing of manufacturing activities. These were externalised to suppliers with high competence levels. While the analysis did not address the question of how suppliers acquired capabilities in the first place, the key message was that they could now become providers of turnkey solutions.

12 The literature uses different terminology to capture the problem-framing/problem-solving distinction. Henderson and Clark (1990) use the terms 'architectural innovation' and 'modular innovation'. Others use the terms 'system innovation' and 'component innovation' (Van Den Ende and Jaspers 2004).

Lead firms focused on upstream functions such as branding and product definition, whereas suppliers focused on an entire range of end-to-end downstream production tasks. The upper limit of the co-evolving complementary specialisation between buyers and suppliers was the outsourcing of generic, base process competences within the sphere of production.¹³ Because linkages were ‘thin’ (highly codified) these did not provide the tacit knowledge necessary to make the transition to innovative capability (see further below).

The important point is that in other industries as well, supply platforms typically originate with a focus on manufacturing services or ‘services manufacturing’ – i.e. production activities provided on a standalone basis. Outsourcing starts with production and this is mirrored in the ‘capability profile’ on the supply side. Supply platforms are unlikely to transform into innovation hubs without a period of sustained capability formation (if at all). A key insight from the innovation literature that deals with capability formation in developing countries is that ‘learning’ takes place in progressive stages.¹⁴ Firms accumulate capabilities in a bottom-up manner (Ariffin and Bell 1996; Bell 2007). It is very seldom that firms start from standalone R&D capabilities and then expand ‘downwards’ towards production.¹⁵ The proposition is that ‘integrated innovation activities’ (characterised by a tight connection between production and innovation activities) are likely to be the first step towards innovation in supply platforms and that the jump from standalone production to standalone innovation is unlikely.

It is well established that local capability formation depends on the ‘absorptive capacity’ of local firms (Cohen and Levinthal 1990; Ernst and Kim 2002). This capacity arises from the prior knowledge base, the intensity of learning efforts and the ability to blend internal and external resources for the build-up of new capabilities. The literature on global value chains has shown that low-cost suppliers often upgrade the quality and scope of their services in response to the requests of lead firms in the USA or European Union (Gereffi 1999; Humphrey and Schmitz 2002). For instance, Humphrey (2004: 33) described how suppliers in horticulture value chains ‘upgraded’ and repositioned as the sector restructured. In this setting, ‘buyers may welcome increasing supply competences as part of a broader strategy of focusing on their own core competences’.

The key proposition discussed here is that where global buyers shift to open business models, this is likely to drive up and change the nature of the ‘requests’ passed on to the supply base and this plays an important role in the deepening of supplier capabilities. In other words, new spaces emerge, but the successful occupation of these spaces by suppliers is not automatic. Understanding the way firms mobilise resources to do this is a key empirical task of this report.

13 However, see footnote 9.

14 Following Bell and Pavitt (1993: 164), this study defines ‘learning’ as the accumulation of capabilities. Furthermore, it is self-evident that ‘learning occurs through the process of innovation ... and that learning strengthens the potential for further innovation’ (Drejer 2004: 557).

15 Today East Asia is host to clusters of so-called ‘fabless’ electronics firms that do not manufacture their own silicon wafers. Instead, they concentrate on the design and development of semiconductor chips. While these provide standalone innovation services today, their capabilities developed over time from their initial specialisation in semiconductor fabrication.

Absorptive capacity must be in place, but it can be used in different ways and there is no clear agreement on whether, or rather to what degree, absorptive capacity is nested in the individual firm or in 'the region' (Niosi and Bellon 2002). Much of the recent scholarly debate on the transition to innovation in developing countries has focused on institutional set-ups supporting innovation (effectively or ineffectually) in regional or national innovation systems (see for instance Lundvall *et al.* 2006; Muchie *et al.* 2003). The key proposition of the innovation systems approach is that the innovative capability is primarily developed in 'local linkages', among enterprises and between enterprises and support institutions. This approach has become very influential worldwide and as will be discussed in the next chapter; it underpins the majority of the literature concerned with capability deepening in the Indian software industry.

The value chains literature reflects the same line of reasoning. Much of this literature has concentrated on the relationship between local clusters and global chains (Giuliani *et al.* 2005; Humphrey and Schmitz 2002; Sturgeon *et al.* 2008). While the nature and direction of causality is not always clear, the dominant perception seems to be that the cluster is the key locus in which capabilities are developed. These capabilities then determine what types of chains local firms can enter (and change by further capability building). The buyers, on the other hand, determine the types of linkages available for 'supplier insertion' through their decisions to outsource activities of different degrees of complexity and codifiability (Gereffi *et al.* 2005). Thick linkages – i.e. linkages characterised by so-called 'relational value-chain governance' – are conducive (*ex post* or *ex ante*) to innovation.¹⁶ It is widely recognised that innovation is characterised by tacitness and that innovation linkages are typically correspondingly thick. Sturgeon argues that if suppliers want to enter relationships characterised by thick linkages, the local policy emphasis should be on competence building and support of clusters and districts, with a focus on building tacit domain knowledge (Sturgeon 2006). Yet the emergence of thick linkages in global supply chains is uncharted territory in empirical terms. The literature on collaborative relationships between co-located firms and/or ethnic business networks is strong (Castilla *et al.* 2000; Dhume 2002; Granovetter 1985; Saxenian and Hsu 2001). However, we know very little about how thick linkages arise or how they work in cross-border value chains.

2.3.2 Learning in project-based firms

The existing literature that is explicitly concerned with the formation of innovation capabilities has focused on industrial sectors such as steel (Figueiredo 2003) and electronics subcomponents (Ariffin 2000). While this study draws on these studies, it examines capability formation in *services firms*, for which the literature offers much less guidance.

This study is concerned, in particular, with suppliers of *knowledge-intensive business services* (KIBS). The KIBS literature has emphasised that learning in such firms tends to be project-based. In other words, most KIBS providers are so-

16 Such chains are characterised by 'clusters of specialist buyers and suppliers with process and/or domain-specific competencies' (Sturgeon 2006).

called project-based organisations (Whitley 2006). Two typical features of such project-based organisations are worth noting (Hobday 2000: 875):

- The ‘knowledge, capabilities, and resources of the firm are built up through the *execution of major projects*’ [emphasis added].
- Projects are ‘the normal mechanism for creating, responding to and executing *new business opportunities*’ [emphasis added].

This suggests that learning and project execution are hard to separate and that the formation of ‘new capability’ takes place – and is best observed – in and around particular projects, not least those that address (new) business opportunities. In outsourcing, such new opportunities are likely to be client-driven. In general, the KIBS literature tends to emphasise learning in client-facing project teams (Miles 2004; 2008; Strambach 2008; Zhou *et al.* 2005). Crucially, for the sake of the bigger picture, learning in such firms is cumulative, linking learning in one project with the application of capabilities in later projects.

This project focus is of direct relevance for this study in terms of both substance and method. The building of capabilities is a process to which many factors contribute. Tracing and specifying the influence of specific factors can be very difficult. Focusing on particular projects carried out by a firm makes this easier. That is why this study examines capability formation by focusing on particular events. How this works will be explained later. Similarly, how the outsourcing and learning dimensions will be brought together will be discussed later. Before doing this, the next section will examine what the existing literature on the software industry in India/Bangalore reveals about the issues raised so far.

2.3.3 Competence leveraging

As has been discussed, capability formation in the supply base may rely on different mechanisms and may take different routes. In order to explore this, this study uses the concept of competence leveraging, the exploitation of an existing stock of competences and its use in a new domain (Sanchez 1994). This concept can serve as a focusing device to explore the dynamics of the formation of innovation capabilities in the outsourcing context.¹⁷ This type of leveraging can occur *within suppliers* and *between suppliers*.

With regard to intra-firm leveraging, Navas-Alemán (2006) compared local and global value chains and showed that some Brazilian footwear and furniture firms operated in several value chains simultaneously. Such ‘multi-chain’ firms showed the highest attainment of ‘upgrading’. Similarly, Lee and Chen (2000) argued that this type of leveraging enabled Taiwanese suppliers to use accumulated capabilities to exploit new markets and make the transition from production (of electronics goods) to innovation activities such as design and engineering. While there are strong indications that competence leveraging is central to capability

17 The literature uses the term leveraging in different ways. Mathews (2006: 2) uses the term to refer to the situation in which a firm can ‘secure more from a relationship than the firm puts in’. This study uses the term to refer to a situation in which one or more firms combine competences from distinct domains and apply them in new areas.

formation, there are limited insights with regard to how such leveraging actually works within supplier firms. The existing literature does not bring these intra-firm dynamics into the open.

From a theoretical perspective, there is reason to believe that intra-firm leveraging may provide a particularly strong recipe for competence-based growth in supplier firms with multiple business activities in different domains. The supplier firm develops capabilities cumulatively in each domain, and it deepens these domain competences when working with different customers. Once multiple competence bases are in place, the firm may then benefit from the cross-leveraging of these bases. As argued by Strambach (2008), providers of knowledge-intensive business services (KIBS) are likely to employ such a strategy (see also Baaij *et al.* 2005). KIBS therefore play a vital role in facilitating the leveraging of competences between customer domains, and new dynamics arise when knowledge and capabilities from different domains combine in different ways.

Yet some of the literature suggests that this type of intra-firm leveraging is not enough: inter-firm leveraging is required. Clustering is essential because synergy effects arise between proximate firms in the supply base: 'they cluster and new specialisations develop' (Schmitz and Strambach 2009: 238). These new specialisations include knowledge-intensive activities and business services. Competence leveraging can then occur between firms within supply platforms that specialise in different subsectors (Kishimoto 2002). Because clustering facilitates such inter-firm leveraging, it is interesting to note that outsourcing typically combines geographic dispersion with spatial concentration (clustering). The bulk of the global-scale extension of manufacturing and services witnessed in recent decades has been concentrated in an expanding, but essentially limited, number of specialised supply platforms. The literature refers to this phenomenon as 'concentrated dispersion' (Ernst 2002; Zaheer and Manrakhan 2001).

The existing literature that is explicitly concerned with the formation of *innovation capabilities* has focused on learning and knowledge creation within a single industrial business line such as steel (Figueiredo 2003) or electronics subcomponents (Ariffin 2000). This study draws on this literature but examines the relevance of competence leveraging across business lines for the ability to supply innovative products and services in global markets.

2.3.4 The changing outsourcing landscape

The literature on offshore outsourcing tends to assume that the impetus comes from above (from the buyer), at least in the first round. As discussed, there is no automaticity in the build-up and deepening of capabilities in the supply base, but in certain circumstances outsourcing can be an important learning opportunity for developing country firms (Hansen *et al.* 2007).

An important point for the purposes of this study is that in a second round of iteration the deepening of capabilities in the supply base can have important feedback mechanisms. It is widely recognised that the effective 'level' of supplier capabilities is important in shaping industrial organisation patterns (Chesbrough 2003b; Christensen 2006; Gereffi *et al.* 2005). Simply put: 'The availability of competent suppliers influences whether and to what degree lead firms outsource'

(Altenburg 2006: 504). For this reason, the effective transformation of capabilities in the supply base is likely to have important ramifications.

This is suggested by Schmitz and Strambach who argue that supply-side organisations 'do not stand still ... they develop a dynamic of their own, and they change the environment in which large client firms operate' (Schmitz and Strambach 2009: 238). Thus, the most recent literature notes the possibility of a 'dynamic from below', but the exact ways in which these dynamics occur are not clear. This study aims to take a further step in unpacking these dynamics.

2.4 Research questions

The overall aim of the study is to explore whether, how and to what extent the adoption of open business models influences the build-up of innovation capability in developing country supply bases. It does this by examining the software outsourcing industry that connects customers in OECD countries with suppliers in India. In order to explore this, the study focuses on four sets of questions derived from the discussion above:

- *To what extent and how have buyers of software services from Indian suppliers adopted (elements of) open business models?* The report does not (seek to) examine demand-side business models systematically. It examines buyers that were associated with 'learning events' in supplier firms, and as such they are particularly suited to explore the proposition addressed in this report. Is the shift to open business models prevalent in such buyer firms (sponsor organisations)? If so, what are the key features of openness? How does openness relate to processes of corporate restructuring and new sourcing practices?
- *What are the key characteristics of the (innovation) activities outsourced to low-cost supply platforms?* This question continues with the analysis of the demand side. It examines 'production' as well as innovation activities, but is particularly concerned with the nature and degree of the latter. Are innovation activities integrated with (and 'hidden' within) production activities or are they supplied on a standalone basis? Are they mainly problem-solving or problem-framing? How does the space for supplier innovation differ across different types of buyers?
- *What were the main sources of inputs into learning and innovation events in supplier firms?* This question shifts the attention to the demand side of the software outsourcing industry and the issue of capability formation in new spaces for innovation. How did they mobilise resources during the attainment of new qualities of capability? What is the relative importance of intra-firm and extra-firm sources? What is the relative role of regional and global sources? Did competence leveraging enhance the process of capability deepening?
- *To what extent and how is innovation outsourcing driven from the supply side?* What is the role of feedback mechanisms arising from capability formation in the supply base? Are such mechanisms direct or indirect? This issue of the dynamic from below arises in a second iteration, thereby moving beyond the core research question.

While these questions derive from recent theorising, there are very few empirical insights to draw on. As mentioned, the research presented in this study is therefore exploratory. Furthermore, these questions address a wide range of phenomena in a (potentially) causal chain of analysis. The concluding discussion seeks to connect the dots between the various elements of the analysis and adopt a dynamic perspective. The next chapter discusses how the study places this research agenda in the context of the software outsourcing industry.

3 Operationalisation and methodology

The previous chapter sketched out a theoretical framework focused on business models and the interaction between the demand and the supply sides in outsourcing. This chapter starts with elaboration of the key concepts and operationalisation for empirical analysis. It describes in more detail some conceptual issues related to business model change and software outsourcing (Section 3.1). It then draws up a vocabulary and apparatus for the assessment of supplier capabilities and for the analysis of capability formation (Section 3.2).

The chapter then proceeds by explaining the key methodological considerations. The main aim is to understand whether and how the shift to openness has contributed to the build-up of innovation capabilities in the global supply platform of Bangalore. No previous studies address this question explicitly and hence this study could not find any 'off-the-shelf' solutions in terms of research strategy. The study therefore needed to find its own methodological pathway. Answering this question required an examination of 'both sides', the demand side and the supply side, and their interrelationships. While previous research has sometimes interviewed different relationship actors as a method of triangulation, the present research went beyond this. The 'both sides' strategy was a fundamental principle in the core research design needed to address the key question.

The key challenge was to investigate processes that are interactive in nature and to examine (rather than assume) causal relationships that unfold over vast geographical space. Very little research on inter-firm relationships (as opposed to literature on MNCs) succeeds in doing this. One exception is the research on the medical instruments industry by Nadvi and Halder (2005). These authors examined changes on the demand side (in Germany) and the supply side (in Pakistan). However, they did not examine concrete inter-firm linkages directly. The latter is what this research has tried to do.

In order to achieve this, the point of the departure of this study is the detailed investigation of 'innovation events' in Indian firms. It is important to understand how the research arrived at this sample of 36 events. Section 3.3 therefore first sets out how the research on the supply side was conducted. A subsample of 12 events, in which the buyer side was researched in detail, was then chosen. The chapter explains how this was done in Section 3.3.6 on researching the demand side. These sections also describe key characteristics of sampled firms as well as how information was obtained within these firms. The last section provides a summary (Section 3.4).

3.1 Business models and software outsourcing

This section starts out by defining indicators and discussing the analysis of business models on the buyer side. While the firm-level analysis of buyers does produce relevant insights, the detailed investigation of open business models commands an analysis of the way these firms use suppliers (or not) in the division of innovation

labour. The chapter therefore proceeds by laying a foundation for empirical analysis of the software development processes that connect demand and supply in the outsourcing context. A major difficulty in the assessment of 'capability dispersion' in the software industry is that there is little agreement about what constitutes innovative activities in this sector. The section therefore defines innovation in the software context and dissects the elements involved in the process. It also lays a foundation for empirical analysis of the software development processes that connect demand and supply in the outsourcing context.

3.1.1 Open and closed business models

In order to analyse the adoption of open business models in the context of outsourcing, it is necessary to maintain the distinction between the sponsor organisation and the wider firm, at least in the context of large corporations. This is because there is often more than one business model at the firm level (Leung 2007; Van der Meer 2007). Focusing on the sponsor organisation (the software service sourcing business unit), one can then examine different aspects and dimensions of the business model:

- the buying side
- the selling side
- innovation management.

Table 3.1 shows the stylised characteristics (indicators) of the open business model and it contrasts these with the closed model. These are used in the empirical analysis of whether buyer firms are adopting open business models.

While the selling and innovation management is concerned with the relationship between the business unit (sponsor organisations), the wider firm, external firms and the market, the buying side has to do with relations between the sponsor organisation and partners/suppliers. Some authors have suggested that the fundamental force driving the shift to the open business model is the increasing availability of external sources of innovation (Chesbrough 2006a). Firms that do not use the resources and external opportunities available in the open innovation landscape may fail to compete effectively. This requires an opening-up towards actors in the external world (such as suppliers, customers and rivals), but it also involves internal transformation.

Some authors have drawn a relatively clear line between the core competence and the open business model. The fundamental difference between the two models (in a highly stylised form) is that the former is based on a closed/internal innovation process whereas the latter is based on an open/external innovation process. As mentioned, the core competence perspective (Prahalad and Hamel 1990) became dominant in business studies during the 1990s. The key is the recommendations this perspective made with regard to the organisation of the innovation process. According to Christensen (2006: 36), 'introvert modes of innovation were argued to be the standards to be met for large successful companies'. The same idea is reflected in the work of Sturgeon (2002) who defined innovative activities as 'core' and production activities as 'non-core'. The

Table 3.1 **Analysing business models – key indicators**

	Closed/core competence		Open
Selling side	The organisation's business model and innovation process is self-contained and it uses internal pathways to the market.	↔	The organisation's resources are used in the business models or innovation processes of external customers/partners.
	There are few innovative links between non-R&D business units, and innovation processes are contained mainly within the business unit.	↔	The organisation's resources are used in the innovation processes of internal customers.
Buying side	The organisation's business model and innovation process is self-contained and it bases value creation on internal knowledge assets.	↔	The organisation includes external resources in its business model.
	Knowledge spillover to suppliers and partners is perceived as a regrettable cost of doing business.	↔	Knowledge spillover to partners is perceived as a potential source of improved competitiveness.
	Risks and rewards accrue to the firm alone.	↔	Risks and rewards are shared with external partners (suppliers) in the innovation process.
Innovation mgmt.	The firm locates the management of innovation in the R&D unit.	↔	Innovation tasks in the organisation reflect the decentralisation of innovative activities to every business unit of the firm.
	The firm perceives its innovation task mainly as a matter of 'technology' (developed in the R&D unit).	↔	Innovation tasks in the organisation include the reinvention or renewal of the business model itself.

Source: Adapted from Chesbrough (2006a: Table 5.2), drawing also on Leung (2007) and Vaitheeswaran (2007).

core tasks were typical lead firm tasks (kept in-house), whereas the latter were typical supplier tasks (outsourced to providers of manufacturing services). The innovation process remained fairly 'closed' within buyer firms. In this view, the opening (outsourcing) of innovation activities *per se* is to move beyond – if not leave behind – the core competence model.

Other authors acknowledge that the innovation process is opening up, but they emphasise that there are 'core' and 'fringe' activities within this process. The distinction between problem framing and problem solving (Brusoni 2005) captured this. Not all activities in the innovation process are strategic (core) to all firms. System integrators use the division of innovation labour to outsource certain parts of their R&D, but the problem-framing function is a core capability. Yet such firms are 'open business model firms' – as defined by Chesbrough (2006a) – since they use the open innovation landscape to create and capture value and because they use key knowledge assets and resources in other companies' businesses. As

Table 3.2 **Phases in the development of business software**

Phases	Description
Inception	Inception is significant for new development efforts; business and requirement risks must be addressed before the project can proceed. For projects focused on enhancements to an existing system, the Inception phase is shorter, but is still focused on ensuring that the project is both worth doing and possible. During Inception, the business case for building the software is made. The Vision, a key intermediary artefact produced during Inception, is a high-level description of the system. It tells everyone what the system is, and may tell who will use it, why it will be used, what features must be present, and what constraints exist. Often the Vision contains the critical features the software must provide to the customer. This is often expressed in so-called use-cases that capture functional requirements. Use-cases allow description of sequences of events that, taken together, lead to a system doing something useful. An initial use-case model is typically drawn up with the use of diagrams that adhere to a modelling language such as the unified modelling language (UML).
Elaboration	The goal of the Elaboration phase is to baseline the architecture of the system to provide a stable basis for the bulk of the design and implementation effort in the Construction phase. The Vision is refined. Design activities focus on the notion of software architecture. The architecture evolves out of a consideration of the most significant requirements (those that have a great impact on the architecture of the system) and an assessment of risk. The stability of the architecture is evaluated through one or more architectural prototypes. Key intermediary artefacts during this stage are the software architecture document (SAD) and the iteration plan for the construction phase.
Construction	The goal of Construction is to complete the development of the system. The construction phase is, in some sense, a manufacturing process, where you emphasise managing resources and controlling operations to optimise costs, schedules and quality. In this sense, the management mindset undergoes a transition from the development of intellectual property during Inception and Elaboration, to the development of deployable products during Construction and Transition. The Construction phase is where you produce code. It is typically the most substantial step in the process, with the bulk of person-hours used in this stage. It is typically divided into iterations that correspond to one component. Each component is built to satisfy one or more use-case(s) and other functionality for the iteration.
Transition	The focus of Transition is to ensure that software is available for its end-users. The Transition phase includes testing the product in preparation for release and making minor adjustments based on user feedback. At this point in the lifecycle, user feedback needs to focus mainly on fine-tuning the product, configuring, installing and usability issues.

Source: Pollice (2003: 3–11).

noted by Carpay and colleagues (2007: 256), ‘there is no conflict between open innovation and core competence in outsourcing R&D’.

Indeed Chesbrough (2003c) argues that lead firms should seek to retain architectural knowledge and integrative competences as external knowledge and technology become more widely available. As pointed out by Christensen (2006), this notion of integrative competences is more consistent with open modes of

innovation than the 'old' notion of core competency is. He notes that core competences are unlikely to become wholly obsolete, but he shows that open business model firms are more aware of the danger that core competences can become 'core rigidities' (2006: 59).

The key insight provided by the literature is that the move beyond the core competence business model is a gradual process with no clear breakpoint. Even though some elements of the innovation process are organisationally de-linked from the firm, this does not mean that the disintegration process is no longer selective. The key empirical task is therefore not only to examine whether buyer firms adopt elements of the open business model, but also the *degree* to which they do so and the *way* in which they do it (i.e. which element they use). The indicators defined above are therefore only the starting point. The further analysis entails a deeper examination of the types of innovation activities that are outsourced and the degree to which these are 'core'. The problem is, however, that this analysis easily falls into the trap of *ex post* rationalisation: 'if the activity is kept in-house it must be core and strategic'. The key is therefore to investigate firm trajectories of software outsourcing and to interpret these against the backdrop of a software innovation and development framework. The next section develops such a framework.

3.1.2 Software development, innovation and outsourcing

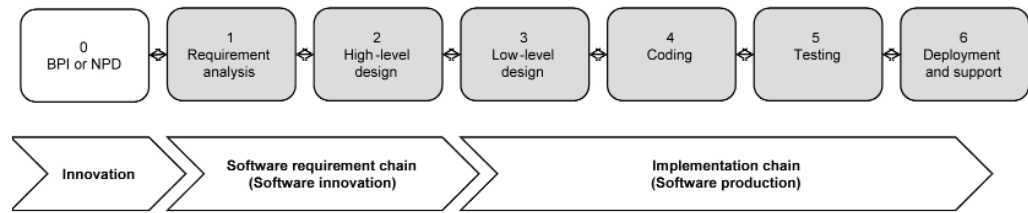
In order to initiate the discussion of how one can classify 'outsourcing' and 'innovative activities' in software, it is useful to discuss the various activities in software development and provide some guide with regard to which of these are likely to constitute the loci of innovation. The section discusses the issue of software development activities in some detail because subsequent classifications pertaining to types of capabilities and types of outsourcing draw heavily on this conceptual basis.

'Software' is a general term used to describe a collection of computer programs, procedures and documentation that perform some tasks on a computer system. Software development is an iterative process, with various phases involving technical as well as non-technical tasks. Feedback loops are unavoidable and several activities can occur simultaneously. Planning and estimation of software development therefore revolve around phases that combine various tasks. Table 3.2 describes the four key phases in a software development project, including typical activities during each phase. One advantage of this 'phase approach' is that it highlights the connection between different activities at different points in time. Table 3.2 shows how multiple activities occur in each phase.

The inception phase is central to the discussion of innovation in the software development process. It is necessary to place the software development process firmly in the context of its use – whether this software is for new product development (NPD) or business process improvements (BPI). This is important because software feeds into larger human or non-human systems:

A software system is often a component of a much larger system. The software engineering activity is therefore part of a much larger systems design activity in which the requirement of the software is balanced against the requirements of other parts of the system being designed... Dealing with

Figure 3.1 **Software activities in the waterfall model – production and innovation**



Sources: Adapted from Royce (1970) and Arora *et al.* (2008).

such a system requires the software engineer to participate in the development of requirements for the whole system. It requires that the software engineer attempt to understand the application area before starting to think of what abstract interfaces the software must meet.

(Ghezzi *et al.* 2003: 3)

In other words, the software value chain connects with and is dependent on a larger value chain. Product development services feed into hardware systems (e.g. software in a phone), as opposed to business process software, which may underpin human systems and routines (e.g. a customer relationship management (CRM) system). Hence, the inception phase is dependent on radically different types of domain knowledge.

This domain knowledge influences the phase of software requirement definition and high-level design. This is the so-called software requirement chain. According to Arora *et al.* (2008), *software innovation* occurs in this ‘requirement chain’ which connects user needs to software functionality. This stage defines what a new or modified software system should do as well as its architecture. These authors contrast this with the ‘implementation chain’ in which a software artefact is actually constructed (coded in a given programming language), tested and released. They refer to this as *software production*.¹⁸ Figure 3.1 shows the requirement and implementation chains in the standard waterfall model of the software development lifecycle. These are the definitions of innovation and production activities in the software context. However, the next section adds further conceptual depth to the concept of innovation and the next chapter discusses the importance of analysing innovativeness in the context of business lines.

In this way, one can think of software production and innovation as occurring in two different parts of the development lifecycle, involving different types of software activities. However, it is important to keep in mind the *interface* between production and innovation activities in the software development process, which

18 It is sometimes said that the term ‘production’ is a misnomer in the services context. However, the term ‘production’ is often used in the software industry itself to denote relatively non-innovative processes. These are mainly implementation activities comprising coding and testing. However, implementation activities are not entirely ‘non-creative’. On the contrary, it has been suggested that they involve as much technical brilliance and creativity as requirement definition does (Brooks 1995). It is important to acknowledge that creative activities occur in both steps of the value chain, but for the purposes of this study, it is feasible to focus on knowledge creation in the requirement stage.

Table 3.3 Phase model of the software process model

Activities	Phases			
	Inception	Elaboration	Construction	Transition
BPI or NPD				
Software requirement definition and high-level design (2)				
Low-level design (3) and coding (4)				
Testing (5)				
Integration and deployment				

Sources: Adapted from Kruchten (2004), Tsui and Karam (2007) and Pollice (2003).

occurs in the elaboration and construction phases. The keyword here is *specification*. The specification is typically a written document (sometimes referred to as ‘the manual’), based on requirements and the definition of the systems as perceivable by the user.¹⁹ These specifications provide instructions about how the software system development team should proceed with its implementation. However, the specified requirements can vary in nature and quality. They may be detailed or not, and they may include more or less instruction about architecture and technology. Specifications that allow for a breakpoint between innovation and production activities for outsourcing purposes require large upfront investment in detailed design specifications. Firms reduce this investment when they have supplier staff onsite to mediate communication flows. Furthermore, it can be reduced by modular ‘object-oriented’ or ‘component-based’ software architecture. This allows the outsourcing of low-level design to the external provider. Software design is a multi-layered process characterised by increasing specificity (or a decreasing scope of available choices about how to proceed). However, there is always some room for interpretation and there can be emergent features in which low-level design appears in the coding process.

Different people with different roles and competences – analysts, architects, designers, programmers and testers – are responsible for corresponding activities. Grouping different people together gives some scope for dividing the work process into separate bundles with distinct contracts. As described by Lott (1997), one contract can involve requirements definition and high-level design, while a second can be dedicated to low-level design, coding and testing. There may be good reasons to bundle low-level design with implementation activities in a cross-

¹⁹ Requirements are both functional (what the system should do) and non-functional (system qualities such as scalability). They can, at least in theory, be constructed independently from technological choices such as programming language.

functional team. There are advantages associated with doing this, such as the reduction of risk, the leveraging of external competences and cost savings. Nevertheless, there are no *given* breakpoints in the process. Buyers may define the work packages in different ways. In other words, the relationship between client and contractor is not predetermined (Lott 1997).

3.1.3 Changing outsourcing practices

If buyer firms in outsourcing industries are shifting to open business models, an important question arises: What types of innovation spaces are opened up for suppliers to occupy? The OECD-focused open innovation literature has concentrated almost exclusively on R&D, and mainly on the 'R' within that process. The focus in this literature is predominantly on access to highly specialised knowledge at the forefront of emerging technologies (Christensen *et al.* 2005; Cooke 2005; Santos *et al.* 2004). The literature builds on the implicit assumption that the 'knowledge boundaries' and the 'production boundaries' of the firms are different (Brusoni 2005: 589). In other words, knowledge outsourcing is often separate from production outsourcing. In short, the focus of existing literature on innovation outsourcing is clear: it concentrates on the farming out of readily observable innovation activities (e.g. R&D).

However, the potential drawback of this approach is that it may not be well equipped for the empirical analysis of the evolution of production outsourcing into innovation outsourcing. Access to 'production' capability and low-cost resources is a key driver of offshore outsourcing, at least initially. But this experience may give rise to a deepening of the outsourcing relationship. Authors who highlight that offshore outsourcing is a learning path point out that:

Over a period of time the outsourcing experience lessens the cognitive limitations of decision-makers as to the advantages that can be achieved through outsourcing in low-cost countries: the insourcer/vendor may not only offer cost advantages, but also quality improvement and innovation. (Maskell *et al.* 2007: 239)

The analysis of the emergence of innovation outsourcing (i.e. the transition from production) therefore warrants a broad view of innovation. To this end, the recent framework by Schmitz and Strambach (2009) provides a starting point. Their typology has two dimensions. The first one is outsourcing or offshoring within and between organisations – between intra- and inter-organisational connections. The second refers to the extent to which innovation is integrated with production of goods and services. As mentioned in Chapter 2, innovation can be delegated to those who are primarily concerned with knowledge creation and have only a loose connection with the production of goods and services, or it can be delegated to those who are tightly connected to the production of goods and services and have the latter as their primary function (see Table 3.4).

However, this framework can only be used in a modified version due to the following reasons.

- This study is not centrally concerned with firm-internal decomposition and thus renders obsolete ODIP Type 1 and 2.

Table 3.4 The ODIP framework

Intra- and interorganisational	Internal	External
Connection between innovation and production		
Loosely connected	<i>Type 1</i> Decentralising the R&D Department; setting up internal knowledge communities	<i>Type 3</i> Commissioning research from universities or other organisations
Tightly connected	<i>Type 2</i> Delegating the development of new products to subsidiaries; setting up internal centres of excellence	<i>Type 4</i> Engaging suppliers of products and services in developing new products or processes

Source: Schmitz and Strambach (2009).

- The central dimension of loose/tight connection between innovation and production is not made operational for application. In this regard, it seems that the more 'absolute' terminology of *standalone* and *integrated* activities is easier to apply.
- The loosely connected type (standalone) seems to be centrally concerned with R&D, but the framework provides no definition of R&D.

With regard to the last point it is clear that software firms, like other KIBS firms, typically 'display wider – or fuzzier – versions of R&D' (Miles *et al.* 1995: 65). Innovation in services industries typically relies heavily on sources that are not directly associated with R&D (Miles 2007; 2008).²⁰ It is therefore important to emphasise that the key is the connection (tight or loose) between production and innovation – not between production and R&D.²¹ For the purposes of classification, R&D is defined in this study as purposeful and sustained knowledge creation for six months or longer (buyer as well as supplier firms).

The conceptual apparatus for analysing outsourcing practices draws on the software development lifecycle. However, because the assessment of supplier capability also draws on this, it is important to avoid tautology of the type: 'if the buyer firm outsources activity X, the supplier undertakes activity X and therefore has its underlying capability'. This line of reasoning is commonplace but it limits

20 R&D may take an informal character in many KIBS firms: 'We found informal R&D taking place in "grey" hours [not registered in company accounts] in KIBS involving high elements of consultancy, where the (financial) room for non-client-led and/or non-project-bound R&D seems to be limited' (Miles *et al.* 1995: 66).

21 R&D is an innovative activity, but innovation does not necessarily involve R&D. R&D is creative work undertaken on a systematic basis in order to increase the stock of knowledge and the use of this stock of knowledge to devise new applications. R&D is a set of activities that may or may not be carried out during different phases of the innovation process. Software development is classified as R&D when its completion is dependent on a technological advance, and the aim of the project must be the systematic resolution of a technological uncertainty. Examples include the development of operating systems, programming languages and new software development tools (OECD 2002).

Table 3.5 **Standalone and integrated innovation outsourcing**

Category	Includes	Excludes
Outsourcing <i>production</i> activities (ODPP)	<i>Production activities:</i> <ul style="list-style-type: none"> ● Coding and/or ● Code testing and/or ● Maintenance 	<i>Innovation activities:</i> <ul style="list-style-type: none"> ● Low-level design ● High-level design ● Requirements
Outsourcing <i>standalone</i> innovation activities (ODIP Type 3)	<i>Innovation activities:</i> <ul style="list-style-type: none"> ● Low-level design and/or ● High-level design and/or ● Requirements 	<i>Production activities:</i> <ul style="list-style-type: none"> ● Coding ● Code testing ● Maintenance
Outsourcing <i>integrated</i> innovation activities (ODIP Type 4)	<i>Production activities:</i> <ul style="list-style-type: none"> ● Coding and/or ● Code testing and/or ● Maintenance plus: <i>Innovation activities:</i> <ul style="list-style-type: none"> ● Low-level design and/or ● High-level design and/or ● Requirements 	

Source: Own adaptation, drawing on Figure 3.1. Note that ODPP refers to the 'organisational decomposition of production activities'.

the depth of analysis, and it is potentially misleading because suppliers may have capabilities at levels that are higher than are needed for any given outsourced activity. This type of tautology is avoided by focusing on the 'highest level' of outsourced activities (in the value chain) and its connectedness with lower levels. In this sense, it is concerned with the nature and length of the outsourced value-chain thread. The proposed framework distinguishes between three types of outsourcing practices. The operational forms are shown in Table 3.5, but some further commentary is needed:

- *Production activities.* These are the knowledge-using activities involved in routine service provision or other operational tasks. When such activities alone are outsourced we may refer to this as the organisational decomposition of production activities (ODPP). The key is that a contract of 'pure' production activities does not extend to the outsourcing of higher-end activities.
- *Standalone innovation activities.* This category corresponds to what Schmitz and Strambach (2009) call 'loose connection' between innovation and production activities. It refers to the provision of knowledge-creating services or new product development functions. These are activities concerned with the generation of 'new knowledge', in generally applicable forms or in more specific forms for new applications. Standalone innovative activity may take the form of outsourced R&D.²² However, 'research' occurs not only in R&D labs. For instance, it may be undertaken by consultants who address a focused assignment. The important point is that these activities are (organisationally) 'de-linked' from production activities.

22 Cross-licensing of IP and 'off-the-shelf' technology is a reflection of standalone innovative activity.

- *Integrated innovation activities.* This category corresponds to the ‘tight connection’ between production and innovation activities (Schmitz and Strambach 2009).²³ These innovation activities are bundled with production processes. This category is important because innovation may be ‘hidden’ in the provision of standard services. This can occur, for instance, when buyers engage suppliers of products and services in the development of new products or processes. This category also bears resemblance to what Bell (2007) calls ‘design and engineering activities’. These involve the often overlooked capabilities used to transform knowledge from generally applicable forms into increasingly specific and concretised forms. In other words, they are typically development intensive. Hence they may be seen as the bridging element between ‘pure’ knowledge creation (e.g. research), and knowledge use (e.g. manufacturing production).²⁴ The important point is that this category combines production with some knowledge-creating elements.²⁵

The literature on innovation outsourcing is almost exclusively concerned with the standalone category. However, the bottom-up perspective suggests that the integrated innovation stage, while often overlooked, is central to the outsourcing learning path. The key characteristic of this type of outsourcing is the bundling of production and innovation activities. The systemic incentives for this type of bundling may be rooted in ‘linkage economies’, ‘whereby controlling multiple value-chain activities enhances the efficiency and effectiveness of each one of them’ (Mudambi 2008: 705). These economies arise because knowledge flows more freely within firms than between firms. For instance, design and engineering activities may become more efficient if they integrate with production activities undertaken by the same firm. However, the process of bundling and unbundling has many determinants. A complex set of determinants influences this process. Transaction costs are important, but they are only one part of the equation, and relative factor costs are sometimes more important. From a buyer perspective, the benefits from low-factor costs in the supply base (e.g. those related to design and engineering-type innovation activities) may simply outweigh the transaction costs associated with the integrated outsourcing of these more complex tasks. This study gives equal attention to the ‘hidden’ innovation activities that are associated with the integrated type as well as the more recognisable innovation activities associated with the standalone type.²⁶ Furthermore, the study seeks to specify their relative importance.

23 This study uses the standalone/integrated terminology interchangeably with the loose/tight connection terminology adopted by Schmitz and Strambach (2008). Empirical chapters use both sets of terms.

24 Design and engineering activities are a set of innovative activities that are not typically considered R&D. Yet these activities can have an important influence on innovation outcomes, not least in developing countries (Bell 2007: Chapter 3).

25 The inclusion of this category is supported indirectly by recent research, which showed that most multinational corporations (MNCs) tend to locate R&D near production sites rather than near technological clusters (Mariani 2002). Also, in the manufacturing context – particularly in the auto and computer sectors – it has been observed that design functions are increasingly pushed onto or acquired by component suppliers (Humphrey 2003; Kishimoto 2004).

26 Some of the outsourcing literature has shown that the successful transfer of production activities to new low-cost localities is accompanied by the handover of a substantial body of seemingly unseen knowledge. This knowledge is particularly tied to non-normal task situations and it supports accelerated learning at the new site (Madsen *et al.* 2008).

Table 3.6 **Examples/indicators of ideas, investments and knowledge**

Idea	<ul style="list-style-type: none"> ● Idea for new product ● Idea for new process ● Idea for new project
Investments	<ul style="list-style-type: none"> ● Investment in training internal staff ● Investment in people (from outside) ● Investment in <i>ad hoc</i> workshops ● Investment in relationships ● Investment by acquiring external firms or business units
Knowledge	<ul style="list-style-type: none"> ● Knowledge embodied in routines and practices ● Knowledge embodied in people ● Knowledge embodied in manuals, documentation material or publicly available sources (e.g. online) ● Knowledge embodied in software or capital equipment (including intangible equipment such as proprietary methodologies)

Source: This chapter.

3.2 Innovation inputs and formation of capability

This section develops a framework to classify sources and linkages in the process by which firms mobilise resources within new spaces in outsourcing relationships. The conceptual apparatus developed here builds on existing frameworks but combines and adapts them in new ways.

Like most other literature, this study examines ‘knowledge’ as a key resource in the innovation process. However, unlike many other studies, this study is not confined to this type of input. Rather, it uses a simple ‘model’ with three elements: ideas, investment and knowledge. These correspond roughly to three overlapping phases.

As will be discussed further in the next chapter, this draws in part on conceptualisation of phases in the software development process. Segelod and Jordan (2004) defined four phases: (1) ideas phase; (2) decision phase; (3) development phase; and (4) commercialisation phase. This study does not examine commercialisation. However, the first three steps define phases that are associated with ideas, resource decisions (investments) and knowledge inputs respectively.

While this phase model was developed with the aim of analysing software development projects, the first three steps can be applied to any project, even if these are not concerned with software development as such. This requires, however, that the notion of ‘development’ should be interpreted broadly as carrying out a project.

Ideas: Most innovation processes/projects are initiated with some type of reference to an end goal, even if this goal may be clearer in hindsight. This focus on how and why a learning or innovation event was initiated is not common in the literature on learning in latecomer firms. However, the focus on ideas is common in management literature (Chesbrough 2007; Hansen and Birkinshaw 2007) and literature on software firms (Jordan and Segelod 2006; Segelod and Jordan 2004). The focus on ideas is important for examining the link between (identified)

Table 3.7 **Different sources of inputs – the matrix**

	Client	Non-client (other)
Internal	Internal client-facing sources/units (Strambach 2008)	Other internal sources/units (Bell 1984)
External	External client-related sources (von Hippel 1988)	Other external sources (OECD 2005)

Note: The table provides references to texts that tend to emphasise sources in each quadrant. These examples are indicative, not exhaustive. Sources provided in the table.

opportunity spaces and the initiation of projects, not least because some authors argue that lead firms increasingly seek to externalise some of their ideas to suppliers and partners (Chesbrough 2003a).

Investments: The decision to take forward an idea is likely to be accompanied/followed by investments in preparatory activities. Firms may invest in hiring people, with particular skills or experience or in the development of such skills by existing employees. They may set up internal R&D projects or communities of practice or they may acquire entire firms or business units. Such investments are made to bridge the ‘gap’ between existing competences/resources and an end goal. The capability literature has convincingly showed that learning requires investment (Bell 1984).

Knowledge: The software industry is knowledge-intensive with a few relatively modest needs for capital equipment. Investment decisions are therefore typically related to some form of knowledge acquisition, where new knowledge (at least to the firm) is required to meet a goal. However, not all knowledge requires investment. Codified knowledge may be widely accessible whereas tacit knowledge requires at least some type of mechanism of development and sharing. Knowledge may become embodied in people, in technology and in organisational arrangements.

It is commonplace to distinguish between internal and external sources (Lauridsen 2006; OECD 2005). However, for the purposes of this study, it is useful to consider also the types of internal and external sources with respect to one central aspect, namely, their relation (or unrelatedness) to customers/clients. The framework therefore considers both dimensions, as shown in Table 3.7. This table provides examples of literature that has tended to emphasise the importance of the respective quadrants for knowledge acquisition or other inputs.

Internal client-facing sources/units: The KIBS literature (Strambach) tends to emphasise learning in client-facing project teams. Learning is cumulative, linking learning in one project with the application of capabilities in later projects (leveraging). Other literature has emphasised the role of the sales departments, such as their participation in trade fairs.

Other internal sources/units: R&D efforts in permanent dedicated departments are typical sources of knowledge in many industries. However, internal sources within the enterprise may also be more of a non-R&D, temporary nature, for example a

Table 3.8 Sources of inputs into events

A. Internal client-facing sources	<ul style="list-style-type: none"> ● Prior or other projects ● Project team ● Sales ● Other
B. Other internal sources	<ul style="list-style-type: none"> ● Non-R&D knowledge creation and knowledge management unit ● R&D unit and activities ● Strategic units and initiatives ● Other
C. External client-related sources	<ul style="list-style-type: none"> ● Customers ● End-users ● Third-party collaborators ● Other
D. Other external sources	<ul style="list-style-type: none"> ● Backward-link sources ● Horizontal-link sources ● R&D institutions ● Other

Source: This chapter. Note that the exploratory nature of the study makes feasible the open-ended nature of the framework, including the inclusion of the 'other' category under each type.

workshop established to solve an immediate technological problem or capability gap. The capability literature has emphasised the role of engineering and quality departments and the role of activities such as training and 'change' activities. Newer literature has emphasised the role of knowledge communities and knowledge management programmes aimed at sharing and utilising knowledge within the enterprise. Strategic units or initiatives – senior management and innovation schemes – may also play a role.

External client-related sources: Because this study deals with an 'outsourcing industry', the role of the buyer (forward linkages) is presumed important (Segelod and Jordan 2004). This category also includes end-users and third-party collaborators that interact with buyers as well as suppliers. Firms may benefit 'passively' from the interaction with buyers as they acquire knowledge and experience in different buyer domains. Presumably this is important in the software industry as information requirements are typically high. On the other hand, firms can benefit 'actively' when buyers invest in supplier capability through different types of progressive support.

Other external sources: There is a multitude of ways in which firms may use external sources. They may be categorised as backward-link sources (such as providers of embodied technology, including software tool providers or providers of KIBS) or horizontal linkages (competitors or alliance partners) or R&D linkages may be formed with research institutes or universities. Finally, a range of other possible sources includes general open information sources such as knowledge from manuals, textbooks or web resources.

In order to explore the potential dynamics of learning in global supply platforms, it is necessary to subdivide external linkages further by geography. This study makes a simple distinction between *local linkages* and *global linkages*. The analysis of

sources can draw on the framework shown in Table 3.8. It is important to note, however, that each of these combinations can contain multiple linkages. For instance, global linkages for knowledge in a particular innovation process may connect to a customer, a standards-setting body and a university department abroad.

3.2.1 Software firms as KIBS – the interaction with customers

Software suppliers, like other KIBS firms, often develop their solutions in close interaction with the customer. As is typical of KIBS, innovation may focus on this interaction as much as on traditional product and process characteristics (Miles 2004). Some authors have invented new concepts such as ‘servuction’ (i.e. services production) to put emphasis on the relation between services firms and their buyers in the services innovation process (Gallouj 2002).

However, this does not mean that supplier firms do not undertake innovation activities independently of customer interaction. These activities sometimes take the form of ‘R&D’ typically undertaken in specialist units in supplier firms. In the field of software for business process improvement, for instance, suppliers may engage in activities to define frameworks and models for business process modelling or next-generation enterprise software architecture. In the field of software for new product development, suppliers may engage in ‘IP development’, typically the creation of proprietary software that enables various forms of functionality (e.g. wireless local area network – LAN) in customer products. Such independent innovation activities may indeed feed into the buyer’s innovation process at a later point. Thus, the sale of a software product or solution – even when customised – may rely on such prior independent in-house R&D efforts and investments. Other innovative activities may be organisational in character, performed independently of customer interaction. In order to conceptualise the interaction process with customers, this study uses the following vocabulary:

- *Extraction* occurs when the supplier can make use of knowledge developed in a specific customer relationship for purposes that are more general. This is also referred to as knowledge harvest.
- *Consolidation* occurs when the company seeks to integrate the knowledge harvest and accumulated experience into the ‘original’ knowledge base and prepare it for general use. This occurs when the firm integrates new knowledge into frameworks and routines.
- *Application* occurs when the firm reapplies consolidated knowledge in new customer settings. For instance, providers of customised business software services integrate different stocks of knowledge and tailor them to customer needs in discrete projects.²⁷

When KIBS providers apply consolidated knowledge in new customer settings they contribute to the innovation process of the buyers of these services (Strambach 2001). In this way suppliers leverage competences across different customers. This is a central feedback mechanism from the KIBS industry to the

²⁷ This vocabulary is akin to what Strambach (2008) refers to as contextualisation, de-contextualisation and re-contextualisation. This part of the conceptual framework draws heavily on her work.

buyer industries. Indeed, co-evolution of capabilities and demand is apparent in most KIBS industries (Strambach 2009 forthcoming).

In order to unpack this dynamic it helps to distinguish between direct and indirect feedback mechanisms. *Direct feedback* mechanisms transmit in a straight line between suppliers and buyers, as the former develops customer-specific competences and the comfort level of the latter rises. This widens the range of options for further outsourcing at the unilateral level. *Indirect feedback* mechanisms are the external effects of increasing supplier capabilities at the multilateral level. These create new options for the 'demand base' as a whole. This means that openness and outsourcing that are initially practised by only a few firms may therefore set in motion a co-evolutionary process, in which supply and demand are recursively moving towards higher-level activities at the aggregate level.

3.3 Researching the supply and demand sides

Empirical research on the supply side involved four main elements: (1) the definition of business segments; (2) firm sampling within these segments; (3) selection and analysis of firm-level innovation events; and (4) 'backtracking' the sources and linkages involved in the innovation process.

3.3.1 Defining business segments

As discussed in the previous chapter, quantitative indicators of innovative capability in software firms are not easily constructed (Rousseva 2008). A key assumption that has guided much of the literature on the Indian software industry is that 'non-innovative software services' versus 'innovative software products' is a key distinction.

The emphasis given to the distinction between services and products originates from pioneering studies of the Indian software industry (Heeks 1996; Subramanian 1992). These studies came out at a time when there was a big difference between body-shopping (staff augmentation) services and the development of so-called packaged software products. This led to the characterisation of the Indian software industry as 'dual sector'.

The approach taken in this study is that the distinction between 'services' and 'products' is unsustainable as an analytical basis for the study of innovation capabilities in the industry. In order to deconstruct the old distinction, the first step is to recognise that software is a *services* industry in the conventional use of the term. The distinction between services and products is vanishing within the global software industry. Today products are rarely 'packaged'. Rather they are provided on a 'software as a service' (SaaS) basis (www.salesforce.com is one of the best examples). On-demand software has been increasing along with corporate IT infrastructures that adopt service-oriented architectures.²⁸

28 The discussion in subsequent chapters will show that the distinction between products and services is blurred. This is because many activities combine elements of standardised reusable artefacts (including own or client 'products') with customised services. For instance, providers of licensable products generate substantial revenues from customisation services. Conversely, certain firms in the custom application development (CAD) business line deploy proprietary frameworks (service products) in the service provision process.

Table 3.9 **Business lines examined in this study (by segment)**

Business process software services	Product development software services
Custom application development (CAD)	Engineering services outsourcing (ESO)
Independent testing services (ITS)	Outsourced product development (OPD)
Infrastructure management services (IMS)	Made in India products (MIP)

The second step required is to find an analytically useful way of reducing the complexity of the rapidly growing Indian software industry. The industry has become highly differentiated and the activities undertaken by firms are correspondingly diverse.

Since 2006 NASSCOM has used two main categories: 'IT Services' and 'Engineering and R&D Services, and Software Product Exports' (NASSCOM 2006b). NASSCOM's categories are a step in the right direction from the previous crude distinction between services and products, but they are insufficient for analysis in this study. The reason is that they derive from a narrow focus on suppliers. An important issue that arises is then how to construct categories for empirical investigation. The study defines a new vocabulary that considers the user perspective. It links the activities of suppliers to software demand as discussed and categorised in the previous chapter. The study of forward linkages (i.e. the demand side) informed the definition of business segments. The definition of segments builds on the observation that two main types of activity drive software demand: (1) business processes improvement activities; and (2) new product development activities (as mentioned in the previous chapter).

The approach taken in this study was to define two main software segments.

- *Business process software services* (BPSS) concentrate on software for business processes, typically provided to IT departments in customer firms or organisations.
- *Product development software services* (PDSS) concentrate on software that relates to the product development process in customer organisations, typically provided to R&D or engineering departments.

Business segments are meso-level categories introduced to replace the 'old' services/products distinction, while also reducing the complexity associated with a large number of business lines. This study examines three business lines in each segment (see Table 3.9).

3.3.2 Sampling

The purposive selection of a sample of 12 Bangalore-based IT software service suppliers used two main criteria. This was the identification of innovation-active firms and the representation of different business lines.

The sample represents Indian-owned firms rather than subsidiaries of multinational firms. The aim of the study is to examine the dynamics of offshore 'innovation outsourcing' to Bangalore. Hence, the focus is on independent Indian

Table 3.10 **Sample firms – primary business lines**

Business lines	Primary focus	Additional focus
1. Custom application development	Infosys, Wipro, MindTree, M-Tec	
2. Infrastructure management service	Microland, Wipro	Infosys
3. Independent testing services	RelQ	Aztecsoft, Infosys, Wipro
4. Engineering services outsourcing	Encore, Sasken	Infosys, M-Tec, Wipro
5. Outsourced product development	Aditi, Aztecsoft	Infosys, M-Tec, Wipro
6. Made in India products	Cranes, Liqwid Krystal	Infosys

IT software service providers.²⁹ Firms of varying sizes were included to avoid the inevitable biases associated with studying either only the giants (e.g. Infosys and Wipro) or only the contenders. Table 3.10 shows the sample firms according to their primary business lines. As seen, these divide equally, with six firms operating primarily within each of these segments.

The aim was to select a sample that could provide an insight into how the two main segments have evolved. As seen in Table 3.11, the size range in terms of employees is vast. To some extent, this is associated with the age of the firms, but it is also dependent on the labour intensity of the main business lines.

A key aim was to identify firms representing ‘the vanguard’ rather than the total population. The purpose of this criterion was to increase the relevance of the sample to the central issue, namely the transition from production to innovation activities in Bangalore.³⁰ The procedure is in some ways akin to Schumpeter’s (1982) approach to the analysis of the ‘circular flow’ which, in the absence of innovative activities, leads to a stationary state (lock-in). He argued that in order to understand how circular flows are broken over time, what matters is what the pioneering entrepreneurs and enterprises do. In this vein, the sampling strategy targeted innovation-active firms. Such firms are defined in the Oslo Manual (OECD 2005: 59) as ‘one that has had innovation activities during the period under review, including those with ongoing and abandoned activities’. The ‘period under review’ in this study is the five years between 2001 and 2006 and the study considered firms that had engaged in at least one ‘innovation event’ in this period. All sample firms fulfil this criterion.

By focusing on the vanguard (innovation-active firms), the sample firms are ‘critical cases’, i.e. cases that have strategic importance in relation to the general problem (Flyvbjerg 2006). This is because if the adoption of open business has an identifiable influence on the build-up of innovative capabilities in India, we would

29 However, several of the firms included in the sample are partly owned by foreign venture capital firms and/or have issued foreign shares. Incidentally, two firms were acquired by US services firm EDS during the period under review. In one case (RelQ), this happened after data collection was completed.

30 Other studies concerned with related issues have constructed samples according to a grading of capability levels *a priori* (Hobday *et al.* 2004). No published material could provide the foundation for such a grading in this case.

Table 3.11 **Sample firms**

Name	Established	Engineers employed	Ownership
Infosys Technologies	1981	43,441	Listed
Wipro Technologies	1946	26,184	Listed
Aztecsoft	1995	4,517	Listed
MindTree Consulting	1999	3,000	Private
Sasken Communication Technologies	1989	2,575	Listed
Microland	1989	1,600	Listed
RelQ Software	1998	700	Private
Aditi Technologies	1994	650	Private
M-Tec (Kshema Technologies)	1997	500	Private
Cranes Software International	1991	310	Listed
Encore Software	1990	100	Listed
Liqwid Krystal India	1999	50	Private

Source: NASSCOM (2007a) and interviews.

Note: M-Tech and RelQ were acquired by MphasiS/EDS in 2006 and 2004 respectively; the number of engineers employed is the figure before takeover. All listed firms are listed in India; several have additional listing in the USA.

expect to find it in the vanguard. Conversely, if it does not have an influence on this group, we may reasonably suggest that the opening of business models in the West has a limited influence on the population as a whole.

3.3.3 Identification and analysis of innovation events

As an extension of the sampling strategy described above, the research sought to identify not only innovation-active firms, but also the most important innovation events within those firms. The purpose was to concentrate data collection around highly developed occurrences of innovativeness with a particular emphasis on innovation events that had considerable importance in changing what the firm did, thus maximising the value of the information collected in order to understand the process of learning.

A gatekeeper informant with a good overview of the company (such as a firm founder, chief executive officer (CEO) or other senior manager) was asked to identify the most important 'innovative events' in the firm over the last five years. With reference to the definition of innovation, these events were defined as innovations that enabled the firms to do or provide something new (or do something better) which it could not do before and which had improved the firm's competitive stance. These informants thus produced a shortlist of innovations or innovative activities (of varying lengths) that were new to the period 2001–06. The informant was then asked which three of the events he or she considered the most 'important' and the further study followed this choice. However, the shortlisting process gave broader insights into innovative activities in the firm.

Table 3.12 **Events – distribution between business lines**

Business line	Firms	Events (code names)
Custom application development (8)	Infosys	CIMBA Influx Tools Group
	MindTree	Sales Tool System TechWorks
	M-Tec	B/OSS COMPASS
	Wipro	Lean Software Factory
Independent testing services (4)	Aztecsoft	I-Test
	RelQ	AssesQ RelQ Online Verticalisation
Infrastructure management services (4)	Microland	CIO Dashboard Solution IT Security Consulting Network Management System
	Wipro	Global Command Centre
Engineering services outsourcing (8)	Encore	VoIP solution Wimax solution
	MindTree	3.3.4 Bluetooth solution
	M-Tec	Build-Operate-Transfer
	Sasken	Botnia Hightech Multimedia Subsystem Symbian Competence Centre
	Wipro	Ultra Wideband solution
Made in India products (7)	Cranes	Global Marketing Network NISA SYSTAT
	Encore	Mobilis
	Liqwid	Codesaw gyanX rRapidSuite
Outsourced product development (5)	Aditi	Digital Music Distribution Platform Mifos Product Transformation Services
	Aztecsoft	ETL Tool Marketing campaign

In almost all of the cases this process was structured and straightforward. There seemed to be no difficulty for managers to produce a shortlist. However, in some firms only one or two events stood out to the manager as particularly important. The reason for asking for three events was, nevertheless, to gain some variance in innovation types in the empirical material. In larger firms the problem was of an inverse nature. Here the gatekeeper informants found it difficult to choose three out of the shortlisted events. In large firms such as Infosys and Wipro, many events got onto the shortlist. Thus, a certain element of arbitrary selection was associated with a strong dependence on the gatekeeper's inputs.

The main investigation period is the five years between 2001 and 2006. The 36 innovation events occurred within this time-frame (although the 'beginning' of an innovation event can sometimes be difficult or impossible to establish). However, in examining the trajectories the study uses a longer time perspective. The guiding proposition is that the period under review was an inflection point in the process of capability building, with an increasing shift from production to innovation capability. The five-year 'window' is suitable for two reasons: (1) the reliability of respondent statements is likely to decline if one traces further back than five years; and (2) the literature indicates that innovation in Indian software firms was limited before this period. However, adopting this window does not mean that the study ignores developments prior to 2001. Rather, the reconstruction of innovation events, the related innovation process and the mobilisation of capabilities go back as far as necessary.

The 36 events are shown in Table 3.12. The analysis presented in this study is concerned with both the examination of patterns among events and the deeper examination of particular events. Insights emerged from the examination of the processes, sources and outcomes of each individual event, and from the analysis of events against the contextual backdrop of segment-level trajectories.

Events may reveal why learning took a particular direction at a particular inflection point. Moreover, from a methodological perspective, the advantage of the events-based approach is that the unfolding of these events may disclose wider patterns that appear less articulated elsewhere. In other words they may carry 'diagnostic qualities': 'A diagnostic event is, of course, not generalizable in itself, but it gives hints to certain patterns of processes which could and should be looked for' (Lund 1994). This rationale led to the choice of sample vanguard supplier firms and activities (not typical supplier firms and activities). The study did not actively seek 'paradigmatic cases' (Flyvbjerg 2006),³¹ but the analysis of events enabled the development of insights and categories describing broader 'emerging paradigms' associated with the key segments and business lines examined in this study.

3.3.5 Backtracking: examining event-level sources and linkages

The 'backtracking' process was particularly concerned with understanding the role of different internal and external actors in bringing about a particular event (who did what). It involved the retracing of the innovation processes and the sources

31 A paradigmatic case is an 'exemplar' or 'prototype'.

involved. This required a further analysis of the innovation resources flowing through these internal and external links.

Building on the framework described in the previous chapter, the analysis of capability formation therefore concentrated on the combination of resources (ideas, investments and knowledge) and levels (internal, local and global). It is important to note that for the sake of simplicity this study defines local linkages as those occurring between organisations within India (rather than within Bangalore).³²

Respondents were then asked to assess the importance of each level for each type of resource. Each level could either be deemed relevant (of some importance) or irrelevant (of no importance) with regard to a particular resource. Respondents then ranked the 'relevant' levels in order of importance. Viewed in this way, a maximum of nine types of linkages can be 'relevant' in the innovation processes.

Focusing on particular events was a way to focus on what the firm 'did' rather than what they 'said'. Open-ended questions about innovation inevitably resulted in a sales pitch. The focus on particular events was therefore useful. It meant that questions were specific; and the interviewing of different people about the same event increased the level of certainty. Overall, more than 100 interviews were conducted in India during the last six months of 2006 and the bulk of these interviews related directly to these events.³³

There were few major difficulties in backtracking internal linkages, but tracing external linkages was not as easy as had been envisaged from the outset. Where possible, information on these external linkages, not only from case firm informants, but also from additional material such as company documents, annual reports and press reports was obtained. However, the most important source was interviews with linkage partners (or other people with specialised insights). Customers were a key category in this regard, and this required research on the demand side, mainly outside India.

3.3.6 Researching the demand side

As mentioned, sample selection at this stage took a 'bottom-up' character as the innovation linkages identified in India aided the identification of demand-side actors. This element of backtracking on the demand side was of critical importance to the research presented in this study. It allowed for the identification of customers and the examination of the role of open business models.

The demand for software is highly heterogeneous. At an abstract level, the demand for corporate software has two sources: business process improvement or product development:

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- 32 The (ir)relevance of linkages specifically within Bangalore was also examined but not included in this study because the findings were not affected.
- 33 Interviews were also conducted with relevant organisations such as the Department of IT in Karnataka State and NASSCOM as well as with other private sector firms with relevant insights. A list of informants is included in Lema (2009b)

Table 3.13 **Classification of buyer firms/sponsor units in the sample**

Industry	Description	Typical sponsor unit	Shorthand
<i>Primary software industry</i>	Providers of software products and services; product development or project teams	Project Team	ISV
<i>Secondary software industry</i>	IT departments in sectors such as automotive, education, healthcare, publishing, services and technology	IT Department	ITD
<i>Telecom and electronics industry</i>	Product development units that use hardware enabling or embedding software	R&D and engineering departments	ETF

- *Business process improvements* (BPI) typically relate to new ways of organising in-house processes or to relationships with external partners. Examples include new customer relationship or logistics management, or new ways of organising IT systems as firms shift to service-oriented architectures (SOA). Such changes typically involve new software systems provided by an in-house IT department or external providers of customised software solutions (or both).
- *Efforts in new product development* (NPD) differ according to the profile of the buyer firm and sponsor organisation. Two types of product development are important for the analysis of software outsourced to India, both in the field of IT. Primary software industry firms are concerned with developing new software products, whether these are of the old 'packaged' type or whether they are 'software as a service' (SaaS) products provided online. Electronics and telecom buyers engage in the development of new hardware products, although these are often software-intensive and include so-called embedded software.³⁴

Firms specialised in software development (the primary software industry) are services firms. However, software development also occurs within IT departments of firms operating in other sectors of the economy (the secondary software sector). Customers in the software-outsourcing industry belong to both the primary and the secondary software industry.³⁵ The 'demand base' for outsourced software services is therefore very diverse. The buyers are IT departments, engineering departments, R&D departments, or product development teams (referred to as sponsor organisations) that use software services to build products or provide solutions for in-house or external use. The nature of the demand for outsourced services therefore varies with the types of sponsor organisation and their roles. The first step in constructing the buyer sample was to assemble a base of named customers, divided into the three categories shown in Table 3.13. The actual sample is shown in a later subsection.

34 BPI and NPD processes are therefore not necessarily software processes as such, but they form the setting for software use.

35 The Indian software producers examined in this study belong to the primary software industry.

Table 3.14 **Offshore buyers (named customers)**

IT departments	Independent software vendors	Telecom and electronics industry
Addison-Wesley	Atari	Epson
General Electric	Embarcadero	Kaga Electronics
General Motors	Microsoft	Nokia
GlaxoSmithKline	PassAlong Networks	NTT DocoMo
Grameen Foundation	SPSS	Motorola
Novartis		Symbian
Thomson		VeriSign
Toyota		
Volvo Group		

Note: Non-disclosure agreements prevent us from disclosing information about and names of certain buyers.

However, it is necessary to provide some further information about the 'population' (the customer base) from which the sample was drawn during the research process. Customers can be divided into named and unnamed firms/organisations. Table 3.14 shows a list of named customers by the buyer segments. The buyer sample is drawn from this list and the purpose of showing this list is to give the reader an impression of the types of firm in each segment.

Unnamed (non-disclosable) customers could not be considered for sampling, yet information about these customers has also informed this research. They can be subdivided into (1) customers named for purposes of research but which could not be included in any written material, and (2) customers not named at all but mentioned as 'a customer' during interviews.

The list in Table 3.14 is therefore incomplete and does not reflect the total base of relevant customers. As a reflection of the sales profile of Indian software suppliers, the list includes mainly buyers outside India.³⁶

Even though such a base of named customers was established it was not easy to gain access.

3.3.7 Access on the demand side

The demand-side 'population' consisted of customers mentioned as 'important' for supplier firms in relation to their own change events.³⁷ Ideally, the backtracking exercises should include interviews with all customers (and other actors), but in practice this was impossible for two reasons: (1) time and financial resources for

36 The list also includes Indian software firms that have served as customers for other software firms.

37 It is useful to contrast with the methodological strategy of Quadros (2008) who studied the effect of ODIP in the Brazilian auto industry, focusing on multinational corporations. The entry point for analysing these processes was 'top-down' in the sense that the processes were identified through the lead firms' activities. With this strategy, he was able to trace the effects of ODIP in subsidiary auto assemblers and original equipment manufacturer (OEM) suppliers through to their networks of subcontractors. In the present study, though, the primary entry point was 'bottom-up' since events and related ODIP processes were identified through the supplier.

Table 3.15 **Buyer sample**

Client firm	Sponsor	Location	Case of outsourcing	Type
Auto manufacturer	ITD	Sweden	Customer relationship management sales tool for trucks	CAD
Electronics OEM firm	ETF	Japan	Bluetooth baseband integrated circuit	ESO
Independent software vendor	ISV	USA	Exact transform and load data warehousing tool	OPD
IT publisher	ITD	USA	Digital workspace value-added service	MIP
Internet services provider	ITD	USA	Billing and operations support solution	CAD
Mobile phone software systems provider	ISV/ETF	UK	Build-operate-transfer and innovation partner programme	OPD
Non-profit organisation	ITD/ISV	USA	Management information system for microfinance	OPD
Online digital media provider	ISV	USA	Online retailing system	OPD
Statistical software vendor	ISV	USA	Product divestment	MIP
Technology and services provider	ITD	USA	Chief information officer dashboard	IMS
Telecom firm	ETF	Finland	Supply chain reconfiguration	ESO
Transportation services firm	ITD	USA	IT system re-engineering	CAD

Note: Firms listed alphabetically by type; many sponsor organisations are wholly owned subsidiaries. ETF = Electronics and Telecom Firms (R&D departments); ISV = Independent Software Vendor (primary software industry); ITD = Information Technology Department (secondary software industry).

this study were limited; (2) the negotiation of access to customers proved particularly difficult.³⁸ Therefore, the selection of 12 buyer firms was strategic as well as pragmatic.

With regard to *strategy*, one of the key hypotheses that inform this research is that changing modes of outsourcing has important effects in the supply base. In particular, innovation outsourcing (ODIP) is likely to have ramifications. When thinking about the relevance of ODIP processes, two key distinctions emerge. First, one can distinguish whether intra-firm or extra-firm actors were the primary drivers of the supplier innovation event. In practical terms, this involved focusing on the 'idea' and then looking at 'who' mainly brought this idea forward. Second,

38 As formulated by Anthony D'Costa: 'Software firms are notorious for not sharing information because of disclosure clauses they have with clients' (personal correspondence).

one can distinguish whether the domain of change was mainly within the firm or outside the firm (e.g. a customer). Clearly, if mainly intra-firm actors drive an innovation event and the domain of change is within the firm that event is unlikely to be related to ODIP. The potentially relevant innovation events for investigating the direct relevance of ODIP are events in which extra-firm actors are key drivers of events for which the main domain of change is external. Such events were sought for inclusion in the sample.

However, with regard to *pragmatism*, the difficulty of gaining access to customers meant that in order to get a substantial base of informants, all opportunities were pursued. Therefore, the partner sample is less than perfect. It proved easier, for instance, to follow up on customers of small firms rather than customers of large firms. Larger firms tended to have more ingrained procedures and rules with regard to disclosing information about partners and customers. Ultimately, issues of pragmatism overtook issues of strategy. While not ideal, the process did generate substantial information that is relevant to the discussion about ODIP.

3.3.8 Buyer sample

The buyer-side sample of 12 firms consists of buyers from the list in Table 3.14. Table 3.15 shows the final sample of buyer firms. The focal point in each case study was on the project in which innovation outsourcing to India occurred.

As seen in Table 3.15, buyer organisations are located across a range of OECD countries. Most buyer firms were therefore interviewed by phone. However, European buyers were interviewed face to face. In three of the buyer firms, it was not possible to interview informants within the organisation directly. In these cases, the empirical work relies on other informants (industry experts and people previously employed in customers' firms) and written documentation.

As will be discussed further in the concluding chapter, this study has limitations. The 'both sides' research design (buyers and suppliers) could only be pursued imperfectly as data collection was asymmetrical: the supply-side information is richer and more voluminous than the demand-side information. However, information provided by suppliers was also often useful in understanding processes of corporate restructuring and strategy on the demand side. Whereas suppliers sometimes gave a 'sales pitch' when talking about their own firms, information provided on customer firms was usually more frank (divulging information about problems). Many of these informants had typically worked very closely with these customers and had sometimes worked within them for months or even years as a part of ongoing projects.

In later chapters, indicative buyer-supplier cases are examined. These relationships were chosen in order to 'represent' each of the three buyer segments. The aim is to examine and show how types of buyers use outsourcing practices that have differentiated consequences with regard to the 'space' for innovation that accrues to suppliers. There are specificities attached to any relationship, but the cases were chosen to increase the 'indicative' value.

In Chapter 5 the study focuses on three particular buyer-supplier relationships. These relationships were chosen in order to 'represent' each of the three buyer

segments. The aim is to examine and show how types of buyers adopt open business models, how they differ and how this has differentiated consequences with regard to the 'space' for innovation that accrues to suppliers. There are specificities attached to any relationship, but the cases were chosen to increase their 'indicative' value.

3.4 Summary

This chapter has sought to build conceptual frameworks for the analysis of the various elements involved in the co-evolutionary framework introduced in Chapter 2. The collection of data started on the supply side for mainly practical reasons. However, this sequence also had a methodological advantage. Starting with the 'dependent variable' reduced the danger of a mono-causal research design, focused narrowly on a particular independent variable (Sayer 1992). The research did not begin with the open business model hypothesis and the aim of testing this in a binary manner. The examination was more open-ended, designed to be sensitive to different (contingent) factors involved in the capability-building process. With the use of this bottom-up approach, the study reduced the risk of false attribution. Rather than studying open business models in isolation, this research sought to examine the relative importance of open business models as well as the other contingent factors involved in capability building. The opening of business models may create new spaces for supplier firms to occupy. However, the study of open business models cannot explain (in itself) why and how developing country firms become equipped to take on new roles. This commands interconnected empirical research covering both sides. Such 'both sides research' (examining suppliers as well as buyers) and the analysis of six different business lines in software outsourcing involved a very high level of complexity. This chapter has sought to explain the key steps taken in reducing this complexity and the empirical basis of the analyses.

4 The opening of business models

A key driving hypothesis in this study is that the adoption of open business models has important implications for sponsor organisations in areas concerned with their software development and production. This has, in turn, led to the outsourcing of (opportunities for) innovation by suppliers. This chapter examines the business models of these sponsor organisations, particularly their changes and the determinants. Furthermore, it initiates the discussion of how business model changes relate to the restructuring of value chains.

This chapter contrasts three different groups of software buyers. These are:

- IT departments (the secondary software industry);
- Independent software vendors (the primary software industry);
- Electronics and telecom industry firms.

The chapter reviews the insights generated from the examination of five IT departments in the secondary software industry (Section 4.1), four independent software vendors in the primary software industry (4.2) and three electronics and telecom buyers (4.3). These sections are concerned with whether or not these (non-random) buyers are associated with wider aspects of business behaviour – aspects summarised in this report as the adoption of ‘open business models’. In the concluding section, the chapter then seeks to summarise the findings (4.4).

4.1 IT departments

Internal IT departments – the secondary software industry – represent by far the most important group of buyers in terms of sales from the Indian software industry. Such departments have emerged as suppliers of IT services to their ‘host companies’ in a diverse range of sectors. IT departments are mainly concerned with customisation and client-specific solutions.³⁹

The Indian software industry is benefiting from an overall increase in aggregate IT spend of these companies, but even more important is the relocation of corporate IT budgets from internal to external spending (NASSCOM 2006b: 426). IT departments are typically buyers of custom application development (CAD), the largest business line in India. In contrast to the two other categories of buyer, the software outsourced by IT departments is typically not included in the products and services sold in the market by host companies. This type of software outsourcing is typically for internal consumption, what Flowers (2007) calls ‘buy-to-use’ outsourcing, not in the IT departments but in their parent organisations.

39 Internal IT organisations can be thought of as dependent software vendors (DSVs). However, a substantial base of independent IT consulting firms that provide customised services is also present in the segment (such as Accenture, EDS and IBM to name some of the largest ones). These may engage in competitive as well as collaborative relations with DSVs.

4.1.1 Auto manufacturing firm

The first example in the IT department category is the case of a European auto manufacturer. The IT department had gone through a major phase of transformation when the firm acquired a number of other auto-manufacturing firms. Following these acquisitions, a new consolidated IT organisation emerged. The parent firm gave the IT department autonomous status along with an instruction to make a profit. The IT department was still a captive subsidiary of the auto firm, but it now had to compete with other IT services suppliers for contracts within the auto group and for external contracts. Through these changes, the IT department was given an innovation mandate. It was encouraged to take on more strategic initiatives and become proactive in its offering of innovative solutions. This meant that the IT department was expected to provide not only technical solutions but also business-improving initiatives. This entailed a deepening of customer- and domain-specific competences. In this way, management was encouraged to redefine the business model – not of the parent company but of the IT department itself.

The department was under tougher financial pressure and needed to define a distinct value proposition to its internal and external customers. This involved a more focused concentration on ‘business tasks’ along with an increased reliance on contractors for the technical deliveries. However, within a short time-span this firm developed a particularly deep relationship with an Indian provider, sharing risks and burdens both ways. This organisation was very explicit about the role of knowledge spillover as a necessary condition for success in the new business model. This allowed the Indian supplier to become centrally involved in knowledge-generation activities in flagship projects. One of these was the CRM Tool for Trucks, discussed in more detail in the next chapter (Auto IT). In this case, the changes in the IT department emanated directly from the parent organisations. While these wider changes are beyond the scope of the study, the key insight is that the sponsor organisation (IT department) had adopted key elements of an open model.

4.1.2 Internet infrastructure solutions provider

The internet infrastructure solutions provider represents a similar but more cautious approach. The key imperative for opening business models arose from a diminished capacity in one of its technology areas: a Billing and Operations Supports Solution (B/OSS). This specific area faced a crisis because key personnel had moved to other areas of the firm and the skills/capacity shortage was then exacerbated by ‘burnout’ (employees taking leave or leaving the company entirely due to stress) as the remaining staff were faced with an increased workload. However, the technology area was still important to the company and this created an incentive to embed third-party resources in their business model. Interestingly, however, the changes in the sponsor organisation were enabled by its long-term dealings with an Indian provider. Initially this sponsor organisation acquired only staff augmentation services from India. This buyer deployed supplier resources (i.e. staff) related to the B/OSS, but had exclusively managed previous projects. However, staff augmentation work on the legacy OSS and related assignments had given selected supplier employees’

valuable experience with the system. This became crucial when the OSS needed 'an upgrade' (a billing system for next-generation services) at a time when most of the people from the original in-house development team had left the company or were engaged in new areas. For this reason, a cross-organisational team from the buyer and the supplier defined requirements for the new systems jointly. On this basis, the supplier developed the specifications documents, and the buyer then approved these. The supplier undertook and coordinated the remaining stages in the software development lifecycle independently.

It was the development of system-specific knowledge – developed incrementally by the supplier – that enabled the sponsor to readjust its business model in an entire technology area. Furthermore, the supplier could also draw on its architectural capabilities developed in other client settings. As the example illustrates, and as will be discussed further in later chapters of this study, the systemic inclusion of external resources into the business model reflected the deepening of outsourcing relationships. The sponsor organisation's innovation challenge was not 'technical', but it was related to the successful change of the model itself, enabling the firm to create value by leveraging external resources in this technology area. This required systematic and deliberate knowledge transfer to the supplier.

4.1.3 IT publisher

The examples provided above show how some buyers are opening backwards to suppliers directly. However, a more general adoption of an open business model can sometimes be detected. The US publishing house is a key publisher of books for information technology professionals. An important element in this firm's shift to increased openness was the establishment of revenue-sharing agreements with alliance partners. It established an online portal and coordinated the pooling of its own material with material from other alliance partners. This was one element in a new strategy for strengthening the competitive advantage in the market for IT and software development literature. Another element was to take the business where the users are – online. The firm had realised that it needed to connect more directly with users. In order to strengthen the forward linkages it aimed to bring an innovation to the market: online experimental and interactive learning solutions. However, developing this in-house was not an option. The company had previously been experimenting tentatively with developing a code library, intended as a learning resource for customers. However, it did not put this to use because it did not work. Although the buyer is a publisher of books on software, its key strength did not lie in practical software development as such. In other words, there was not the required stock of in-house development capabilities. However, the buyer was able to take the next step when the supplier, offering its turnkey online learning solution, approached it. The new Digital Workspace Value Added Service enabled users to take smaller pieces of code and then extend it as a 'coding experience'. According to the buyer, this solution was not easy to develop because it required a deep understanding of the programming technologies themselves. The buyer did not see alternative solutions in the market because there were no competitors offering comparable features. During a period in which the buyer actively marketed the solution, the collaboration between the companies was close. The supplier quickly added new features needed by the buyer, such as

online assessment (skills tests). It initially marketed the solution with great enthusiasm; it heavily promoted the solution and offered it with around 50 book titles. One of the key potential advantages of this solution was that it enabled the buyer to get closer to the customers. The publishing house mostly sells its books through retailers. However, with this solution, it was able to reach these users directly; users which the publisher would not otherwise have access to and which it could possibly 'persuade' to move from paper products to online products. However, subsequent reviews showed that the solution did not generate the amount of activity that it had anticipated. From the buyer perspective, the outcome was disappointing but from the supplier perspective, the open business model created space in which it could deploy, deepen and demonstrate its innovative capability.

4.1.4 Technology and services conglomerate

In most cases, it is overly simplistic to assume that a firm has only one guiding business model. Different divisions of a firm may have different business models. Cases described above have also highlighted this. However, in no case is this clearer than in the large US technology and services group. Despite this, there are cross-cutting trends at the overall organisational level. For instance, the group is renowned for its active stance towards outsourcing and offshoring to India. It has become an ingrained part of its business practices across a wide range of domains. In the late 1990s, it consolidated most of its shared business process service functions in a wholly owned Indian subsidiary.

This subsidiary transformed the main IT department from a cost centre to a profit centre, forced to compete for internal and external contracts.⁴⁰ This spin-off company caters for most of the business process needs, but some of the group's information technology needs are coordinated by an in-house shared services division headquartered in the USA. This division is responsible for managing the infrastructure of many business units across the world. The organisational model of this unit has undergone substantial change – with the help of a Bangalore-based supplier – to a point at which it is almost a 'virtual organisation' with little actual technical capacity in the field of IMS.

A key milestone in this transformation of business model was provoked when internal customers pushed for increased transparency in IT infrastructure management services. The sponsor turned to its Indian supplier of IMS to develop a CIO Dashboard. This dashboard now reports the status of the entire fleet of systems at all times, including related supplier activities, and provides near symmetrical information levels between users (chief information officers (CIOs) across the world), the sponsor organisation (in the USA) and the supplier (in India). This allowed the supplier to become wholly responsible for IMS while the sponsor organisation has taken on a new role, functioning mostly as a relationship management organisation.

40 This subsidiary provided customer services, finance accounting and analytics. In 2004, it sold a majority stake to private equity firms.

4.1.5 Transportation services company

An example of an extensive business model transformation is that of the US transportation services firm. Despite increasing use of IT in all of the company's undertakings, the IT department in this firm remained at a stagnant size. It focused primarily on basic helpdesk functions, with very few software development activities. While this had worked well for a number of years, changes were needed for a more radical business transformation envisaged by the firm's management. In 2003, this company made a decision to make a major shift in its business model to strengthen its position in the third-party logistics (3PL) market. In this business the transportation services company takes a greater responsibility for coordinating its customers' supply chain logistics needs, i.e. the model is open on the 'sell side'. However, the IT application portfolio, built incrementally over the years, did not optimally support the 3PL business unit. In order to do this it needed IT systems that supported new value-added services such as load building and optimisation. It wanted a one-stop IT solution to handle receipt of orders, carrier notification, load building and a tracking website for clients. As most new processes were IT-based, the IT department needed to play a key role in the business model transformation.

However, while the IT department was capable of keeping existing systems running and improving them incrementally, it needed outside help to design a system that could support the envisaged business processes. While cost drove previous outsourcing, the access to expertise and technological overview drove this engagement. An Indian software company had strong expertise in the logistics domain with more than 1,000 full-time employees working in the transportation unit and a proven record of accomplishment in strategic consulting and business process re-engineering in this area. This firm was engaged to undertake a major project of Business Process and IT System Re-engineering. A cross-organisational team engaged in a business process modelling (BPM) exercise and remodelled the workflow processes. They designed a system that optimised the order system, integrated off-the-shelf load-optimisation tools, and consolidated the customer-facing processes in a web-based interface. While IT consulting firms from the local environment could have provided the same services as well or better, it was felt that there were strong advantages associated with outsourcing the BPM/consulting assignment with subsequent implementation phase to the same vendor. The end-to-end outsourcing to an integrated processes consultant and supplier of implementation services secured certain coordination benefits. Drawing largely on external assets, this IT department became a primary driver of firm-level business model transformation.

4.1.6 Discussion

It appeared above that an important element of the open business model was prevalent in this group of buyers – the deliberate use of suppliers' assets in their innovation efforts. They seek cost reduction and external asset leveraging not only in the construction part of the project lifecycle, but well beyond. The IT departments include suppliers in important innovative activities. In order to explain this it is useful to examine the wider changes that gave rise to it. It was often the 'host organisations' in which IT departments reside (or who own them) who pushed the shift to openness in the secondary software industry.

In many buyer organisations, innovation outsourcing was still nascent but it was the culmination so far in efforts of firm-level restructuring which entailed a shift away from the old integrated IT department.⁴¹ The advent of the 'open network' approach to corporate governance is central. It means that business activities and internal supply chains become variable and subject to market conditions. Large firms have gradually forced the IT department in the secondary software industry to operate under more market-based conditions. In many cases, firms have spun off the IT department as separate (but often wholly owned) companies that must bid for (internal) projects alongside rivals.

The trend within this segment has been increasing organisational detachment from parent organisations. They have typically not been part of the revenue-generating engine of the firms. Rather they have featured on the 'expenses' side of the balance sheet. However, parent organisations now demand that IT departments make a profit and they expose them to competition in internal as well as external markets. With budgets that are more independent, these new IT organisations also look outside the parent organisation for growth opportunities and for solutions to immediate problems. In this setting, many IT departments have aimed to become more vertically specialised. This poses great challenges as they must transform their organisations and upgrade the competence profiles of the in-house employees. Outsourcing is the other side of the equation. Corporate changes are translated into new sourcing frameworks in which more of the deliveries are transferred to suppliers. These organisations shift assets out of old functions, but they want to do so while also increasing business revenues. By engaging suppliers in new activities, they sometimes also reduce the internal assets that used to support these activities.⁴²

Interviews with 'global sourcing' managers in IT departments revealed that parent companies sometimes pushed for the reduction or specialisation of fixed assets and offloaded more high-end work to suppliers. From the point of view of the firm, software outsourcing, even when it was innovative and mission critical, did not relate to a core profit area of the firm (such as new product development) but to supporting functions. For the typical IT department itself, software development and other aspects of software-related IT system management are – or were until recently – core activities. However, from the overall organisational point of view typically they are not.⁴³

41 The nature of IT departments' CAD outsourcing has changed in important ways over the last ten years. In a survey of 290 senior IT managers (Overby 2007), it was found that more than half of those who made use of offshore outsourcing were satisfied with the level of innovation provided by the offshore supplier. Satisfaction levels were highest for those who outsourced to focus on core business and gain access to specific skills, whereas those who stated that cost saving was the main reason were the most dissatisfied. However, the majority of respondents expressed a need for the suppliers' further engagement in innovation activities.

42 This need is illustrated by the recent changes in the IT department in British Airways (BA). The use of suppliers from India to undertake higher-order activities enabled the IT department in BA to increase the number of projects it carries out without taking on more internal staff. 'Its own staff, meanwhile, have had the opportunity to move out of software development and support work and into different roles, such as business analysis.' Interview with the Head of IT delivery in BA for a *Financial Times* special report (Thomas 2007).

43 Yet innovation processes and organisational change at the firm level is typically highly dependent on underlying and facilitating IT systems.

4.2 Independent software vendors

Independent software vendors (ISVs) constitute the so-called primary software industry. Such firms produce software as their primary business. Sometimes programme managers and project teams from these firms may engage in so-called outsourced product development, in which the firm outsources parts of the software product development process to an Indian provider. This type of transaction is what Flowers (2007) calls buy-to-build outsourcing.

4.2.1 Developer of corporate database tools

A Silicon Valley-based developer of software and tools for corporate databases opened its business model in a domain that was new to the firm. Established in the early 1990s, the firm developed all products completely in-house for the first ten years. However, it had spotted a gap in the market for an Extract Transform and Load (ETL) Data Warehousing Tool aimed at small organisations. However, this was 'brand new work' for the client organisation. It was felt that there was not the critical mass of in-house skills in this area and there was a consensus that the firm needed external help with the development of the new tool. In other words, it was decided to use external resources in a specific function of the firm's business model. It therefore collaborated with an Indian OPD⁴⁴ firm with extensive expertise in the database tools. In a previous incarnation this supplier was an own-brand developer of the database tool, but this business model was abandoned due to limited sales. However, the supplier was the owner of a tool that proved useful to the buyer. Modified and re-branded, it became part of the client's product portfolio. This was done initially under a licence, such that risks and rewards were shared between the firms. In order to make the new product work, the product needed a number of modifications. The supplier coordinated this transformation process. The client, on the other hand, was responsible for feeding in market knowledge generated from user panels and surveys and for helping to make critical decisions on the design and prototyping of the user interface etc. This type of knowledge transfer was seen as a key way to improve the product to increase commercial success.

4.2.2 Developer of statistical software

Open innovation in the ISV business line can take forms other than distributed or outsourced product development. As emphasised by Chesbrough (2006a), the open business model concerns not only knowledge sourcing and innovation, but also new pathways to the markets. If assets fail to generate revenues internally, they can become profitable when other firms bring them to market. So far, this has been the least used route to engaging with Indian software firms, but recently this trend has picked up, also with larger and more market-dominating firms.⁴⁵ A

44 British and North American firms sometime use the term 'offshore product development' to denote that they are outsourcing the product development to an offshore (Indian) provider.

45 Microsoft was the owner of an enterprise group chat product but recently it sold the intellectual property rights to Aditi Technologies. Five of the top ten global banks (according to Forbes) use this product. The solution is mission critical for firms in which some divisions use it as their main communication and inter-team collaboration tool since e-mail is too slow. These firms were unwilling to upgrade to new software, but as a part of the deal the Indian provider will work closely with the seller to help customers move to a new customer-based platform in the future.

US firm concentrated mainly on statistics for business and social sciences, but it was also the owner of a statistical package for use in the hard sciences. This product had become part of the product portfolio with an acquisition made mainly because of access to specialised human resources and strong capabilities in visual graphics (i.e. statistical visualisation). The firm made no new investment in the scientific software package as internal resources were concentrated on the flagship package. Only four programmers were working on the maintenance of the scientific statistics package and this period saw sales decline steeply. The firm chose a strategy of *product divestment*. The intellectual property rights to the package were transferred to a Bangalore-based developer of scientific software. In this new setting, more than two hundred developers were engaged in a major remake of the product. The Indian firm relaunched an upgraded version with enhanced capabilities and it was able to secure greater market sales figures under the new Indian ownership.

4.2.3 Non-profit technology centre

A non-profit technology centre adopted a radical version of the open business model. As part of a large global non-governmental organisation (NGO), the technology centre focused on technological solutions in the microfinance space. However, the concentration was not on technical competences as such, but on domain competences: its core role was to understand the particular needs of microfinance institutions (MFIs) and other stakeholders in the microfinance community and to coordinate the technology development process from an organisational point of view. In the words of the director, 'Our core competence is microfinance, not technology. So we decided to outsource'. He referred to the flagship product of the organisation, the Management Information System for Microfinance. The organisation did not outsource just parts of the innovation process but the entire technology development process. The requirement process involved people from both the buyer and the supplier organisations, but the supplier was able to play a critical role since the buyer did not have an in-house engineering team of its own. The organisation was young but 'born open', aiming to create bespoke technology without internal technical resources.

4.2.4 Online digital media provider

Another example of such a 'born open' new generation of software product developer is Digital Media Networks. The next chapter discusses this firm in more detail. It engaged an Indian firm to develop its Online Platform for Retailing and Legal Sharing of Digital Media. With its technology development and operations completely outsourced to India, this firm is a typical open business model firm, focusing on alliance management and new models for revenue sharing with its partners.

4.2.5 Discussion

In terms of openness, the ISVs (the primary software industry) shared many features with the IT departments (the secondary software industry). Outsourced product development in the ISV segment emerged as a labour arbitrage practice with a clear division of labour between buyer and supplier. In many cases, the

buyer was solely responsible for all activities in the requirements stage and all design activities, whereas Indian software providers would concentrate on implementation services, including coding, quality assurance (testing) and documentation. There are indications that most large and dominant ISVs (of the likes of Microsoft and SAP) remain close to this model.⁴⁶ If they shift innovation for new product development to India at all, they keep it in-house in their own subsidiaries. However, small ISVs have adopted radically open models, relying on Indian firms for mission-critical activities. In some firms, the outsourcing of the technical elements of the innovation process became an ingrained element of the business model. While this may be a trend that cuts across the ISV segment to some extent, it is particularly visible in smaller start-ups that define a vertically narrow competence profile for their organisations. In this type of ISV, the technology operations are almost completely outsourced. This allows for a new breed of entrepreneurs and managers to build technology organisations without large in-house engineering teams.

4.3 Electronics and telecom firms

Electronics and telecom firms were already pioneers in the location of software development activities in Indian subsidiaries in the 1980s. This study, however, focuses on outsourcing. It examines product engineering and R&D divisions of electronics firms that engage in so-called engineering service outsourcing and outsourced product development. The focus is on clients that acquire software code (components) used in the development of marketable electronics artefacts. In some cases, buyer firms insert so-called embedded software into electronics artefacts (buy-to-build). The software that is outsourced plays an integral role in the electronics product, but it typically remains hidden to the user.

4.3.1 Developer of mobile telephony devices

The first example in this group of buyers is a well-known developer of handset devices – a large firm with multiple business models related to different functions and technology areas of the firm. It undertakes most of the core R&D processes in-house or with organisations residing in its home location. However, this firm moved from a highly integrated model to the outsourcing of manufacturing and certain ‘contextual’ R&D processes. Indian firms now play a major role as providers of software services for such contextual R&D. One firm in particular has become a preferred supplier for R&D (due to the acquisition of a firm residing in close proximity to the headquarters and core R&D centres). The inclusion of this firm in the R&D network was part of a wider effort of supply chain reconfiguration and strategic management of external relationships associated with business

46 The ‘old guard’ of established software companies did not seem to be at the forefront of innovation outsourcing to India, although elements of the open business model were present. While these do outsource innovative activities to India on a substantial scale, the shift is incremental and carefully guarded. This impression arose from information provided by suppliers as no established firms of the calibre of Microsoft, Oracle or SAP took part in the core sample. To some extent, this may reflect a research bias because more established primary software firms might simply be more secretive about their outsourcing practices.

model transformation. However, there are still limits to openness. R&D is organised hierarchically and core R&D is kept in-house. The next chapter presents this case in more detail (Telecom Corp).

4.3.2 Manufacturer of electronics devices

As a large division of a Japanese industrial conglomerate, this firm is another example of a buyer with multiple business models. To this day, this firm engages in in-house production and product innovation.⁴⁷ It undertakes key innovative activities within the firm, but it has an extensive global network of R&D centres, with the most important ones being in Japan, the UK and the USA.⁴⁸ The product engineering and development division remains in Japan, but it has become increasingly open towards collaborating with other firms regarding the technologies that go into the products themselves. The use of external licensing has increased. This is where software providers from India have come to play a more prominent role. For instance, this division developed a Bluetooth chip for a hands-free system used in automobile space. The firm needed to incorporate the Bluetooth functionality into the chip platform architecture and customise this to work with a particular radio technology. The firm realised that Bluetooth is a software-intensive technology and chose to outsource the Bluetooth-enabling software component. Rather than developing software for the Bluetooth baseband chip itself, it would be faster to source this from a dedicated provider. The supplier provided 'product realisation services', involving customisation of the IP block and integration with the buyer's on-chip radio technology. From the customer perspective, Bluetooth is an add-on technology whereas the supplier is among the top players with solutions in this field. Thus, the supplier was able to tap into a large volume of specialised resources (50 people at the peak) in this domain and it significantly reduced the time to market for the product. As this example illustrates, the opening up for Indian software design services relates mainly to components technologies. The Indian provider designed the software component independently and provided this on a modular basis. While the Bluetooth-enabling software component had some minor ramifications for the architecture of the overall system, overall chip design was the buyer's responsibility.

4.3.3 Developer of mobile telephony software

A consortium of leading handset manufacturers from Europe and Asia owns and controls this ISV.⁴⁹ It is based in the UK, but like most other firms in the telecom space it is heavily globalised and has relied from its establishment on a network of internal and external providers for certain aspects of technology development. In other words, the firms had become significantly open in terms of inputs. However, the buyer had invented a set of five policy categories for labelling its software code. The label denotes the legal arrangements that should underpin development activities. The highest level is confidential source code, which it does not distribute

47 This firm also markets electronics products under an own-brand name in other product lines.

48 The last of these focuses on the development of application software for PC-based electronics.

49 It was established in 1998 to create an alternative to the Microsoft CE in Smartphone operating systems.

Table 4.1 **Key features of sponsor organisations’ business models**

	IT departments					Independent software vendors				Electronics and telecom firms		
Firm Number	1	2	3	4	5	6	7	8	9	10	11	12
Aspect of business model												
Selling side	A. The organisation’s resources are used in the business models or innovation processes of external customers/partners	X		X			X		X		X	X
	B. The organisation’s resources are used in the innovation processes of internal customers	X	X	X		X		X	X	X	X	X
Buying side	C. The organisation includes external resources in its business model	X	X	X	X	X		X	X	X	X	X
	D. Knowledge spillover to partners is perceived as a potential source of improved competitiveness	X	X		X	X		X	X			
	E. Risks and rewards are shared with external partners (suppliers) in the innovation process	X				X	X					
Innovation mgmt.	F. Innovation tasks in the organisation reflect the decentralisation of innovative activities to every business unit of the firm	X	X	X	X	X			X		X	
	G. Innovation tasks in the organisations include the reinvention or renewal of the business model itself	X		X		X		X	X			

Note: X denotes evidence that confirms the statement. Note that empty fields do necessarily indicate that evidence falsifies the statement. In some cases, there was no data available to verify the statement. In such cases fields were left empty. The numbers refer to sponsor organisations in the following firms:
 1. Auto manufacturing firm; 2. Internet infrastructure solutions provider; 3. IT publisher; 4. Technology and services conglomerate; 5. Transportation services company; 6. Developer of corporate database tools; 7. Developer of statistical software; 8. Non-profit technology centre; 9. Online digital media provider; 10. Developer of mobile telephony devices; 11. Developer of mobile telephony software; 12. Manufacturer of electronics devices.

at all. It undertakes all development activities in-house in the UK. Another category is jointly developed source code, which can become subject to co-development involving external providers by special legal arrangement. Driven by cost advantages, one Indian supplier had been a major partner for the development (implementation) and maintenance of certain parts of the code in this second policy

category. Operating at this level, the Indian organisation was not initially involved in independent design activities. However, to make more use of the qualified Indian resources for more central parts of the system, it partially acquired the customer-specific resources of the supplier, which was then established as a captive unit. This was a so-called Build-Operate-Transfer (BOT) Arrangement. In this way, some source code design activities that are closer to the core of the system relocated to the captive unit in India. The upgrading of offshore activities was associated with a transformation of the relationship underpinnings between lead firm and supplier and a gradual change of business model.

4.3.4 Discussion

Electronics and telecom firms had shifted to open business models already in the 1990s, but the broad-based use of India as a resource base is a more recent phenomenon. The case study firms have complex organisational structures, with multiple R&D centres across the globe, mainly in the USA, Europe and Japan, but increasingly also in China. On the software side, the buyer firms in this segment had all made use of staff supplementation (body-shopping) services provided by Indian suppliers – and to varying degrees continue with this practice. In this mode, buyers hired support staff employed by Indian organisations for particular projects, mainly for routine activities such as testing and technical writing. The shift to the outsourcing of software design activities to India is a much more recent phenomenon. This is part of an open systems model of innovation in this segment. The sample firms are large firms and they operate in an industry in which open innovation is an established practice. However, openness had clear boundaries. Firms were cautious about the knowledge distributed to suppliers.

Reduced time to market is essential for all of the three segments and this increases the global competition for design and engineering resources. The searches for resources that can help transform new ideas and knowledge into workable solutions is intensifying. In many cases it is much faster to draw on specialised capabilities possessed by others than it is to generate these capabilities in-house. There are internal qualitative constraints related to specific skills. However, a somewhat different but less acknowledged type of constraint sometimes drives this type of outsourcing. These are quantitative constraints arising not from the lack of specific or specialised skills *per se*, but rather from the lack of *enough* skilled resources to develop products on time. Interviews and case material from all groups showed that such capacity constraints arising from tight engineering labour markets in some OECD countries were an important incentive to use India as a new supply base for innovation resources.

4.4 Summary and conclusion

The purpose of this chapter was (1) to examine the nature of business models in the sample of buyer firms and (2) to explore whether/how the adoption of open business models drives (innovation) outsourcing that creates opportunities and/or resources for developing capabilities of suppliers. Key features of sponsor firms' business models are summarised in Table 4.1.

The main findings can be summarised as follows:

Selling side of the business model: Half of sponsor organisations exploit their resources and capabilities beyond the host firm's business model. These sponsor organisations capture value from sharing their resources and capabilities with customers and partners. These organisations can be described as being 'genuinely open on the selling side' of the business model as they share their assets with other firms or deploy them in other firms' innovation processes. Such firms exist within all three of the buyer categories and there seems to be no pattern in this regard, although the nature of genuine openness on the selling side varies across categories. In addition, the material indicates that although only half of sponsor organisations are 'genuinely open on the selling side', the majority are involved in innovation processes in the wider host firm. This is central because – as will be discussed – the innovation resources that are deployed forwards in the (firm-internal) value chain are different from those that are sourced from suppliers.

Buying side of the business model: All but one of the sponsor organisations include external resources in the business model. This is perhaps unsurprising, as data collection has occurred in the context of outsourcing and events and relationships associated with the formation of new innovation capability in supplier firms. However, the findings here indicate that sponsor organisations do not just use external resources in isolated cases of outsourcing. Rather it has become an integral part so that they have become 'genuinely open on the buying side' (to the extent that the business model would collapse without the availability of these external resources). Interestingly, this means knowledge spillover to suppliers was seen as a (potential) source of increased competitiveness in the majority of firms. While this was only confirmed explicitly by interviews in some of the cases, it could often be confirmed indirectly by firm-level practice (sharing business knowledge). Of further interest is the finding that electronics and telecom firms are an exception to this pattern. With regard to the sharing of business risks and rewards, this only occurred in three cases. Thus while sponsor organisations have become dependent on supplier inputs, this does not mean that relationships have typically deepened to the degree of genuine alliances.

Innovation management: In most cases, the innovation tasks in the sponsor organisation reflect the decentralisation within the firms. This was particularly true in IT departments. They were increasingly required to innovate and provide impetus for innovation in other parts of the firm. Moreover, five cases indicated that the sponsor organisation had been charged with a mandate to reinvent their own business model, often with a more fine-grained segmentation of the innovation process and the refocusing on (new) select innovation areas.

The findings suggest that most sponsor organisations have adopted important elements of the open model but this varies between buyer segments and firms. An interesting question is, of course, why this has occurred. The evidence collected for this report can only give a partial answer with two elements. The first element is that the sponsor organisations were drawn into providing inputs into the innovation process of other parts of the company or external customers. While resulting dynamics require further investigation, it seems that changes on the selling side (and associated reskilling and deployment of resources) often created a vacuum in the organisation, thereby prompting changes on the buying side.

The second element of the answer is that sponsor organisations were significantly influenced by the changing outsourcing landscape in Bangalore. The concept of open business models covers a broad-ranging portfolio of firm behaviour, so it is necessary to specify that the detected impact related mainly to the buying side of sponsor firms' business models. However, this influence seems rather strong and widespread. In a majority of the case studies the evidence suggests that opening of business models was directly influenced by the attainment of general and customer-specific capabilities by suppliers.

However, even though many of these firms are adopting important elements of the open business model, this is sometimes an extension of the 'old style' core competence model, rather than a radical departure from it. Buyer organisations are simply decreasing the scope of the 'core', or shifting it forward in the value chain (towards end use). In other cases, the distinction between core competence and open models becomes blurred once we use these concepts to study the empirical world. The next chapter examines in more detail the nature and limits of outsourced activities practices by open business model buyers. The final chapter then examines the dynamics and limits in a framework of co-evolution.

5 Outsourcing and the emergence of new spaces for innovation

The previous chapter showed that a new generation of buyer firms has emerged. These buyers have adopted important elements of the open business model, albeit in different ways. This qualifies much of the literature on the Indian software industry, which has failed to acknowledge the changing nature of outsourcing. However, from a theoretical point of view it is perhaps less surprising. In the manufacturing context – particularly in the auto and computer sectors – it has been observed that design functions are increasingly pushed onto or acquired by component suppliers (Humphrey 2003; Kishimoto 2004). In the business services context some OECD suppliers often provide *ad hoc* innovations that are highly customised and centred on specific, often practical, problems (Gallouj 2002). The proposition discussed in this chapter is that whereas buyers increasingly outsource such problem-solving innovation activities to suppliers, the same is not true for problem-framing activities.

Before addressing this proposition head on, it is useful to examine the nature of software innovation outsourcing across the three segments. As mentioned, the minimum criterion for the use of the term ‘innovation outsourcing’ is the outsourcing of *software design* activities (in the elaboration phase). Section 5.1 uses the distinction between integrated and standalone innovation. Section 5.2 then addresses the issue of problem-framing activity directly. Section 5.3 discusses the limits to outsourcing and Section 5.4 draws the conclusions.

5.1 Standalone and integrated innovation

This section discusses the specific characteristics of openness-driven innovation outsourcing. The focus here is on whether firms outsourced design activities (and perhaps higher-order functions) separately or whether these activities integrated with implementation functions. The section also discusses the relationship between outsourced activities and buyer–supplier linkage characteristics.

5.1.1 IT departments

Traditionally, CAD outsourcing to India has tended to follow the pattern in which only implementation activities such as development and testing are externalised to suppliers. Firms kept activities in the requirement stage – i.e. those that connect directly with user-level organisational change – in-house with the sponsor, which has an intricate understanding of the needs of its parent organisation. However, as in other software settings, IT departments can make large financial and engineering resource savings by outsourcing a larger chunk of the software development lifecycle. Most IT departments face the simultaneous forces of growth in demand and a pressure to cut costs. The personnel engaged in requirement activities are most costly in absolute terms as well as in terms of opportunity cost. Experienced business analysts and software architects employed in-house by the IT departments in large organisations need to concentrate on the most mission-critical projects, even if this halts other potential

projects. The external demand for innovation in client-firm IT departments often exceeds in-house capacity. Moreover, the nature of demand is changing. Because (non-IT) business units have become increasingly specialised and processes are more IT-based, there is a need for consultants from the IT departments who can define the opportunity, scope the work and identify the current and future methods of operation, based on solid domain experience and insights. In this setting, there is a greater need to draw on skilled resources from external organisations for engagement in innovation processes.

Innovation outsourcing in this setting takes the integrated form, in which implementation and requirement activities are bundled within the supplier's domain. Suppliers are engaged not only to create software artefacts (implementation) but also to co-define requirements. This is an interaction-intensive process characterised by high complexity and tacit knowledge. The buyer-supplier interface is therefore substantially thicker in this type of project, compared to implementation projects in which processes are easy to codify. In end-to-end CAD outsourcing the project-based relationship is typically of a long duration in which the engagement period can last several years. Certain phases tend to be face-to-face intensive and suppliers often post personnel in the buyer premises on a permanent or semi-permanent basis.

5.1.2 Independent software vendors

Compared to the electronics segment, the outsourcing of innovation in the primary industry takes a markedly different form. Recall the cases of start-up organisations with very few engineering resources. Since these buyers concentrate their efforts on forward linkages, there is a good understanding of what the market or users want, but few technical resources to work on new product development. The bridge between buyer's vision and supplier's implementation arises through co-design. Therefore, when primary software industry organisations outsource design activities, this typically takes the form of an extension of basic services outsourcing. Outsourced design activities integrate with the operational processes of transforming the specifications on paper into a workable product.

Technical inseparability increases the need for organisational connectedness. Buyer and supplier sometimes co-define requirements; they are not easily 'transferred' from the former to the latter. This requires thicker buyer-supplier interfaces, which typically take the form of temporary conjunction onsite at the buyer's premises. Discussions typically revolve around non-functional (technical) requirements, but may also extend to functional requirements. Recall the example of the outsourced development of a management information system (MIS) for use in the microfinance industry. The firm outsourced all aspects of product realisation (implementation) and depended on the software supplier for inputs into the requirement stage. The two companies approached the requirement definition phase from two different ends. The buyer's core competence rested with the user domain (microfinance) and not technology as such. By contrast, the supplier had previous experience of building numerous MISs on a variety of technology platforms. While the specification document stated, for instance, that the system should have a module for a savings account, the supplier laid out the different options for how such an account could work. The decision-making processes

related to functional attributes of the system were therefore collective. The supplier provided many design activities, even functional ones.

5.1.3 Electronics industry firms

As mentioned in Chapter 4, electronics firms are often large players with globalised organisations and supplier networks. In order to situate the software activities outsourced to India, it is therefore necessary to consider the character of the production and innovation networks coordinated by buyer firms. On the operational side, most manufacturing activities are offshored, mainly to independent providers of electronics manufacturing services (EMS). Two electronics buyers had substantial manufacturing activities in India, but the examined outsourced engineering services to India were unrelated to these operations. On the product development side, these functions were primarily coordinated from the home location. This pattern follows what has been described as the de-linking of production and innovation in the electronics industry (Sturgeon 2002). In this sense the outsourcing of supplier-designed technology components and the related customisation services are technically separated from the physical building (production) of the product (e.g. a chip or a handset). Hence, the outsourcing to India took the form of standalone innovation activities. This finding is supported by information from interviewees on the supplier. Informants stated that they would 'never' interact with the operational units of buyer firms in this segment.

Because of technical disconnectedness, outsourcing arrangements were also characterised by a large degree of organisational decomposition. In other words, the buyer–supplier interfaces are relatively thin, with the vast majority of work conducted offshore and relatively limited inter-organisational collaboration. The requirement transfer is typically based on a normal technical requirement document that may be complemented by videoconferences to clear up misunderstandings or even by in-person meetings, depending on complexity. Clients draw on generalised assets (solutions) developed by the supplier, and the main engagement is limited to customisation. Thus the main project-based relationship, in which software components are customised, is of relatively short duration (as opposed to the commercial relationship which may be longer). Whereas the 'engagement period' (project duration) may take many months, the key phases in which buyer–supplier interaction takes place are much shorter. Face-to-face interaction may not be required at all, or it may be limited to a few days.⁵⁰

5.2 Problem solving and problem framing

This section reviews three buyer–supplier case studies, one from each buyer segment. These are 'indicative' examples as they all feature trends and dynamics of wider relevance. The first section looks at the character and evolution of relationships and focuses on the outsourcing (or not) of problem-framing activities.

50 The most communication-intensive phases are in the beginning (requirement transfer and architecture) and sometimes, if the project is complex, also in the end (acceptance testing). The most time-consuming period in which the solution is actually developed (implementation) is self-contained within the supplier domain.

This is then related to the findings of the previous chapter. The three buyer–supplier case studies are:⁵¹

- Primary software industry firm ‘Digital Media Networks’ and the outsourcing of product development (OPD) to Aditi Technologies.
- Secondary software industry firm ‘Auto IT’ and the outsourcing of custom application development (CAD) to MindTree Consulting.
- Electronics firm ‘Telecom Corp’ and the outsourcing of engineering services (ESO) to Sasken Communication Technologies.

The common trait is that problem-framing activities identify what the software should do and broadly how it should do it. In other words, it relates to the step in the software project lifecycle that deals with *requirement definition*. In the electronics segment, this is associated with overall product architecture and systems integration. In the primary software industry it relates to the identification of user needs (e.g. from market and customer surveys) and the capturing of these in the definition of functional specifications. The same is true for the secondary software industry but, in this setting, there is a much more direct relationship with users. Requirement definition is based on explicit needs and business modelling efforts. This chapter therefore asks whether requirement definition is outsourced or not.

5.2.1 Digital Media Networks and Aditi Technologies

Digital Media Networks is a privately funded US start-up company in the online digital media business. It was established in 2002 to provide a media service engine for legal digital content sharing, as an alternative to illegal peer-to-peer sharing. The founder and CEO previously had a career in Microsoft in which he was a senior sales leader. The firm is ‘born open’ with a complex business model and revenue-sharing agreements. As a business-to-business (B2B) company, this firm focuses its managerial resources on sales, network alliances and strategic management. A strong network of industry contacts helped the CEO to build the business and the various commercial and technical networks it entails. The media service engine was based on Microsoft technology and standards, content was provided by record label companies such as Sony, Universal and Warner, third-party providers such as PayPal provided critical components and outlets were provided by Microsoft Media Player and eBay. The company was the exclusive alliance partner for powering eBay’s foray into the music download business.

With an inherently open business model, the decision to outsource the entire product development to an offshore provider was an easy one – it was inherent in the business plan. This decision had been made for three primary reasons. First, it was believed that time to market for the flagship solution was crucial for the success of the firm. However, it was felt that it would not be possible to quickly build a team in-house with sufficient knowledge and experience as such a team was not easy to assemble in the USA. Second, it was important to have ability to ramp up and down effortlessly, once the major phase of creation was complete

51 Names of buyer firms have been changed to protect confidentiality.

and to ramp up again for the second release. Such flexibility could not be achieved with an in-house team. The third reason was the combination of rich experience and low cost. Most importantly, the firm was attracted by the ability to get inputs to the project from an experienced product development firm. India was the key location for firms specialised in outsourced product development.

As the very foundation of the firm's business, the solution provided by Aditi was mission critical. The initial requirement had been described in just an eight-page 'visioning document'. This became the starting point for Aditi Technologies, a Bangalore firm specialised in OPD.⁵² This document formed the basis for proposal building and preparatory activities. Requirements were then settled during a one-week meeting at the firm's office. Thus, Aditi was closely involved in the requirements definition stage. As explained by the CEO of the firm, some of the requirements came from the supplier's ability to envisage usage scenarios. When asked about whether it was a concern that the supplier would not understand the end-user scenario he replied:

There were things they thought of that we missed. This group at Aditi, there were many things they brought to the table that added value. I would like to think that we thought of most of the usage cases, but there were things they brought to the table that we hadn't even thought about. So I wouldn't say that they don't understand the consumer situation, again there were many cases where they did add value there.

(Digital Media Networks informant, 8 November 2007)

For Digital Media Networks, the focus on sales and the management of an open business model was enabled by a far-reaching outsourcing strategy in the sphere of technology. It was decided very early to outsource the development of the core technology platform to Aditi. The availability of the supplier's R&D services allowed for an operational business model focused on customer-facing activities and management of alliance relationships. This was dependent on the supplier's depth of competences in the involved technology domains, which could aid technology decisions for the system as well as the ability to provide end-to-end solutions from vision to launch.

However, the radical outsourcing strategy was not adopted without problems. At the outset, the leadership in the firm had envisaged a business model with no in-house technical resources. This strategy needed to be revised. The main complicating factors were about communication between non-technical (buyer side) and technical (supplier side) people in the distributed work environment. The division of labour which was originally envisaged did not work. The buyer came to realise that a certain amount of overlap was needed. As the CEO explained, 'you need to have technical people on your side who completely understand the vision of the project' in order to effectively manage the relationship with the offshore provider. Therefore, an in-house technical team was gradually built to improve the work process for the release of the second version of the system. As this illustrates, the adopters of the open business model may fall short of their initial goals.

52 The CEO in the buyer firm drew on his personal relationship with the founder of the supplier firm, whom he knew from their coinciding employment at Microsoft. A sense of trust resulting from this network connection was a key element in the decision to ally with this particular supplier.

5.2.2 Auto IT and MindTree Consulting

For more than 30 years, until 1998, Auto IT was the in-house IT division of a European auto manufacturer specialising in trucks and buses. In 2001, the firm acquired two truck manufacturers (located in France and USA) and its new IT services division was consolidated in Auto IT, which had become a wholly owned subsidiary. The new organisation was to play a new role, offering its services in the international marketplace for software development services. In the same year, the organisation initiated a competitive-sourcing programme and established relationships with suppliers in Poland and India, in order to reduce costs, speed up deliveries and learn from skilled partners. The outsourcing practice grew rapidly and the customer base expanded beyond the capacity of the organisation; it therefore was clear that a strategy of internal competence transition was needed. This strategy had two main elements. First, Auto IT needed to establish a new role for the organisations, one that was closer to the customer and with more of the deliveries managed by suppliers. Second, it needed internal employees – now perceived as ‘high-cost employees’ – to move up the value chain, ‘out of the technical areas and over to the business side of things’ (Auto IT informant, 13 June 2007).

A key element in the definition was the experience that was gained from partnering with MindTree Consulting, a spin-off from Wipro. According to the CEO, the relationship with MindTree ‘is the only true partnership of [Auto IT]’. In 2001, Auto IT had already engaged MindTree to build and maintain a new global dealer management system (DMS) for its trucks division. The system was eventually rolled out in 18 countries and was perceived as ‘mission critical’. MindTree’s independent development of the system and the effective building of new skills showed Auto IT that the increased outsourcing to capable suppliers could support a new growth strategy.

Over time, MindTree has become more closely involved in the outsourced projects, and the supplier is involved in complex tasks in the software development lifecycle. It no longer merely develops systems to Auto IT’s specifications, but also participates in the development of those specifications by finding resolutions to user requests. A good example was the development of a CRM sales tool for a leading trucks manufacturer. With external financing, this was a critical project with high visibility. The decision to engage MindTree in the end-to-end development of the system was rooted in a ‘critical situation’. The packaged legacy CRM system for pre-owned trucks was being phased out by the provider, and the customer urgently needed a new system in its place. However, the proposal initially developed by Auto IT, which deployed in-house resources for the critical phases of the project, had a budget and a schedule that was far beyond what the customer was willing to accept. After deliberations among the Board, it was decided to challenge MindTree by giving them key responsibility for the project, in order to avoid the loss of an important business opportunity. However, there was also a more fundamental reason that was to do with the difficulty of transferring complex knowledge. As an informant in MindTree explained,

They wanted to develop the system themselves and then involve us in the next phase of back-end integration. That was the initial plan they presented to the management. But [the executive vice president and head of Auto IT’s

‘region international’] felt that this was not right. He knew us very well. He said: ‘You say that you will involve MindTree in Phase Two. But when it comes to Phase Two, you will come back and say that MindTree does not have the business knowledge of Phase One, so we cannot involve them. So don’t make that mistake. Involve MindTree from the beginning’. That is when the whole plan changed. Later on they told us that it was one of the best decisions they had taken.

(MindTree informant, 18 July 2007)

MindTree was able to draw on its experience from working on and developing CRM systems for customers in other industrial domains. However, MindTree used this ‘generic knowledge’ in this business-critical project within Auto IT. It was able to do so because of the close relationship between the two firms. A full-time MindTree manager is posted permanently onsite, with access to the entire corporation. Key personnel in the supplier firm have accumulated customer-specific knowledge and competences incrementally, which has enabled them to add value and provide Auto IT with new ideas capabilities for innovation in new projects. Such a process has occurred in several domains, and this enabled MindTree to cross-feed knowledge between projects and domains. As the Head of Global Sourcing explained,

Over time, they built a lot of competence in the after-market area over the projects they did in that area, and they were able to cross-feed between projects to also further develop the ideas and put them into the next project in the same domain area.

(Auto IT informant, 20 June 2007)

This type of cross-feeding is what Chapter 2 refers to as competence leveraging. This competence leveraging in the supplier firm was one factor that enabled new sourcing strategies in the buyer firm. Ultimately, this was related to organisational transformation. In a short time-span, Auto IT made a complete transformation from an organisation that was part of a large and vertically integrated company, to an IT consultancy organisation with an open business model. It has opened its forward linkages by competing in the global market and its backward linkages through competitive sourcing. This has initiated a process of internal competence transition and a corresponding transition in outsourced services. Today, 27 per cent of the consultants engaged across projects are sourced from contractors. Auto IT now uses external ideas and innovative competences from India for its Auto IT-signed solutions.

5.2.3 Telecom Corp and Sasken Communication Technologies

In the early 1990s when Telecom Corp introduced its first Global System for Mobile Communications (GSM) handsets to the market, the company was able to undertake all processes in-house, even the design of its own chips. As an industrial conglomerate, Telecom Corp could internalise all stages of mobile phone development, including R&D, design, assembly and manufacturing. But over time, this strategy was abandoned. Throughout the 1990s and continuing in the 2000s, it sold off parts of the corporation to focus on key processes, using the newly formed firms as suppliers. During the 1990s, the value of purchases grew three

times faster than the value of sales. During the 2000s, the firm consciously worked to reduce R&D spending and rely more on an external network of providers. A key driver of this process of externalisation is the increasing complexity of technologies and supply chains, factors that make it impossible to undertake all innovation processes in-house. A distinction developed between elements and processes that were 'core' and 'context' respectively.⁵³ The latter included so-called commodity R&D and technology, which was now acquired in the market.

A fraction of this contextual R&D was provided by Indian firm Sasken Communication Technologies, a firm specialised in IP development and outsourced engineering services for the handset industry. For instance, Telecom Corp made some use of video application and codec⁵⁴ licensing from Sasken. These are subcomponents and commodity inputs. As stated by an informant in the firm, 'There has been some licensing of certain applications and features, but they are not really key components'. The relationship between the two firms was strengthened in 2005 when the venture capital arm of Telecom Corp made a US\$3 million investment in Sasken. Despite this, Sasken was unable to license out or work on more critical technology and processes for Telecom Corp. Sasken had developed core applications such as an integrated multimedia suite, but the supplier was unable to sell this to the firm:

The problem for Sasken is that multimedia happens to be one of the key areas for Telecom Corp... In order for Sasken to sell their subsystem it would have required that Telecom Corp makes a decision to withdraw its own in-house developed sub-system and replace it with Sasken's and start paying money to Sasken for the licensing and the further development. The control over that subsystem would not have been inside Telecom Corp... There are certain areas there in which Telecom Corp would like to keep the control in its own hands. This multimedia subsystem and multimedia applications and services are those things that are not likely to be outsourced or licensed from outside. (Telecom Corp informant, 27 July 2007)

Sasken was not the only Indian firm that supplied Telecom Corp with outsourced engineering services. Wipro, a major Indian service provider, was a key source of outsourcing and staff augmentation services for particular Telecom Corp projects. Wipro was a part of the R&D supply chain in a major way. However, certain core hardware and software design and testing services (including radio frequency testing) were not outsourced to this supplier. As stated by an informant, there are certain types of processes and knowledge that Telecom Corp keeps under Finnish control.⁵⁵ The reason was a concern within the firm about dependence on this large firm for critical resources. There were certain types of knowledge that it did not want to put in the hands of this supplier. Rather it sourced these services from a small number of Finnish firms. Most of these adopted 'follow sourcing'

53 According to the Chief Technology Officer in Nokia, Pertti Korhonen, 'Nobody can master it all... You have to figure out what is core and what is context'. Quoted in Engardio and Einhorn (2005).

54 In telecommunications, short for coder/decoder – a device that encodes or decodes a signal. Codecs can be implemented in software or hardware.

55 This informant was a senior manager in Botnia Hightech and a former manager in Telecom Corp.

strategies, and went global in order to service Telecom Corp in new markets such as China and India. This led to Sasken becoming part of the innovation chain, but there were clear limits to the involvement.

Telecom Corp had a very close relationship with Botnia Hightech, a small Finnish supplier of design and radio frequency testing services. Leading managers in Botnia had an employment history in Telecom Corp. However, Botnia was not globally oriented and did not have the size to venture abroad as was required by Telecom Corp. For this reason, Botnia was put under pressure to merge with Sasken in order to service Telecom Corp in Finland and globally (in India and Mexico). As a result, Sasken acquired Botnia in 2006. This act of supply chain coordination exercised by Telecom Corp was initiated for two primary reasons. The first was to ensure that the particular engineering service capabilities of Botnia could be scaled up globally. The second was to create some counterbalance to Wipro and to develop a certain degree of control over certain R&D services outsourced to Indian organisations. On the other hand, this reconfiguration of the supply chain – a global *recomposition* of the innovation process – provided Sasken with an opportunity to move into new competence areas, such as advanced hardware testing, which had previously been out of bounds for Indian suppliers.⁵⁶ However, it did not enable the firm to move into mission-critical R&D such as high-level design services or a licensing implementation service for key components such as multimedia applications.

5.3 The limits to outsourcing and the problem of inseparability

There are important differences between standalone and integrated innovation activities. The increasing complexity of product development in the electronics industry is the main driver of standalone innovation outsourcing to India. Even developers of subcomponents cannot generate/attract and maintain all resources and capabilities internally. This is not a novel insight. Other studies of the globalisation of innovation reach a similar conclusion. Cooke (2005), for instance, showed how biotechnology firms pioneered open innovation on a global scale, in order to overcome intra-firm knowledge constraints by tapping into the regional knowledge capabilities of clusters. Ernst (2005) showed how lead firms in the electronics industries used Asian suppliers for chip design. In both industries, innovating firms draw on knowledge from the global supply base and absorb it into their own products. They concentrate on the integration of new knowledge and resources for the development of new products. Hence, they play the role of systems integrators.

This is typical of complex industries in which different firms with different competences are required to handle the various stages in the product development process (Brusoni 2005). This chapter has shown how this type of industry organisation drives specific activities in Indian software firms, such as those performed in the engineering services segment. Cost was an important element in the 'location' of these activities (in India), but cost did not drive the opening up of innovation in its own right. The complexity of knowledge was the main driver of openness and cost competitiveness arose in the second stage.

56 This route strengthened when Sasken's new Finnish unit coordinated the acquisition of Nokia's Adaptation Software R&D entity in Bochum, Germany, in 2008.

The outsourcing of integrated activities is different because the knowledge-seeking and cost-reduction elements came together in opening the innovation processes and underlying business models. In this sense, it is a novel form of open innovation and it has proven to be an immensely important category for the analysis of software innovation outsourced on a global scale. Yet it is not on the radar screen of the open innovation literature.

This new form of innovation outsourcing is prevalent in the primary and in the secondary software industries. In the first instance, the pressure to cut costs and speed up the development cycle is driving software organisations to outsource non-core activities. However, when this decision has been made there are sometimes compelling reasons for incrementally adding higher-order activities. This not only solves the common problem of finding generally skilled software engineers in adequate numbers, but it also relieves constraints related to highly skilled internal resources. These are now able to concentrate on high-priority projects or move into non-technical business activities altogether. These organisations reduced the opportunity costs of internal resources by relying on outsourcing of some high-end activities. By shifting over to what one informant termed 'the business-side of things', internal staff undertake activities that create more rent.

Innovation outsourcing also reduces the substantial coordination costs associated with upfront investments undertaken during the elaboration phase. Business analysts and software architects construct the high-level design and the specifications at this stage. They need to write these specifications in a highly detailed form if the buyer intends to transfer them to a supplier who will take over during the construction phase. However, these investments can be externalised by involving the supplier in the elaboration phase. In other words, there are 'linkage economies' at play. Because the supplier firm performs high-level design activities as well as execution, it increases the efficiency of each of these activities. The supplier relies on the cognitive proximity of in-house staff in order to 'transfer' these specifications to the execution team in the offshore development centre.

This is a key difference between outsourcing guided by core competence strategy and outsourcing by firms that have adopted the open business model. D'Costa (2003; 2004) is the scholar who has undertaken the most in-depth assessment of the constraints associated with the core competence paradigm of software outsourcing. He showed that one of the key constraints arose from the way outsourcing relationships were structured:

No firm wants to co-locate critical projects overseas due to coordination and communication problems... These problems arise because of the 'modular' approach to software development. Each project/product is decomposed into self-contained modules, each with varying demand on tacit knowledge, making it possible to co-locate certain modules in certain places. However, the tension between increasing coordination costs and the criticality of certain modules limits what can be done offshore in India. Total learning with modular projects is constrained since exposure of Indian engineers to innovative projects is only partial. This hinders domain and systems integration expertise, spheres of considerable import for building competence. It also limits 'transferability' of tacit knowledge as user-based interaction is constrained. Also, rising costs in the more user-driven iterative process makes

geographically dispersed modular software outsourcing risky, thereby limiting suppliers' market exposure.

(D'Costa 2004: 57)

This was confirmed in previous work by this author. Because of the 'modular approach' to software development, learning possibilities in the supply base tended to be constrained because exposure to critical capabilities and end-users was limited (Lema 2009a). The findings of the present study suggest, however, that outsourcing in the open business model shows different features.

In the core competence business model, buyers seek to limit outsourcing to implementation activities. These implementation activities are easier to codify than higher-order activities.

However, in the open business model, buyers often seek to leverage supplier assets in higher-order activities. This means that the buyer needs to draw the supplier into the architecture and sometimes even the 'vision' of the project (see Table 3.2). Activities in these stages are much more difficult to codify and the previously 'modular' pinch-point interface between buyer and supplier changes character.

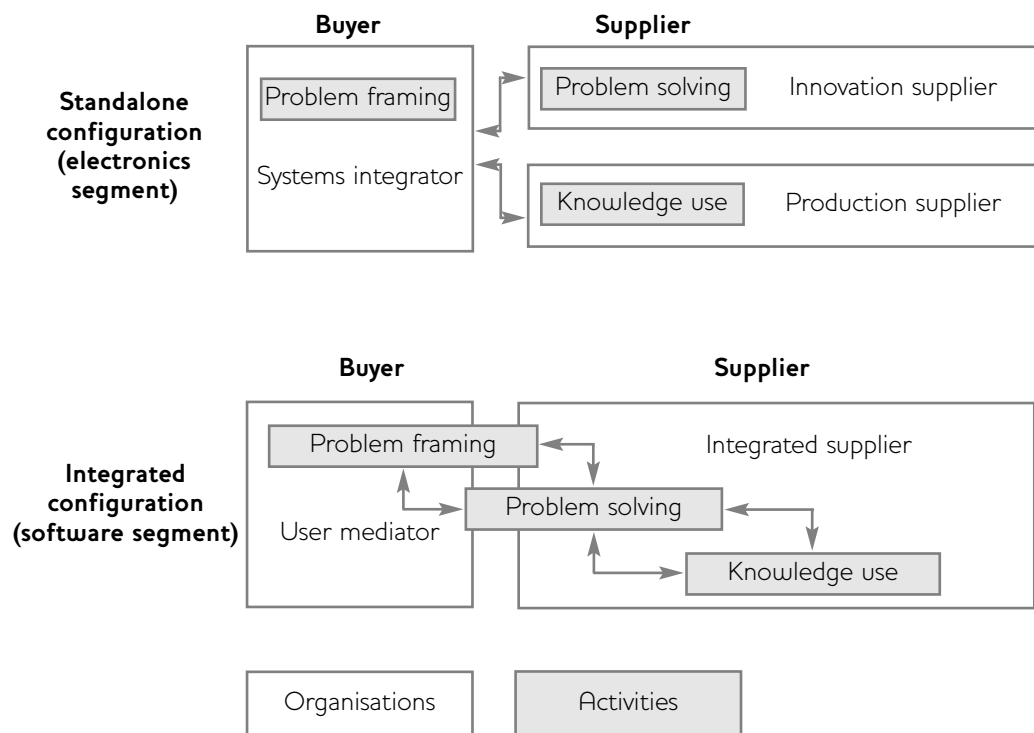
The literature led us to hypothesise that requirement definition will be kept in-house by buyer firms. This was addressed in Section 5.2. However, as the three case studies showed, the advent of open business models means that in reality this is not clear-cut. The case material suggests that there are differences between buyer segments in this regard. Electronics and telecom firms mainly outsource problem-solving and innovation support activities. Engineering services tend to feed into highly coordinated networks and innovation processes in which Indian service providers play a specialised and bounded role. The buyers provide carefully defined and limited spaces in which suppliers can operate. In the software buyer segments (primary and secondary), the adopters of open business models do not always follow such a practice. As the case studies illustrated, suppliers are now often invited to participate in requirement definition activities in a substantial way.

These differences are related to the pattern identified in the previous section which distinguished between standalone and integrated innovation activities. Using this terminology, the overall pattern that emerges is:

- When innovation takes a standalone character, software suppliers are not engaged in problem-framing activities.
- When innovation and production are integrated, there is a greater scope or incentive for involving suppliers in problem-framing activities.

The case studies indicated that innovation emerges as an incremental extension of 'standard' outsourcing and it becomes subject to competition and market dynamics. But these constraints are only translated into innovation outsourcing because of the advent of open business models in which an increasing number of assets – including assets that were until recently perceived as 'core' – are shifted from 'fixed' to 'variable' status in the client organisation. Software architecture capabilities, for instance, have become more variable. Buyer firms may deploy their own architects or use those of a supplier. This is where the integrated type of

Figure 5.1 **Problem framing in standalone and integrated innovation outsourcing**



innovation outsourcing differs from standalone innovation outsourcing. The development of products and systems is exactly what is outsourced. The logic that enables the sourcing-in of new knowledge and licensable commodity technology but prohibits the externalisation of 'systems integration' does not apply. This is why this type of outsourcing is associated with more opportunities for involving suppliers in problem-framing activities.⁵⁷

These findings are somewhat counterintuitive. Because standalone innovative activities are undertaken within the realm of innovation (e.g. new product development), it is easy to assume that these are 'most proximate' to problem framing. However, loose connectedness means that different roles – e.g. systems integration versus modular component provision – can easily be assigned to separate organisations. Typically, there are relatively modest interactive requirements. In this way, there are limits to functions of the product development processes that are externalised to software suppliers. First, only software-related functions are outsourced. Physical product design and related activities are typically kept in-house (or outsourced to specialised providers of hardware design services). Second, the interface between the software component and the overall product is specified by the overall product design (and the technical standards). This has implications for the division of labour between buyer and supplier. The buyer is overseeing the design of the overall product (e.g. a chip or wireless

57 This insight is generated not only from the examination of buyer–supplier relationships and information provided by client informants. Fieldwork on the supplier side that investigated 'innovation events' showed that suppliers operating in tightly connected settings were much more likely to engage in requirement definition than did 'de-linked' suppliers.

device), and defines the functional requirements of the component. These specify the behaviour of the component and the interface (external design). The supplier is left with responsibility for non-functional requirements (such as performance, security and reliability) and internal design. Hence, the value chain thread for which suppliers are responsible is relatively short.

Conversely, because integrated innovation activities are undertaken in tight connection with production (i.e. implementation) it is easy to assume that these are the 'furthest away' from problem framing. However, this is not the case. This is because some problem-solving activities are difficult to codify in the software industry. If buyers want to outsource problem-solving activities, they typically need to open up for elements of the problem-framing processes. It is not always possible to draw a clear dividing line between problem solving and problem framing. It was this limit to codifiability and the resulting needs for buyer–supplier interaction that explains why co-framing of requirements was widespread in the tightly connected relationships that were studied in this research. Buyer firms expanded the outsourced value-chain thread from implementation activities and all the way into the realm of problem framing. It is not easy to stop and draw a clear line of demarcation at the stage of problem solving.

Figure 5.1 illustrates the difference between the standalone and the integrated setting in this regard.

This does not mean that the distinction between core and non-core (or strategic and non-strategic) has vanished. It has shifted to somewhere else. The key innovation processes – those that provide the most value in new business models – are becoming non-technical. Instead of focusing on product and systems development, managers focus on developing new business models in which the critical component is the customer interface. Internal resources are deployed in the areas that enhance user knowledge and sales capability, in managing other external relationships and in capturing rent from new business models. The issue of core innovation arises mainly in firms that are willing to let go of component knowledge (problem solving), while they seek to retain architectural knowledge (problem framing). In this scenario, architectural knowledge is what matters and knowledge spillover arising from buyer–supplier interactions is a dangerous threat. However, when the rent-generating processes move forwards towards the user, architectural knowledge loses some of its strategic importance. This insight applies to the software industries, but not to electronics. It does show, however, that the 'modular view' and the associated vision of labour division have limited applicability for a new generation of firms for which competitive advantage and profitability increasingly lie outside technical areas.

Interestingly, related research on the German software industry generated findings which support the findings presented here: 'Software firms in Germany re-focus on higher-value tasks which often depend very heavily on vertical knowledge and – quite often – on experience-based knowledge of the customers' business processes generated over long-term relationships' (Oswald 2008: 72). Consistent with the findings of this research, Oswald found buyers keep high-level design activities at home in most cases, but vanguard firms are now beginning to outsource these to offshore locations.

As these dynamics evolve, new upper boundaries emerge. Technical problem framing, and sometimes even certain aspects of non-technical problem framing, have become less strategic for certain buyers. The new strategic core lies increasingly in non-technical areas and the customer-facing units. This was clearly expressed by buyers. As an informant stated: 'We do not want to bring in someone else to take the layer between us and the customer' (Auto IT). Controlling access to the customer is increasingly vital.

A delicate situation can occur when buyer and supplier engage in joint requirement definition, which is intrinsically tied to the user setting. To deal with this situation firms invoke the concept of 'ownership', a non-legal term used in the software industry normally to ensure the individual encapsulation of interdependent objects (modules) by the assignment of modification rights (as opposed to reading rights) to pieces of code. With reference to joint requirement gathering for the operations support solution (OSS) project, a supplier project manager explained that although they may have 'reading rights' (in the figurative), they do not have ownership.

The activity is owned by [the buyer] and we don't intend to take that ownership. We want them to own it because it is interfacing with the customer and they do have a very good understanding of the business processes. We are clear both ways that they don't want us to own that activity. They still want to maintain the customer relationship and interaction.

(M-Tec informant, 18 October 2007)

With reference to this general relationship level, informants at the management level in supplier firms echoed this. As one of the founders of Infosys stated, suppliers need to respect the strategic concerns of buyers. The most demanding element in the innovation process is the anticipation of user needs. For client firms in the software industries cognitive and cultural proximity is therefore a core capability to them. 'This is where the boundary is and that has to be respected'. On the supplier side, this means that the upper limits of the current innovation space are clearly defined. It is vital for business relationships that there is a clear agreement on these upper boundaries.⁵⁸ The danger is that mutually beneficial relationships are turned into competitive ones. As this chapter has shown, suppliers have become drivers of innovation outsourcing in their own right, but they are very careful to push the process ahead of the curve.

The open innovation paradigm has described the decreasing role of corporate R&D labs and the corresponding increase in the use of external R&D. However, most of the literature has mainly focused on research and development of new (patentable) knowledge.⁵⁹ It has focused on 'R' rather than 'D'. However, the open innovation processes discussed and analysed here are development-intensive,

58 Nandan Nilekani, then CEO at Infosys: 'You have to be close to your customers. That is what companies need to do. They do not want to outsource that, and they shouldn't. But everything else can be outsourced' (quoted in Nussbaum 2006).

59 Similarly, much of the debate on offshoring of innovation has focused on R&D for adaptation to local markets needs, technology monitoring, and the cost and availability of scientists and researchers in emerging countries (Gammeltoft 2006; UNCTAD 2005). The case presented here does not follow the typical pattern of internationalisation of innovation that is driven by lead firms' need to conduct R&D to adapt products and processes to local conditions.

with very little traditional research content. While this is true across the three user segments, the analysis suggests that the nature of the outsourcing of software innovation services differs markedly across segments.

5.4 Conclusion

This chapter has sought to examine key characteristics of the innovation activities outsourced to Indian suppliers. In contrast to most studies on the globalisation of innovation, this study does not equate innovation with R&D. The chapter did not adopt a narrow focus on 'standalone innovative activities' but sought to examine innovation activities more broadly by including the set of activities grouped under the heading of 'integrated innovative activities'. The chapter showed that this broad view was warranted. It is not possible to measure the distribution of different types of innovative activities outsourced to India, but standalone innovative activities – the traditional focus of most reports and studies on the subject – are demanded by a group of buyers that connect to a relatively small business line in the Indian software industry. By contrast, the groups of buyers that connect to substantial business lines (most notably CAD) are also those who create the demand for integrated innovation activities. By inference, the conclusion is that integrated innovative activities are quantitatively much more substantial than standalone activities.

Moreover, integrated innovative activities are not only most substantial in quantitative terms, they are also more important with regard to 'transformative potential'. First, the chapter has shown that there is 'a way out' for the majority of business lines that have hitherto been constrained by forced lock-in. Second, it has shown that, in contrast to standalone activities, there are much more elusive, and perhaps faster moving, upper boundaries for integrated innovation. Unexpectedly, the study did identify innovation activities that extended beyond problem solving within this category. The space for innovation seems to have changed considerably in some cases.

6 Innovation inputs and formation of capability

This chapter seeks to highlight some of the key mechanisms that enabled Indian suppliers to move into new spaces. It examines the sources involved in the innovation process across the 36 events. It starts with an overview of the importance (frequency) of different linkages and resources in the innovation process. Section 6.2 then examines the role of ideas and investments whereas the following section (6.3) focuses on knowledge linkages in the global and local economy. In section 6.4 the chapter explores the role of competence leveraging in the capability formation process. Section 6.5 turns to the *effect* of capability formation by examining how it changes the outsourcing landscape. Section 6.6 draws conclusions and discusses the insights we can derive at this stage with regard to whether and how ‘openness’ influences capability formation in the supply base.

6.1 Innovation inputs

As was discussed in the introductory chapter, the dominant hypothesis in the literature is that the main route to innovative capability is through the local innovation system. While intra-firm dynamics receive occasional mention, there seems to be widespread agreement (sometimes implicit) that local knowledge linkages between firms are a key precondition for the development of innovative capability. Yet the existing literature does not bring the specific learning mechanisms into the open. This is a key aim of the present study.

This chapter examines capability formation by investigating the origin of the ‘resources’ used in supplier firms’ innovation processes. The study distinguishes between three types of innovation resources: ideas, investment and knowledge (all defined broadly). These may be ‘sourced’ internally or externally. With regard to external acquisition, a differentiation is made between local (in India) and global sources. Hence, this chapter operates with three different ‘levels’ at which resources may be acquired: internal, local and global. However, the linkages for a given resource (e.g. knowledge) are not necessarily limited to one level. Different types of linkage may combine in different ways over the various stages of the innovation process.

The tendency to combine linkages from different sources is reflected in Table 6.1. As seen, the importance of internal linkages is high across all three types of resource. In other words, firms drew largely on their own resources in order to innovate. This is unsurprising but not always given sufficient attention. Firm-level innovation depends on strategic intent and prior endowments (Bell 2006; Ernst and Kim 2002). However, firms also drew on external linkages. As Table 6.1 shows, firms drew frequently on global sources of ideas and investment and massively on external sources of knowledge. In other words, the firm-internal level and the global level blended during the course of most innovation events.

Table 6.1 Sources in the innovation process (frequencies)

	Ideas	Investments	Knowledge
Internal linkages	High	High	High
Local linkages	Low	Low	Medium
Global linkages	Medium	Medium	High

Note: 36 innovation events were examined. This table counts the number of cases in which a certain type of linkage (constellation) was of 'some importance', i.e. not absent. This means that at least one linkage of this constellation was identified in a given event. The following principle was used to define importance: High = 24–36 cases; Medium = 12–23 cases; Low = 0–11 cases.

Self-evidently, the blending of internal and global sources depends on significant internal resource generation.⁶⁰ Firms had established innovation councils, R&D departments, incubation schemes, knowledge management programmes, etc. However, the analysis here is focused mostly on external resources. The importance of the firm-internal level is sometimes given insufficient emphasis, but the importance of this level is undisputed. The question for our purposes is how and in what ways firms drew on and benefited from external learning mechanisms.

6.2 External sources of ideas and investments

The use of ideas and investment 'sourced' globally was of 'medium' importance across cases in the sample. It is clear from the case material that there was often a tendency for these resources to come from the same source (actor). Thus while there are important exceptions, investments from (global) sources were typically provided by the organisations which had also been involved in developing the ideas. If they had participated in formulating ideas, they were also likely to contribute with knowledge in the elaboration and implementation phases of the innovation process. In other words, there are also some identifiable constellation patterns with regard to the global level. This section discusses the overall acquisition from global sources of ideas and investments respectively.

6.2.1 Ideas

Global sources were involved – to some degree – in the idea formulation phase in nearly half of total cases. This shows the generally high level of global involvement in the idea generation phase. Moreover, it is interesting to note that in more than a third of cases global actors and sources were *more* important than internal sources for formulating ideas. In the vast majority of cases, the external actors were buyers or alliance partners. Such global actors were either passively or actively involved.

With regard to *passive* transmission, observation of best practice in other competing firms was important. For example, the establishment of the tools group in Infosys was modelled over the preceding establishment of a similar group with

⁶⁰ A basic source of resource generation is the establishment of staff training programmes. Firms invest as much as 6 per cent of annual revenues on training and skill enhancement (NASSCOM 2008: 94).

the same functions in one of the world's most dominant software corporations. While Infosys employees had been exposed to this idea through their work with this customer and alliance partner, there was little or no active collaboration.⁶¹

In most cases ideas were transmitted *actively*, for instance in the form of a suggestion or a proposal, typically from a customer. Forward linkages to customer and end-user were by far the most important source of new ideas. Often the interaction with a particular customer (or multiple customers in a particular field) provided an impetus or even a direct request. Certain buyer firms requested new types of service and this can spark internal learning projects related to new functions or technologies. Ideas were often very specific. For instance, the CIO Dashboard was developed at the request of a particular customer (see below). However, later the dashboard could be used to improve the service levels for other customers as well.

It is widely recognised that open innovation firms increasingly make use of ideas generated externally. However, in the software sector the opposite is also true – buyer firms externalise ideas created internally if this can bring direct benefits. This is a consequence of prior decomposition (often of production activities). If an IT department wants to make improvements to certain processes, such as infrastructure management and development, and if these processes are outsourced there is almost no other way. If an electronics firm has reduced its internal R&D capacity, but needs an affordable ultra wideband (UWB)-enabling software component, for instance. If an electronics firm has reduced its internal R&D capacity, but needs, for instance, an affordable ultra wideband (UWB)-enabling software component it is only a logical step to suggest to an Indian firm that they should develop one.

In the majority of cases the passing down of ideas occurred when customers had identified a need or problem that could be addressed with (changes in) the supplier's services in terms of practices or scope. With regard to scope it was a customer, for instance, that suggested Aditi engage in end-to-end product development in a project evolving around the creation of a relatively complex web application. The initiating product idea was referred to as 'a vision' rather than a clear idea. This left open a very wide scope for joint collaboration in the interface between the idea and the elaboration phase. To this end, a core team of Aditi employees was moved onsite to translate a 'vision document' into functional specifications.

As will be discussed, some buyer firms seem to be guided by the idea that the advantages and the savings (time and costs) outweigh the expenditure associated with investments in supplier firms' capabilities, typically of a semi-specific nature. However, the important point in this regard is that while customer requests for innovations are often initially client-specific, these may be applicable to subsequent reuse with other buyers or markets to varying degrees. Chapter 2 refers to this as 'leveraging'. This applies not only to accumulated capabilities but also sometimes to tools, frameworks and semi-standardised solutions. When a customer firm plays this role, it is referred to as an 'alpha customer'. Such a

61 At least, active collaboration was not mentioned during interviews.

customer helps in developing a set of capabilities or reusable frameworks/tools for a particular area by providing requirements, feedback and other resources.

In the case of the Fault Reporting Tool, the idea phase was initiated with a customer request. The CIO Dashboard was a proactive drive, but the idea was co-developed by an alpha customer who also co-funded the project. Thus, the customer was also closely involved in the conceptual design of the system in order to ensure that it would meet its needs.⁶²

Similarly, in the case of the online assessment solution it was an important global lead customer that provided the idea in its own self-interest. The customer saw a large potential for improving its information technology learning solutions by adding the assessment capability. Hence, while this was implemented for the lead customer in the first instance it subsequently enabled the firm to reconfigure its business model and open up the growing Indian market for information technology training products and services. The assessment of skills remains a highly critical issue in the Indian software industry.

As mentioned, new types of solutions are often cross-applicable, even if they are first developed in customer-specific settings. The cases mentioned here were initiated upon ideas (and financial resources) provided by an 'alpha customer' but subsequently they were implemented with a wide range of customers. Such 'alpha customers' were identified in many customers across business lines.⁶³

Alpha customers were invoked in different ways. In some of the cases mentioned above it was the buyer that provided the initiative for change. This tended to occur in cases in which suppliers were relatively small and less powerful *vis-à-vis* their customers. On the other hand, stronger suppliers would sometimes involve alpha customers in the idea phase, but the events tended to be initiated internally or jointly. As will be discussed, this was typical of advanced events.

6.2.2 Investments

Requests for innovation and capability building by customers were sometimes accompanied by opportunities for direct financing. The development of the dashboard was part-financed (60 per cent) by the client. Similarly, both the Auto IT–MindTree and Digital Media Networks–Aditi projects (discussed in Chapter 5) involved learning phases that were co-financed by the customer. When a project required the mastering of a particular technology or skill which was not fully developed in the supplier firm, a separate small time and materials contract was sometimes made to co-finance preparatory training activities such as workshops or courses (in addition to the main contract for work). However, 'investments' were most typically of the non-financial kind, often described as 'contributions' in terms of time taken out to deepen the relationship.

62 An informant underlined the importance, '[The customer] is an alpha customer for us. We have a special relationship with them, they helped us develop our six sigma practises; they taught us how to innovate'.

63 The term alpha customer derives from the software product development world in which the alpha phase is the core build-up and design stage in the product development. This precedes a 'beta release' to a limited number of customers for usability testing before eventual formal launch of the product.

Event-related investments were provided by global sources in one third of the cases, with the slight majority of these investments taking a complementary role to the investments made by the innovating suppliers themselves. As mentioned, these were often the same events that benefited from external ideas and initiative. The investment decision was typically made and negotiated somewhere in between the idea formulation and elaboration phase of the events. The investments themselves were typically concentrated in the elaboration phase. They took two major forms – direct and indirect financing.

Direct investments took place when customers paid for (parts of the) creative and development activities in the elaboration phase. This was typically provided by alpha customers and occurred in innovation related to the improvement in ongoing buyer–supplier relationships. It also occurred in more standard-type customer projects that were characterised by the fact that both buyer and supplier considered it ‘innovative’ (in the sense that it necessitated greater than usual knowledge generation in the supplier firm) and in which problems could not be solved without a preparatory phase of training, workshops and problem solving. Typically, these activities were billed separately or were isolated in the main contract.

Good examples are the online dashboard in which the alpha customer financed 60 per cent of the development cost as well as the sales tools and billing system, where customers paid 50 per cent of training/knowledge transfer sessions that preceded initiation of the projects. In the latter case, for instance, the customer designed and arranged for intense training and knowledge transfer sessions that were over and beyond what was specified in the contract.⁶⁴

In this regard, it is also worth mentioning Aditi, which developed its product transformation service offering based on a particular project that was initiated by a key alliance partner and owner of a platform technology. The alliance partner wanted a US-based independent software vendor (ISV) to migrate its flagship product to its own technology base. Therefore, the alliance partner wholly financed Aditi’s development of a proof-of-concept (POC) for the transformation and functional improvement of the ISV’s product. In this case, investments made in the elaboration phase were billed separately and to a different organisation.

According to informants, *indirect investments* were much more widespread and broad-based. However, they are also more difficult to pinpoint from a data collection point of view because they occurred in various phases and were typically not thought of as ‘investment’ but as ‘contributions’ by global actors. One way in which such contributions were made can be illustrated by the case of Aztecsoft’s Data Integration Tool.⁶⁵ For the development and enhancement of the product to meet the customer’s needs, the gathering of requirements was facilitated by the customer, in particular through the organisation of client panels

64 Sasken received very similar services in relation to the development of the Symbian Competence Centre but in this case the costs were indirectly covered by Sasken since this firm needed to pay a (substantial) fee in order to be designated as a certified competence centre.

65 The contribution made by the customer is easily detectable in this case because the legal and responsibility-level ownership initially remained within the supplier, whereas the package was marketed by the buyer on a contractual basis.

and events.⁶⁶ Furthermore, since the customer had developed its own product it was able to suggest ways in which to improve the product for the intended markets. As the business relationship matured and the customer established an in-house team dedicated to the package, the customer made investments in the 'relationship' and made efforts to ensure that all the project team members in the two firms understood how they could and should interact with their counterparts. According to the buyer, substantial upfront investments (of time rather than hard costs) constituted 'hidden overheads', but these investments in relationship management proved well spent in the long run. Similarly, another buyer established a network of partner relationship management coaches throughout its organisations in order to facilitate 'seamless' cross-organisational collaboration.

6.3 External knowledge linkages

It was established that global knowledge linkages were of importance in a very large number of cases. However, it was not discussed *how* important customers and other global sources were within cases. In order to address this issue, respondents were asked to rank the three different levels in terms of importance. Ideas provided by global actors were either first or second most important in almost half of cases. With regard to investments, the same was true of one third of cases, and for knowledge it was more than eight out of ten cases. This reflected the fact that the blending of internal and global resources was a dominant trait of the innovations examined. This is clearly reflected in Table 6.2, which shows the relative importance of the different sources of knowledge across events.

Furthermore, the table shows that in more than one third of events the most important source of 'knowledge' was one or more actor at the global level. However, as shown above, what matters is the combination of different sources. The combination of internal and global sources was by far the most important.

A common characteristic – particularly of those events that were advanced and research-based – was that they drew on a multiplicity of sources. Backward linkages were sometimes made to third-party providers of software tools and technology components, but these were not critical. By contrast, horizontal and institutional linkages were sometimes central. Linkages to standards-setting networks were sometimes decisive, mostly in the ESO segment, but occasionally also in advanced events in the CAD segment. Section 6.3.1 discusses this in more detail.

6.3.1 Global knowledge linkages

Vertical linkages. Knowledge linkages to customers' firms were of very high overall importance. Customers and end-users played a key role in providing critical knowledge in most innovation events. This was the single most important element of external 'sourcing' across the events examined. The purpose of this

66 These requirements have driven new technology initiatives and innovations in the product development. Client feedback throughout this cycle has strengthened the capabilities required.

Table 6.2 **Combination and relative importance of knowledge sources across events**

Firm	Event name	Internal	Local	Global
Aditi Technologies	Digital music distribution platform	••	–	•••
	Mifos	•••	•	••
	Product transformation services	••	–	•••
Aztecsoft	ETL Tool (extract, transform and load)	•••	–	••
	I-Test	•••	••	•
	Marketing campaign	•••	••	–
Cranes Software	Global marketing network	••	–	•••
	NISA	•••	••	•
	SYSTAT	••	•••	•
Encore Software	Mobilis	•••	•	••
	VoIP solution	•••	–	••
	Wimax solution	•••	–	••
Infosys	CIMBA	•••	–	••
	Influx	•••	–	••
	Tools Group	•••	–	••
Liqwid Krystal	Codesaw	••	–	•••
	gyanX	••	•••	–
	rRapidSuite	••	•••	–
Microland	CIO Dashboard solution	•••	–	••
	IT security consulting	•••	•	••
	Network management system	••	–	•••
MindTree	Bluetooth solution	•••	–	••
	Sales tool system	•••	–	••
	TechWorks	•••	••	•
M-Tec	B/OSS	••	–	•••
	Build-Operate-Transfer	••	–	•••
	COMPASS	•••	–	••
RelQ	AsessQ	•••	–	••
	RelQ Online	•••	–	••
	Verticalisation	•••	–	••
Sasken	Botnia Hightech	•••	–	••
	Multimedia Subsystem	•••	–	••
	Symbian Competence Centre	••	–	•••
Wipro	Global command centre	•••	–	••
	Lean software factory	•••	•	••
	Ultra wideband solution	•••	–	••

Source: Informants' rankings. Note that the table is sorted by innovation type, local sources, and global sources.

Key: ••• = First most important; •• = Second most important; • = Third most important; – = Not important.

subsection is to provide a brief overview of the various ways in which knowledge was acquired through forward linkages. It distinguishes between learning from buyers and learning from end-users.

Advanced innovation often involved user–producer interaction around customisation of semi-standardised solutions. Influx is a good example. This framework was proactively home-grown. However, it was critically dependent on an alpha customer. As explained by informants, such frameworks only ‘come alive’ and become useful when they are applied in customer settings; no amount of in-house development can substitute for this process. In other words the distinction between the elaboration and implementation phase becomes blurred in the initial collaboration with the alpha customer.

The case of ultra wideband (UWB) is an illustrative example. In this case, the whole phase of architecture and design (the elaboration phase) involved an alpha customer. During this phase, Wipro interacted with the customer and subsequently Wipro developed a silicon reference model as a demonstration of this new capability domain (used for marketing purposes). This process is typical for advanced innovations related to standards-based intellectual property solutions. Each IP block has a core base that needs to be customised for each customer, but the ‘linear model’ of innovation does not apply in this case. In other words, these bases cannot be completed and tested without being applied in a user setting. Therefore, the development of this core intellectual property is based on the interplay between in-house R&D and application with an alpha customer. Thus, the alpha customer was typically involved in the platform development phase. In this phase, requirements, information, and feedback provided by the customer fed into the platform development phase.

In many ‘intermediate’ events, the Indian companies had become co-creators of innovation in specific (internal or external) end-customer projects. In these cases knowledge development was often a joint activity involving team members from both buyer and vendor. The core knowledge-generation element was typically a phase of joint definition of requirements and architecture, typically of an entire project. The supplier was brought along on the project because of specialised competences, typically in a specific technological/functional field, but also sometimes because of industry domain competences.

The OSS project provides an example. The supplier was working alongside the customer in all phases of development, including inception and elaboration, launch and stabilisation and next release planning. The key knowledge came from the customer in the form of access to previous product architecture and from ‘knowledge transfer’ sessions. During the whole project duration there was close interaction between buyer and supplier, facilitated by dedicated physical infrastructure and key personnel, who were onsite throughout the period.

Another example is MindTree’s development of a sales tools system for the IT wing of a major group in the auto industry. The customer (based in Sweden) wanted to provide a sales tools system for an auto manufacturer in the group (based in France), that in turn wanted to supply this to its sales forces across the globe. Much of the critical knowledge derived from a pre-existing system and its users (primarily auto dealers) but also in the sales and IT departments of the auto

manufacturer. Information and certain specification had been organised by the first degree customer and was provided formally upon project initiation. However, during the course of the development of the system the company needed to go back to the second and third degree customers/users in order to conceptualise the bridge between the existing system and requirements for the new system. This necessitated lengthy consultative interaction throughout the process.

Another type of forward knowledge acquisition is *learning directly from users*. This type of knowledge acquisition is enhanced when firms have a direct or indirect relationship with end-users. Direct linkages were identified primarily in the advanced events in the software product business line (made-in-India products). Cranes, for instance, inherited surveys of Systat users when this product was acquired. This formed the basis of the 'product transformation' which was subsequently carried out. However, Cranes also employed selected lead users in US academic institutions to work as consultants and idea providers. Some of these worked very closely with Cranes (and some spent several weeks in their Indian office).⁶⁷

In the data integration case, the contact to end-users was mediated by the buyer but it essentially enabled the supplier to innovate on behalf of the customer by following a lead user strategy. Very similar mechanisms were identified in similar events. In Aditi's product transformation event, a key driver in adding new functionalities came from information (and some limited interaction) with end-users in the USA that was facilitated by the external partner. These interactions were initially aimed at 'getting a sense of the thing', with the aim of creating such improvements. The customer coordinated information and contact to selected end-users who could give Aditi insights into the product aims and the needs of the end-users. This ultimately enabled the firm to innovate on behalf of the customer.⁶⁸

In no cases were backward linkages in the global economy the most important source of knowledge; furthermore it was the least frequently mentioned linkage type at the global level. In order to give an idea of backward linkages overall, this subsection describes some cases in which backward linkages were important features as complementary/subsidiary sources, but not the most critical. Backward linkages were mainly connections to three types of KIBS – third-party software tools providers, consultants and technology component providers.

Software tools can be considered 'capital goods' of the software industry and there are linkages to *software tools providers*. According to informants, software development tools are among the most important factors in overall productivity increases. However, this is not easily captured in innovation events. The use of these tools is so fundamental to the software development process and its

67 As an informant explained, 'They went to certain key customers and they asked, "what do you need? What do you want?" and they tried out certain things. So they had, in fact, a fairly small focus group of people who pushed them hard and who told them "this is what we don't like about Systat". And they fixed it. It's that simple'.

68 Insights from this firm also show that customer mediation of linkages also occurred with regard to linkages to actors other than users. In a different event the customer provided specific information related to the third-party systems (including eBay and PayPal) in which the system needed to be integrated and the customer was largely responsible for mediating interaction with these actors.

improvements that these tools were rarely mentioned by informants. But two examples are provided below.

First, an enterprise project management (EPM) tool was used for the development and implementation of the COMPASS system (Comprehensive Project Analysis Support Solution). For this event M-Tec relied primarily on knowledge and training provided by the Project Management Institute (PMI). However, it used HP (Hewlett-Packard) to supply a base software system (Mercury) which was then customised to support the processes defined by M-Tec. Along with the system itself M-Tec also received onsite training and consultancy services from HP related to system integration. Secondly, as already mentioned, a Tools Group was created as a single point of contact for interaction with third-party software development tools providers aimed at structuring and optimising the use of such tools. While the most important source of knowledge was a collaborator that had created its own organisational entity for the same purpose, a lot of interaction occurred with the providers of tools themselves.

Knowledge was sometimes also supplied by non-software KIBS such as general *consultants*. When Wipro developed its Lean initiative, they brought in consultants from Japan to help them formulate a Lean strategy. Wipro contacted several other consultancies, but eventually there was nobody who had any experience with Lean in the software context, but these were still mentioned as a part of the journey.

The above examples are cases in which suppliers' products and services are mainly for internal use in processes innovations. Hence they are only indirectly embedded in the provision of services to customers. However, in certain cases – particularly in the R&D and products lines – knowledge was embedded in components that are integrated into the final solution on a licence basis. Thus there were linkages to *technology component providers*. A good example is Sasken's Multimedia Subsystem for mobile phones. Depending on the specific customer requirements for its system, Sasken will have up to 90 per cent of required capabilities in-house. Remaining specialised components/skills are sourced from outside in order for Sasken to take on the role of a comprehensive solutions provider. The company has therefore developed relationships with Israeli suppliers in the field. These transactions are rarely one-off or thin in nature. For instance, IXI Mobile provides an application framework and for this Sasken has secured a dedicated development support team at the supplier's sites in Israel and in Ukraine.

Horizontal linkages. Horizontal linkages were either multilateral in the form of linkages to and participation in standard-setting networks or unilateral in the case of acquisitions of companies with complementary competences.⁶⁹

Multilateral linkages also sometimes played a role. As already mentioned, Influx relied critically on early customers that collaborated in the development phase. However, Infosys also benefited significantly from joining the Business Process Management Initiative (BPMI), the leading standards consortium for BPM, when

69 In some cases, these linkages also featured vertical and institutional dimensions as customer firms participated in firm networks that enforced *de facto* standards.

the firm was developing the Influx framework. Through interactions with other firms working in similar areas, it helped develop the necessary expertise and it facilitated the creation of the specifications for modelling end-to-end business processes. The internal research efforts in this area enabled Infosys to become a standard maker rather than merely a standard taker. It participated in the development of open-source, non-software modelling language frameworks that were used as the basis for its own modelling tools.

It has also been mentioned that Wipro benefited from diverse linkage types in its development of the UWB solution. Participation in first the Institute of Electrical and Electronics Engineers (IEEE) subcommittee and later the WiMedia alliance meetings proved critical. According to Wipro's delegate – a principal architect – this was 'mainly to track the trends'. Thus, it became important in the idea formulation phase. However, the continued participation in the specifications committee of the WiMedia alliance provided the knowledge necessary to ensure interoperability with other elements in the ecosystem. Direct feedback and comments on the specifications into the alliance were confined to and mainly provided through emails. Indirectly, however, a greater influence on the evolving technology was gained through interactions with the alpha customer when issues of specifications were discussed and then these feedbacks and suggestions were channelled through the alpha customer that was a member in the Media Access Control (MAC) specifications committee. Similarly, in other events in the R&D area the association with standard-setting networks was a crucial differentiator between advanced and intermediate innovations (the latter tended to relate to more mature technologies in which the scope for knowledge addition is confined). In developing their Bluetooth solutions, MindTree's participation in the Bluetooth Special Interest Group (SIG), a standard-setting organisation, was important in securing specifications for interoperability of an evolving technology. As capabilities increased, MindTree itself became important in Bluetooth standards development and enhancement after gaining voting rights as an associate member (as distinct from Board member). Furthermore the participation in the Bluetooth SIG has been the key point of contact for alignment with strategic customers.

A *unilateral* type of global horizontal knowledge sourcing is the acquisition of companies with new knowledge or relationship assets. Wipro brought in capabilities to the UWB development process from NewLogic, an Austrian semiconductor design services provider and supplier of intellectual property cores for wireless applications. MindTree's acquisition of Finnish firm Botnia brought in complementary and customer-specific capabilities. RelQ's acquisition of French firm International Testing became an element in its processes of verticalisation and domain competence deepening.

Institutional linkages. Linkages to *traditional knowledge institutions* do occur in the case material, but not as frequently as one might expect. In general, it was argued that linkages to academia were increasing in importance along with the criticality of domain competences. Hence these links were not only formed with software technical institutions, but from a much broader field. For instance, one informant mentioned that a European academic expert had been hired to ensure compliance of an information system developed for a customer in the financial industry with Basel Accord regulations on operational risks. However, such

instances do not appear in the events-based material. Only in two cases were such linkages mentioned.

Infosys established relations with the Business Process Management groups at the Queensland University of Technology in the development of Influx. These were partly facilitated by the company's acquisition of an Australian firm specialising in the design, building and integration of business solutions. Cranes established close connections with Purdue University and gained access to resources relevant to the further development of Systat. Connections to academia were also mentioned in other cases, but these appeared marginal.

Linkages to '*non-traditional institutions*', such as open-source repositories/networks were of more central importance to some events. These may be viewed here as 'institutions' simply by virtue of being a non-firm establishment. In these cases, firms sourced knowledge embodied in semi-standardised software solutions (akin to semi-manufacture in the world of industrial production). These solutions are integrated as components into the final solution and therefore they may be viewed as earlier stages in the knowledge development process. Such linkages were not widespread as the main source of external knowledge (two cases) but they often took the role of a supporting form of external knowledge.

Microland's Fault Reporting Tools, for instance, were constructed on an open-source base (Open NMS). Previously these fault-reporting tools were licensed at a significant cost from a major third-party information technology company. Thus, in this case, embodied technology was freely available to use in a process innovation. Significant customisation was needed but the open-source base was a key component in the overall innovation. Another case in which open-source components were used directly in the innovation processes is MindTree's TechWorks. In the above cases the use of open-source resources was of a non-interactive kind. However, active collaboration between the innovating firm and the open source was also used. Aditi received active contributions from open-source developers in its development of the Mifos package. In addition, 'international hotshots' in agile software development (ASD) methods (open-source principles of organisation) were hired to arrange workshops at Aditi on a consultancy basis and the key people in the firm read widely on the process methodology.

The increasing shift towards open standards in many fields – not only in the hard technology domain, but also with regard to business processes – has eased entry for certain Indian firms into innovative activities.⁷⁰ Another type of open standard is that which is found in open-source software (West and Gallagher 2006). Not surprisingly, Indian firms are increasingly involved in open-source software networks.⁷¹ This has been an important facilitator of process innovations. For instance, the introduction of Web 2.0 principles of corporate communication – not only within firms, but also between buyers and suppliers – has been based on open-source solutions. Similarly, online code libraries and tools from sites such as SourceForge.net enhance general productivity improvements.

70 The increasing importance of open standards is intrinsically tied to the open innovation phenomenon (Simcoe 2006).

71 IBM has recently established Linux Competence and Solutions centres in Bangalore.

6.3.2 Local knowledge linkages

This section continues with the examination of vertical, horizontal and institutional linkages within India.

Vertical linkages. Local vertical firm linkages appeared in four cases only. Liqwid Krystal is now exploiting the booming software industry by licensing out their key online learning and certification tool (rRapidSuite) to two of India's largest software companies, one of which is based in Bangalore (and included in the sample). The Bangalore-based company was the first customer. Critical knowledge and specifications were gathered during exploratory meetings as well as in the implementation phase, where the customer implemented the solution on its large training campus. According to the CEO, location mattered: 'We couldn't find a better test-bed for our new products than right here at home'. The company benefited from local contacts and networks in bringing the product to market. This example shows that as the software industry in Bangalore is booming and diversifying, local market opportunities are emerging for smaller niche firms. Thus, to some extent the software industry in India is becoming a market in itself. Hitherto such an inter-firm division of labour has been strikingly absent due to conformity of business models focusing on a narrow range of activities within the software development process. As emphasised by NASSCOM (2007b), many of the innovation activities of the software industry in India have been concentrated on inputs (i.e. acquisition of skilled labour) because this is the critical bottleneck for further growth of many companies. Liqwid Krystal has exploited this space.

Another example of critical interaction with users is Encore Software, a company focused on producing proprietary digital signal processing software for the global telecoms industry, but the firm has made several attempts to diversify into the design and marketing of 'affordable information appliances' (small low-cost computers) to the Indian and other low-cost markets. In developing the Mobilis, feedback from users of previous product versions and users in the private sector was critical. Local user groups that were given a demo version of the Mobilis provided the most valuable knowledge. As the Mobilis is aimed at markets in developing economies, the local setting provided a suitable setting for the pilot run.

Similarly, Aditi Technologies acquired a contract to develop a microfinance package for the US-based Grameen Technology Centre. In developing this product, the company benefited from interaction with a local user NGO, Grameen Kota, which was provided with a beta trial and gave essential feedback. The three companies mentioned here are all small product-oriented companies, and two of them have explicit strategies in which the local market features prominently.

The above cases relate to forward linkages to customers. However, linkages to suppliers were also present in one event. Microland, a smaller player in the Information Systems (IS) outsourcing space, outsourced the programming tasks involved in the development of both their security solution and online dashboard. However, the interaction with this supplier was thought to bring only marginal improvements to the innovations since this production phase occurred subsequent to the major creative innovation phase.

Respondents in case study companies as well as other informants reported a generally increasing awareness of and interest in domestic market opportunities.

But with the exception of the companies mentioned above, respondents did not mention interaction with local firms and users as an important interface in their innovation processes.

Horizontal linkages. Local horizontal linkages were the most used type of knowledge sourcing, not least in *multilateral* linkages. The most frequent form of horizontal knowledge sourcing was related to the acquisition of knowledge about practices used in similar (and hence competing) companies. For instance, when MindTree designed its award-winning knowledge management (KM) system, this took the form of open collaboration. During several critical phases the overall 'KM community' (i.e. a network of KM managers from leading software companies in Bangalore) provided inspiration and reference points. For instance, before developing Insight and establishing the principles on which it should be used, the top five software firms in Bangalore were surveyed through onsite visits to understand how they had structured their intranet KM systems. Thus, KM managers in other companies were consulted and were open to information sharing including hands-on inspection of their systems. This survey became critical in the design of the system, for instance in the decision to integrate it under OpenMinds, the overall KM system. But most frequently such best practice surveying was of an indirect form, i.e. from employees with experience from competing firms, and the knowledge acquired was perceived to be of less importance.

While MindTree made use of interactive sourcing of knowledge, most cases of horizontal knowledge sourcing were of a more passive kind. Often companies would use observations of best practice of other companies to inform key choices (e.g. RelQ's verticalisation or M-Tec's COMPASS).

Wipro made use of a local consultancy company, Erehwon Innovation Consulting, in both defining the innovation strategy and in the implementation of some of their chosen 'quantum innovations', including the establishment of the Global Command Centre and implementation of Lean in Software.⁷²

Aztecsoft drew on local sources for the critical knowledge in two innovation events. First, it made an important expansion of its business portfolio by establishing an independent testing services centre in which customers (including some of the world's largest independent software vendors) can have their own products tested before release. The capabilities involved in this type of testing are different from testing which occurs as an integrated part of the software development process. To acquire these capabilities the company bought a dedicated testing company based in Pune (near Mumbai).

Institutional linkages. Bangalore is well endowed with knowledge institutions and these knowledge institutions are relatively well linked with the private sector. The Board for Information Technology Education Standards (BITES) brings together educational institutions and human resource managers in fine-tuning the curricula to the general needs of the industry. Several of the case studies also showed that knowledge institutions and private firms are linked bilaterally, where companies provide sponsorships in knowledge institutions, host interns, etc. However, what is the role of these institutions in firms' innovation activities?

72 Erehwon also assisted one other of the case firms in defining strategy but it was not involved in the implementation phase.

In one case, a company that focuses on software packages for scientific analysis (Cranes), significantly improved a software package, NISA, for finite element analysis (FEA). Close cooperation with the mechanical engineering department in Indian Institute of Science (IISc) (involving a professor becoming a member of the Board of the company) enabled the team to add new and advanced features to the product, which are not available in alternative FEA software tools. In collaboration, user conferences have been held at IISc involving different types of lead users, which have provided advanced insights related to new features and development of the product. Focusing on hard sciences, this company has developed multiple and institutionalised linkages with IISc, involving joint laboratories and research programmes. But this company also has linkages to other knowledge institutions. To develop their statistical analysis package the firm developed close linkages with the Indian Statistical Institute in Calcutta where a renowned scientist was engaged on a consultancy basis.⁷³

In the case material, vertical firm–knowledge institution linkages appear twice. Liqwid Krystal had commercial success with an e-learning suite for software engineering (mentioned earlier) which was integrated into the products of large global publishing houses. But the company wanted to address the end-user market directly. It was found that the best route to this was by transforming the solution into an online product sold directly to the huge and growing educational sector in India. Critical feedback was provided by lead users including IISc and the Indian Institute of Information Technology Bangalore (IIITB).⁷⁴ Today the solution is made available to more than 150,000 students in 128 university colleges across India.

Another event in which a local knowledge institution was important was in the case of Encore’s development of WiMax technology. A group of interns from a local college were engaged with an in-house team to develop a Wimax protocol stack. Indeed, there is reason to believe that companies producing ‘made-in-India products’ are more likely to form university–industry linkages (UILs) than companies engaged in the major IT services business lines.

6.4 Competence leveraging

This section discusses leveraging, first between firms in the supply platform and then within firms.

6.4.1 Leveraging within the supply platform

Section 6.1 suggested that the regional level was of limited importance with regard to the *sourcing* of knowledge for supplier innovation. Is the same true with regard to competence leveraging, the *exploitation* of knowledge in new domains?

73 Occasionally, firms may hire faculty from knowledge institutions as domain experts on a consultancy basis. One example that was given of this was a company that was engaged project for a US based bank and in this project an academic expert was engaged in helping the team to translate the Basel II requirements into specifications for the project.

74 Both of which have courses that use the system.

Informants suggested that the role of the 'region' for application of knowledge was still relatively limited, but growing. The data collected for this research supports this view. Previous fieldwork, concentrating on the cluster dynamics in Bangalore during the 1990s growth period, suggested that internal transactions and active knowledge linkages between 'rival' (co-located) software firms were virtually absent (Lema and Hesbjerg 2003). This is no longer the case. There are indications of an emerging regional learning trajectory arising in the slipstream of the increasing maturity and diversification of software firms' activities. It arises from the internal and external demand for new services and functions, which has caused some otherwise distinct business lines to connect or spin off wholly new lines of business. Hence, there is increasing specialisation.

To illustrate this point, recall the case of the IT publisher presented in Chapter 4. This US-based buyer firm had opened its business models, increasingly collaborating with other publishers around the sharing and cross-selling of content. It concentrated increasingly on connecting with users and sourced innovative solutions from outside to this end. However, the solution for online experimental coding and skills assessment, sourced from a Bangalore firm, was not deemed a success and after a few years of offering this solution, it was discontinued. However, during the course of working with this solution, the supplier had developed valuable experience and distinct capabilities. It used these capabilities to address a new growth market – the Indian software industry. Hence, the supplier, Liqwid Krystal, is now exploiting the booming software industry by licensing out its key online learning tool (rRapidSuite) to two of India's largest software companies, one of which is Infosys. These firms used the solutions for in-house training and skills assessment.

Recall also the case of Digital Media Networks and Aditi, mentioned in the previous chapters. It has already been discussed how this relationship was driven by the adoption of open business models on the demand side. One clear indicator of this demand drive is that the sourcing strategy adopted by the customer was so much ahead of the curve that the capabilities needed to realise this project exceeded the immediately available capabilities in Aditi. The independent design of this type of application was a new experience for the supplier. However, the problem was solved by leveraging competences within the cluster. A number of people were brought in from Talisma, a made-in-India product (MIP) company, to provide specific expertise in product architecture and design functions that had not previously been provided in the OPD space. This was facilitated by an ownership overlap between the two firms. Five experienced 'project heads' were brought in from Talisma to work on the inception-framing stages of the project (problem-framing activities).⁷⁵ This example shows that the rise of innovative OPD services builds on previously accumulated capabilities in other business lines, not least the MIP business lines.

75 These two companies had a shared history but split up at the turn of the century (when the OPD opportunity arose) in order not to jeopardise relationships with OPD customers concerned about core competences. The company initially handled support activities for Microsoft. Talisma was conceived from the experiences of the Microsoft support team. In this sense, the evolution can be traced further back to other functional roles.

The independent testing services (ITS) business line is another good example of this. A new business line grew out of CAD and emerged during the 2000s. Traditionally considered a low-value activity, testing was usually undertaken in-house by the development teams as an integral part of the software development process. The skills required for testing are similar to those used in development. However, there is increasing acknowledgement that many problems arise when developers test their own systems or products. The testing process is easily separated from the development workflow and a particular facilitator of this business line is that testing is considered 'non-intrusive'. Over the period 2001–06 dedicated testing services companies such as RelQ, emerged as significant players, as did separate testing divisions in large companies such as Wipro and Infosys. Revenues from standalone testing services amounted to US\$282 million in 2006.

RelQ is a good example of this. In 1998, this firm was the first Indian company to become established as a dedicated software quality and testing organisation. All senior managers had long histories of working in the CAD segment in other suppliers, specialising in quality assurance. Carving out testing as a separate and independent activity allowed the company to establish new and innovative processes in this area. The firm rethought the role of testing in the software development process. By separating testing from the development processes, rather than performing testing in-house and often in conjunction with programming, new cross-applicable knowledge bases could be developed for this field, including test standardisation and other formal processes to manage the quality of the software test efforts. While the provision of standard ITS is a routine-based activity, RelQ (and incumbents in the ITS field) have accumulated the critical mass of specialised expertise in this area that enabled them to enter the field of test consulting and provision of 'transformational services'. Indian ITS firms increasingly engage in testing management and consulting services such as test strategy and quality assurance and certifications.

The examples above have discussed *active* leveraging of competences, not *passive* leveraging arising from the rotation of labour, from professional networks, etc. A liberal paraphrasing of the literature on clusters in developing countries (Schmitz 1999), suggests that while the latter is necessary for the breakthrough to innovation capabilities, it is not sufficient: active leveraging is required. Such active leveraging across firms *has* increased in importance since the turn of the decade. However, to give a full explanation of the 'dynamic from below' it is necessary to consider active leveraging within firms. This is what the next section does.

6.4.2 Competence leveraging within firms

Leveraging within firms is intrinsically tied to interaction with customers in different domains. In order to explain this intra-firm level it is necessary to reflect on the deepening of capabilities (a) at the domain level and (b) across domains.

Knowledge deepening at the domain level. The review of customer cases showed that the 'shift' of standalone and integrated innovation activities to India was driven by a number of factors, including the prospects of access to specialised capabilities and more generic manpower resources. Typically, this drive unfolds within specific business lines and domains.

Learning processes unfold as interactions between the available knowledge stock and the application and development of this knowledge in specific domains and customer settings. In this way, the ODIP-facilitated learning process that is initially project-based becomes cumulative between projects. It involves the interrelated phases of extraction, consolidation and application of knowledge.⁷⁶

Extraction. As discussed, the development of frameworks and tools is often aided by so-called alpha customers whose needs are aligned with/complementary to the strategic intent or vision of the provider. Many innovation events were expressions of the development and use of such standardised frameworks combined with the 'knowledge harvest' associated with their initial and subsequent applications. This can be applied with new customers or with the same customer in new projects. Recall the example of how MindTree was cross-feeding knowledge and capabilities between different projects in Auto IT.

Consolidation. To this end, the use of corporate knowledge management (KM) systems is critical. As discussed, these systems have all been put in place by major suppliers, some of which make KM an organisational trademark. MindTree, for instance, has been widely recognised for its dedication to cross-company knowledge management initiatives. One element of MindTree's KM programme involves the 'operational harvesting' of knowledge that seeks to incorporate experience from every single project into the knowledge repository. Another example is Aditi's experience with Digital Media Networks and the development of a new end-to-end product development offering.

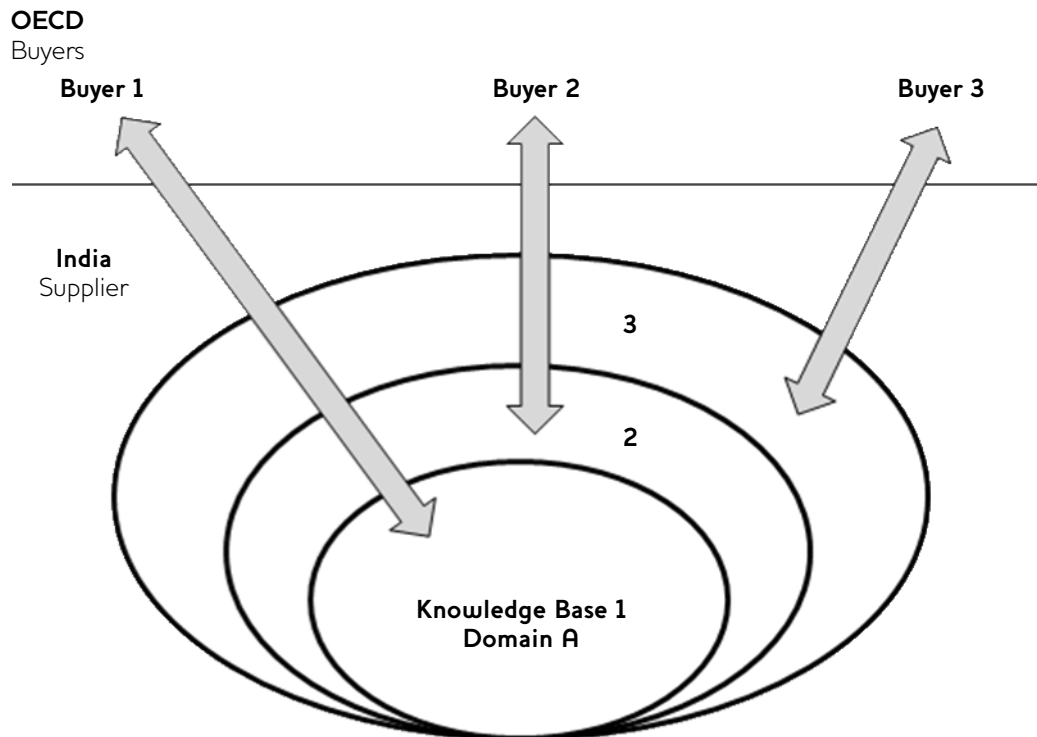
Application. These existing stocks of knowledge are often embedded in standardised frameworks, models, practices and routines primarily related to a functional objective. While much software work in the offshore outsourcing context is shaped by the nature of requirements from customers, the use of these frameworks means that the suppliers are also pushing ideas forward in the processes of application.

While every software development project is unique, it will rarely start from an entirely clean sheet to solve the business problems. It does not include repeated tasks as in a manufacturing setting, but it does involve codified process frameworks and reusable artefacts, plans, schedules, etc. as well as tacit knowledge vested in 'experience'. As depicted in Figure 6.1, the continuing process of knowledge extraction, consolidation and application amounts to a gradual (incremental) expansion of the knowledge base, as the supplier firm works with new customers in a particular domain. The important step is the explication of accumulated experience in particular customer projects. This process and the new knowledge base it produces may open up opportunities for the supplier to add value in new customer projects within the same domain.

Competence leveraging across domains. The previous section limited the discussion of ODIP to interactive processes occurring within business lines. However, as discussed, buyer firms outsource across multiple functional domains. This has given rise to ODIP dynamics on the supply side that cut across functional domains at the firm level. In order to capture this it is useful to make the

76 I thank Srinji Rajam, CEO of Ittiam, for drawing these dynamics to my attention.

Figure 6.1 Domain knowledge deepening



Source: Lema (2009b)

distinction between horizontal (functional) and vertical (sectoral) knowledge domains. This distinction seems particularly relevant because of the critical importance of domain capabilities and because the structuring of supplier firms along vertical and horizontal lines is exactly what happened in the Indian software industry at the turn of the century (Lema and Hesbjerg 2003).⁷⁷

At the firm level, the single-domain analytical focus is sufficient for smaller specialised firms. However, larger firms (such as MindTree, Mphasis, Infosys and Sasken in the sample) work among multiple domains.

The case of Infosys is a particularly good example. Like most first and second tier companies, two overlapping types of organisational entity structure this firm:

- *Industry business units* (IBUs) focused on vertical user domains. The vertical industry domain groups are further divided along subsector lines. Furthermore, they include offshore development centres (ODCs) for particular customers with ongoing relationships.
- *Horizontal business units* (HBUs), also referred to as enterprise capability groups, focused on functional domains. These are sometimes subdivided into technology areas such as the Infosys SAP Practice.

Currently the firm has six verticals and six horizontals, as shown in Figure 6.2.⁷⁸ In order to connect seamlessly with customers the vertical organisational structure

⁷⁷ Lema and Hesbjerg (2003) used the terms 'verticals' (customer domains) and 'horizontal' (service lines).

⁷⁸ In addition, two geographically focused units, the India business unit and the new growth engines unit (focusing on China and other high-growth economies) were established to address new market opportunities.

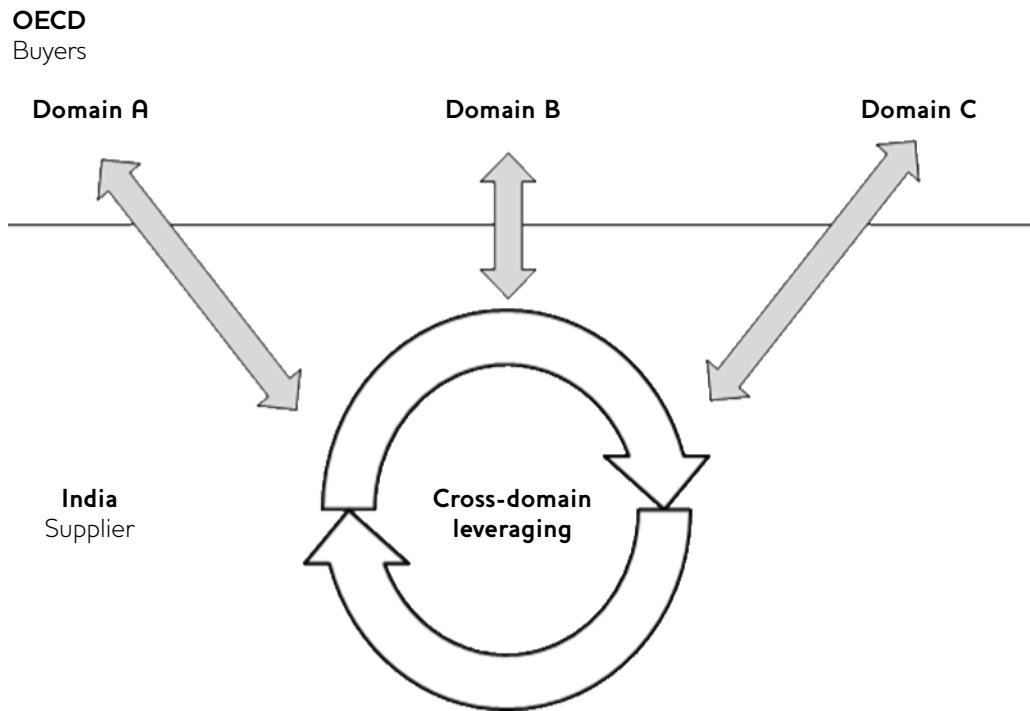
Figure 6.2 **Domain competence grid at Infosys technologies**

	Banking and Capital Markets	Communications, Media and Entertainment	Energy, Utilities and Services	Insurance, Healthcare and Life Sciences	Manufacturing	Retail, Consumer Product Goods and Logistics
Consulting Solutions						
Enterprise Solutions						
Infrastructure Management Services						
Product Engineering And Testing Services						
Independent Validation Solutions						
Systems Integration						

Source: Infosys marketing material; interviews.

takes primacy. The IBUs are built around cross-functional teams related to different functions both within horizontal domains but also across them. Much vertical domain competency building is a ‘top-down’, customer-oriented process. The domain knowledge experts and the IBU heads are typically not based in India but in the ‘market location’ in proximity to customers. This domain knowledge is critical to the company’s efforts at supplying solutions that register closer to the core of the customer’s business.

Because most HBU members deploy across vertical groups (at any given point in time), these constellations are ‘virtual’ in nature. This deployment is managed on a demand basis. For example, teams from independent testing services will work as ‘internal’ consultancy teams, depending on client demand for testing across verticals such as banking or healthcare. Each horizontal area has its own group of practitioner domain experts that develop ‘solutions’ that are applicable across customer domains, e.g. automated testing frameworks in the field of testing. However, the horizontal groups are also supported by a group called Software Engineering and Technology Labs (SETLabs) assigned with a bottom-up

Figure 6.3 **Cross-domain leveraging**

Source: Lema (2009b).

capability-building function. This organisation scans the external world for technology trends and creates new frameworks and solutions. In addition the company also has a 'domain competency group' (now part of the consulting solutions HBU) that engages in more forward-looking and proactive capability deepening in vertical domains. This group is charged with scanning the external environment and engaging in professional settings to build vanguard industry-specific expertise.

This process of extraction, consolidation and application of knowledge is facilitated by the constant reshuffling and combination of vertical and horizontal domain specialists. This mobility in the 'expert layer' of staff results in the intersection of knowledge and related capability dynamism in the supplier firm. It amounts to a cross-feeding of knowledge and capabilities between sponsors working in different horizontal and vertical domains, as illustrated in Figure 6.3. Such cross-domain application of capabilities was evident in many innovation events. As mentioned, such events were often related to bodies of knowledge or frameworks with potential for repeated application.

A good example is Influx, the proprietary framework and system for business process modelling developed in Infosys. It was a new framework and toolset for business processes engineering consulting – a core problem-framing activity – and it enabled the automation and codification of business process models into specifications for offshore development. In this sense, it was concerned with taking the global delivery model to the next phase in the evolution of the industry.

Upon completion of projects, so-called 'Influx champions' across different IBUs are debriefed and involved in case-study generation with the aim of strengthening the

framework in general and in the specific vertical domains in particular. The experience is then fed back into the Influx team. It has been used in more than 200 customer projects.⁷⁹ The customers work in a wide range of vertical domains including banking and capital markets, energy, logistics, manufacturing and retail. In functional terms, assignments spanned consulting, enterprise solutions and systems integration. The important point is that Infosys is able to provide capabilities and knowledge that draw on the practices of other firms in the customer domains and in other domains. This provides Infosys with a strong knowledge base for consultancy services and advisory work provided to the customer.

To give another example, the processes of competence development and leveraging are built into the framework for delivery of value-adding activities provided to the customers in MphasiS (M-Tec). These value-adding activities are described as deriving from processes in which MphasiS is 'Understanding and representing stakeholder requirements through *pre-field activities* and requirement analysis, while leveraging domain expertise ... [and] sharing best practices *gleaned from our myriad projects* and highlighting areas for improvement through business process re-engineering and technology' (MphasiS 2008).⁸⁰

This dynamism associated with the cross-feeding of knowledge and capabilities between domains has emerged with the transition of customers to more open business models in which sponsors actively seek to capture value from outside. Increasingly customers sought to leverage the capabilities of supplier-firm experts and other resources that had developed because of dealing with projects of a similar nature with other customers.

6.5 The dynamic from below

Much of the literature on outsourcing emphasises that outsourcing is a learning process (Lewin *et al.* 2008; Maskell *et al.* 2007). Yet learning in the supply base is assumed rather than studied. Capability formation is sometimes seen as a simple effect of buyer-firm strategies whereas firms at the 'receiving end' of outsourcing decisions are frequently seen (implicitly) as passive.

79 More than 30 buyer companies have benefited from of Infosys' Influx methodology for their business processes management changes. Clients include information technology wings of leading services firms such as Goldman Sachs, the American Stock Exchange, Royal Bank of Canada, Statoil, GAP and Electrolux. Many of these companies had a long history of outsourcing elements of their information technology development and maintenance (CADM) to Infosys. Through these relationships, employees in Infosys had often spotted opportunities for improvement that would eventually improve the quality of services provided to the internal customer. Infosys suggested that Influx could be rolled out free of charge in some cases. In many cases, this has marked the beginning of deeper and ongoing relationships evolving around change management consulting.

80 Pre-field activities refer to decontextualised (abstracted) knowledge development and consolidation related to the specific class of problem. This is aimed at enabling a holistic view of possibilities and stakeholder requirements that may not be obtained already by customers. It is based on research efforts but the team will also 'seek past experience' within the business analysis group, which coordinates a virtual network of intra-firm domain experts. This enables the leveraging of expertise and best practices that can be built into solutions.

Even the literature that is explicitly concerned with supply platforms and developing country firms has produced few insights into how supplier firms learn in the context of outsourcing. The learning process in supplier firms is still a 'black box'. Recognising this, a recent article has argued for the need to pull together the global value-chain approach and the capability approach (Morrison *et al.* 2008), but it does not itself provide empirical analysis, nor does it suggest how this 'fusion' can be operationalised. This study has taken a step in that direction by paying attention to the intra-firm level and the dynamics of capability formation.

Previous sections showed the way in which firms have mobilised resources to address (and create) new opportunities. The changing demand conditions and reconfiguration of value chains did not transpire into a 'benign escalator' for supply-base firms. On the contrary, this chapter showed that the combination of global *and* firm-internal resources was critical and tended to go hand in hand in the learning process. External resources can create significant value, but internal resources are needed to absorb and exploit it (Cohen and Levinthal 1990). The shift to openness may present an important opportunity, but if firms want to transform the opportunity into reality, firm-internal strategic intent and investments are necessary. The degree (and nature) of firm-internal investment is one of the most important contingent factors – if not *the* most important factor – that determines whether the shift from closed to open innovation and business models translates into the dispersal of innovative activities. The blending of firm-internal and global resources was of the most critical importance. This blending process is inevitably one that occurs *within* firms in the supply base and one that needs to be actively managed.

Nevertheless, the importance of global linkages should not be downplayed. In fact, the study has shown how buyer firms have sometimes provided the space and, in certain cases, even the resources (ideas, investments and knowledge) needed to build the innovative capabilities of suppliers. The path towards openness on the buyer side has strengthened this dynamic. The openness strategy meant that it was sometimes in a buyer's interest to 'externalise' some capabilities to the supply base that had hitherto been off limits.

From a supplier perspective, this may give rise to cautious optimism. This is reinforced by the fact that critical advances were made 'on the ground', in and across customer-facing units, rather than in 'R&D labs'. While the latter were important for the most advanced capabilities, this report has emphasised the importance of innovation activities with production activities. The examination of trajectories on the supply side showed that this type of activity was cardinal to the acquisition of innovation capabilities as well as to the further deepening of the same. It was capabilities developed in the 'application phase' of the innovation process that gave rise to an independent dynamism arising from the cumulative development of capabilities in customer projects and the leveraging of competences across customer domains.

It is commonly held that clustering in low-cost supply bases is essential for the development of innovative capabilities (Chaminade and Vang 2008b) and exploitation of the opportunities created by openness (Schmitz and Strambach 2009). Nevertheless, despite the importance commonly attributed to spatial synergies in supply platforms, the evidence suggests that competence leveraging

within firms in the supply base is more important than competence leveraging *between* clustered suppliers. This does not mean that location is unimportant – far from it. There are important endowments and passive externalities that accrue to firms located in a dynamic hub like Bangalore. Nevertheless, as has been mentioned, leading software vendors in Bangalore have achieved within the firm what certain clusters achieve between firms.

The proposition of own dynamics that change the landscape commands an exploration of feedback mechanisms. Such feedback mechanisms can be either direct or indirect. Each type is discussed in turn.

6.5.1 Direct feedback mechanisms

Direct feedback mechanisms are those that transmit between individual buyers and suppliers as they deepen the outsourcing relationship. Over time, the cognitive frame in which outsourcing decisions are made is increased. This is the learning curve on the buyer side (Maskell *et al.* 2007). The frame expands, not least because the buyer's 'comfort level' rises as supplier capabilities become 'proven' over time.

However, another effect has greater long-term importance – the learning curve and the development of client-specific knowledge on the supplier side. In other words, proven capability levels increase over time and because suppliers get to know the client's systems, the scope for outsourcing is increased over time. In many cases, the move to innovation-oriented outsourcing projects reflected an evolving relationship between buyer and supplier over time. As argued by NASSCOM some buyers are beginning to utilise global sourcing to drive strategic imperatives: 'This evolution of expectations, towards an increasing emphasis on beyond-cost benefits, is observed to be closely correlated with the offshore experience of the buyer' (NASSCOM 2008: 87).

As an example, take the case of the internet solutions provider mentioned in Chapter 4. This firm had relied on staff augmentation services from a small Indian supplier for many of its projects, including a comprehensive OSS. However, the in-house part of the team that had been involved in developing the so-called 'legacy system' had been effectively reduced because of stress and exhaustion (referred to as 'burn-out') among some of the most critical employees. Hence, this team was effectively diminished to a size below the threshold needed to actively manage the development of the new system. Previous projects had been managed exclusively by the buyer. However, staff augmentation work on the legacy OSS system and related assignments had given selected supplier employees valuable experience with the system. Despite bids from competitors – including large and powerful ones – the project was allocated to the particular supplier because of its system-level knowledge and price competitiveness. While previous projects had relied to some limited extent on co-design skills, this project required independent design skills the supplier had developed over time, but mainly in relation to smaller projects. The supplier was in a good position to take on this role and develop the system 'from concept' because of the previous staff augmentation work on the legacy system. In this way the deepening of outsourcing relationships, from 'routine' to higher-order activities, sometimes reflected the accumulation of domain- and customer-specific knowledge that had

been transferred to the supplier. From the buyer perspective, innovation outsourcing became a compelling extension of standard services outsourcing. On the supply side, firms could benefit from the exploitation of the knowledge that had become embodied in its staff as a by-product of previous engagements. However, the leveraging of competences between projects (within or between buyer firms) depended on deliberate and systemic capture and transfer of learning from project to project.

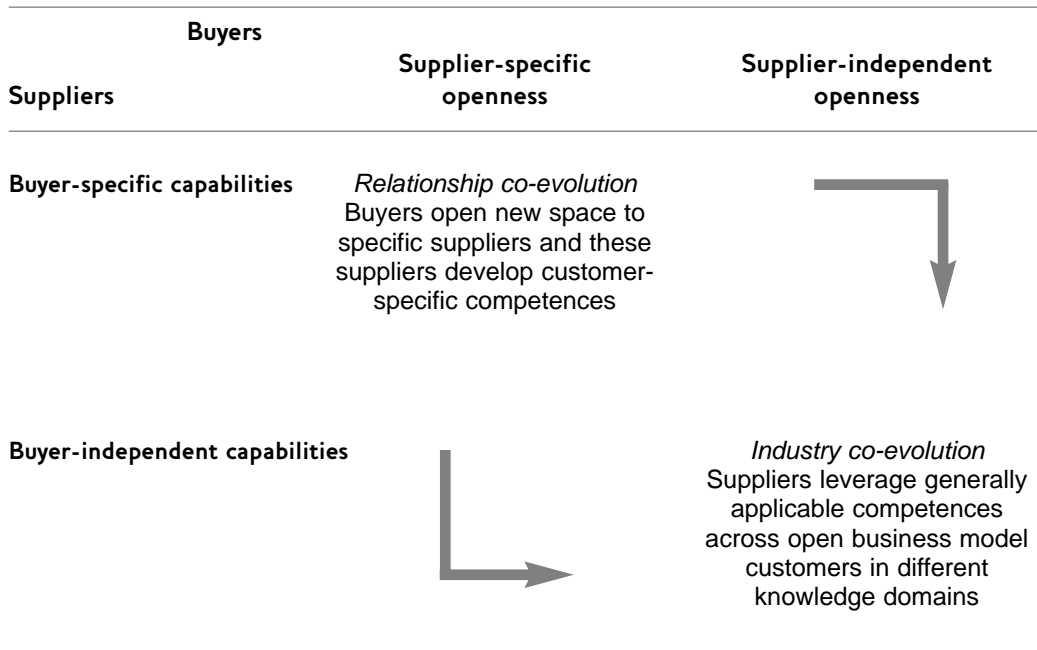
Another example is the IT department in a major US technology and services conglomerate. By relying on 'total outsourcing' for NMS, this organisation effectively became a 'virtual sponsor', employing only a very small number of people to oversee the activity and manage the relationship with the supplier. The buyer had initially relied on staff augmentation for its NMS but had shifted the entire execution capacity to its supplier. In this setting, the process improvements related to the service were best placed with the supplier. This arises when suppliers have been so closely engaged in the development of systems that the best critical mass with intimate system knowledge exists in the supplier firm and hence the supplier has become equally or better equipped to define and implement change processes (at a lower price). In some cases the buyer has no or very few in-house resources for the selected areas. Hence, the change and knowledge-creation processes are offloaded onto suppliers who work intimately with the selected areas on a day-to-day basis.

This is not to suggest there is always a smooth transition. The move to outsourcing of higher-level activities was often prompted by crises on the buyer side. The key point is that supplier capabilities gave the buyer a new way out of the crisis. Such crises were very often the extra push that led buyers to exploit customer-specific knowledge developed in supplier firms. The boundaries were often pushed in the efforts to overcome particular problems. This can be seen as the occasional fuel injection that often keeps the firm-level co-evolutionary cycle in motion. But there are also inter-firm effects. The vanguard projects are of crucial and direct importance to the buyer. But the wider significance arises because the capabilities developed in the supplier firm during these projects can be deployed with other customers. This is referred to as indirect feedback mechanisms.

6.5.2 Indirect feedback mechanisms

Indirect feedback mechanisms are the externalities that arise from the use of a shared supply base. Hence, the feedback effect is not 'appropriated' by a single buyer firm. Rather, it transmits between multiple actors. These mechanisms arise not from the customer-specific knowledge in the supply base, but from the more generic domain capabilities that are developed over time. Whereas the direct feedback mechanisms are easily observable in the study of relationship trajectories, the indirect feedback mechanisms are more 'in the air'. Yet they are detectable in buyer practice as well as evident from informants' statements. Furthermore, they have wider implications because they allow – or even induce – buyers to change their outsourcing practice and ultimately their business models. What goes on in India and other service supply bases has now become of significant importance to some segments of the primary and secondary software industry in OECD countries.

Figure 6.4 Interaction of the dynamic from above and below



As a start-up firm, Digital Media Networks is a good example. Outsourcing to India was inherent in the business plan even before the firm’s inception. The venture might not even have been possible had the firm not adopted its vanguard outsourcing strategy. In this sense, the Indian supply base has allowed the firm to emerge at the forefront of a new generation of software as a service (SaaS) ISVs in which the back-end technology operations are completely outsourced. In this open business model, the main energy is devoted to non-technical tasks such as sales and alliance management. Without an in-house engineering team, it could depend on the external provider to facilitate the right technology choices and build a competitive solution from just a vision. As a start-up firm, the management could build and grow the firm while the Indian collaborator was responsible for all technology needs. Indirectly, they benefited from other firms’ OPD projects that had helped Aditi to gain domain knowledge and architectural capabilities.

In the case of Auto IT and MindTree Consulting, direct and indirect mechanisms merged. MindTree had previously developed a dealer management system for Auto IT and had gained high competence levels in the aftermarket area. MindTree was able, for this reason, to partake competently in the inception and elaboration phases of the CRM sales tools project. They were able to cross-feed client domain-specific competences between the different projects they provided for Auto IT. However, they were also able to draw on the experiences developed from working with other clients on CRM systems in other settings, and then use this knowledge in the processes. In other words, competence leveraging on the supplier side occurred in the client-specific relationship as well as between clients. In this way the relationship with MindTree was a key enabling factor in Auto IT’s efforts to transform its business model. This enabled MindTree to add value to Auto IT in the defining phases of the project. It is precisely for this reason that problem-framing experience equips vanguard supplier firms with the dynamic capabilities that induce further outsourcing in a profound way.

6.5.3 *Dynamic from below and above*

These insights suggest that there is a top-down and a bottom-up dynamic that have begun to reinforce each other. It is not possible based on the present empirical information to shed equal light on all the causal mechanisms involved. Yet Figure 6.4 seeks to summarise the interplay between the dynamic from above and below as identified in this study.

A key point is that co-evolution unfolds at the relationship level (unilateral relationship co-evolution) as well as the aggregate level (multilateral industry co-evolution). The information in this study provides stronger evidence of the former than of the latter. To some extent, this reflects the fact that in methodological terms, industry co-evolution is difficult to examine empirically. In order to do this one would need detailed aggregate data on buyer inputs and supplier outputs over a long period. Such data do not exist, partly because of quantitative measurement problems and partly because buyers are located in many different parts of the world.

Yet this study provides certain insights – or hints – into how the dynamic unfolds. Previous chapters showed that relationship co-evolution – often based on a very supplier-specific type of openness on behalf of the buyer – was also associated with a high degree of resource provided by the buyer. Suppliers may benefit passively from information exchange with the buyer, but in relationship co-evolution, the buyer is often an *active* provider of resources (ideas and investments). Over time, however, the supplier may consolidate buyer-specific competences and develop generally applicable competences (bottom left arrow). This development of new capabilities facilitates – along with a range of other factors – the shift to supplier-independent openness in established firms and the establishment of open start-up firms on the demand side (top right arrow). The analysis in the two preceding chapters showed that relationship-specific as well as supplier-independent openness guide buyer strategies. The material does not provide the basis for determining the balance. Yet it suggests that to some extent relationship-specific co-evolutions may develop, like rings on the water, to include more firms. In this scenario, suppliers leverage widely applicable competences across customers that operate in different domains.

6.6 Conclusion

This chapter examined how suppliers built innovative capability in and around select projects. The existing literature tends to give primacy to regional dynamics. This literature builds on the observation that the global software industry exhibits a location pattern of ‘concentrated dispersion’ (Ernst 2002; Zaheer and Manrakhan 2001). Because software firms are clustered in regions like Bangalore, theory leads us to believe that innovation-enhancing synergy effects can arise. In principle, the adoption of open business models should enhance such dynamics. Such open business models are likely to be accompanied with an organisational decomposition of the innovation process (ODIP), and supply-base clusters can provide the arena for making connections between different types of ODIP which will therefore reinforce each other (Schmitz and Strambach 2009).

Despite the proposition in the theoretical and empirical literature, it was found that ‘local’ sources of capability were of a second order. The evidence suggested that the existence of strong inter-firm linkages in the cluster was not as important as

the literature suggests. Other factors are external to 'the model', but they are likely to play a role. The quality of engineering graduates, for instance, influences the long-term 'upgrading' of the industry (Patibandla 2006).

It was shown that the concurring attainment and demonstration of new capability was heavily dependent on 'intrapreneurship' and knowledge management in and around select projects. This questions the received wisdom which has tended to view this firm-centricity insufficient (Chaminade and Vang 2008b; Vang and Chaminade 2006). NASSCOM argues that 'ingrained mental models are preventing firms from innovating more'; and one of the perceptions most heavily criticised is that, 'Collaboration is not really needed in the services space to innovate – firms are better off on their own' (NASSCOM 2007b:10). This study suggests that the strategies, priorities and practices of leading managers are more effective than commonly anticipated.

Curiously, however, the concept of the local innovation system is useful as a loose metaphor for what goes on inside supplier firms. These firms combine different stocks of knowledge and tailor them to customer needs. This involves labour rotation and joint action between different business units and it gives rise to significant knowledge spillover from project to project. This requires flexible organisational structures around distinct capability domains and this enables multi-domain suppliers to achieve within the firm what certain clusters achieve between them. Almost 20 years ago, a similar observation was made in a different part of the world. Analysing the importance of flexible specialisation in Germany, Sabel (1989) observed this type of organisation was not only present in regional economies, but also within firms: 'As large firms reorganise, they try to recreate among their specialised units the collaboration characteristics of relations among firms in the flexible specialisation economies' (Sabel 1989: 103).⁸¹

It is clear from the analysis in the present chapter that global actors play a key role in the emergence of intra-firm innovation systems. In many outsourcing relationships, the supplier benefits because of a high degree of information exchange which arises as an 'externality' of the transaction. Of particular importance to this study is the relatively high level of active involvement or support provided by buyer firms – often so-called alpha customers – in bilateral relationships. Unlike other industries, intensive interaction is a necessity in certain types of outsourcing. This chapter has shown that active forms of learning and leveraging with and from customers were crucially important.

This chapter has also shown how the dynamic from below has important knock-on effects. It has shown the importance of the supply base in an evolutionary and self-reinforcing cycle. It has unfolded some of the 'pull' dynamics by describing some of the direct and indirect feedback mechanisms (back to buyer firms) that were important in this case. The next chapter argues that the dynamic from below is an important element in the shift to new successive phases. Whereas previous research has shown that the development of supplier capabilities has primarily *enabled* co-evolution, this report suggest that supplier firms have become one of the *drivers* (a dynamic from below) of this process in their own right.

81 This was exemplified by the 'Bosch Model' in which the German supplier of technology and auto parts had achieved a level of dynamism between different units located in Baden-Württemberg which was otherwise normally associated with collaboration between firms.

7 Conclusion: openness and dispersal of innovative capabilities

There is widespread agreement that outsourcing is changing the world economy. Some recent literature suggests that offshore outsourcing in a variety of sectors has extended from the provision of simple services to innovation activities (Engardio and Einhorn 2005; Lynn and Salzman 2007; Maskell *et al.* 2007), but the recorded changes on the demand side have not been followed up with systematic assessments of the changes on the supply side. This report sought to provide an in-depth analysis of outsourcing and the complex processes it sets in motion.

It began by suggesting that the discussion about outsourcing of innovative activities needs to be rooted in the wider discussion of changing business models. It then asked whether changing business models in developed countries leads to the build-up of innovation capabilities in the developing world. The existing literature provides only very limited insights on this question. This report has sought to address this gap. The hypothesis that drove the study was that the adoption of open business models in buyer companies had an important influence on the rise of innovative software services in Bangalore, India. The report aimed to provide some empirical answers to the issues raised by Schmitz and Strambach (2009), in their research agenda on the organisational decomposition of innovation and global distribution of innovative activities. This concluding discussion summarises and discusses the evidence provided by this study.

Section 7.1 reviews the insights with regard to open business models and (innovation) outsourcing. The chapter then proceeds in section 7.2 with a discussion of supply-base capability development and how this changes the outsourcing landscape. Section 7.3 connects the discussion back to ‘the received wisdom’ and shows how the analysis of changing business models is central to the explanation of recent development in the Indian software supply base. The last section discusses limitations of the study and issues for future research.

7.1 Open business models and outsourcing

The shift to open business models has an important influence on the global distribution of innovation activities. This was the proposition set out in Chapter 2. The mediating mechanism, it was proposed, is the shift to new lead-firm sourcing strategies adopted by buyers in the OECD. Empirical evidence from the software outsourcing industry was presented and reviewed in Chapters 4 and 5. These chapters sought insights from and contrasted three buyer segments in the software outsourcing industry. However, it is important to recall that sampling was not random. The study examined buyer firms that had been identified (with the help of informants in supplier firms) as being connected to ‘events’ of capability building in supplier firms. In other words, these buyers had engaged in the outsourcing of innovation to suppliers. What types of business models underpin the sourcing strategies of such firms? Can elements of the open business model be identified? What are the characteristics of their outsourced

activities? (How) do they open new spaces for supplier innovation? The answers to these questions are summarised in the following two subsections.

7.1.1 The adoption of open business models

The examination of business models suggested that the sampled buyers' strategies and practices are open to different degrees. However, while openness varied, none of the buyers could be described as being 'closed' in terms of their business model. Crucially, the study has indicated there are connections between different elements of the business models in buyer organisations. Changes on the selling side and in innovation management were connected with increased openness on the buying side. This, in turn, led to increased externalisation of knowledge-creating activities, as innovation outsourcing became a (sometimes defining) feature of the business model. As a result, these buyers can bring products, systems and services to the market faster, cheaper and with greater flexibility. They concentrate increasingly or even entirely on the business and creative aspects of the products and services, not on technical aspects. The (re)focusing of buyer organisations on new and increasingly non-technical capabilities reflect (firm-level) internal changes in the innovation process and it has gone hand in hand with an increasing need for external knowledge-creating functions.

This is highly relevant for ODIP research in the following sense. In their agenda-setting paper, Schmitz and Strambach (2009) ask whether different kinds of ODIP might reinforce each other. This study suggests that in the software industry the answer is 'yes'. The opening of business models, in some of these buyer firms, involved two stages of ODIP. In the first stage, innovation was decentralised within the firm, with increased responsibility for innovation delegated to individual business units (sponsor organisations), including IT departments and product development teams. This type of firm-internal decomposition (ODIP Type 1 and Type 2, as defined in Table 3.4) was geographically localised in and around firm headquarters. In the second stage, sponsor organisations passed on a subset of innovative activities – in certain cases a rather substantial subset – to suppliers in India. In other words, ODIP (Type 3 and Type 4) became inter-organisational and global.

These dynamics require further examination; in particular, differences between buyer segments need to be better understood. This study could only provide a sketch of these differences and information was obtained by focusing only on certain fix-points (events) out of many possible fix-points, a problem which is most profound in the context of large firms. However, the data suggested that electronics and telecom firms were most restricted. Interestingly, information from the case studies suggested that while they were part of open innovation networks – not least on the selling side – innovation management was more 'traditional' and the sourcing of innovative activities was more confined. They maintained a focus on certain core capabilities (systems integration), while only opening up in certain non-core areas. By contrast, IT departments in large corporations and small independent software vendors had adopted the 'deepest' versions of the open business model. Buyers in these categories had applied comprehensive principles of openness – on the selling side, on the buying side and in corporate innovation management. Core competences are not obsolete, but they are changing towards an increasing emphasis on non-technical development, and systems integration is not necessarily the 'holy grail'.

This warrants a discussion and possible revision of the assumptions that underpin the outsourcing literature. As mentioned, it is widely assumed that the core competence model is the foundation of outsourcing strategies. It is thus an apparent paradox that advanced and high-value innovative services are offshored to low-cost suppliers, even though most of the literature advises against it (Jensen 2009: 7). However, this study has sought to provide an explanation by showing that innovation outsourcing is not necessarily ‘irrational’ behaviour because the adoption of open business models changes the expected patterns of conduct. In a wider perspective, this has potentially important consequences for low-cost suppliers. Further research should therefore seek to determine the extent and depth of open business models in the context of offshoring. Is the adoption of open models confined to a very small minority of vanguard buyers or is it emerging as a more widespread phenomenon?

7.1.2 *New sourcing practices*

While this uncertainty remains, it is clear that buyers that have an open business model rely on and have an expectation of ‘innovation’ by suppliers. In the sample, some buyer firms were trying to push innovative activities onto suppliers – not to hold them back.

While the notion of ‘innovation outsourcing’ is gaining increasing recognition, the identification of outsourced *problem-framing* functions to suppliers was particularly unexpected. It runs counter to the proposition that the ‘quality’ of outsourced innovative activities is limited to ‘problem solving’ (Schmitz and Strambach 2008), ‘subsystem design’ (Chesbrough 2003c) or simply ‘routine low-end innovation’ (Chen 2008). The proposition found in the literature is that integrative capability in technical fields is strategic to buyer firms, and the strengthening of supplier capabilities in these realms is against their interests. However, some buyer firms in the sample perceived outsourcing of innovative activities – even problem-framing aspects – as an opportunity for business transformation and increased competitiveness. This also means that for some buyer firms the ‘spillover’ of systems-level (problem-framing) knowledge to the supplier is no longer a regrettable by-product, but an opportunity for deepening their own competitive strategies.⁸²

Interestingly, there was sometimes a *tight connection* between problem-framing functions and routine programming activities (coding and testing), as these were integrated in the suppliers’ package of activities. In order to explain this, it is necessary to recall the counter-intuitive findings presented in Chapter 5: in settings in which there is a tight connection between production and innovation activities as in ODIP Type 4 (integrated innovation activities), there was scope for involving suppliers in problem-framing functions. As shown in this study, some IT departments and independent software vendors build on their experience with the outsourcing of lower-level software design activities and then take a step further in giving suppliers the responsibility in the entire chain of software development

82 Chapter 5 suggested that there are indeed forces that hold back outsourced problem-framing activities; but there are also other forces that push problem-framing activities forward. The evidence suggested that in the context of open business models, the dispersive side has gained added strength in the ‘tug-of-war’.

activities, including elements essential for the definition of the system or product. This means that suppliers are not ‘moving up the value chain’ in the normal sense, in which high-value activities are acquired and low-value activities are left behind. Rather they are stretching their value-chain thread in the upward direction, thereby reaping significant linkage economies, in which the provision of multiple value-chain activities improves the efficiency of each one of them. This suggests that the primary and secondary software industries exhibit special characteristics that incentivise the organisational bundling of ‘production’ and ‘innovation’.

This is important because integrated innovation activities are largely overlooked, not only in most of the literature on ‘openness’ (Chesbrough *et al.* 2006; Christensen *et al.* 2005; Cooke 2005) but also in much of the literature that deals with the globalisation of innovative activities (Ernst 2006; 2008; Gammeltoft 2006; UNCTAD 2005). These literatures are mainly preoccupied with ‘hard’ forms of innovation, undertaken in an R&D department and appropriated by patents. Many analyses focus on a too narrow set of data, and they miss the hidden dimension of globally mobile innovation activities. Integrated innovation activities are often ‘hidden’ and therefore off the radar screen. This study suggests that this is an unfortunate blind spot. Integrated innovation activities are ‘silent but significant’. The significance arises not only in terms of their volume dominance (compared to standalone innovation), but also in terms of their potential for further ‘deepening’ of outsourcing relationships.

The study linked this deepening with *new spaces for supplier innovation* in the software outsourcing industry that links OECD customers with Indian suppliers. These spaces seem to have increased in the 2000s compared to earlier phases of the evolution of the industry. However, while these spaces have changed in terms of ‘size’, this does not suggest that there are no limits to the outsourcing of innovative activities. In order to recognise the limits, the concept of problem framing needs to be unpacked. In particular, the study found that problem framing combines technical and non-technical elements. While there is clear evidence of frequent supplier participation in technical activities, participation in non-technical activities is (still) a rare incident. The size of these new spaces seems to be largely determined by the nature of new business models. The gradual shift to open business models means that wider arrays of lead firms’ assets have become variable. As mentioned, customer firms concentrate increasingly on forward linkages to the customer (and linkages to key partners). The technical coordination of production and innovation processes is no longer as important as the non-technical functions and the management of relationships. The control of relationships forward in the value chain is a key aim. In other words, buyers have pushed strategic priorities and fixed assets to a higher level of the value chain. These findings suggest that in a rapidly changing world it is a fallacy to view the limits to innovation outsourcing as given. It is not feasible to assign ‘fixed values’ to categories such as strategic and non-strategic.

7.2 New supplier capabilities and the changing outsourcing landscape

There is nothing new in the fact that firms from the so-called ‘centres’ of global capitalism search the globe for resources (and markets) that increase their profit and ensure their survival in a competitive landscape. However, whereas certain

types of production outsourcing may be associated with limited learning exponentials, 'knowledge-seeking outsourcing' may have further potential.⁸³ This study focused on new spaces, i.e. opportunities for innovation created by customer demand in the software outsourcing industry. As stressed in Chapter 2, such spaces may emerge, but occupying these spaces is not an automatic process. Understanding *how* suppliers did this was a key task of Chapter 6. How did suppliers take advantage of new opportunities? What was the relative role of local and global linkages? Answers to these questions are provided in the next subsection. The following subsection then turns to the issue of the changing outsourcing landscape – the *effect* of capability formation in the supply base on buyer practices. Can this effect be identified in the software outsourcing industry? If so, what forms does it take? In a sense, this is an obvious outcome of increasing supplier capabilities. But as emphasised by Schmitz and Strambach (2009), very little is known about these processes and the factors that make them happen.

7.2.1 The development of capabilities in innovation projects (learning events)⁸⁴

The starting point for the part of the research concerned with attainment of new qualities of capability was the acknowledgement that outsourcing creates new opportunities, but these opportunities are not transformed into realities automatically. To unpack this, the research has conceptualised the process in terms of (1) the emergence of new opportunity spaces, and (2) the processes by which suppliers mobilise and combine resources in innovative projects to fill them. The study has then sought to provide a first-hand account of the events/projects in which suppliers have attained these new qualities of capability.

The study has provided evidence that the *combination of global and firm-internal resources* was critical and tended to go hand in hand in the learning process. This blending process is inevitably one that occurs *within* firms in the supply base and one that needs to be actively managed. In this sense, findings support the proposition that the degree (and nature) of firm-internal investment and effort is one of the most important contingent factors – if not *the* most important factor – that determines whether the shift in outsourcing models translates into the dispersal of innovative activities. The challenge for suppliers is to manage increasingly complex processes as the transition from production to innovation proceeds. This suggests that even though many supplier firms exploited their initial positions in global value chains to develop striking innovative capacities, the changing demand conditions and reconfiguration of value chains did not transpire into a 'benign escalator' for supply-base firms.⁸⁵

However, the report has also shown how *buyer firms* have sometimes provided not only the space, but also contributed with critical resources (ideas, investments

83 Dunning (1993; 2000), highlighting asset and knowledge-seeking investments, has described similar dynamics in multinational firms.

84 This subsection draws on Chapter 6 in this report. For further details on and analysis of the inputs into innovation projects (learning events), see Lema (2009b).

85 The term 'benign escalator' was used by Martin Bell in research meetings at Science and Technology Policy Research (SPRU) and IDS.

and knowledge) needed to build the innovative capabilities of suppliers. This is reinforced by the fact that critical advances were made in and across customer-facing units, not just in 'R&D labs'. The initially basic capabilities arising from the cumulative development of capabilities in customer projects can act as a seedbed for further substantial deepening.

In order to understand the dynamic interaction between firm-internal and global (often customer-derived) sources in capability formation processes, the study used the concept of *competence leveraging*. Such competence leveraging was a key mechanism in the development of innovative capability. The adoption of open business models has facilitated the deepening of domain knowledge across a variety of business lines and the engagement in multiple business activities gives rise to intra-firm synergy effects, emerging from the connection of different knowledge domains. In some cases, strong suppliers draw on distinct knowledge bases to make choices about (customers') technology and IT-enabled business processes. In this way, the strong Indian suppliers now need to 'know more than they sell'.⁸⁶ They do not dilute their core capabilities by operating in multiple business lines; rather the leveraging of knowledge and experience across these business lines is becoming a core capability in itself.

As described immediately above, the evidence suggests that competence leveraging *within* firms in the supply base was of critical importance. It was much more important than competence leveraging *between* clustered suppliers. These findings are surprising from the perspective of the extant literature on the Indian software industry and the specific case of Bangalore. Most of the existing literature on the Indian software industry searches for local linkages (Balasubramanyam and Balasubramanyam 2000; Chaminade and Vang 2008b; Parthasarathy and Aoyama 2006; Vang and Chaminade 2006). As was discussed in Chapter 2, one dominant hypothesis in the literature is that the main route to innovative capability is through *the local innovation system*. Some authors have made the stronger claim that innovative capability cannot develop unless the industry is reoriented drastically to become closely coupled with the local market and its supporting institutions (D'Costa 2006). This study suggests that the current strategies, priorities and practices of leading managers – focused mainly on *intra*-active learning and global linkages – may be more effective than commonly anticipated. The evidence suggested that the existence of strong local inter-firm linkages in the cluster was not as important as the literature suggests. Despite the proposition in the theoretical and empirical literature, it was found that 'local' sources of capability were often of second order importance.⁸⁷

7.2.2 The changing outsourcing landscape

Much of the literature on offshore outsourcing tends to assume (often implicitly) that the impetus comes from above, driven ultimately by factors such as the

86 Paraphrasing Brusoni *et al.* (2001), Stephen Flowers (2007) argued that on the demand side certain lead firms have relied on IT outsourcing (within Europe) to the extent that they 'know less than they buy' – thereby diminishing their in-house capacity to make informed choices about critical infrastructure.

87 This might change if and when these innovative Indian firms focus (some of) their efforts on challenges that arise within India (rather than challenges rising in OECD countries).

shortages and high costs of engineering workers in OECD countries. Buyers make decisions about outsourcing whereas suppliers merely respond to these decisions. While it is true that buyers ultimately decide how and what to outsource, this report has suggested that the supply base can have an important influence on the conditions in which these decisions are made. The chapter showed that increasing capabilities in the supply base had important *feedback effects*. Some of these feedback linkages were *direct* and relationship-specific. Others were *indirect*, accruing to the wider demand base for particular services. The analysis suggested that the emergence of suppliers with innovative capabilities (combined with low-cost delivery) became a novel driver of new outsourcing practices in some buyer firms.

It seems that this *dynamic from below* not only accelerates outsourcing, it also changes the very notion of what outsourcing is about. It has induced immense organisational change whereby buyers have been rethinking mission statements and operating models. It suggests that the accumulation of innovation capability in India has ramifications for the rest of the world. As stressed in Chapter 4, there is some indicative evidence that sponsor organisations were influenced by the changing outsourcing landscape in Bangalore and that this influence extended to the ‘shaping’ of business models itself. The evidence suggested that opening of business models was directly influenced by the attainment of general and customer-specific capabilities by suppliers.

As will be discussed in the next section, the evidence provided in this study suggests that in the software industry, the changes in the developing world have had a profound impact on development in the OECD. Whether this is likely to occur elsewhere is an open question. There are, of course, still immense structural barriers. However, there is strong indication that to some degree ‘what used to be part of the “periphery” is now driving changes in the “centre”’ (Schmitz 2007a: 57).

7.3 Co-evolution in the software outsourcing industry

It is commonly recognised that the Indian offshore industry is a product of outsourcing by firms in the OECD countries. It is less acknowledged that the reverse is also true – the phenomenon of offshore outsourcing in the software sector is closely associated with the emergence of the supply base in India. This section first summarises very crudely the evolution of the industry and argues that the forefront of software outsourcing to India has co-evolved in three main phases. It then seeks to connect these phases back to the issue of changing business models on the demand side.

7.3.1 Three phases in the software outsourcing industry

The introduction to this report summarised the received wisdom about innovation and the formation of innovative capability in the Indian software industry. This report has suggested that key elements of the received wisdom need to be revised since it does not tally with recent (still emerging) developments. As is often the case, reality has moved faster than social scientific research. To appreciate this it is necessary to view these developments in a time perspective.

For this reason, three crude phases of the software outsourcing industry are summarised below.

First phase – 1980s. The spread of networked computers in businesses in the USA and the EU gained a foothold in the mid- and late-1980s. This shift to networked computing created a huge demand for software services, some of which was provided by Indian firms. A handful of early entrants – including Infosys, Microland and Sasken – emerged in this period. ‘The onsite service model emerged as the dominant business model [in India] by the end of this period’ (Athreye 2005a: 26). This staff augmentation (or ‘body-shopping’) model emerged in the 1980s but was in fact the dominant mode up until the late 1990s (Lema 2009a). There were technical reasons for the dominance of this model, primarily poor communications technology. This meant that Indian engineers depended on air travel to customer sites in the USA and the EU. However, it is argued here that there was another reason as well – staff augmentation reflects a firm’s or an IT department’s need for corporate control. These organisations did not need to outsource services to external providers that would carry out software development activities independently, but they could still gain significant cost advantages. It was a first step in this process of vertical disintegration, but production systems remained closed within the firm. The value delivered to customers was almost exclusively in the form of labour cost savings.

Second phase – 1990s. The dramatic boom that occurred in the 1990s – mainly in the second half – had its roots in two new sources of demand, namely the booming US internet economy and the so-called Year 2000 (Y2K) problem.⁸⁸ In this period, a large number of suppliers entered the market. The establishment of the first Indian software technology park in Bangalore in 1991 provided access to satellite links for data transfers and communication. This is when the so-called offshore model of software development became established. A large number of supplier firms – including the majority of those discussed in this research – entered the market in this period. During the 1990s, the Indian software industry became firmly rooted in the emerging offshore model and was dominated by routine-based tasks in the field of standard application development and maintenance. This niche was complementary to the changing nature of external lead firms that were increasingly following ‘core competence’ strategies. Indian firms became virtual extensions of their customers’ IT departments, thereby helping them to achieve greater operational efficiency (Lema 2009a).

Third phase – 2000s. The third phase has been discussed in this research. The cases and trajectories of innovation outsourcing discussed above are reflections of a relatively new tendency to adopt open business models. Beginning after the 2001 slowdown in the IT sector, buyer and supplier alike have reconfigured or deepened their business models, increasingly emphasising outside knowledge and capabilities. New strategies and sourcing frameworks have defined a more inclusive role for suppliers. The vanguard Indian firms have diversified their lines and businesses and developed new domain competences. Vanguard suppliers have developed domain expertise and frontline capabilities, and they are no longer only in execution mode.

88 This arose because early dates in computer systems were typically written in two digits (e.g. 99) rather than four (e.g. 1999). This meant that many systems could not work after the turn of the century.

They also take part in the processes that define and transform customers' or end-users' IT and software systems. This type of function is referred to as 'transformational services'. However, as has been discussed, these end-to-end services are also transformational in a more fundamental sense: the sourcing of transformational services allows firms to restructure their business and redefine the way in which value is captured. The services provided by leading-edge suppliers influence elements of the core business strategy of selected customers.

There was very limited offshore outsourcing of software to low-cost suppliers before the Indian 'offshore model' emerged on a significant scale in the 1990s. As has been argued, Indian firms and their customers were the pioneers who developed the offshore model in software, including its frameworks, systems and practices. They also drove the transition to transformational outsourcing, which combines production and innovation activities. OECD-headquartered consultancy houses are now mimicking the value proposition of Indian firms, expanding their offshore development centres in India at a rapid pace. India is thus taking centre stage in defining the forefront of software offshoring. However, it is crucial to recognise that this evolution has occurred in the context of changing business models on the demand side.

7.3.2 The role of buyer firm business models

This report suggests that the three phases of the software outsourcing industry are associated with the changes in broad business models (managerial megatrends) as set out in Chapter 2:

- closed business models
- core competence business models
- open business models.

The existence of the closed (vertically integrated) business model preceded the existence of a software industry – let alone an 'offshore' software-outsourcing industry – but the timing of the core competence business model (1990s) and the open business model (2000s) helps to explain recent developments in software outsourcing. Table 7.1 and Table 7.2 show these phases from the perspective of demand and supply respectively.

These are overlapping trends. To this day, buyer firms make use of staff augmentation services. Both the staff augmentation and the core competence strategies are alive and strong in the 2000s. However, while these are still dominant, the impact of increasingly open business models is beginning to show in software-sourcing practices. While this is particularly true where companies have succeeded in developing strong relationships with their suppliers, it is clear that firms now expect a greater level of innovation in the supplied products and services. The conclusion put forward here is that practices have evolved in a way in which first the core competence strategy and then the open business models strategy have come to define the vanguard.

By highlighting the co-evolution over time of practices and capabilities in the most advanced buyers and suppliers, this report shows that there is a strong mutual reinforcement in the evolution of 'openness' in software. Systemic gains could be

Table 7.1 Demand-side trends (IT departments and ISVs)

	1980s	1990s	2000s
Business model	Closed business model. Focus on achieving scale capacity without changing internal practices	Core competence business model. Focus on systems development and retention of core technical tasks such as high-level design	Open business model. Focus on customer interaction and domain understanding of customer's/user's business. Relationship capabilities – forwards and backwards
Sourcing practice	Body-shopping – onsite capacity boost	Outsourcing of programming tasks (unidirectional knowledge flow)	Outsourcing of (integrated) innovation activities

Note: The table describes the *emergence of trends*, not successive phases. It draws on Chapter 7 and sources cited in this section.

derived from the cross-feeding of projects and buyer-related knowledge in the supply base. In this sense, there are new systemic advantages to be gained for outsourcing companies that adopt open business models. The study suggests that the organisational decomposition of the innovation process meant that suppliers were equipped with key resources in the process of transforming – or rather extending – production capabilities into innovation capabilities at the turn of the century. This meant that the vanguard supply base deepened its innovation capabilities, thereby accelerating the process of decomposition through direct and indirect feedback mechanisms. It argued that the ability of the supply base to develop capabilities to first exploit and then accelerate demand during various stages of the software-outsourcing sector was key. Over various phases and at impressive speed Indian firms have reinvented value proportions and business models. Of course, India is not the only destination for software outsourcing. However, according to informants on the buyer side, firms in India have been at the forefront all along, and have been in the vanguard in changing the mental model of outsourcing from cost to innovation. India is the primary reference point in software outsourcing and it has acted as an important supply-side driver of business model transformation in the customer base. Hence, it has facilitated changes in not only the scale of outsourcing but also the direction. The dynamics of co-evolution were not only self-reinforcing, they were also transformative.

7.4 Limitations and issues for further research

As stressed in the introduction, the research presented in this report was exploratory in design, encompassing a wide range of phenomena and relying mostly on in-depth interview data. Such an exploratory design is useful for shedding light on a fresh area of research, but less suited to 'measure' the prevalence of certain phenomena and the strength of causal relationships. One of the aims of this research was to devise, in conceptual and methodological terms, a way to examine the issue of open business models and their consequences in

Table 7.2 **Supply-side trends**

	1980s	1990s	2000s
Business activities (value proposition to customers)	Staff augmentation (Indian firms as people providers)	Operational efficiency (Indian firms as non-core virtual extensions to customers)	Comprehensive solutions and innovative services
Engagement model	Onsite	Onsite/offshore	Global – onsite consulting and offshore implementation

Note: The table describes the *emergence of trends*, not successive phases. It draws on Lema (2009a; 2009b) and sources cited in this section.

terms of the global distribution of innovative activities. There was very little research to build upon, particularly as previous research did not take account of interactive causality between demand and supply.

The study does not suggest that the open business model is the only factor that influences the ‘global shift’ in innovative activities towards emerging economies. Rather this shift – to the extent that it occurs – is influenced by a multitude of variables in both the ‘old’ and ‘new’ innovative regions (Altenburg *et al.* 2008). The purpose of this study was to explore whether changing business models make a difference. In this sense, the study marks the beginning of an enquiry, not the end. The material and findings provided in this study have covered substantial ground, but there are still many limitations and open questions with regard to the conclusions that one can ‘infer’ from the results provided here. Certain limitations of this study surfaced during the course of analysis and this section links these limitations to key issues for future research.

First, the empirical base examined in this study does not allow us to draw any conclusion on how prevalent the adoption of open business models is more widely. The interviews were limited to a small purposive sample of buyers. The aim of the empirical work was not to make a systematic assessment of software buyers in general but to identify turning points in the sense of change in trends. The evidence provided important insights into the direction of change, but the study does not have the empirical basis to assess how widespread this change is. It is not suggested that the shift to open business models is ‘sweeping’ the global software industry. As has been emphasised, it is clear that this trend exists alongside more established core competence strategies. The co-evolutionary approach enabled the analysis of how some buyers have begun to supersede the core competence strategy, but this approach was pursued in imperfect ways. Most importantly, the empirical material on the demand side did not symmetrically match the data on the supply side in terms of depth and breadth. The data enabled the detection of the open business model as a significant new development with important ramifications for suppliers, but this basis does not allow for a measurement of its precise strength. Neither does the data provide the basis to speculate whether similar dynamics are likely to unfold in other sectors. Research exploring co-evolution in other sectors and countries is needed.

Second, future research using purposive but systemic sampling techniques to compare buyers with open and other (more closed) models is needed. Although the study does provide outlines of a conceptual framework for differentiating open business models from other business models, further work should refine the basis for distinguishing and classifying observed business behaviour of buyer firms on the demand side in order to address this issue. Systematic comparison on the supply side is also needed. In particular, future research should compare suppliers that transformed opportunities into realities and those that did not. The way to do this is to focus on particular opportunity spaces (e.g. low-cost IT consulting) and address reasons for success and failure in such spaces.

Third, future research should seek to disentangle the changes at various levels of analysis – sub-firm level, firm level and inter-firm firm level – particularly in the context of large corporations. Such large corporations raise the level of complexity and pose additional difficulties. On the demand side, it is easy to hypothesise that there is a strong positive relationship between (1) increasingly pervasive and increasingly ‘deep’ innovation outsourcing in supplier-facing business units and (2) a rising propensity among large firms to adopt broadly open business models at the overall firm level.⁸⁹ However, this is a hypothesis in need of testing. On the supply side, the focus on customer-facing project firms was useful, but at the same time leaves open questions about the influence of other sources, processes and mechanisms of capability development at the firm level, particularly those that are independent of outsourced projects. It is also necessary to adopt a firm-level approach in order to investigate the ability to manage the learning and knowledge connections between projects and the intensity of efforts in this area.

This leads to the fourth point, namely that future research on capability formation in supplier firms should adopt time-sensitive approaches. This is so because the probability that a supplier wins a contract with opportunity for new qualities of innovative activity depends on proven ‘levels’ of capability that proximate those needed in the prospective project. These proven levels of capability are likely to reflect *pre-existing* processes of capability formation. To study this it will be necessary to adopt a phase approach that can retrace the connection between projects through time. The guiding assumption is that the ability to win advanced projects in Phase 2 depends on proximate capability levels demonstrated through projects in Phase 1. The ability to demonstrate advanced capabilities in Phase 1 depends, in turn, on the active leveraging of competences acquired in other projects during the same stage and in earlier stages.

Fifth, future research needs to tease out what the adoption of open business models means for policymakers in the old innovative regions (in outsourcing OECD countries) and in new innovative regions (in low-cost supplying countries). How does the adoption of open business models affect the competitiveness of firms in OECD countries *vis-à-vis* Chinese and Indian firms? Are firms in the West breeding their future competitors by opening up the innovation process to firms in India, China and other countries? Or does the new division of labour strengthen their competitive position? How can public policy make a difference? In India, public

89 The overall level should include all different kinds of outsourcing (including areas such as manufacturing and back-office business processes) to all geographic destinations.

innovation policy has not played a major role so far. However, local policy can perhaps play a role in connecting the newly acquired capabilities to challenges that arise from within India. The domestic IT market in India is currently growing at 20 per cent per annum. This may reduce the 'demand deficiency for innovation' (Rosenberg 1963) that has so far led suppliers to neglect the search for solutions to domestic challenges (D'Costa 2006). At the same time India has an active 'ICT for Development' programme informed by the work of Prahalad (2006) on the opportunities for profitably innovating to meet the needs of low-income consumers. If these developments connect with each other, it would mean that India is not just 'catching up' with the global technological frontier but in some cases also stretching this frontier in new directions. The specific characteristics of this type of innovation may be particularly favourable for other low-income economies. In this sense, the Indian build-up of capability of the problem-framing kind opens up the possibility of giving innovation policy a new role.

References

- Altenburg, Tilman (2006) 'Governance Patterns in Value Chains and their Development Impact', *The European Journal of Development Research* 18.4: 498–521
- Altenburg, Tilman; Schmitz, Hubert and Stamm, Andreas (2008) 'Breakthrough China's and India's Transition from Production to Innovation', *World Development* 36.2: 325–34
- Ariffin, Norlela (2000) 'The Globalisation of Innovative Capabilities: The Malaysian Electronics Industry', PhD thesis, Brighton: Science and Technology Policy Research, University of Sussex
- Ariffin, Norlela and Bell, Martin (1996) *Patterns of Subsidiary-Parent Linkages and Technological Capability-Building in TNC Subsidiaries: The Electronics Industry in Malaysia*, Brighton: Science and Technology Policy Research
- Ariffin, Norlela and Figueiredo, Paulo N. (2006) 'Globalisation of Innovative Capabilities: Evidence from Local and Foreign Firms in the Electronics Industry in Malaysia and Brazil', *Science Technology and Society* 11.1: 191–227
- Arora, Ashish (2006) 'The Emerging Offshore Software Industries and the U.S. Economy', in Susan Margaret Collins and Lael Brainard (eds), *Brooking Trade Forum 2005: Offshoring White-Collar Work*, Washington, DC: Brookings Institution Press
- Arora, Ashish; Forman, Chris and Yoon, Jiwoong (2008) 'Software', in Jeffrey T. Macher and David C. Mowery (eds), *Innovation in Global Industries: U.S. Firms Competing in a New World*, Washington, DC: National Academies Press
- Arora, Ashish; Arunachalam, V.S.; Asundi, Jai and Fernandes, Ronald (2001) 'The Indian Software Services Industry', *Research Policy* 30.8: 1267–87
- Athreye, Suma (2005a) 'The Indian Software Industry', in Ashish Arora and Alfonso Gambardella (eds), *From Underdogs to Tigers: The Rise and Growth of the Software Industry in Brazil, China, India, Ireland, and Israel*, Oxford and New York: Oxford University Press
- (2005b) 'The Indian Software Industry and its Evolving Service Capability', *Industrial and Corporate Change* 14.3: 393–418
- (2004) "Role of Transnational Corporations in the Evolution of a High-Tech Industry: The Case of India's Software Industry" – a Comment', *World Development* 32.3: 555–60
- Baaij, Marc G.; Bosch, Frans A.J. Van den and Volberda, Henk W. (2005) 'The Impact of Management Consulting Firms on Building and Leveraging Clients' Competences', in Ron Sanchez and Aime Heene (eds), *Competence Perspectives on Managing Interfirm Interactions*, Oxford: Elsevier
- Balasubramanyam, V.N. and Balasubramanyam, Ahalya (2000) 'The Software Cluster in Bangalore', in John H. Dunning (ed.), *Regions, Globalization, and the Knowledge-Based Economy*, Oxford and New York: Oxford University Press

Basant, Rakesh and Chandra, Pankaj (2007) 'Role of Educational and R&D Institutions in City Clusters: An Exploratory Study of Bangalore and Pune Regions in India', *World Development* 35.6: 1037–55

Bell, Martin (2007) *Technological Learning and the Development of Production and Innovative Capacities in the Industry and Infrastructure Sectors of the Least Developed Countries: What Roles for ODA?*, Brighton: Science and Technology Policy Research, University of Sussex

— (2006) 'Time and Technological Learning in Industrialising Countries: How Long Does it Take? How Fast is it Moving (if at all)?', *International Journal of Technology Management* 36.1/2/3: 25–39

— (1984) "'Learning" and Accumulation of Industrial Technological Capacity in Developing Countries', in Martin Fransman and Kenneth King (eds), *Technological Capability in the Third World*, New York: St. Martin's Press

Bell, Martin and Pavitt, Keith (1993) 'Technological Accumulation and Industrial Growth: Contrasts between Developed and Developing Countries', *Industrial and Corporate Change* 2.2: 157–210

Brooks, Frederick P. (1995) *The Mythical Man-Month: Essays on Software Engineering*, Reading, MA: Addison-Wesley

Brusoni, Stefano (2005) 'The Limits to Specialization: Problem Solving and Coordination in "Modular Networks"', *Organization Studies* 26.12: 1885–907

Brusoni, Stefano; Prencipe, Andrea and Pavitt, Keith (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

Carpay, Frans; Hang, Chang Chieh and Yu, Dan (2007) 'Management of Outsourcing R&D in the Era of Open Innovation', *5th International Symposium on Management of Technology*, Hangzhou, China: Zhejiang Univ Press

Castilla, Emilio; Hwang, Hokyu; Granovetter, Ellen and Granovetter, Mark (2000) 'Social Networks in Silicon Valley', in Chong-Moon Lee, William F. Miller, Marguerite Gong Hancock and Henry S. Rowen (eds), *The Silicon Valley Edge*, Stanford: Stanford University Press

Chaminade, Cristina and Vang, Jan (2008a) 'Globalisation of Knowledge Production and Regional Innovation Policy: Supporting Specialized Hubs in the Bangalore Software Industry', *Research Policy* 37.10: 1684–96

— (2008b) 'Upgrading in Asian Clusters: Rethinking the Importance of Interactive Learning', *Science Technology and Society* 13.1: 61–94

Chandler, Alfred D. (1977) *The Visible Hand: The Managerial Revolution in American Business*, Cambridge, MA: Belknap Press

Chen, Yun-Chung (2008) 'Why Do Multinational Corporations Locate their Advanced R&D Centres in Beijing?', *Journal of Development Studies* 44.5: 622–44

- Chesbrough, Henry W. (2007) 'Why Companies Should Have Open Business Models', *Sloan Management Review* 48.2: 22–8
- (2006a) *Open Business Models: How to Thrive in the New Innovation Landscape*, Boston, MA: Harvard Business School Press
- (2006b) 'Open Innovation: A New Paradigm for Understanding Industrial Innovation', in Henry William Chesbrough, Wim Vanhaverbeke and Joel West (eds), *Open Innovation: Researching a New Paradigm*, Oxford: Oxford University Press
- (2003a) 'The Era of Open Innovation', *Sloan Management Review* 44.3: 35–41
- (2003b) *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Boston, MA: Harvard Business School Press
- (2003c) 'Towards a Dynamics of Modularity', in Andrea Prencipe, Andrew Davies and Michael Hobday (eds), *The Business of Systems Integration*, Oxford: Oxford University Press: 174–99
- Chesbrough, Henry W.; Vanhaverbeke, Wim and West, Joel (2006) *Open Innovation: Researching a New Paradigm*, Oxford: Oxford University Press
- Christensen, J.F. (2006) *Whither Core Competency for the Large Corporation in an Open Innovation World?*, Oxford: Oxford University Press
- Christensen, J.F.; Olesen, M.H. and Kjær, J.S. (2005) 'The Industrial Dynamics of Open Innovation – Evidence from the Transformation of Consumer Electronics', *Research Policy* 34.10: 1533–49
- Cohen, Wesley M. and Levinthal, Daniel A. (1990) 'Absorptive Capacity: A New Perspective on Learning and Innovation', *Administrative Science Quarterly* 35.1: 128–52
- Cooke, Phil (2005) 'Regionally Asymmetric Knowledge Capabilities and Open Innovation: Exploring "Globalisation 2" – A New Model of Industry Organisation', *Research Policy* 34.8: 1128–49
- D'Costa, Anthony P. (2008) 'Extensive Growth and Innovation Challenges in Bangalore, India', in G. Parayil and A. D'Costa (eds), *The New Asian Innovation Dynamics: China and India in Perspective*, Basingstoke and New York: Palgrave Macmillan
- (2006) 'ICTs and Decoupled Development: Theories, Trajectories and Transitions', in G. Parayil (ed.), *Political Economy and Information Capitalism in India: Digital Divide, Development Divide and Equity*, Basingstoke: Palgrave Macmillan
- (2004) 'Export Growth and Path-Dependence: The Locking-in of Innovations in the Software Industry', in Anthony P. D'Costa and Eswaran Sridharan (eds), *India in the Global Software Industry: Innovation, Firm Strategies and Development*, Basingstoke and New York: Palgrave Macmillan
- (2003) 'Uneven and Combined Development: Understanding India's Software Exports', *World Development* 31.1: 211–26

- D'Costa, Anthony P. and Sridharan, Eswaran (2004) 'Conclusion: Global Links, Domestic Market, and Policy for Development', in Anthony P. D'Costa and Eswaran Sridharan (eds), *India in the Global Software Industry: Innovation, Firm Strategies and Development*, Basingstoke and New York: Palgrave Macmillan
- Dhume, Sadanand (2002) 'From Bangalore to Silicon Valley and Back: How the Indian Diaspora in the United States is Changing India', in Alyssa Ayres and Philip Oldenburg (eds), *India Briefing: Quickening the Pace of Change*, The Asia Society
- Dossani, Rafiq (2006) 'Globalization and the Offshoring of Services: The Case of India', in Susan Margaret Collins and Lael Brainard (eds), *Brookings Trade Forum 2005: Offshoring White-Collar Work*, Washington, DC: Brookings Institution Press
- Drejer, Ina (2004) 'Identifying Innovation in Surveys of Services: A Schumpeterian Perspective', *Research Policy* 33.3: 551–62
- Dunning, John H. (2000) *Regions, Globalization, and the Knowledge-Based Economy*, Oxford: Oxford University Press
- (1993) *The Globalisation of Business*, London: Routledge
- Engardio, Pete and Einhorn, Bruce (2005) 'Outsourcing Innovation', *Business Week* 21 March: 82–94
- Ernst, Dieter (2008) 'Innovation Offshoring and Outsourcing: What Are the Implications for Industrial Policy?', *International Journal of Technological Learning, Innovation and Development* 1.3: 309–29
- (2006) *Innovation Offshoring: Asia's Emerging Role in Global Innovation Networks*, East-West Center Special Reports Honolulu, HI: East-West Center
- (2005) 'Complexity and Internationalisation of Innovation – Why is Chip Design Moving to Asia?', *International Journal of Innovation Management* 9.1: 47–73
- (2002) 'Global Production Networks and the Changing Geography of Innovation Systems. Implications for Developing Countries', *Economics of Innovation and New Technologies* 11.6: 479–523
- Ernst, Dieter and Kim, Linsu (2002) 'Global Production Networks, Knowledge Diffusion and Local Capability Formation', *Research Policy* 31.8/9: 1417–29
- Figueiredo, Paulo N. (2003) 'Learning, Capability Accumulation and Firms' Differences: Evidence from Latecomer Steel', *Industrial and Corporate Change* 12.3: 607–43
- Flowers, Stephen (2007) 'Organisational Capabilities and Technology Acquisition: Why Firms Know Less than they Buy', *Industrial and Corporate Change* 16.3: 317–34
- Flyvbjerg, B. (2006) 'Five Misunderstandings about Case-Study Research', *Qualitative Inquiry* 12.2: 219–45
- Fromhold-Eisebith, Martina (1999) 'Bangalore: A Network Model for Innovation-Oriented Regional Development in NICs?', in Edward J. Malecki and Päivi Oinas

(eds), *Making Connections – Technological Learning and Regional Economic Change*, Aldershot: Ashgate

Gallouj, Faïz (2002) 'Innovation in Services and the Attendant Old and New Myths', *Journal of Socio-Economics* 31.2: 137–54

Gammeltoft, Peter (2006) 'Internationalisation of R&D: Trends, Drivers and Managerial Challenges', *International Journal of Technology and Globalisation* 2.1/2: 177–99

Gereffi, Gary (1999) 'International Trade and Industrial Upgrading in the Apparel Commodity Chain', *Journal of International Economics* 48.1: 37–70

Gereffi, Gary; Humphrey, John and Sturgeon, Timothy (2005) 'The Governance of Global Value Chains', *Review of International Political Economy* 12.1: 78–104

Ghezzi, Carlo; Jazayeri, Mehdi and Mandrioli, Dino (2003) *Fundamentals of Software Engineering*, Upper Saddle River, NJ: Prentice Hall

Giuliani, Elisa; Pietrobelli, Carlo and Rabellotti, Roberta (2005) 'Upgrading in Global Value Chains: Lessons from Latin American Clusters', *World Development* 33.2: 549–73

Granovetter, Mark (1985) 'Economic Action and Social Structure: The Problem of Embeddedness', *American Journal of Sociology* 91.3: 482–510

Hansen, M.T. and Birkinshaw, J. (2007) 'The Innovation Value Chain', *Harvard Business Review* 85.6: 121–30

Hansen, Michael W.; Schaumburg-Müller, Henrik and Pottenger, Eugene (2007) *Outsourcing for Development. Towards a Developing Country Firm Perspective*, Copenhagen Business School

Heeks, Richard (1996) *India's Software Industry: State Policy, Liberalisation, and Industrial Development*, New Delhi: Sage Publications

Heitzman, James (2004) *Network City: Planning the Information Society in Bangalore*, New Delhi and New York: Oxford University Press

Henderson, Rebecca M. and Clark, Kim B. (1990) 'Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms', *Administrative Science Quarterly* 35.1: 9–30

Hobday, Michael (2000) 'The Project-Based Organisation: An Ideal Form for Managing Complex Products and Systems?', *Research Policy* 29.7/8: 871–93

Hobday, Michael; Rush, Howard and Bessant, John (2004) 'Approaching the Innovation Frontier in Korea: The Transition Phase to Leadership', *Research Policy* 33.10: 1433–57

Hoekstra, Bob (2006) 'Innovation in R&D', in NASSCOM (ed.), *Building an Ecosystem for IT Innovation in India*, New Delhi: National Association of Software and Service Companies

Humphrey, John (2004) *Upgrading in Global Value Chains*, Geneva: ILO, Policy Integration Department, World Commission on the Social Dimensions of Globalization

- (2003) 'Globalisation and Supply Chain Networks: The Auto Industry in Brazil and India', *Global Networks* 3.2: 121–41
- Humphrey, John and Schmitz, Hubert (2002) 'How Does Insertion in Global Value Chains Affect Upgrading in Industrial Clusters?', *Regional Studies* 36.9: 1017–27
- Jensen, Peter D. Ørberg (2009) 'Offshoring of Advanced and High-Value Technical Services: Antecedents, Process Dynamics and Firm-Level Impacts', PhD dissertation, Copenhagen: Department of Intercultural Communication and Management Copenhagen Business School
- Jordan, Gary and Segelod, Esbjorn (2006) 'Software Innovativeness: Outcomes on Project Performance, Knowledge Enhancement, and External Linkages', *R&D Management* 36.2: 127–42
- Kaplinsky, Raphael (2005) *Globalization, Poverty and Inequality*, Cambridge: Polity Press
- Kishimoto, Chikashi (2004) 'Clustering and Upgrading in Global Value Chains: The Taiwanese Personal Computer Industry', in Hubert Schmitz (ed.), *Local Enterprises in the Global Economy: Issues of Governance and Upgrading*, Cheltenham: Edward Elgar
- (2002) *The Taiwanese Personal Computer Cluster: Trajectory of its Production and Knowledge System*, Brighton: University of Sussex
- Kobitzsch, W.; Rombach, D. and Feldmann, R.L. (2001) 'Outsourcing in India', *IEEE Software* 18.2: 78–86
- Krishnan, Rishikesha (2007) 'Can India Become an Innovation Powerhouse?', paper presented at workshop on Asian Drivers: China and India Shaping the Global Political Economy – Challenges for European Development Policy, Eighth Annual Global Development Conference, Beijing, China, 12–13 January
- Kruchten, Philippe (2004) *The Rational Unified Process: An Introduction*, Reading, MA: Addison-Wesley
- Kumar, Nagesh (2001) 'National Innovation Systems and the Indian Software Industry Development', paper prepared for World Industrial Development Report 2002, Vienna: UNIDO
- Kumar, Nagesh and Joseph, K.J. (2005) *National Innovation Systems and India's IT Capability: Are there Any Lessons for ASEAN Newcomers?*, RIS Discussion Papers 72, New Delhi: Research and Information System for the Non-Aligned and Other Developing Countries
- Lauridsen, Laurids (2006) 'Governance, Technology and Development', in Ahmed Shafiqul Huque and Habib Zafarullah (eds), *International Development Governance: Publication Administration and Public Policy*, London: CRC Press
- Lazonick, William (2008) *The New Economy Business Model and Sustainable Prosperity*, Sloan Industry Studies, Boston, MA: MIT
- Lazonick, William and O'Sullivan, Mary (2000) 'Maximizing Shareholder Value: A New Ideology for Corporate Governance', *Economy and Society* 29.1: 13–35

- Lee, J.R. and Chen, J.S. (2000) 'Dynamic Synergy Creation with Multiple Business Activities: Toward a Competence-Based Business Model for Contract Manufacturers', in Ron Sanchez and Aime Heene (eds), *Theory Development for Competence-Based Management, Advances in Applied Business Strategy*, Stanford, CT: Jai Press
- Lema, Rasmus (2009a) 'Global Value Chains, Business Organisation and Structural Transformation of Bangalore's Software Cluster in the 1990s and Beyond', in Rajesh Kumar and Murali Patibandla (eds), *Institutional Dynamics and the Evolution of the Indian Economy*, Basingstoke: Palgrave Macmillan
- (2009b) 'Outsourcing and the Rise of Innovative Software Services in Bangalore', draft DPhil thesis, Brighton: IDS, University of Sussex
- Lema, Rasmus and Hesbjerg, Bjarke (2003) *The Virtual Extension: A Search for Collective Efficiency in the Software Cluster in Bangalore*, Roskilde: International Development Studies, Roskilde University
- Leung, C.H. (2007) 'Evolution of the Business Model', Master's thesis (Innovation Management), Eindhoven: Department of Technology Management, Technical University of Eindhoven
- Lewin, Arie; Massini, Silvia and Peeters, Carine (2008) *Why Are Companies Offshoring Innovation? The Emerging Global Race for Talent*, CEB Working Paper 08/009, Brussels: Université Libre de Bruxelles, Solvay Business School, Centre Emile Bernheim
- Lott, C.M. (1997) 'Breathing New Life into the Waterfall Model', *IEEE Software* 14.5: 103–5
- Lund, Christian (1994) 'Tinkering Methodology', in Christian Lund and Henrik Secher Marcussen (eds), *Access, Control and Management of Natural Resources in Sub-Saharan Africa – Methodological Considerations*, Occasional Paper 13, Roskilde: International Development Studies, Roskilde University: 10–23
- Lundvall, Bengt-Åke; Intarakummnerd, Patarapong and Vang, Jan (2006) *Asia's Innovation Systems in Transition*, Cheltenham UK and Northampton MA: Edward Elgar
- Lynn, Leonard and Salzman, Hal (2007) *'Innovation Shift' to the Emerging Economies: Cases from IT and Heavy Industries*, Sloan Industry Studies, Boston, MA: MIT
- Madsen, Erik S.; Riis, Jens O. and Waehrens, Brian V. (2008) 'The Knowledge Dimension of Manufacturing Transfers: A Method for Identifying Hidden Knowledge', *Strategic Outsourcing: An International Journal* 1.3: 198–209
- Mariani, Myriam (2002) 'Next to Production or to Technological Clusters? The Economics and Management of R&D Location', *Journal of Management and Governance* 6.2: 131–52
- Maskell, Peter; Pedersen, Torben; Petersen, Bent and Dick-Nielsen, Jens (2007) 'Learning Paths to Offshore Outsourcing: From Cost Reduction to Knowledge Seeking', *Industry and Innovation* 14.3: 239–57

- Mathews, John A. (2006) 'Catch-up Strategies and the Latecomer Effect in Industrial Development', *New Political Economy* 11.3: 313–35
- Memedovic, Olga (2008) 'Editorial', *International Journal of Technological Learning, Innovation and Development* 1.3: 227–36
- Miles, Ian (2008) 'Patterns of Innovation in Service Industries', *IBM Systems Journal* 47.1: 115–28
- (2007) 'Research and Development (R&D) Beyond Manufacturing: The Strange Case of Services R&D', *R&D Management* 37.3: 249–68
- (2004) 'Innovation in Services', in Jan Fagerberg, David C. Mowery and Richard R. Nelson (eds), *The Oxford Handbook of Innovation*, Oxford: Oxford University Press
- Miles, Ian; Kastrinos, Nikos; Bilderbeek, Rob and den Hertog, Pim (1995) *Knowledge-Intensive Business Services: Users, Carriers and Sources of Innovation*, Manchester: PREST, University of Manchester
- Mitra, Sramana (2008) 'The Coming Death of Indian Outsourcing', *Forbes*, 29 February 2008
- Morrison, Andrea; Pietrobelli, Carlo and Rabellotti, Roberta (2008) 'Global Value Chains and Technological Capabilities: A Framework to Study Learning and Innovation in Developing Countries', *Oxford Development Studies* 36.1: 39–58
- MphasiS (2008) *Business Analysis Practice*, Bangalore: Business Analysis Group, MphasiS
- Muchie, Mammo; Gammeltoft, Peter and Lundvall, Bengt-Åke (2003) *Putting Africa First. The Making of African Innovation Systems*, Aalborg: Aalborg University Press
- Mudambi, Ram (2008) 'Location, Control and Innovation in Knowledge-Intensive Industries', *Journal of Economic Geography* 8.5: 699–725
- Nadvi, Khalid and Halder, Gerhard (2005) 'Local Clusters in Global Value Chains: Exploring Dynamic Linkages between Germany and Pakistan', *Entrepreneurship and Regional Development* 17.5: 339–63
- NASSCOM (2008) *Strategic Review 2008: The IT Industry in India*, New Delhi: National Association of Software and Service Industries
- (2007a) *The Indian IT Industry*, Company Search – Online Directory, www.companysearch.nasscom.in (accessed June 2008), New Delhi: National Association of Software and Service Industries
- (2007b) *NASSCOM-BCG Innovation Report: Unleashing the Innovative Power of Indian IT-ITES Industry*, New Delhi: National Association of Software and Service Companies
- (2006a) *Building an Ecosystem for IT Innovation in India*, New Delhi: National Association of Software and Service Companies

- (2006b) *Strategic Review 2006: The IT Industry in India*, New Delhi: National Association of Software and Service Industries
- Navas-Alemán, Lizbeth (2006) 'Opportunities and Obstacles for Industrial Upgrading of Brazilian Footwear and Furniture Firms: A Comparison of Global and National Value Chains', PhD thesis, Brighton: IDS, University of Sussex
- Niosi, Jorge and Bellon, Bertrand (2002) 'The Absorptive Capacity of Regions', paper presented at Colloque Economie Méditerranée Monde Arabe, Sousse, 20–21 September
- Nussbaum, Bruce (2006) "'Borderless Thinking" Equals Innovation', *Business Week*, 2 February. Available at www.businessweek.com/innovate/content/feb2006/id20060202_010265.htm (accessed June 2009)
- OECD (2005) *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, 3rd edition, Paris: Organisation for Economic Cooperation and Development /Eurostat
- (2002) *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development*, Paris: Organisation for Economic Cooperation and Development
- Oswald, Philipp (2008) *ODIP and the Global Distribution of Innovation Activities in the German Software Industry*, Marburg: Department of Geography, Philipps-Universität
- Overby, Stephanie (2007) "'What Does it Take to Get IT Outsourcers to Innovate?'", *CIO Magazine*, 15 October
- Parthasarathy, Balaji and Aoyama, Yuko (2006) 'From Software Services to R&D Services: Local Entrepreneurship in the Software Industry in Bangalore, India', *Environment and Planning A* 38.7: 1269–85
- Patibandla, Murali (2006) *Evolution of Markets and Institutions: A Study of an Emerging Economy*, New York: Routledge
- Patibandla, Murali and Petersen, Bent (2002) 'Role of Transnational Corporations in the Evolution of a High-Tech Industry: The Case of India's Software Industry', *World Development* 30.9: 1561–77
- Pavitt, Keith (2005) 'Innovation Processes', in Jan Fagerberg, David C. Mowery and Richard R. Nelson (eds), *The Oxford Handbook of Innovation*, Oxford and New York: Oxford University Press
- Pfannenstein, Laura L. and Tsai, Ray J. (2004) 'Offshore Outsourcing: Current and Future Effects on American IT Industry', *Information Systems Management* 21.4: 72–80
- Pollice, Gary (2003) *Using the Rational Unified Process for Small Projects: Expanding Upon Extreme Programming*, Cupertino, CA: Rational Software Corporation, IBM
- Porter, Michael E. (1990) *The Competitive Advantage of Nations*, New York: The Free Press

- Prahalad, C.K. (2006) *The Fortune at the Bottom of the Pyramid*, Upper Saddle River, NJ: Wharton School Pub
- Prahalad, C.K. and Hamel, G. (1990) 'The Core Competence of the Corporation', *Harvard Business Review* 68.3: 79–91
- Quadros, Ruy (2008) *Brazilian Innovation in the Global Automotive Chain: Implications of ODIP*, Campinas: University of Campinas
- Rosenberg, Nathan (1963) 'Capital Goods, Technology, and Economic Growth', *Oxford Economic Papers* 15.3: 217–27
- Rousseva, Rossitza (2008) 'Identifying Technological Capabilities with Different Degrees of Coherence: The Challenge to Achieve High Technological Sophistication in Latecomer Software Companies (based on the Bulgarian Case)', *Technological Forecasting and Social Change* 75.7: 1007–31
- Royce, Winston (1970) 'Managing the Development of Large Software Systems', *Proceedings of IEEE WESCON* 26.1–9
- Sabel, Charles (1989) 'Flexible Specialisation and the Re-Emergence of Regional Economies', in Paul Hirst and Jonathan Zeitlin (eds), *Reversing Industrial Decline? Industrial Structure in Britain and Her Competitors*, Oxford: Berg
- Sako, Mari (2005) 'Outsourcing and Offshoring: Key Trends and Issues', background paper prepared for the Emerging Markets Forum, London: Said Business School
- Sanchez, R. (1994) 'Towards a Science of Strategic Product Design: System Design, Component Modularity, and Product Leveraging Strategies', paper presented at Second International Product Development Conference on New Approaches to Development and Engineering, Brussels, May
- Sandulli, Francesco D. and Chesbrough, Henry (2009) *The Two Sides of Open Business Models*, SSRN, <http://ssrn.com/abstract=1325682>
- Santos, José; Doz, Yves and Williamson, Peter (2004) 'Is Your Innovation Process Global?' *Sloan Management Review* 45.4: 31–7
- Saxenian, A. and Hsu, J-Y. (2001) 'The Silicon Valley – Hsinchu Connection: Technical Communities and Industrial Upgrading', *Industrial and Corporate Change* 10.4: 893–920
- Sayer, R. Andrew (1992) *Method in Social Science: A Realist Approach*, London: Routledge
- Schmitz, Hubert (2007a) 'The Rise of the East: What Does it Mean for Development Studies?', *IDS Bulletin* 38.2: 51–8
- (2007b) 'Transitions and Trajectories in the Build-up of Innovation Capabilities: Insights from the Global Value Chain Approach', *Asian Journal of Technology Innovation* 15.2: 151–8
- (1999) 'Collective Efficiency and Increasing Returns', *Cambridge Journal of Economics* 23.4: 465–83

Schmitz, Hubert and Strambach, Simone (2009) 'The Organisational Decomposition of Innovation and Global Distribution of Innovative Activities: Insights and Research Agenda', *International Journal of Technological Learning, Innovation and Development* 2.4: 231–49

— (2008) *The Organisational Decomposition of the Innovation Process: What Does it Mean for Global Distribution of Innovation Activities?*, IDS Working Paper 304, Brighton: IDS

Schumpeter, Joseph A. (1982) *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*, New Brunswick NJ and London: Transaction Publishers

Segelod, E. and Jordan, G. (2004) 'The Use and Importance of External Sources of Knowledge in the Software Development Process', *R&D Management* 34.3: 239–52

Simard, Caroline and West, Joel (2006) 'Knowledge Networks and the Geographic Locus of Innovation', in Henry William Chesbrough, Wim Vanhaverbeke and Joel West (eds), *Open Innovation: Researching a New Paradigm*, Oxford: Oxford University Press

Simcoe, Tim (2006) 'Open Standards and Intellectual Property Rights', in Henry W. Chesbrough, Wim Vanhaverbeke and Joel West (eds), *Open Innovation: Researching a New Paradigm*, Oxford: Oxford University Press

Strambach, Simone (2009 forthcoming) 'Path Dependency, Path Plasticity – the Co-Evolution of Institutions and Innovation – the German Business Software Industry', in R. Boschma and R. Martin (eds), *Handbook for Evolutionary Economic Geography*, Cheltenham: Edward Elgar

— (2008) 'Knowledge-Intensive Business Services (KIBS) as Drivers of Multi-Level Knowledge Dynamics', *International Journal of Service and Technology Management* 10.2/3/4: 152–74

— (2001) 'Innovation Processes and the Role of Knowledge-Intensive Business Services', in K. Koschatzky, M. Kulicke and A. Zenker (eds), *Innovation Networks: Concepts and Challenges in the European Perspective*, Heidelberg: Physica Verlag

Sturgeon, Timothy (2006) 'The Governance of Global Value Chains; Implications for Industrial Upgrading', paper presented at Industrial Upgrading, Offshore Production, and Labor, Social Science Research Institute, Duke University, 9–10 November

— (2002) 'Modular Production Networks: A New American Model of Industrial Organization', *Industrial and Corporate Change* 11.3: 451–96

— (1997) *Does Manufacturing Still Matter?: The Organizational Delinking of Production from Innovation*, Working Paper 92B, Berkeley: Berkeley Roundtable on the International Economy

Sturgeon, Timothy and Lee, Ji-Ren (2005) 'Industry Co-Evolution: A Comparison of Taiwan and North American Electronics Contract Manufacturers', in Suzanne

- Berger and Richard Lester (eds), *Global Taiwan: Building Competitive Strengths in a New International Economy*, Armonk, NY: Sharpe
- Sturgeon, Timothy; Van Biesebroeck, Johannes and Gereffi, Gary (2008) 'Value Chains, Networks and Clusters: Reframing the Global Automotive Industry', *Journal of Economic Geography* 8.3: 297–321
- Subramanian, C.R. (1992) 'Software – Dreams of Riches', in C.R. Subramanian (ed.), *India and the Computer: A Study of Planned Development*, Delhi: Oxford University
- Thomas, Kim (2007) 'Outsourcing is More Than Just Saving Money', Special Report on Digital Business, London: *Financial Times*
- Tschang, Ted (2005) 'The Indian Software Industry: Past Progress and Future Prospects', *International Journal of Contemporary Sociology* 42.1: 93–106
- Tsui, Frank F. and Karam, Orlando (2007) *Essentials of Software Engineering*, Sudbury, MA: Jones and Bartlett Publishers
- UNCTAD (2005) *Transnational Corporations and the Internationalization of R&D*, Geneva: United Nations Conference on Trade and Development
- Vaitheeswaran, Vijay (2007) 'Something New Under the Sun', A Special Report on Innovation, *The Economist*, 13 October
- Van Den Ende, Jan and Jaspers, Ferdinand (2004) *Governance Modes for Systemic Innovation. Service Development in Mobile Telecommunications*, ERIM Report Series Reference No. ERS-2004-067-ORG, available at SSRN: <http://ssrn.com/abstract=595003> (accessed June 2009)
- Van der Meer, Han (2007) 'Open Innovation the Dutch Treat: Challenges in Thinking in Business Models', *Creativity and Innovation Management* 16.2: 192–202
- Vang, Jan and Chaminade, Cristina (2006) *Building RIS in Developing Countries: Policy Lessons from Bangalore, India*, WP 2006/02, Lund: Center for Innovation, Research and Competence in the Learning Economy
- Vijayabaskar, M. and Krishnaswami, Girija (2003) 'Understanding Growth Dynamism and its Constraints in High Technology Clusters in Developing Countries: A Study of Bangalore, Southern India', in Sunil Mani and Henny Romijn (eds), *Innovation, Learning and Technological Dynamism of Developing Countries*, Tokyo: UNU Press
- von Hippel, Eric (1988) *The Sources of Innovation*, New York and Oxford: Oxford University Press
- West, Joel and Gallagher, Scott (2006) 'Patterns of Open Innovation in Open Source Software', in Henry W. Chesbrough, Wim Vanhaverbeke and Joel West (eds), *Open Innovation: Researching a New Paradigm*, Oxford: Oxford University Press
- West, Joel; Vanhaverbeke, Wim and Chesbrough, H.W. (2006) 'Open Innovation: A Research Agenda', in Henry W. Chesbrough, Wim Vanhaverbeke and Joel West (eds), *Open Innovation: Researching a New Paradigm*, Oxford: Oxford University Press

Whitley, R. (2006) 'Project-Based Firms: New Organizational Form or Variations on a Theme?', *Industrial and Corporate Change* 15.1: 77–99

Wibe, Mona Domaas and Narula, Rajneesh (2002) 'Interactive Learning and Non-Globalisation: Knowledge Creation by Norwegian Software Firms', *International Journal of Entrepreneurship and Innovation Management* 2.2/3: 224–45

Williamson, Oliver (1981) 'The Modern Corporation: Origins, Evolution, Attributes', *Journal of Economic Literature* 19.4: 1537–68

Zaheer, S. and Manrakhan, S. (2001) 'Concentration and Dispersion in Global Industries: Remote Electronic Access and the Location of Economic Activities', *Journal of International Business Studies* 32.4: 667–86

Zeng, Ming and Williamson, Peter J. (2007) *Dragons at Your Door: How Chinese Cost Innovation is Disrupting Global Competition*, Boston, MA: Harvard Business School Press

Zhou, Ji-zhong; Tang, Chao-ying and Xiong, Wei (2005) 'Interactive Relationship between KIBS and Knowledge Environment', *International Journal of Technology Management* 32.3–4: 288–301