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Published in:
International Journal of Technological Learning, Innovation and Development

DOI (link to publication from Publisher):
10.1504/IJTLID.2014.064701

Publication date:
2014

Document Version
Early version, also known as pre-print

Offshore outsourcing and innovation capabilities in the supply base: evidence from software firms in Bangalore

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Abstract: This paper contributes to the growing body of literature concerned with the global redistribution of innovative capacity towards the emerging economies. It does so by asking whether Indian software firms have developed significant innovation capabilities. It draws on evidence from ten software service suppliers in Bangalore (India) and the examination of key change events within these firms. The study finds evidence of deepened capabilities for significant – 'problem framing' – innovation in India. The findings challenge the predominant view about outsourcing and innovation capability in Indian software industry. It also challenges existing perspectives in the broader literature on the acquisition of innovation capabilities by suppliers in global value chains.

Keywords: outsourcing; global value chains; firm capability; innovation capabilities; upgrading; problem framing; software industry; Bangalore; India; software industry; knowledge intensive; supplier; supply base.

Reference to this paper should be made as follows: Lema, R. (xxxx) 'Offshore outsourcing and innovation capabilities in the supply base: evidence from software firms in Bangalore', *Int. J. Technological Learning, Innovation and Development*, Vol. X, No. Y, pp.000–000.

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1 Introduction

Recent literature suggests that outsourcing changes the international division of labour between developed and developing countries. It is clear that outsourcing 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 (Schmitz, 2007; Chaminade and Vang, 2008). Moreover, there is increasing suspicion that this acquisition of productive capability from outsourcing is now followed by the shift to innovation capabilities (Altenburg et al., 2008). There is, however, limited evidence of how deep it goes. This paper feeds into the debate about the change in the global distribution of labour, particularly in innovative activity, and it examines this relationship in the context of the software services industry in Bangalore, India. The purpose of the paper is to examine whether firms in the Bangalore software industry have started to acquire innovative capability and whether it extends to ‘significant’ or ‘advanced’ innovative capability. If the division of labour is changing substantially we would expect this to be identifiable in an advanced export platform such as Bangalore.

The Indian software industry has received a lot of attention in the academic and business literature. However, the dominant argument about the ‘quality’ of capabilities is that, due to outsourcing, Indian firms have become strong in production/execution capabilities but remain weak in innovation capability (Arora et al., 2008; Dossani, 2006; Arora, 2006). Or as Sharma (2014, p.77), puts it: ‘a major weakness of the Indian industry is inadequate thrust on innovation, product development and focus on R&D. One can safely say that most of the technologies deployed in Indian IT sector are either imported or their intellectual property is in non-Indian hands’. 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 do not do the thinking. The customers do. India executes’ (Mitra, 2008).

The emphasis on ‘productive’ capacity is strong in the dominant literature on the Bangalore software supply platform and the Indian software industry more generally (D’Costa, 2006, 2009; Chaminade and Vang, 2008). D’Costa argues that the rootedness of India’s competitive advantage in low labour costs gave rise to ‘extensive growth’, the linear expansion of the work force, without a corresponding increase in the deepening of skills (D’Costa, 2003, 2004). Indian firms tended to focus on the lower value-added stages of the software-development cycle in which learning opportunities were limited. By contrast, innovation activities were typically non-globalised and bound to the locations of customers and software lead firms in OECD countries (see also Tschang, 2005).

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. The formation of these capabilities did not change the division of labour between buyers and suppliers, but they were necessary to exploit the opportunity that arose with offshore outsourcing. The National Association of Software and Services Companies (NASSCOM) reached the same conclusion in a major study on innovation. It found that innovation was ‘heavily skewed’, focused predominantly on competitiveness ‘sustaining’ efforts of improving inputs (human resources) and business processes, 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, 2007a).

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 deeper innovative capability in the *long haul* [see, for example, D’Costa and Sridharan, (2004), p.276]. This paper examines whether the transformation of capabilities – from software production to innovation – is already underway in the Bangalore supply platform, and how deep the capabilities go.

This study seeks to examine whether the influence of outsourcing goes beyond the global redistribution of production activities to enhance also innovative activities and capabilities in supplier firms in low-cost countries. Examining the case of Bangalore, this paper concentrates on the exploration of a particular variable in this equation, namely on the quality of capability in the outsourcing supply base. The question that drives this paper is therefore whether firms in the Bangalore supply base have developed 'significant' types of innovation capability.

The paper focuses on the period between 2001 and 2006 because previous studies – as outlined above – have indicated that there was very little innovation capability in the Indian software industry before the turn of the century (Altenburg et al., 2008; Lema, 2009). To examine the key question, the study is particularly focused on the possible observation of peak capabilities associated with the software development process. It is concerned with the most sophisticated capabilities demonstrated by software suppliers in the observation period and the study uses the term 'peak capability' to refer to this.

The paper has the following structure: Section 2 sketches out three phases of development in the Indian software industry, highlighting the role of outsourcing in driving growth and development. Section 3 introduces the conceptual framework. The study draws mainly on the literature on outsourcing and global value chains. This literature addresses explicitly the connection between outsourcing and supplier capabilities. However, it is unclear how 'advanced' innovation capabilities should be defined and specifying how this can be assessed is in itself an important task of the paper. Section 4 describes the research design and methodology. It explains how the study identified instances of peak capability in different software service business lines and how it assessed the data. Section 5 provides the results of the empirical analysis. The concluding Section 6 brings out the implications of the findings and discusses the limitations of the research.[1]

2 India's software industry

India's software industry has evolved over three main phases that are closely linked to outsourcing practices of buyers in OECD markets (Lee et al., 2014). The broad developments of this evolution is well known, but it is necessary to provide a brief context and literature review in order to bring out the value added of the findings revealed in later sections of the paper.

Networked computers gained a foothold in businesses in the USA and the EU in the mid- and late 1980s. This shift to networked computing created a huge demand for software services. A handful of early entrants emerged in this period in India (Heeks, 1996), driven by the demand for 'onsite services' in customer locations (Athreye, 2005a). This onsite staff augmentation (or so-called 'body-shopping') model thus emerged in the 1980s but was in fact the dominant mode up until the late 1990s (Lema, 2009). There were technical reasons for the dominance of this model, primarily poor communications technology, but also an emphasis on corporate control over IT processes on the demand side. This meant that Indian engineers depended on air travel to customer sites in the USA and the EU. The value delivered to customers was almost exclusively in the form of labour-cost savings.

The dramatic export 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. In this second period, a large number of suppliers entered the market. During the 1990s, the Indian software industry became firmly rooted in the emerging ‘offshore model’ whereby buyers outsourced software development sub-processes to Indian providers. This work was dominated by routine-based tasks – coding and testing to external specifications – 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, 2009).

The emergence of the third phase in the 2000s is the focus of this paper. This period started with a temporary slump in the sector due to a decline in demand caused by the technology sector in the USA in 2001, but software exports from India surged from just over USD 5 billion in 2001 to almost USD 18 billion in 2006. Importantly, firm managers in the sector agree that the 2001 slow-down in the IT sector was an inflection point in which buyers and supplier alike re-evaluated and reconfigured their business models (Lema, 2010a). With regard to the demand side, this has been backed up by research which has shown that offshore outsourcing to India has become more profound and knowledge seeking (Lynn and Salzman, 2007; Lewin et al., 2009; Maskell et al., 2007; Engardio and Einhorn, 2005). However, the observed changes on the demand side are rarely complemented by supply side research. This is unfortunate because new sourcing strategies have important ramifications in India – they create new spaces for suppliers (Lema, 2010b). The question is therefore, whether this transpired into upgrading of innovation in the supply base.

It is commonplace to seek insights from data on conventional indicators such as R&D expenditure and US patents. Parthasarathi and Joseph (2004) found that less than 10% of Indian IT software services firms reported R&D expenditure in 2001. Arora (2006) showed that in 2005, Indian owned IT firms filed and had granted very few US patents. They had granted far fewer than Indian MNC subsidiaries in the same field – and these subsidiaries, in turn, had granted fewer than their headquarters in the West. This data has been used to suggest that there has been no significant shift from software production (or ‘programming’, i.e., coding and testing) to innovation in the Indian software industry. However, there are reasons to question the value of these indicators. For instance, the majority of Indian owned firms have a service focus (rather than software product or electronics focus), which minimises the need for R&D investment and patents (Bhatnagar, 2006). These standard metrics reflects patterns of innovation only in certain kinds of sectors (NESTA, 2007; Miles, 2004). The question is whether suppliers of outsourced software services innovate in ways that are only partially reflected in these metrics – whether significant ‘hidden innovation’ occurs. In order to explore this, one needs to rely on qualitative case study material. To aid such an analysis, the next section draws up the analytical framework used in the study.

3 Conceptual framework

The purpose of this section is to seek insights from the literature on outsourcing and global value chains and devise a conceptual framework to classify innovation activities (by software suppliers). While there is agreement that there are different types and degrees of innovativeness, there is also agreement that it is difficult to define and measure. This section specifies the framework used in this study and combines this with a brief review of the literature.

3.1 Outsourcing in global value chains and supplier capability

To what extent does outsourcing facilitate the accumulation of innovation capabilities by suppliers? There is a relatively clear view running through the general literature on outsourcing and value chains. This literature focuses on the connections between global buyers (so-called lead firms) and local capabilities in low-cost countries (Ernst and Kim, 2002; Sturgeon, 2002; Gereffi et al., 2005; Schmitz, 2007). The view is that the accumulation and deepening of production capabilities extends at best to minor innovation capabilities but not to major or advanced innovation capabilities.

Value chain research 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 the European Union (Gereffi, 1999; Humphrey and Schmitz, 2002). Until recently, the value chain literature maintained that only certain low-end stages of the chain tend to be outsourced to emerging market economies, mainly manufacturing and standardised services. Mudambi (2008) argued that lead firms have different strategies for the control of the value chain, but one common characteristic is that innovation activities tend to remain in so-called advanced economies. However, there is now a literature that recognises that some innovation activities are offshored. Outsourcing includes not just routine activities but also knowledge-intensive activities, including some R&D activities (Ernst, 2008; Hansen et al., 2008). Ernst (2006) suggested that 'transformations in strategy and organisation have provoked fundamental changes in innovation management and enhanced the mobility of innovation'. Nevertheless, the literature on global outsourcing and value chains still argues that dispersed innovation activities are of a second order. This follows the dominant view of multinational corporations, which posits that such corporations 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), p.622].

The literature thus posits that innovation capabilities in low-cost supply bases are limited because buyers will only outsource activities that are non-strategic. Schmitz argues that strategic innovation activities are 'problem framing'. He argues that 'problem framing is exactly what the lead firms of global value chains do' [Schmitz, (2007), p.156]. He draws on the modularity literature, which shows that firms in most industries seek to avoid the effective loss of synthesis and system integration capabilities (Brusoni et al., 2001; Brusoni, 2005; Pavitt, 2005). This system integration activity is a critical step in the innovation processes, even where the systems integrator (buyer) itself is a sub-system supplier in intermediate markets. The failure to retain this 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, (2003), p.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 system components. 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). This is why problem framing is defined as a 'significant' innovation capability.

3.2 Framework for classifying innovative activity in the software industry

In order to classify innovative activities the study

1 draws on the waterfall model of the software development lifecycle

2 applies the concepts of problem framing and solving to the software development processes to identify steps that are likely to constitute the loci of different forms of innovation activities.

As shown in Figure 1 it uses a fourfold distinction to classify innovation tasks:

a *Problem framing*: activity directed towards the definition of new systems/products, including their high-level architecture (requirement analysis and high-level design).

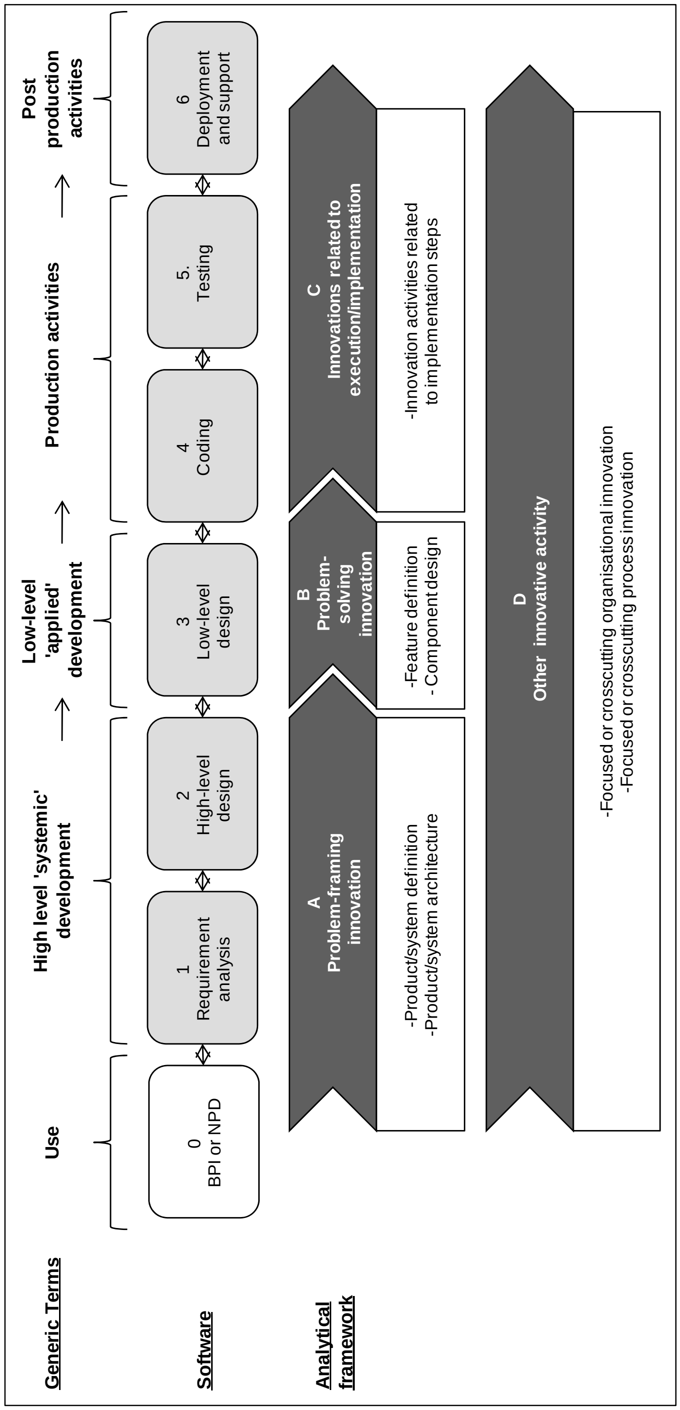
b *Problem solving*: activity directed towards system components including those concerned with separable features or functionality. This category therefore includes the improvement of existing systems by providing new add-on functionality (low-level design).

c *Improving execution*: activity directed towards the development or enhancement of processes pertaining to software programming. It improves the execution/implementation steps in the software development processes (coding and testing).

d *Other innovative activity*: activity directed towards any other aspect of general business, including delivery, marketing or change/expansion of the business portfolio (crosscutting innovative efforts).

Problem framing bridges non-software innovation activities [related to the immediate use: business process improvements and new product development (NPD)] and software innovation activities (related to the defintion of the software system, requirements and high-level design). Problem solving is more limited in scope and bridges core innovation and software production, even though it has an independent element of knowledge addition within the confines of an overall architecture. Execution in itself is not an innovative activity. However, firms may undertake innovative activities to improve execution. In addition, firms may undertake innovative activity not directly related to the development of software (in a broad sense, the 'development processes'), but to other commercial and organisational aspects of business. Figure 1 shows the indicators of these different types of activity.[2]

Figure 1 Innovative activity in the software outsourcing industry: a framework for classification



This conceptual approach provides a tighter grip for the classification of innovative activity in the software outsourcing industry, than do the frameworks based on the Oslo Manual (OECD, 2005) or the technological capabilities (TC) approach (Bell and Pavitt, 1995; Ariffin and Figueiredo, 2006). Since the framework presented here relates to relatively concrete steps in the software value chain it reduces the problems that arise when observed phenomena can be classified as both ‘product’ and ‘process’ and where it is difficult to judge whether a change is ‘basic’, ‘intermediate’ or even ‘advanced’. Because it relates to features of systems development (problem framing/solving) that have wider applicability, it is easier to make meaningful inter-industry comparison (Lema et al., 2012).

4 Research design and methodology

This study was designed to examine the relevance of the dominant hypothesis in the literature. This hypothesis posits that the acquisition of innovative capability within Bangalore software suppliers does not occur at all (D’Costa, 2009; Arora, 2006) or is limited to process and organisational capability (Athreye, 2005b, 2005a); problem-framing capability does not spread to suppliers in the outsourcing business because buyers keep these in-house or close to home (Schmitz, 2007).

This hypothesis is meant to function as focusing devises for an exploration, not as a statement that can be tested in the statistical sense. The study is exploratory because

1 it builds mainly on a small sample of corporate change events in a limited number of firms

2 information about these events could only be obtained through in-depth interviews

3 the data collected encompass a broad range of phenomena.

This research approach was chosen for a particular reason: the innovation patterns associated with software suppliers are poorly understood (2006), so if innovation capabilities can (or cannot) be identified in the software supply base in Bangalore it is important to understand and unfold what this means. It is important to explain key aspects of the research design and methodology because certain choices were made to maximise the explorative power of the study, and these choices have implications for the conclusions one can draw based on the study of the sample.

4.1 Sampling of business segments, firms and events

The sampling process utilised three analytical levels:

1 business segments or industry subsectors

2 firms operating within these segments

3 change events within the firms.

The definition of business segments in the Indian software industry builds on the observation that two main types of activity drive software demand:

1 business processes improvement (BPI) activities

2 new product development (NPD) activities.

The approach taken in this study was therefore 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. The study included sub segment business-lines for analysis as shown in Table 1. These are described further in the next section of the paper.

The main criteria to select firms was purposive sampling designed to get in-depth information about the nature of new capabilities acquired during the period 2001–2006. A small sample of 10 Bangalore-based IT software service suppliers was selected using two main criteria.[3] The first was representation of the two different software segments. A few of the chosen firms are 'pure 'players' (focused on a single line of activity) but the majority of sampled firms engage in multiple business activities. The second criteria was the identification of 'innovation-active firms' (if possible). Such firms are defined in the Oslo Manual [OECD, (2005), p.59] as 'one that has had innovation activities during the period under review, including those with ongoing and abandoned activities'. These were identified thorough a review of the Indian business press and with the aid of academic industry experts in Bangalore.

The firms sample and their engagement in chosen business lines is shown in Table 3. The sample represents Indian-owned firms and does not include subsidiaries of multinational firms. The aim of the study is to examine independent Indian IT software service providers in Bangalore in the context of outsourcing.[4] 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.

The next step was the identification of firm-level change events. The study uses such events in supplier firms as a focusing device. Such an event refers to an importance instance in which a firm has done something new (or better) for the first time, indicating a step in the learning process (the accumulation of capability). Such an event may be, for example, the undertaking for the first time of a customer project that involves new challenges and related learning. The study uses these events to examine the activities and underlying capabilities.

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. The procedure in this study 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 and peak capability.

Table 1 Innovative activity in the software outsourcing industry: indicators

Shorthand category	*Descriptive category*	*Typical association with activities in waterfall model*	*Outcome indicators (examples)*
Type A	Problem-framing innovative activity	High-level design and requirements	New system/product development
			Product or system co-development
			Systems and business consulting activity
			New method of requirement definition
			New organisational unit devoted to consulting, high-level design or requirements
Type B	Problem-solving innovative activity	Low-level design	New module or system components
			New licensable intellectual property component
			Re-writing existing software and adding new features or properties
Type C	Innovative activity related to implementation/execution	Coding and testing (programming)	Development of new software tools
			Development of re-usable software components
			New test methodology
Type D	Other innovative activity		New general project management methodology
			New organisational structures
			New business line added to business portfolio

Table 2 Business lines examined in this study (by segment)

Business process software services (BPSS)	*Product development software services (PDSS)*
• Custom application development (CAD)	• Engineering services outsourcing (ESO)
• Independent testing services (ITS)	• Offshore product development (OPD)
• Infrastructure management services (IMS)	

Table 3 Firm sample

	Established	*Size*	*Business Lines*				
			BPSS			*PDSS*	
			CAD	*IMS*	*ITS*	*ESO*	*OPD*
Wipro Technologies	1946	Big	X	X	(X)	X	(X)
Infosys Technologies	1981	Big	X	(X)	(X)	(X)	(X)
Sasken Communication Technologies	1989	Medium				X	
Microland	1989	Medium		X			
Encore Software	1990	Small				X	
Aditi Technologies	1994	Medium					X
Aztecsoft	1995	Medium			X		X
MTec (Kshema Technologies)	1997	Medium	X			(X)	(X)
RelQ Software	1998	Medium			X		
MindTree Consulting	1999	Medium	X			X	

Notes: In terms of size, the table distinguished between engineers employed at the end of the observation period in 2006: (big = above 10.000; medium = 1.000 to 10.0000; small below 1.000). X = observed presence in business line; (X) = presence in business lines, but not studied in this research.

The main investigation period for events is the five years between 2001 and 2006. The events occurred within this timeframe (although the exact ‘beginning’ of an event can sometimes be difficult or impossible to establish). 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

2 the literature indicates that innovation in Indian software firms was limited before this period.

4.2 Data collection

Data was collected during the last six months of 2006. In each firm the adopted procedure was to ask a gatekeeper informant with a good overview of the company (such as a firm founder, chief executive officer (CEO) or other senior manager) to identify the most important 'change events' that signified 'learning' in the firm over the last five years. They were asked to relate this to firm-level trajectories and to provide examples of different types of events (and in different business lines). These informants thus produced a 'shortlist' of events (of varying lengths) that were new to the period 2001–2006. The informants were then asked to single out three events considered the most 'significant' and (if possible) events that were examples of 'innovation' – in simple terms, new products (offerings), processes or organisational arrangements. This produced a portfolio of 29 peak capability events. Since these represented cases of innovation (in all cases), these may also be thought of as 'innovation events'.[5]

The researcher conducted more than 100 interviews in total and the majority of interviews then related directly to the events. He interviewed personnel that had been centrally involved in the events: department heads, account managers, project managers, architects, etc. Several informants were interviewed more than once.

Open-ended questions about innovation can easily result in the respondent making 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. The researcher also drew on company documents, material on websites and press reports. In many firm cases the researcher could draw on a previous round of work focused on the situation in the 1990s (Lema, 2009) and where relevant, interviews were also conducted with external organisations (mainly customers) for purposes of triangulation.

4.3 Implications for assessment

The sampling procedure has important implications for the assessment of innovativeness. At a very general level, the design and outcome of the sampling process itself provides some type of the answer to the question of whether innovative capability exists in the industry. A minimum level of innovation activity is a product of the sampling method itself, but there can be no presupposition about activity beyond such a minim level.

It is important to recognise that the findings cannot be used to make systematic generalisations about the Bangalore – let alone Indian – software industry. It can, however, be used to show whether the conclusions of much previous research need to be corrected. I refer here to its largely negative conclusions concerning the innovativeness of Bangalore firms. Showing whether these conclusions need to be revised is important. If they indeed need to be revised, it is equally important to show why: is it a matter of time or method?

5 Innovative capabilities in the software supply base

This section concentrates on the types of capabilities developed by sampled suppliers by the end of the observation period. The core of this research examined a 'portfolio' of innovation activities that had occurred in sample firms. Providing examples from this portfolio in some detail is necessary because there is little agreement on what software innovation is. However, certain of the events are more important to this research than others in addressing the overarching question. The most important ones are those that shed light on the following questions: What was the 'highest level' of innovation type in each business level? Was there any evidence of problem-solving and problem-framing innovation capability levels? In order to classify innovation activities in change events, the section draws on the framework proposed in Section 3.2.

5.1 Differences between business lines

Table 4 summarises the key results of the analysis, indicating the 'highest level' within each business line, as well as the number of events explored at each level. Table 4 indicates that

1 there is a variation in the levels reached across business lines

2 there is evidence of problem-framing innovative activity, but only within certain business lines.

Table 5 shows the 'code names' of events that revealed different types of innovation. Some of these are mentioned and described below, but it is beyond this paper to describe all of these systematically. The identification of problem framing capability was unexpected. In order to explain what such type of innovation capability means in practice, it is necessary to describe some of the underlying events in some detail. However, the section first seeks to unearth the differences between business lines.

Table 4 Overview of events across observed types of innovation

	BPSS			*PDSS*	
	CAD	*ITS*	*IMS*	*ESO*	*OPD*
Type A	*3*				*3*
Type B	-		*1*	*5*	*1*
Type C	*2*	*2*	*1*	-	-
Type D	*3*	*2*	*2*	*3*	*1*

Table 5 Event code names

Type	*Business lines*	*Firms*	*Event code name*
Type A	CAD	Infosys	Influx
	CAD	MindTree	Sales tool system
	CAD	M-Tec	B/OSS
	OPD	Aditi Technologies	Digital music distribution platform
	OPD	Aditi Technologies	Mifos
	OPD	Aztecsoft	ETL Tool
Type B	ESO	Encore Software	VoIP solution
	ESO	Encore Software	Wimax solution
	ESO	MindTree	Bluetooth solution
	ESO	Sasken	Multimedia subsystem
	ESO	Wipro	Ultra wideband solution
	IMS	Microland	CIO dashboard solution
	OPD	Aditi Technologies	Product transformation services
Type C	CAD	Infosys	Tools group
	CAD	MindTree	TechWorks
	IMS	Microland	Network management system
	ITS	Aztecsoft	I-Test
	ITS	RelQ	AsessQ
Type D	CAD	Infosys	CIMBA
	CAD	M-Tec	COMPASS
	CAD	Wipro	Lean software factory
	ESO	M-Tec	Build-operate-transfer
	ESO	Sasken	Botnia hightech
	ESO	Sasken	Symbian competence centre
	IMS	Microland	IT security consulting
	IMS	Wipro	Global command centre
	ITS	RelQ	RelQ online
	ITS	RelQ	Verticalisation process
	OPD	Aztecsoft	Marketing campaign

Notes: The purpose of selection was to provide a portfolio of events in sample and examine differences across business lines. Therefore, these events cannot be used assess and compare the types and levels of capabilities in individual firms.

5.1.1 Business process software services

Problem framing activity (*Type A*) was identified in the *Custom Application Development* (CAD) business line. CAD is the development of software applications to the customer's requirements. NASSCOM describes CAD as 'delivering customised (to client requirement) development of software application and interfaces' or 'enhancements of existing systems, packaged applications or pre-engineered templates' [NASSCOM, (2007b), p.712]. This business line provided the entry-point for Indian firms into the global software industry from the mid-1980s onwards when the staff augmentation model (body shopping) became established. By 2006, annual software exports had reached USD 5 billion, accounting for just under 40% of total export revenues.

The nature of CAD events sheds some light on processes of transition witnessed by the sampled firms. As will be elaborated, this transition has seen firms enter the provision of what in industry jargon is termed 'transformational services'. In a 'standard CAD service' relationship, the provider enters the process after specification has been defined. Therefore, these services facilitate changes within customer organisations rather than efficiencies for specified processes. In the terminology introduced earlier, they are concerned with requirement analysis and high level design and they rely on the capabilities of business analysts and system architects that are concerned with framing the problems of buyers. The important point is that these capabilities can be deployed in connection with advanced CAD projects (as is the case in the events discussed below) and that they may be perceived as consulting activities within the CAD business line. Thus according to several interviewees, the figures for consulting activity provided by NASSCOM (2% of exports by 2006) underestimate the reality because work that is billed and registered as CAD often contains consulting tasks. For instance, Infosys in its annual report states that 3.5% of services are consulting. These are mainly the revenues generated on a 'standalone basis' by Infosys Consulting, a distinct US incorporated business unit. However, informants in that firm stated that consulting activities were more likely to be in the 20% to 30% category if one counts in the consulting activities that take place as a part of CAD contracts. Similarly, *The Economist* (2007) states that according to the CEO, 'Infosys now generates nearly a quarter of its revenues from consulting'.

Turning to *Infrastructure Management Services* (IMS), this is a relatively new business line, emerging in India after the turn of the century. According to NASSCOM, 'IMS encompass all the services that relate to monitoring, managing and enhancing performance of a client's IT infrastructure backbone' [NASSCOM, (2008), p.212] and traditionally it was seen as something that had to be done on-site. Now, this activity is moving offshore and it is now the single most important activity conducted under the heading of information system outsourcing. By 2005, it was responsible for almost 5% of software exports (USD 0.6 billion). While it is clear that the provision of these services grew out of the software industry, the bread-and-butter activities conducted in this segment are not mainly concerned with software development as such but with monitoring and maintaining existing systems. However, *innovative activities* in this business line *do* typically involve software activities. Events in IMS give evidence of 'modular innovations' in the form of problem solving (*Type B*) subsystem improvements to customer networks and ongoing services. Microland for instance designed, developed and implemented *CIO Dashboard* improving the system monitoring process in customer firms, including the ongoing work undertaken by IMS suppliers. This was added as module to customers systems, but did not change the overall architecture or nature of existing systems (designed by others). IMS has thus evolved from basic provision to change-oriented services, albeit within the boundaries of problem solving. Firms are beginning to undertake some knowledge-generation activities independently (e.g., definition of subsystems). However, in *Global Command Centre* in Wipro this business line is now being taken towards network consulting, that is, not only management of client infrastructure, but also associated advice on how clients can improve this IT infrastructure (along with possible implementation). While the solid evidence is still sketchy, informants say that suppliers are now beginning to provide IMS services that re-define the nature of services, hence also moving into the sphere of consulting in this segment.

Emerging during the 2000s, *Independent Testing Services* (ITS) is a new business line that grew out of CAD (NASSCOM, 2006). 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 critical step for the establishment of this business line was to separate testing (organisationally) from the development workflow. Customers have embraced this service because testing is considered ‘non-intrusive’. It provides customers with a ‘lower-risk approach to engaging with an offshore service provider’ [NASSCOM, (2006), p.68]. Over the period 2001–2006 dedicated testing services companies such as RelQ, emerged as significant players, as did separate testing divisions in the large companies such as Wipro and Infosys. Revenues from standalone testing services amounted to US$282 million in 2006. Carving out this space as a separate and independent activity allowed these companies to establish new and innovative processes in this area. Specialised independent testing companies rethought the role of testing in the software development process. By separating testing organisationally, 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, some firms have accumulated a critical mass of specialised expertise in this area that has enabled it to enter the field of test consulting. Using its proprietary framework *AsessQ*, RelQ increasingly engaged in testing management and consulting services such as test strategy and quality assurance and certifications for IT departments in OECD countries. In this way, Indian suppliers have forayed into the area of execution-improving innovation (*Type C*). This does not ‘show up’ as a trajectory along the software development chain; it reflects a different trajectory of (functional) knowledge domain deepening. While this business line is (almost necessarily) confined to innovation capability related to execution, the success of advanced firms in this business line relies on deep knowledge specialisation which has emerged out of India’s focus on certain routine processes.

It is interesting to note that in BPSS, as one element of the upward trajectory, new business lines have emerged as distinct knowledge domains that grew out of CAD. These have enabled new independent businesses, but multi-domain firms have also used these new business lines to strengthen core CAD services and the provision of integrated services. For instance, firms such as Infosys and Wipro have benefited from the cross leveraging of CAD and IMS consulting. The examination of these business lines has indicated that firms no longer only undertook *knowledge-using* activities specified by customers. On the contrary, there is some evidence that sampled firms, in varying degrees of depth within their respective business lines, moved into *knowledge-providing* consulting activities that redefine systems and processes in the customer base.

5.1.2 Product development software services

Engineering Services Outsourcing (ESO) is concerned with those activities 'that augment or manage processes that are associated with the creation of a product or a service' [NASSCOM, (2008), p.261].[6] Although such ESO services had been provided in India in the late 1990s, the 'take-off' for more broad-based growth in this business line occurred in the early 2000s. As with CAD, the 2001 market downturn in the technology sector hit this business line hard, but paradoxically it came to work to its advantage in the longer run by placing greater emphasis on the costs involved in product development in telecom and IT hardware firms. This business line experienced fast growth from 2003 onwards, growing an average 43% a year in the period between 2003 and 2006. In 2005 export revenues from this segment amounted to USD 2.2 billion. This type of service is different from other services because it tends to be relatively labour-extensive compared to other business lines. As it is easily recognised as 'high-tech', many firms often point to activities in this field as examples of innovative activities.

Engineering services in sampled firms are focused on hardware/software technologies and concentrate on the sub-segment of ESO that NASSCOM terms 'R&D services' because they often involve IP development, which is retained within the supplier organisations. These services are 'providing R&D for hardware and software technologies, as well as software running on embedded systems' (NASSCOM, 2008). All the ESO innovation activities in the sample are oriented towards hardware/telecom clients and most are related to so-called 'embedded software'. In this segment, a key business model involves the development of software components pertaining to different standards-based technologies used in the telecommunications industry. These equip telecom products with inter-communicative capabilities secured by hardware vendors' use of standards-based technology protocols. Indian firms operating in the ESO space develop software technology components that enable these technologies in customers' products. Such 'embedded software' therefore plays an integral role in the electronics it is supplied with and it is usually written for special-purpose chips integrated into these products. The firms in the sample have benefited from increased demand after the turn of the century but, it also appears that the basic nature of services provided (*vis-à-vis* those undertaken by customers) have been relatively stagnant. They develop solutions, provide implementation services and earn licensing revenues. However, these solutions do not change customer designs and services remain problem solving in nature (*Type B*). The solutions are rarely 'significant' or 'strategic' from the buyers' point of view, although there is some indication that Indian firms are now getting into the game at an earlier stage of the technology curve (e.g., *UWB* and *Wimax*).[7]

Turning to *Outsourced Product Development* (OPD), the transition in this business line is akin to the CAD trajectory. Like the global sourcing of application development services, OPD is becoming increasingly recognised as a core element in so-called independent software vendors (ISVs) in Europe and the USA. During the late 1990s and early 2000s the main driver for these ISV was the significant cost arbitrage opportunity provided by supplies in India. For this reason, the work conducted in the Indian supply base was manpower-intensive, lower-end activities of coding and testing. However, ‘the demonstrated success of India-based development centres in delivering not only cost, but also on quality and technological superiority has attracted an increasing level of interest in offshore product development to India’ [NASSCOM, (2006), p.405]. Dedicated OPD firms, such as Aditi and Aztecsoft, have now emerged and they provide services akin to OEMs and own design manufacturing (ODM). Several larger companies now also provide such services. The line of activities generated export revenues worth USD 0.5 billion in 2005. As will be elaborated below, the innovation capabilities in the OPD space grew out of the MIP business line. The main standalone players have backgrounds as own brand product developers [Made in India (MIP) products]. While they started out with coding-to-specs activities, the evidence unexpectedly suggests that they are now capable of providing advanced services of the problem-framing kind (*Type A*).

OPD is now in essence a service space. The increasing ‘service’ element of the product space is also evident in ESO, which has added on new ‘implementation service’ activities in addition to core IP development and standalone licensing. They have developed IP-driven service capabilities. These developments are interesting because upgrading has taken a different route than was anticipated in the literature from the 1990s and early 2000s. It was commonly anticipated that upgrading into innovation activities needed to take the products route. A key assumption that has guided the literature was that there was a distinction between ‘non-innovative software services’ and ‘innovative software products’. 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 services and the development packaged software products in terms of the ‘space’ for innovation. Because services were sourced and controlled by powerful buyers there was a need to ‘decouple’ from these segments and break the reliance on service-oriented business models (D’Costa, 2003). The findings of this study provide grounds to question the validity of this argument.

5.2 Problem-framing innovation capability

This subsection provides examples of problem framing innovation in the CAD and OPD business lines. It is necessary to describe events in some detail in order to provide context and to show how and why these events are classified as problem framing. As will be shown these events were significantly innovative – in the sense discussed in this paper – because they redefine buyer’s products and processes and they add value through the provision and application of consolidated domain knowledge.

5.2.1 Examples from CAD

In CAD, the study examined problem framing innovation capability in three events, two of which are described here. *Influx* in Infosys was a framework to be applied across projects, whereas *Sales Tools* in MindTree was a particular customer project where the supplier was engaged in requirements definition and high-level design.

In 2001, the management team in Infosys was in intense strategic deliberations concerning how the firm should respond to the slump that had hit the company with the slowdown in the US technology sector at that time. According to one of the company founders, the leadership group realised that the firm had to enter the ‘creamy layer’ that was occupied by brand-name consultancy houses. The new strategy was to develop the company’s consulting business, helping the customers to meet business challenges through improvements to business processes. The events in Infosys are closely associated with the initiatives that were made to make this transition. Notably, the firm developed Influx, a proprietary framework and system for business process modelling (BPM). It was a new framework and toolset for business processes engineering consulting, and hence this was a key tool for aiding the consulting element of CAD, a key priority for the firm. The framework and the underlying knowledge base were developed over several years and the process was lead by a dedicated team, working full-time on coordination and development. A key element relating to this framework was 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 by adding requirement analysis and systems design to the core execution capability. The many Infosys projects using this framework were concerned with defining customer requirements, thereby indicating activities at the problem-framing level of the waterfall model. In many of these projects, Infosys has interacted directly with end-users to ‘capture’ and define requirements for business process improvements.

As an example, this framework was used in 2003 with a US transportation services firm. This customer firm 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 customer’s supply-chain logistics needs. 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. 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. Infosys 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 areas. Infosys was therefore engaged to undertake a major project of business process and IT system re-engineering. A cross-organisational team engaged in a BPM exercise and re-modelled 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. From the buyer perspective, the end-to-end outsourcing to an integrated processes consultant and supplier of implementation services secured important coordination benefits.

MindTree is a Wipro spinoff, established in 1999 with the explicit aim of creating a knowledge-intensive software solutions company. It initially latched on to the US internet economy by providing e-business integration services on the enterprise side, but soon after inception the market took a downturn in 2001. As a survival strategy the slump was used to ‘build processes for the future’ in areas such as tools, methodologies and quality in the more traditional CAD space. Once this business line picked up, a key mechanism for the deepening of domain knowledge and related processes was to develop a strong knowledge management culture and system. Furthermore, MindTree was concerned with following in the footsteps of the established firms by becoming a ‘global company’ by instituting a strong presence in customer locations.

The development of a *Sales Tool System* for a key player in the global automotive industry reflected such increased domain capabilities. It involved architecture work and the deployment of accumulated business-level knowledge. With external financing, this was a critical project with high visibility to the buyer. 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 the IT department in the auto group, which deployed in-house resources for the critical phases of the project, had a budget and a schedule that was far beyond what the end-customer (a French member of the auto group) was willing to accept. After deliberations among the board, it was decided to challenge MindTree by giving them responsibility for the entire project in order to avoid the loss of an important business opportunity. MindTree was able to draw on its experience of working on and developing CRM systems for customers in other industrial domains. However, key personnel in the supplier firm have accumulated domains and customer-specific knowledge and competences and this has enabled them to add value in this project through the definition of so-called use cases (user scenarios). During the course of the design of the system MindTree needed to go back to the second- and third-degree customers/users in order to conceptualise the bridge between the new system and the system to be replaced. This knowledge was generated at a substantial ‘organisational distance’ from MindTree (and with the mediation of the first-degree buyer). Nevertheless it helped MindTree in its first time, end-to end development of such a system. In this way, the event therefore shows how buyers and supplies can come together in co-framing requirements for new solutions.

5.2.2 Examples from OPD

Problem framing capability was also identified and studied in three change events in OPD. Two examples are provided here, *Digital Music Distribution Platform* in Aditi and *ETL Tool* in Aztecsoft.

Aditi Technologies is a pure-player in the OPD space, established in the mid-1990s by entrepreneurs returning to India from the USA. The CEO came from a position as a general manager of a division in Microsoft. During the 1990s the firm concentrated on developing its own CRM product, Talisma, while also supplying services, including technology support for ISVs. In the early 2000s the CRM product business was spun off, so the firm could become a pure-play OPD firm. Initially most work was downstream-oriented and typically related to upgrades and add-ons for existing products for which documentation was clear. Today the firm has acquired capabilities for end-to-end NPD.

This is evident from the development of a complex web-application – a Digital Music Distribution Platform – for a US start-up firm. This media service engine was based on Microsoft technology and standards, and record label companies such as Sony, Universal and Warner provided content. The buyer firm was the exclusive alliance partner for powering eBay’s foray into the music download business. Although this buyer firm was operating within the IT sector, it did not have an in-house engineering team. As the very foundation of the buyer’s business, the solution provided by Aditi was mission critical. The initial idea had been described in just an eight-page ‘visioning document’. This became the starting point for Aditi and as this document formed the basis for proposal building and preparatory activities. Requirements were ‘settled’ jointly during a one-week meeting at the Digital Media office. Thus, Aditi was closely involved in the requirements-definition stage and was responsible for system design and integration with third-party systems. As explained by the CEO of the buyer firm, some of the design features and associated requirements came from the supplier’s ability to envisage usage scenarios – and bringing to the table issues that the buyer ‘had not even thought about’. 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.

The independent design of this type of application was a new experience for the supplier. However, the ‘experience problem’ was solved by leveraging competences from the past. A number of people were brought in from Talisma to provide specific expertise in product architecture and design functions that had not previously been provided in the OPD space. Five experienced ‘project leads’ were brought in to work on the inception stages of the project (problem-framing activities). This example thus suggests very concretely that the rise of innovative OPD services builds on previously accumulated capabilities in the MIP business line.

The case of Aztecsoft tells a similar story. This firm was founded in 1995 in a small office leased from Software Technology Parks of India in Electronics City, an electronics industrial park just outside Bangalore. It intended to create an excellent Indian software product for the global market. In the first five years, the company’s major focus was the development of the product, Jpact – Java Powered Access Technology – a product for information access, integration and distribution via the internet, a so-called extract, transform and load (ETL) tool. Despite considerable sales and marketing efforts in the USA, the firm was unable to attain commercial success with this ETL tool product. Instead, the firm turned to software product development for clients on a contract basis to pay off the product development and related expenses. The firm moved on to the services model as it realised it did not have the resources to market such a product in the vastly competitive US market.

Today, Aztecsoft is focused on deploying the accumulated and specialised capabilities by providing value-added services. By providing critical product-engineering services rather than just the non-core activities, the firm is helping customers move on to emerging business models in the ISV market. The best example is the transformation of Jpact into a new solution marketed by a key client, a California-based developer of database life-cycle technologies that help companies build, optimise and manage databases. By leveraging the Jpact product the firm was able to quickly create new cutting-edge features as well as entirely new products in order to leapfrog the customer’s competition, e.g., in online functionality. While product development and roadmap is the responsibility of Aztecsoft, the customer is now able to bring an innovative new product to the market under its own brand name. In order to make this work, the product needed a number of modifications and 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, enabling co-construction of system features, including the critical decisions on the design and prototyping of the user-interface.

5.2.3 Limits

The literature posits that it is architectural technical knowledge that matters. However, for many buyers, competitive advantage and profitability increasingly lie outside technical areas. Technical problem framing have become less strategic for certain buyers. Therefore, while this study has identified upgrading into problem framing innovation activity, this does not mean that there are currently no limits to the scope of innovative service provision. The new strategic core lies increasingly in non-technical areas – the business side and the management of end-user and stakeholder relationships. The question is whether current problem framing activity will act as a springboard for further penetration of the extended value chain.

5.3 Crosscutting and supporting innovations

The discussion above concentrated on the unexpected types of innovation capability. However, it needs to be emphasised that the analysis of the portfolio of events gave a range of examples of areas in which firms have developed new capabilities. Many of these support upgrading of (unexpended) innovative capability. In other words, crosscutting process and organisational innovations (*Type D*) support new activities and ways of operating that are essential to filling new business spaces. Upgrading requires supporting innovation for several reasons. For instance, the movement up the technical chain of activities also means that more management responsibility is shifted to India. Firms undertook change activities to consolidate their management capability (e.g., *COMPASS*, a Comprehensive Project Analysis Support Solution, in M-Tec). In addition, a strong presence in customer location has become increasingly important (e.g., Sasken acquired *Botnia Hightech* in Finland to buy in to personal relationships developed over many years and into tacit product knowledge and knowledge concerning customer needs and strategies). Related, the increasingly global organisation requires strengthened infrastructure to connected front-end, customer-proximate activities with back-end systems and processes (e.g., *CIMBA*, Customer Information Management by All, developed in Infosys). These initiatives were important, but they did not spearhead the upgrading of the industry.

The key objective of this section was to describe the types of innovation capability that were achieved by firms in the sample by the end of the observation period. This chapter has shown that sampled firms have moved over time towards increasingly innovative activities. It has illuminated elements of the transitions and trajectories, and it has shown the nature of the new spaces into which sample firms have moved. In different ways, these are ‘innovation spaces’ but ‘innovativeness’ is a loose concept. This chapter has substantiated what innovativeness is in the software outsourcing industry by providing the evidence of innovation activity and capability. It described the *ways* in which sampled firms have been ‘innovation active’ – both within and beyond the expected types.

6 Discussion and conclusions

The underlying hypothesis that drove this study was that outsourcing has a major influence on the formation of innovation capabilities in developing countries. Some recent literature suggests that offshore outsourcing in a variety of sectors has extended from the provision of simple services to advanced and innovative activities (Engardio and Einhorn, 2005; Lynn and Salzman, 2007; Maskell et al., 2007). However, the recorded changes on the demand side have not been followed up with supply side research. The main aim of the study was to examine whether the supply-side changes include the acquisition of 'advanced innovation capabilities'.

The study was informed by the general literature on supplier capabilities in outsourcing and value-chain relationships (Schmitz, 2007; Mudambi, 2008; Hansen et al., 2008) and the specific literature on the software industry in Bangalore/India (Arora et al., 2008; D'Costa, 2009; Dossani, 2006; Chaminade and Vang, 2008). Running through both of these literatures is the clear view that supplier capability in the outsourcing context extends at best to basic innovative capability. The underlying rationale for this view was summarised in the guiding research hypotheses that the acquisition of innovative capability does not occur at all or is limited to process and organisational capability. This concluding section brings together the insights to explain why this view needs to be revised, highlighting that the detection of newfound innovation capability is related to time as well as method.

6.1 The rise of innovative software services in India

This research has sought to contribute to the literature by specifying the type of peak capability that has emerged since 2001. It concludes that some firms have not only acquired process and organisational innovation capabilities, but also customer-focused problem-solving and problem-framing innovative capability. Contrary to expectations, the study found that the deepening of capabilities in core services and product functions was detectable alongside process and organisational capability. The identification of advanced (problem-framing) innovative capability suggests that a segment of suppliers have progressed to an unexpected stage of innovative service provision.

This study does not suggest 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 research as a whole indicates a steadily 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 in the upward direction.

Many empirical studies made during the last decade have concluded that 'the majority of software work undertaken in India is low-end' and that the industry is 'locked in' to a growth model based on labour costs. Indeed, some of this author's own work (Lema, 2009; Lema and Hesbjerg, 2003) and the work of others (Arora et al., 2008; Dossani, 2006; D'Costa, 2003, 2004) has mainly concentrated on some of the forces that have constrained upgrading of the industry. However, while there is no doubt that much work is still 'routine', this study shows that change on the supply side is currently breaking existing patterns. The real world is running a great speed and as usual, academic research is struggling to keep up. In this case, it seems that the dominant view is influenced mainly by research that was concerned with the growth of the offshore outsourcing to India during the 1990s. The correction of this dominant view is overdue.

Related, it is interesting that the history of successive studies on the Indian software industry in the global division of labour provides another example of a general problem alluded to by Bell (2006). Research about global change and re-structuring of the division of labour only wakes up very gradually to the fact that a dynamic process is under way. Each successive study suggests that its snapshot observations constitute a steady state, and few studies seek to 'join the dots' that indicate a continuous process of change.

6.2 The significance of revealed innovative capability

The revealing of problem-framing capability was particularly surprising given the prevailing view in the literature on outsourcing: that advanced innovative activities remain located in OECD countries and that only basic and routine innovation reaches suppliers in developing countries (Schmitz, 2007; Chen, 2008; Schmitz and Strambach, 2009). The study adds new insights to this literature because it concentrates on types of innovation that are commonly neglected. As pointed out by Bell and Figueiredo (2012, p.36) the innovation 'discourse' has often been based on studies of certain types of industries ('high-tech industries' such as pharmaceuticals or semiconductors) and on certain types of innovation (breakthrough discoveries, radically new products, etc.). Other types of innovation are often seen as much less important and the attention of policy-makers is often aligned with such views. The problem is that policy-makers may fail to pay sufficient attention to the capabilities that matters the most in settings that differ from template reference models of high-tech and science-based innovation. In this case, it appears that important blind spots exist in the analyses of outsourcing and capabilities in new supply bases. To account for 'hidden innovation' (NESTA, 2007), discussions about firms supplying global value chains need to include a broader array of innovative activity that are deemed important for growth and competitiveness by managers themselves. This is particularly true in services industries where conventional innovation indicators have limited applicability (Miles, 2004).

The method and findings in this study challenges the view of research that is based mainly on narrow indicators. The key point for this study is that innovation is not confined to R&D and patented IP – even though such metrics tend to take centre stage in the discussion about innovativeness in the Indian software industry.[8] A large part of the literature has focused too narrowly on knowledge that is 'detached' from ongoing service provision. This bias features in some of the most influential empirical assessments of the innovative activities undertaken in the Indian software industry (Arora et al., 2008; Dossani, 2006; Arora, 2006).[9]

The methodological problems discussed here are not merely academic; they are highly relevant to policy makers. A key problem in the design and implementation of policies for industrial innovation and development in developing and emerging economies is that it often builds on a narrow view of innovation activities and innovation capabilities. As mentioned, many policy makers see innovation mainly as conventional R&D activities undertaken within universities and public research laboratories, aiming ultimately at 'new to the world' innovations (Bell and Figueiredo, 2012). In many cases, a more fruitful approach is to devise policies for the development of innovative capabilities on the ground – to support the movement of firms along the broad capability spectrum such as the one discussed in this paper. In the case of policy makers concerned with the particular case of the software industry in India, further development is dependent on

a continuous availability of quality manpower

b growth in domestic IT consumption

c the further building of capability to increase ‘innovation, R&D and product development’ (Sharma, 2014).

It is the last point which is most challenging because we still know little about how to develop the capabilities that matter. This analysis suggest however, that crucial innovative capacity arises mainly within firms, through interactive learning with customers, and by cross-fertilising customer knowledge domains (see also Lema, 2012), rather than in R&D labs populated by scientists or in product development teams working on patentable inventions. This paper has drawn attention to the need of a more comprehensive perspective on innovative capabilities in the process of designing and implementing policies for further development of the Indian software industry.

6.3 Limitations and new questions

The method adopted in this study has advantages with regard to producing fresh insights into the main issue about whether or not global redistribution is taking place. However, as a piece of exploratory qualitative research, this study marks the beginning of an enquiry, not the end. The material and findings provided in this study have covered some ground, but there are still many limitations and open questions with regard to the conclusions that one can ‘infer’ from the results provided here.

The analysis of the small sample of firms/event provides very limited opportunity for extrapolating results to the general population. In other words, the findings cannot be generalised. It is not a sample from which anything – or at least very little – about the precise innovativeness of the overall population can be inferred.

Nevertheless, deductive reasoning suggests that because the research has identified instances of (advanced) innovative activity, a positive answer can be offered with regard to the question that drove this paper. Moreover, the group of firms studied here is important, but these firms are not the only innovation-active firms in Bangalore (or wider India); and because Infosys and Wipro are included in the sample, it is responsible for a very large share of total exports revenues by Indian-owned software firms. There is reason to expect that comparable capability levels can be identified in leading multi-domain competitors such as Tata Consultancy Services and Satyam. This has some significance because collectively these ‘big four’ account for the bulk of software export revenues from Indian-owned firms. In this regard, it should be noted that this paper did not examine multinational firms located in Bangalore. This is particularly important because related research suggests that multinational firms are willing to offshore some activities to India that they will not outsource to independent providers (Lema et al., 2012).

This paper has used the software industry to add insights to the debate about outsourcing and the corporate redistribution of innovation capabilities towards emerging economies. It has suggested that the shifting location of innovation incorporates increasingly 'significant' (or advanced) forms of innovation in the software industry. The findings therefore suggest that it is now time to move beyond the long running debate about *whether* such redistribution is occurring in the software industry and proceed to the equally important question of *when* and *how* it occurs. The pessimism in the prevailing literature needs correction, but it would be equally misleading to suggest that outsourcing facilitates innovative capability automatically. It is not suggested here that insertion in global value chains, or globalisation more broadly, is a 'benign escalator' for developing country firms. As emphasised, this research has studied a purposefully selected (successful) sample, but from both a corporate and public policy perspective, the important question for future research concerns the factors that make the difference between transformation and stagnation. Such research should examine successes as well as failures. Furthermore, such work needs to examine the interconnected changes on both the demand and supply side, and it needs to identify the key contingent factors that policymakers can address.

Acknowledgements

The author is grateful to Hubert Schmitz (Institute of Development Studies) and Martin Bell (SPRU) for valuable research guidance and constructive comments. Rishi Krishnan and Murali Patibandla (both from the Indian Institute of Management Bangalore) are thanked for help and support during fieldwork in India. The author also wishes to thank the many individuals in the Bangalore software industry who provided information and insights, and the Danish Agency for Science, Technology and Innovation (Social Sciences) for the PhD fellowship grant which made this research possible. The author is grateful to Paulo Figueiredo for constructive comments on an earlier version of this paper.

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Notes

1. This paper adopts a rather narrow focus on the quality of capabilities in the Bangalore software supply base. A comprehensive analysis of the global redistribution of innovative activities in the context of outsourcing should include a deeper examination of buyer strategies, buyer-supplier relationships and learning mechanisms in the supply base. The original study that gave rise to this paper examined these factors and their interconnections but they are outside the scope of the present article. Further details are provided in Lema (2010b).
2. These indicators were verified by informants in expert interviews. The framework suggests that the different types of innovation – from A to D – are characterised by decreasing complexity.
3. The original sample examined two additional firms (and seven events) from the 'MII' software product business line. However, these are ignored in the present study in order to maintain the focus on outsourcing.
4. 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 (M-Tec/MphasiS and RelQ) were acquired by US services firm EDS during the period under review. In one case (RelQ), this happened after the core phase of data collection was completed.
5. One of ten firms reported one event in the MIP product business line. This event is ignored and the total portfolio does therefore not add up to 30.

6 Some of the services provided from India under this heading are not software services and therefore are not considered in this study. These are typically design services provided to firms in industries such as automotive, aerospace and construction. In this study, the focus is on the engineering of software components (for electronics products).

7 If one wants to dig deeper, the key differentiator within this category is the start date of development with regard to the maturity curve of the standard-based technology. More mature technologies are less risky and generally involve less development time. Another differentiator is the degree to which firms can offer further product realisation services along with the IP blocks.

8 For example, Sharma (2014, p.77) writes: "India has improved its performance in relation to indictors of capacity to innovate – number of scientists and engineers engaged in R&D, spending on R&D as percentage of GDP – as well as innovation output in the form of patents and research papers published in peer-reviewed journals".

9 Coincidently many of these studies have a genesis as reports to US policy-makers concerned about the potential 'competitive threat' from India. There is a danger that such assessments fail to capture the most important developments.