Problem framing in new innovation spaces

Insights from software outsourcing

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Problem-framing in new innovation spaces: insights from software outsourcing

Rasmus Lema

14.1 INTRODUCTION

Over the last three decades, outsourcing has had a major influence on the international division of labour. It is clear that it has been an important reason for the enormous build- up of production capabilities in the developing world, in particular in the export platforms of Asia. While there is increasing acknowledgement that the globalisation of research and development (R&D) and innovation is following produc-tion, it is not clear how this process unfolds and whether it extends to advanced innovation.

Until recently, the literature on outsourcing and global value chains maintained that only certain stages of the chain was outsourced to low-cost economies, mainly manufacturing and standardised services. Innovation activities, on the other hand, remained in so-called advanced economies (Mudambi, 2008). Outsourcing should merely strengthen suppliers' existing position in the global division of labour – where competitive advantage is defined primarily by low cost. Innovation activities were 'detached' from outsourced tasks and they remained centralised in and around lead firms and global buyers residing in advanced economies.

There is now increasing acknowledgement that outsourcing is changing in nature: firms are outsourcing activities, which they used to undertake in-house. They are farming out knowledge-intensive activities, including some innovation and R&D activities (Ernst, 2008; Jensen, 2009; Manning et al., 2008; Tate et al., 2009).

This chapter seeks insights by focusing on the global software-outsourcing industry and the supply platform in Bangalore (India), one of the most prominent cases of latecomer development in the global economy.

So far the literature on the software industry has tended to argue that the global division of labour is relatively stable (for example, Sharma, 2014). This is the key conclusion arising from studies that have been looking at 'hard indicators', mainly the distribution of patented intellectual property and formal R&D expenditure (Arora, 2006; Arora et al., 2008; Dossani, 2006). However, this conclusion is closely related to the division of tasks in distributed software development projects. Arora (2006: 400) 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. . . . Most of the functions offshored (especially to India) involve production, while design has tended to remain local.

In other words, 'production' is outsourced, but 'design' is not. Core and strategically important innovative activities of OECD-based customers, R&D and product development, are typically perceived as 'non-globalised' and 'bound' to their home locations; they are thought to depend on localised and intricate linkages between firms and institutions in lead markets (see Wibe and Narula, 2002: 243). For example, Hoekstra (2006) argues that outsourcing relationships do not provide proximity to tacit knowledge and domain expertise because customers are at a physical and social distance from India. Furthermore, key constraints arise from the way outsourcing relationships are 'modularised' and structured.

According to D'Costa (2004: 57), 'No firm wants to co-locate critical projects overseas due to coordination and communication problems . . . 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.' Hence, because lead firms keep core competences in-house, the formation of innovative capabilities in India is constrained. 'Export services that are outsourced to India are likely to remain non-critical adjuncts to central functions' (D'Costa, 2003: 214). These were the conclusions derived by scholars studying software outsourcing ten years ago, so this chapter provides a critical discussion of whether this still holds true.

The chapter questions the widely held position – following Arora (2006) and D'Costa (2004) – that only lower-order activities are outsourced. To develop this understanding of emerging innovation spaces in India, the chapter adds to the literature on knowledge-intensive outsourcing (Jensen, 2012; Manning et al., 2008; Massini and Miozzo, 2012; Tate et al., 2009)

and qualifies the argument that outsourcing relationships are unlikely to evolve beyond certain threshold levels because they do not provide supplier proximity to tacit knowledge and domain expertise.

The key contribution of the chapter lies in specifying the circumstances in which innovative tasks may (or may not) be relocated from Western countries to India, thereby creating new spaces for innovation at the Indian end of the outsourcing relationship. It develops an understanding of how innovation spaces are created in India, by focusing upon problem-solving and problem-framing tasks in software development. The next section presents the conceptual framework for the study, combines this with a review of the relevant literature and specifies the knowledge gaps and questions explored in this chapter.

14.2 OUTSOURCING AND INNOVATION: INSIGHTS FROM THE LITERATURE

The nature of innovation activities that are potentially 'transferred' to emerging economies through outsourcing is debated because it has traditionally been seen as a cost-driven phenomenon. There is widespread agreement that access to 'production' capability at low cost is the main driver of offshore outsourcing, at least initially. However, outsourcing may evolve from production as the experience may give rise to a deepening of the outsourcing relationship. It may therefore be important to pay attention to many the intermediate stages between pure production activities, which depends only on the *use* of existing/given knowledge, and pure research, which is only concerned with the *creation* of knowledge.

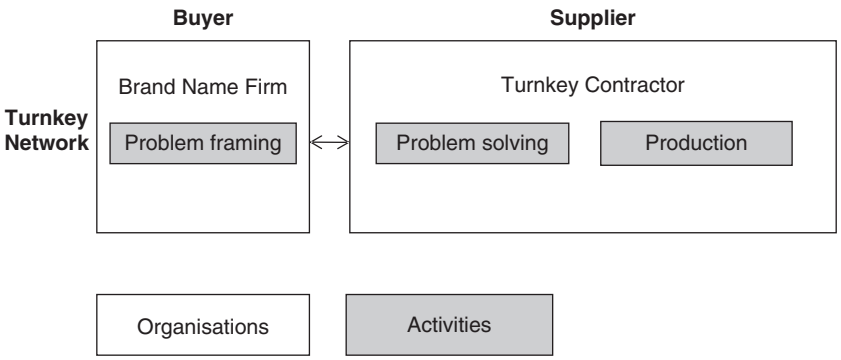
Schmitz and Strambach (2009) have recently emphasised the need to recognise not only innovation activities that are loosely connected to production (standalone innovation), but also those that are tightly connected to production (integrated innovation). In an outsourcing setting the latter could arise through the engagement of suppliers of manufacturing services in developing new products or processes. The key characteristic of this type of outsourcing is that it concentrates on the acquisition of a good or services but that some innovating by the supplier is required to provide this good or service. Despite the acknowledgement of the changing nature of outsourcing, most of the literature argues that dispersed innovation activities are of a second order.

Schmitz (2007) suggests that the notion of 'advanced' innovation in global value chains can be specified further. He argues that this type of innovation activity is 'problem framing'. He draws on the modularity literature, which shows that tasks that integrating technology and systems

are critical steps in the innovation processes, even where the integrator (buyer) itself is a sub-system supplier in intermediate markets (Brusoni, 2005; Brusoni et al., 2001; Pavitt, 2005). The failure to retain the 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, 2003: 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).

The hypothesis identified in the literature is thus that the 'quality' of outsourced innovative activities is limited to 'problem solving' (Schmitz and Strambach, 2009), 'subsystem design' (Chesbrough, 2003) or simply 'routine low-end innovation' (Chen, 2008). Integrative capability in technical fields is strategic to buyer firms and that the strengthening of supplier capabilities in these realms is against their interests.

In manufacturing, this constellation is evident in the turnkey production network as found in Figure 1. In this type of network the problem framing tasks are undertaken by the brand name firm whereas the all remaining problem solving and production tasks are undertaken by the turn-key contractor. Adapted from Sturgeon (2002), there is a chain of three activities in turnkey production networks. Problem-framing includes activities like product R&D, product definition, functional design, form design and prototype fabrication. Problem-solving activities include process R&D,



Source: Adapted from Lema (2012a), based upon Sturgeon (1997)

Figure 14.1 Problem-framing and solving in turnkey production networks

design for manufacturing and testing. Production includes manufacturing, component purchase and assembly.

Even in manufacturing but especially for software, the question is whether problem-framing and problem-solving activities can be separated. Henderson and Clark (1990) distinguish between two different kinds of relevant knowledge. The first is knowledge of the system components and the second is knowledge about the linkage between them, that is, architectural knowledge. In many industries, component knowledge is provided by suppliers, whereas architectural knowledge is retained by lead firms that function as system integrators. While such structures are particularly pronounced in industries dealing in highly complex products, some scholars have suggested that coordinating and integrating specialised knowledge is an important feature of innovation processes in general (Pavitt 2005). System integrators must have architectural knowledge as well as some degree of component knowledge in order to cope with technological change and product-level interdependencies. They must 'know more than they make' (Brusoni et al., 2001) and this requires the presence of in-house staff that possess a 'higher level understanding'.

However, a number of scholars have pointed out that there are limits to decentralisation through modularity (Chesbrough, 2003; Ernst, 2005). Research on the outsourcing of printed circuit board manufacturing confirms that the overall design parameter typically remains in the hands of the customer because the requirements depend upon the electronics product into which it is inserted. A part of the design process is transferred to competent suppliers who then gain some scope to draw on and further develop distinct in-house competences (Lee and Chen, 2000). Ernst (2005) has shown that there are limits to modularity in chip design because of cognitive complexity. Technology change in this sector was unpredictable and changed faster than the ability to codify.

Modular production and innovation networks are dependent on what Baldwin and Clark (2006) call a pinch point in the flow of activities, that is, a codified and standardized transfer (hand-off) of design parameters and specifications. However, the establishment of such a pinch point can be difficult and costly. If a lead firm wants to place a transaction in a particular location it must define and find a way to measure the transacted 'objects' (Baldwin, 2008). Significant costs can occur when the buyer undertakes product definition and specifies service-level agreement, process-approach, testing methods, and so on. Transactions between firms (externalisation) are more likely to occur where these costs are low. By implication, the outsourcing of standardised product components is feasible and straightforward when firms can rely on general industry standards and on clear specifications. The ability to codify becomes more difficult as

you proceed with functions that have knowledge-creating elements, such as design and engineering activities (D&E) or even R&D.

This has important implications for the division tasks between buyers and suppliers in outsourcing relationships in software. Dividing the value chain up into functions that are undertaken by separate firms (as in Figure 1) is relatively straightforward when lead firms have a strategy of 'controlling the creative heart of the value chain, while outsourcing all other activities' (Mudambi, 2008: 702). By contrast, 'linkage economies'[1] may make such splitting up more difficult when lead firms adopt a more deliberate strategy to outsource innovation.[2] In such cases lead firms may find it more efficient to bundle an increasingly large share of the value chain thread with supplier firms and work much more closely with suppliers on the highly creation tasks. This typically means firm transactions cannot be fully specified *ex ante*. The 'pinching' of the inter-firm link is likely to be pushed to the limit, but the parties may invest in a (temporary) 'transaction-free zone'. Such zones are 'physical, virtual, or social spaces where, by convention, a designated set of transfers occurs freely' (Baldwin, 2008: 181). Such zones are needed to facilitate complex, interdependent, and iterative transfers in the task network.

So far there are few studies that have examined modularity patterns in offshore software outsourcing empirically through case studies, even literature assumes that modularity dynamics pose threshold limits to the outsourcing of highly creative (problem-framing) work. The literature suggests more or less explicitly that this type of activity remain 'non-globalised', not only in software outsourcing (Arora et al., 2008; Dossani, 2006) but sometimes also more widely in outsourcing generally (Mudambi, 2008; Schmitz, 2007; Sturgeon, 2002). To explore this assumption, the next section examines the character and evolution of outsourcing relationships and focuses on the outsourcing (or not) of problem-framing activities.

14.3 CASE STUDIES OF OUTSOURCED SOFTWARE: PROBLEM-SOLVING AND PROBLEM-FRAMING

Despite the 'non-globalisation of innovation' argument discussed in the introduction, recent literature suggests that more complex tasks are being outsourced from the rich world to emerging markets (Jensen, 2009; Manning et al., 2008; Tate et al., 2009). Following upon this recent research, this chapter seeks to understand how more complex activities are outsourced as well as how and why this occurs in software. To do so, the

Table 14.1 Chain of activities in software development

Problem framing	Requirement analysis and definition; high-level design
Problem solving	Low-level design
Production	Programming (coding and testing); deployment

Source: Lema (2012a)

empirical analyses draws on the empirical analysis put forth in the previous section.

This chapter is based on a larger piece of work, specified in Lema (2012a). Table 14.1 outlines our conceptualization of problem-framing, problem-solving and knowledge-using activities in software development. The problem-framing activities identify what a product or system should do and broadly how it should do it. It relates to the step in the software project lifecycle that deals with requirement definition and high-level design, which mainly occurs in the inception phase of projects.

Analysing software along these lines is done by analysing three different buyer–supplier relationships in the case studies[3] to maximise the comparative element of the chapter.

There is a primary software firm focused solely on the development of software systems. This is Digital Media Networks and the outsourcing of product development (OPD) to Aditi Technologies. There is a secondary software firm with an origin as an in-house software developer for a large manufacturing enterprise. This is Automobile IT and the outsourcing of custom application development (CAD) to MindTree Consulting. There is also an electronics firms producing and purchasing software for its hardware products. This is Telecommunication Corporation and the outsourcing of engineering services (ESO) to Sasken Communication Technologies. The buyer firms are all incorporated in Europe or the US and the supplier firms in India.

14.3.1 Digital Media Network 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 with the idea of a media service engine for legal digital content sharing. Aditi Technologies, was established in 1994 by entrepreneurs returning from the US. The chief executive officer (CEO) came from a position as a general manager of a division in Microsoft. During the 1990s the firm concentred on developing its own customer relationship management (CRM) product,

Talisma, while also supplying services, including technology support for independent software vendors (ISVs). In the early 2000s the CRM product business was spun off, so the firm could concentrate solely on outsourced product development. Today the firm has 650 employees and has acquired capabilities for end-to-end new product development.

The founder and CEO of Digital Media Networks previously had a career in Microsoft in which he was a senior sales leader. The firm was '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.

The decision to outsource the entire development of the system 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 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 US. Second, it was important to have the ability to ramp up and down effortlessly once the major phase of creation was complete 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 prices comparable or below US prices. Most important, the firm was attracted by the ability to get inputs to the project from an experienced product development firm.

As the very foundation of Digital Media's business, the solution provided by Aditi was mission critical. The initial requirement had been described in just an eight-page 'visioning document'. This document formed the basis for proposal building and preparatory activities. Requirements were then settled during a one-week meeting at the Digital Media office. Thus, Aditi was closely involved in the requirements-definition stage as pertaining to the technical solution. As explained by the CEO of Digital Media, some of the requirements came from the supplier's ability to envisage usage scenarios. When asked about whether there 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 were they did add value there (Digital Media informant).

For Digital Media, the focus on sales and the management of a new business model were 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.

The radical outsourcing strategy was not adopted without problems. At the outset, the leadership in Digital Media 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.

14.3.2 Automobile IT and MindTree Consulting

For more than 30 years, until 1998, Auto IT was the in-house information technology (IT) division of a European auto manufacturer now specialising in trucks and buses. In 2001, the firm acquired two truck manufacturers (located in France and US) and the IT services divisions were consolidated in Auto IT, which had become a wholly-owned subsidiary. The IT 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 was therefore 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 organisation, 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).

A key element in the definition of requirements was the experience that was gained from collaborating with MindTree Consulting, a spin-off from Wipro. MindTree was established in 1999 by a former Wipro leader with the explicit aim of creating a knowledge-intensive software solutions company. The firm 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. 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 customised application development (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. Top management and founders drove this process as an opportunity for building deeper domain competences in the CAD segment as one of key vehicles for upgrading in this segment.

According to the CEO of Auto IT, the relationship with MindTree 'is the only true partnership of Auto IT'. Already in 2001, Auto IT had 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 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 depended on 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 was able to draw on its experience of 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 was able to do so because of the close relationship between the two firms. A full-time MindTree manager is posted permanently on site, with access to the entire buyer organisation. 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.

14.3.3 Telecommunication Corporation and Sasken Communication Technologies

In the early 1990s when Telecom Corp introduced its first GSM (Global System for Mobile Communications) 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. However, 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. The latter included what the firm referred to as '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. Established in 1989, Sasken was one of the firms hit severally by the technology slump of the early 2000s due to its dependence on the US 'dot com' technology sector. The slump spurred a refocusing of the firm from the personal computer (PC) domain to the mobile communications domain. According to informants, the downturn was used to make investments for the future in this area. The relationship with Telecom Corp reflects the firm's new profile as a pure player in this area.

For instance, Telecom Corp made some use of video-application and codec licensing from Sasken. These are subcomponents and commodity inputs. As stated by an informant in Telecom Corp: 'There has been some licensing of certain application 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 Telecom Corp (Telecom Corp informant):

> 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 subsystem 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.

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 an informant stated, there are certain types of process and knowledge that Telecom Corp keeps under European control. The reason was a concern within Telecom Corp 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 domestic firms. Most of these adopted 'follow sourcing' 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 Wireless Hightech, a European supplier of design and radio frequency testing services. Leading managers in Wireless Hightech had an employment history in Telecom Corp. However, Wireless was not globally oriented and did not have the size to venture abroad as was required by Telecom Corp. For this reason, Wireless was put under pressure to merge with Sasken in order to service Telecom Corp in Europe and globally (in India and Mexico). As a result, Sasken acquired Wireless 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 Wireless could be scaled up globally. The second was to create more balance in the supply network and to develop a degree of control over certain R&D services outsourced to Indian organisations. On the other hand, this reconfiguration of the supply chain 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. 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.

14.3.4 Analysis and Insights from the Case Studies

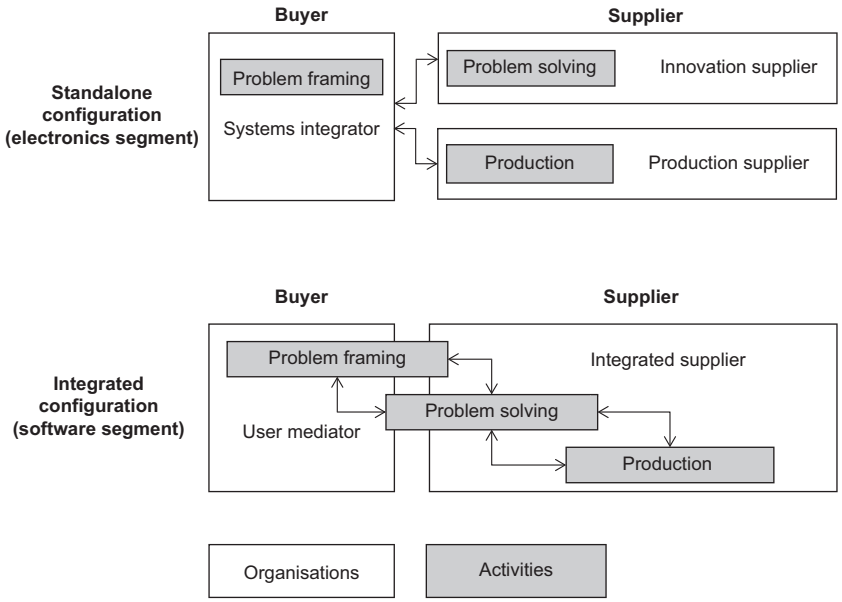
A series of points from the analysis and insight are discussed here. A first point is that outsourcing of problem-framing activities does occur but is confined to software services. In the software services industries, represented by Digital Media Network and Auto IT, suppliers are now often invited to participate in requirement-definition – problem-framing activities – in a substantial way. In the primary software industry of Digital Media networks it relates to the identification of user needs (for example, 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 of Auto IT, but in this setting there is a much more direct relationship with users. The insights from both cases run counter to the extant hypothesis that such problem-framing activities are kept at home in buyer organisations.

This finding is specific to the software buyer segments as opposed to the electronics hardware segment. As the Telecom Corp case illustrated, electronics and telecom firms mainly outsource problem-solving and innovation support activities, thus confirming largely to the extant hypothesis identified in earlier sections. Indeed, the analysis of Telecom Corp and Sasken illustrate that engineering services provided in India tend to feed into highly coordinated networks and innovation processes in which these Indian service providers play a specialised and bounded role. In Telecom Corp problem framing is associated with overall product architecture and systems integrations. The firm provides carefully defined and limited spaces in which suppliers can operate.

The second point is that certain elements of problem-framing are becoming less strategic to buyers of software services. Outsourced problems helped certain buyers to tackle particular challenges define more narrow core competences for their own organisations. This does not mean that the distinction between strategic and non-strategic activities has vanished. It has shifted to somewhere else. The key innovation processes – those that provide the most value in new business models and ensure future competiveness – are becoming non-technical. Instead of focusing on product and systems development, managers focus on the customer interface. Internal resources are deployed in the areas that enhance user-knowledge and sales capability; they are increasingly focused on managing external relationships and on capturing rent from new business models.

This means that new upper boundaries emerge for what the buyers are prepared to outsource. This was clearly expressed by buyers. As an informant in Auto IT stated: 'We do not want to bring in someone else to take the layer between us and the customer.' Controlling access to the customer is increasingly vital. Even though suppliers may contribute substantially to functional requirements, the lead firm are strongly positioned as mediators and relationship anchor-points forward and backwards in the chain. Thus, the question arises for firm management, namely whether firms are willing to let go of component knowledge (problem-solving), while seeking 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, the



Source: Lema (2012a)

Figure 14.2 Problem-framing in standalone and integrated innovation outsourcing

strategic importance of architectural knowledge is reduced in the services segment.

The third point is that problem-framing activities and system development activities are often outsourced in a bundle. Key differences across the case studies relate to the bundling of value chain tasks. Where innovative services are bought on a standalone basis, they do generally not extend beyond problem-solving. Where production and innovation tasks are integrated there is a wider scope for or incentive to draw the supplier into problem-framing elements of the development process. Based on the analysis of the case studies, Figure 14.2 illustrates the difference between the standalone and the integrated supplier setting in this regard.

Standalone innovative activities are typically undertaken within the realm of new product development. It is therefore easy to assume that these are 'most proximate' to problem framing. However, a loose connectedness as detected in software outsourcing by electronics firms means that highly differentiated roles – for example, systems integration vs modular component provision – can easily be assigned to

separate organisations. Typically, there are relatively modest interactive requirements despite a high degree of system interdependency. The interface between the software component and the overall product is specified by the overall product design and the technical standards. The buyer is overseeing the design of the overall product (for example, a chip or wireless 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.

Conversely, because integrated innovation activities are undertaken in tight connection with production (that is, 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 primary and secondary software industry. If buyers want to outsource problem-solving activities, they typically need to open up for elements of the problem-framing processes. Buyer firms expanded the outsourced value-chain thread from implementation activities all the way into the realm of problem-framing.

The modular view on outsourcing suggests that while specialised component knowledge can be acquired externally, lead firms are likely to retain architectural knowledge and integrative capacity in-house (Baldwin and Clark, 2006; Pavitt, 2005). However, the analysis above suggests that this point may have been exaggerated when it comes to software. Or, to be more precise, it suggests that the modular view only applies in certain segments of the software outsourcing industry where integrated suppliers provide a full range of innovation and development functions.

The fourth point is that limits to codification are a driver of outsourcing of problem-framing activities. It is not always possible to draw a clear dividing line between problem-solving and problem-framing.[4] It is 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. Sometimes requirements and specifications have not been fully fleshed out at the point of engagements and sometimes they are virtually impossible to work out at this point. More importantly, they are virtually impossible to relay to a supplier firm.

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 coding phase. This process of codification of requirement is what Baldwin and Clark (2006) refer to as

the costly process of 'pinching'. However, these costs can be reduced and externalised by involving the supplier in the elaboration phase. 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 onsite staff and on highly developed methods for the within-firm 'transfer' of these specifications to the execution team in the offshore development centre.

In highly evolved outsourcing relationships, the buyer needs to draw supplier staff into the architecture and sometimes even the 'vision' of the project. Hence they take part in the inception phase, and activities in this phase are very difficult to codify. A pinch-point is virtually impossible to establish and the inter-firm connection becomes relational. They create limited transaction-free zones by placing supplier staff onsite, thereby reducing the problems that arise in the organisational-geographical nexus of advanced offshore outsourcing. These zones typically exist for a limited period; but occasionally they are created on a permanent basis so that the suppliers can obtain a deep level of understanding of the vision and context of consecutive projects. They are drawing suppliers into the 'creative heart of the value chain', not only to externalise the cost of pinching but also to leverage supplier assets in higher-order activities.

14.4 CONCLUSIONS AND IMPLICATIONS

There are now several strands of literature that stress the centrality of outsourcing in the debate about the global distribution of innovation activities (Jensen, 2009; Manning et al., 2008; Maskell et al., 2007). Yet, the more precise extent and importance of outsourcing is a matter of controversy, not least because of conceptual ambiguity. The challenge confronting the researcher is to identify particular hypotheses, provide definitions and find ways to examine them. This is what this chapter has sought to do. The aim of the chapter was to explore the widely held hypothesis that lead firms keep advanced innovation in-house (or closes to home) while dispersing only tasks of a second order. It has drawn on evidence from the global software outsourcing industry that connects lead firms in OECD countries with suppliers in Bangalore, India. While recent literature suggests that services outsourcing is becoming more knowledge-intensive, there is controversy about how deep these relationships and complexity goes and why.

The framework proposes to equate advanced innovation with those elements of software development that are 'problem-framing'; these elements define what the software should do and how it should do it. One of the main results of the case study research was that some buyer are beginning

to open up the problem-framing process, relying on key inputs from Indian providers of software services.

The case studies showed how IT departments and independent software vendors build on their experience with the outsourcing of software design activities to take a step further and give suppliers the responsibility in the entire chain of software development activities, sometimes including those that define the system or product. Outsourced activities are no longer merely non-critical adjuncts to central functions. Indian firms even become involved in specifying (framing) and solving 'mission critical' problems.

This chapter has also cast light on the issue of why and how innovative tasks are shifting to the supply base, including critical observations about salient conceptual and causal connections that are central to the literature on outsourcing and innovation.

The literature stresses that offshore outsourcing has emerged as a cost-driven phenomenon, and that the scope innovation is constrained by the prominence of activities with high labour requirements (Mudambi, 2008). It is commonly assumed that labour-intensive activities have fixed or unfavourable learning exponentials and that such activities do not provide access to crucial domain expertise and tacit knowledge which 'sticks' to customer locations. The cases in this chapter confirmed that 'routine' production tasks are important, but this did not limit the scope for further capability building as discussed in the introduction. There is considerable scope for innovation as an incremental extension of routine outsourcing low-cost countries.

Three main findings relate the specific case of software outsourcing from US and Europe to India to the broader issue of the development and flows to specific innovation spaces.

One finding is that in a rapidly changing world it is not feasible to assign 'fixed values' to categories such as 'strategic' and 'non-strategic'. Architectural knowledge is only strategic in certain circumstances and it is a fallacy to view the limits to outsourcing as given. The chapter has suggested that that supplier firms have moved into the chamber of 'advanced' innovation activity – not despite the interest of buyers but often because of the interests of buyers.

Second, it appears that the constraints of modularity in products and organisation may have been over-emphasised. Despite, the initial focus on 'low end' tasks and less critical projects, outsourcing relationships seems to have provided 'sufficient' knowledge and domain expertise for the subsequent outsourcing of higher-end tasks and more critical projects. The inability to fully codify tasks often means that even if systems have a modular architecture, face-to-face interaction is necessary. Iterative

information flows are forged with the presence of onsite personnel (actual proximity) supplemented with new technologies that enable frequent and high-bandwidth communication across geographical distance (virtual proximity).

Finally, linkage economies can be achieved through the integration of production and design tasks in the outsourced value chain thread. 'Integrated innovation outsourcing' reduces the substantial coordination costs associated with up-front investments undertaken during the initial phases of software projects. Buyers reduce and externalise the substantial tasks of detailed codification and communication by drawing supplier closer to the vision of the project. There are cumulative dynamics arising from initial outsourcing of mundane tasks, which may lead to further rounds of more advanced outsourcing of innovation.

These three findings suggest that the roads used to redistribute increasingly deep innovative activities are paved by global production networks and lead firms in these networks. But redistribution does not occur automatically. It requires active efforts in supplier firms, including internal investments, project organisation or learning and external acquisition of knowledge to meet new demands.

A crucial question is how this deepening will affect the economic power balance between the current demand-bases (the loci of buyers and lead firms in OECD countries) and the new innovation spaces in China and India. Will the further outsourcing of innovative tasks create mutually beneficial relationships whereby buyers shift to higher value activities, shedding more and more complex activities to Indian suppliers, but keeping them in a complementary and subordinate function? Or will it create relationships that entail risks for the buyers who may eventually lose their competitive edge in problem-framing and customer-related activities?

NOTES

1. Linkage economies arise from connections between the production functions associated with different activities in the value chain. Mudambi (2008) argues that if linkage economies are high, lead firms are likely to opt for offshore foreign direct investment (FDI) rather than outsourcing. Information flows with highly complex knowledge are easier to forge between units within a single firm than between disparate enterprises.
2. For example, if these lead firms adopt more or less 'open' business models (Lema, 2010).
3. These cases are drawn from a larger study of 36 'critical events' for attainment of innovation capability in ten Indian software firms. A major task for the analysis of these events was the analysis of external sources of innovation. It is the retracing of customer linkages that forms the basis of the material presented in this chapter. Interviews were made in the buyer firms in order to understand driving forces and circumstances for

outsourcing of different types of activities across the software value chain. In total, more than 100 interviews were conducted covering both the supply and demand side using semi-structured questionnaires. Most buyer firms were therefore interviewed by phone. However, European buyers were interviewed face to face. Names of buyer firms (but not supplier firms) are anonymous as to adhere to non-disclosure agreements. Further details on methodology are provided in (Lema, 2012a, 2012b).

4. The distinction between problem-solving and problem-framing is not in the buyers' minds. Their language was vague referring to (in CAD) 'the tasks of high-cost employees' and 'the business side of things'. In most cases they want a specific and often pressing problem solved, and this then becomes a route to 'value-chain creep' in which suppliers enter the loci of problem-framing activity.

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