Chapter 4
Tracking Offshoring and Outsourcing Strategies in Global Supply Chains

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Abstract The dynamics in industrial business networks, caused by the disaggregation of firms' value and supply chains, cause product life cycle phases and tasks to be transferred from advanced market economies to emerging market economies. In this chapter, I track the linkages between changes in a lead firm's business environment and changes in the lead firm's strategic offshoring and outsourcing actions; I also track how these changes in the lead firm's behaviour are then translated into a supplier firm's strategy and offshoring decisions. Additionally, I discuss offshoring and outsourcing strategies in global value chains. The increasing level of highly skilled labour in emerging market economies enables industrial business networks to rearrange themselves along with shorter life cycles. Furthermore, I find that different firms typically react to their customers' strategies with the same approach but implement and schedule their implementation in different ways. These differences in the execution and implementation patterns of offshoring and outsourcing also differ among industries.

Keywords Global value chains · Offshoring · Outsourcing · Industrial business networks

Globalisation is much more than simply moving employment and activities from developed nations into nations with lower-cost forces. Such a simple conclusion obscures the complicated skein of cross-border relationships that have evolved out of firm strategies seeking to balance the kaleidoscope of variable including labour and inventory costs, transportation, quality, concentration of valuable knowledge in clusters and temporal proximity to customers. Understanding firm strategies at the single moment in time is complicated enough, but unfortunately, these variables also fluctuate (Kenney and Florida 2004, p 1).

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4.1 Introduction

The disaggregation of a firm's value and supply chains has accelerated in the past decade, especially among global high-tech firms. Other firms in other industries appear to be following this trend. This disaggregation of firms' value and supply chains has caused different product life cycle phases and tasks to be transferred away from advanced market economies to several different locations around the world and among emerging market economies (Blinder 2007; Mudambi 2008). However, the product life cycle phases and tasks contributing most of the value and the control of global value and supply chains have continued to remain in advanced market economies (Ali-Yrkkö 2010; Ali-Yrkkö et al. 2011). Nevertheless, there is increasing concern that these high-value product life cycle phases and tasks will be offshored as well. Offshoring entails the moving away of not only tangible assets but also intangible assets, especially those related to commoditised technologies (Ali-Yrkkö and Seppälä 2012 forthcoming).

Grossmann and Rossi-Hansberg (2008) approach this same disaggregation of firm value and supply chain from the international trade theory perspective by separating trade in tasks from trade in goods. Baldwin's approach (2006, 2009) moves to a finer resolution level and discusses unbundled value and supply chains. This division of international trade into trade in tasks and trade in goods and the unbundling of global value and supply chains mirrors the current working environments of any multinational enterprise, hereafter referred to as an MNE (Linden et al. 2009; Ali-Yrkkö et al. 2011). These two approaches represent the prevailing perspectives regarding global value and supply chains. However, there are many other perspectives (see Porter 1995; Baldwin and Venables 2011).

Managing offshoring and outsourcing strategies for global value and supply chains has been recognised by several authors (see Dunning 1993, 1998; Pyndt and Pedersen 2006). In this chapter, I extend the existing literature not by tracking a single firm's offshoring and outsourcing strategies and behaviour, a single moment of time; instead, I follow the causes and effects of a lead firm's behaviour in the context of disaggregated global supply chains in a longitudinal study. By tracking the offshoring and outsourcing strategies in high-tech global supply chains and their respective industrial supplier networks between 2000 and 2010, I am able to answer the following research question:

> How have offshoring and outsourcing advanced in global high-tech business networks and supply chains?

I track changes between 2000 and 2010 in the following characteristics of lead firms: (1) business environment; (2) offshoring and outsourcing strategies; (3) operational structures and (4) industrial supplier networks. This approach enables me to analyse the linkages between changes in a lead firm's business environment and the lead firm's strategic offshoring and outsourcing decisions and then to observe how these changes in the lead firm's behaviour are translated into a supplier firm's strategy and corresponding decisions regarding offshoring and

outsourcing contexts. Furthermore, I explain how different technology and service-based firms in industrial supplier networks have executed their offshoring and outsourcing strategies and relocated different product life cycle phases and tasks, such as research & development, production and after-sales services from advanced market economies to emerging market economies.

In this chapter, I use a case study methodology to examine the contemporary phenomenon of offshoring and outsourcing in high-tech business networks and supply chains, and I use the multi-case approach to capture differences in firms' behaviour (Eisenhardt 1989; Yin 1994). Furthermore, the multi-case approach is then supplemented with 14 interviews with industry experts, current and former representatives of mobile telecommunications industry. All interviews were conducted between August 2010 and May 2011.

The reminder of this chapter is structured as follows. The next section introduces the analytical framework, that is, industry dynamics, new emerging markets, global value chains and offshoring versus outsourcing, paying particular attention to ascendant definitions. The research context and the methodology are described in section three. The transformation of the mobile telecommunications industry business networks is then explained in detail in section four. The main results, a comparison to transformations in business networks within the mobile phone industry and conclusions, conclude the chapter.

4.2 Analytical Framework

Each industry, each global supply chain and its respective industry supplier networks evolve at different rates of speed depending on changes in business environments, global operational structures and product life cycles (see Fine 1998; Funk 2004; Doz and Kosonen 2008). High tech, for instance, is one of the fastest evolving industries today. Its products can have technology life cycles measured in tens of years. However, the most striking difference among all of the industries is the timeframe available for making decisions (Fine 1998; Eisenhardt 1989).

Fine (1998) argues that each firm has its own position in terms of industry dynamics; these positions typically vary between firms. In each firm, the status varies between being horizontally integrated and vertically integrated. By analysing its business environment, a firm can define its own and its competitors' positions. Along with the analyses of industry dynamics, a co-evolutionary model towards competitors' sharing of industrial supplier networks has emerged (Sturgeon and Lee 2001; Möller and Rajala 2007). Industrial supplier networks in Asia, especially in China and India, have been the dominant factor behind this change in industrial network structures (Seppälä 2010, 2012). This change among global value and supply chains has shifted from transferring only tangible assets to transferring intangibles as well (Mudambi 2008).

The concept of global value chains is typically used to analyse the value added by a firm in a global industry and in its global value chain from "mines" to

"consumers" (Ali-Yrkkö 2010; Ali-Yrkkö et al. 2011). Furthermore, the concept of global value chains can be used to examine and analyse a firm's global strategy and position compared with others within its industry business network. Kogut and Kulatilaka (1984) and Porter (1995) originally designed the value chain framework to examine organisation-level or firm-level production and supporting value creation processes and the contributions of these towards developing a competitive advantage. Kogut and Kulatilaka (1984) argue the following:

> Global strategies succeed by creating certain economies along and between value added chains i.e., each firm creates its own value added chain, and by designing marketing programs that adapt products to national needs and yet exploit these in upstream economies.

However, both Kogut and Kulatilaka (1984) and Porter (1995) base their value chain frameworks and analyses on the notion that value as such is often created by activities within the firm, which then vary considerably between firms. Pyndt and Pedersen (2006) extend that by considering that the firm's ability to affect other companies in the value chain may constitute a critical source of competitive advantage. This finding confirms the importance of investigating entire value and supply chains rather than focusing on a single firm.

Mudambi (2008) offers a framework that combines several of the above contributions. He identifies three different global value chain management/business models; integrated, semi-integrated and low cost. An integrated global value chain management/business model represents cases in which an MNE controls the value throughout the product life cycle, including the intellectual property and technology (often customised) rights. A semi-integrated global value chain management/business model represents cases in which the MNE controls design and markets for the product, minimising outsourcing and its control of intellectual property and technology rights. The actual production processes are often offshored and outsourced as well, which means that under this global value chain management/business model, the intellectual property and other rights can also be contractually outsourced. The low cost business model is, in this case, regional not global. In many ways, this global value chain management/business model is very similar to an integrated way of thinking. Under this model, the component supplier tends to own the intellectual property and other similar rights. Often, these technologies are also mature technologies from a technology life cycle perspective.

In addition to discussion on industrial dynamics, global value chains and the disaggregation of global value chains, it is important to recognise the systematic knowledge transfer catch-up effect between advanced market economies and emerging market economies (Mudambi 2008). This knowledge transfer—catch-up effect acts to balance inequalities between the economies. This knowledge transfer—catch-up behaviour can be identified from the decisions of Finnish MNEs in the period from early 2000 to 2011 (Ali-Yrkkö and Tahvanainen 2009).

Dunning (1993, 1998) considers that there are four motivational factors behind strategic decisions of the firm while planning for offshoring and outsourcing strategies: is a firm (1) a market-seeking firm, supplying goods to that market;

(2) a resource-seeking firm, looking for cost benefits; (3) an efficiency-seeking firm, looking for cost advantages or (4) exploring these options as a strategic consideration; for example, aiming to follow its customers and/or competitors? As mentioned earlier, these four motivational factors represent the key decision-making criteria of each firm.

Offshoring and outsourcing are typically treated as firms' strategies that need to be simultaneously understood (Contractor et al. 2010). Furthermore, Contractor et al. (2010) consider outsourcing and offshoring to be the two outcomes of the same strategic drivers that force firms to make new strategic decisions in terms of where to relocate research & development, industrialisation, production and after-sales service-related tasks. However, there exist opposing views as well. Therefore, the optimal position of each MNE in its disaggregated global value and supply chain is to be carefully analysed to understand firms' strategic decisions in this context while observing the role of transaction cost economics.

Contractor et al. (2010) consider that each firm has six different options for each value and supply chain task and/or activity. Firms typically operate domestically and/or externally in a foreign country. Simply put, offshoring entails moving jobs, task and/or activities out of a firm's home country (Blinder 2007). In contrast, outsourcing can happen in-house, cooperatively with another firm and/or through a market transaction through a partnership and/or any supplier. Today, in many cases, outsourcing occurs as offshoring. This elaborated view of offshoring and outsourcing builds on several studies such as those by Grossman and Helpman (2002) and Pyndt and Pedersen (2006).

Fill and Visser (2000) discuss about the principal factors and drivers associated with the decisions related to the outsourcing spectrum. The outsourcing spectrum offers a framework of outsourcing tasks from relieving capacity overload to a variety of strategic partnerships supplying predetermined, assembly, products or services. Drivers related to outsourcing occur more in the form of decision-making tools to support actual decision making and enabling the quantitative comparison of firms. Mudambi and Tallman (2010) describe the outsourcing spectrum as a make, buy or ally process occurring between firms that include the transfer of tangible assets, including some knowledge intensiveness related to production and innovations, that is, some degree of specific capabilities of the firm.

In the mobile telecommunications industry, outsourcing goes beyond Mudambi and Tallman's (2010) definition, especially when considering commoditised technologies (Seppälä 2010). In relation to the above, Greenstein (2005) discusses different business models of outsourcing, such as contract manufacturing (CM), contract design and manufacturing (CDM) and original design and manufacturing (ODM), all of which are relevant to mobile infrastructure industry. The developments in mobile telecommunications industry continue to follow the development patterns of the personal computer industry, where a Taiwanese ODMs deliver most of the world's personal computers.

4.3 Research Context

Developments in the mobile telecommunication industry can be divided into four distinct eras. The first-generation (1G) cellular systems, deployed in the 1980s, represented the simplest communication networks. The second-generation (2G) cellular systems were the first to apply digital transmission technologies for voice and data communication. To address the poor data transmission rates of the 2G network, technological enhancements called 2.5G technologies such as general packet radio service (GPRS) and 2.75G Enhanced Data Rates for GSM Evolution (EDGE) were developed. 3G networks are also referred to as universal mobile telecommunications systems (UMTS). However, China has developed its own standard, called time division synchronous code division multiple access (TD-SCDMA). As of today, the wireless networks are evolving from 3G to 4G architectures, which then provide a platform for the all-IP convergence of mobile and fixed networks, which in turn gradually leads to non-IP networks. These continual changes in technology have resulted in the increasing complexity of business environments as well as enhanced business and earning models of individual firms.

The increases in the number of mobile telecommunication infrastructure investments, especially in new market economies, have been another key factor behind recent developments in the mobile telecommunication industry and its technologies. These developments continue today. Figure 4.1 shows how the market focus has been shifting away from advanced economies to new market economies as well as the development in mobile subscriptions from 2000 to 2011. These two major developments have driven many companies to make decisions related to strategies and operations, especially those concerning the disaggregation of their value and supply chains to match market requirements.

4.3.1 Methodology

I use a case study methodology to examine the following question: *How have offshoring and outsourcing advanced in global high-tech business networks and supply chains?* I thus use the multi-case approach to capture differences in firm behaviour supplemented with 14 qualitative interviews (Eisenhardt 1989; Yin 1994). Interviews were conducted between August 2010 and May 2011 with industry experts and current and former representatives of the mobile telecommunications industry. Each interview lasted for two to four hours. The interviews focussed on four major topics: (1) tracking key changes in the business environment; (2) tracking changes in strategies and how they were communicated to the suppliers; (3) tracking changes in supplier networks and (4) tracking how different suppliers reacted to the changes. The interviews were followed by telephone calls and emails to ascertain and confirm case data. Furthermore, a multi-case approach,

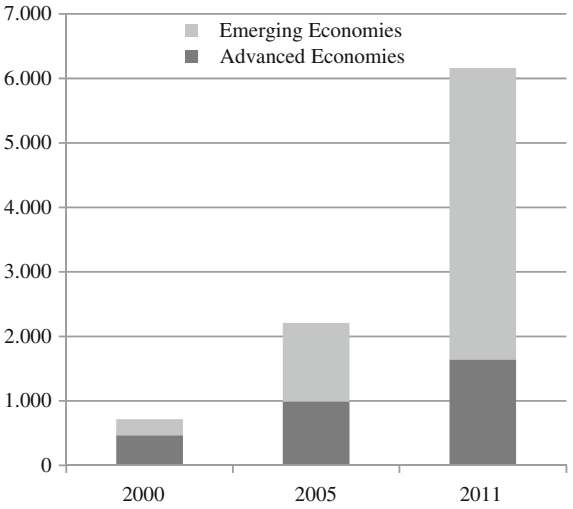

Fig. 4.1 Mobile phone subscriptions—advanced economies versus emerging economies (*Source* ITU statistics)

together with supplemented interviews, including a cross-case analysis, provides a richer and deeper understanding of micro-level processes of offshoring and outsourcing in the context of specific industry networks.

In my multi-case approach, I focus on describing changes in Nokia Networks, later nokia siemens networks (NSN), a Finnish telecommunications infrastructure business network, from 2000 to 2010 in terms of its (1) business environment; (2) offshoring and outsourcing strategies; (3) operational structures and (4) supplier network. The supplier networks perspective includes such firms as Efore, Alteams, Scanfil, Elcoteq and Incap. All of these firms have different and lengthy histories with NSN. The case firms were selected by direct contact with key personnel and requesting their participation. However, I wanted to ensure that there is a reasonable variance between the firms' strategic and operational processes. Therefore, I make reference to earlier studies and to recent changes in the industry networks' setting indicating that the emerging economies will continue to play an important role while considering new offshoring and outsourcing locations for research & development, production and after-sales services-related tasks.

4.4 Empirical Analysis

4.4.1 Increasing Complexity of the Business Environment

The competitive landscape of the mobile telecommunications infrastructure industry has been shifting away from a traditional hardware and software landscape to more of hardware, software and service landscape. This shift, together with technological changes within the mobile infrastructure industry, has rapidly

Table 4.1 The shift in competition in all Nokia Networks/Nokia Siemens Networks among all business areas

2000	2005	2010
Alcatel	Alcatel	Lucent-alcatel
Ericsson	Ericsson	Ericsson, Huawei
Motorola	Motorola	ZTE
Nortel	Nortel	NEC
Siemens	Siemens	Cisco
	Huawei	IBM
	Lucent	HP
	NEC	Accenture
	Cisco	Amdocs
	Juniper networks	Oracle
	IBM	
	HP	
	Accenture	

Source Nokia 20-F reports 2000–2010
Nokia Siemens Networks combines Nokia's Networks Business Group and the carrier-related businesses of Siemens Communications. In 2011, Nokia Siemens Networks completed the acquisition of certain parts of Motorola.

altered the nature of competition and firms' strategies, moving the firms towards new unknown (Bettis and Hitt 1995). Furthermore, new competition has emerged through new incremental technologies. It is meant to represent an increase in new competition for not only traditional hardware and software suppliers but also other players in a value chain, such as telecommunications operators.[1] Table 4.1 demonstrates change in the competitive landscape in the mobile infrastructure industry between 2000 and 2010 from the perspective of Nokia (Nokia Networks and Nokia Siemens Network), which can be considered one of the key players in the industry.

Therefore, the competitive landscape has been changing; for example, countries such as China have been offering incentives, such as tax incentives, for MNEs to continue to transfer operations from advanced economies to emerging economies. These initiatives, in addition to getting new business (i.e. new contracts), have been the main reason for MNEs' leading their supplier networks to move their operations as well.

This trend towards horizontal integration in the mobile infrastructure industry landscape seems to continue until the next disruptive technologies are launched. The next such disruptive technologies that could change the competitive landscape of the existing MNEs could be in the area of photonic switching (see Reiley and Sasian 1997) and/or quantum computing (see Williams 2011) technologies. These technologies will be made publicly available in the next ten to fifty years.

[1] Nokia Capital Markets Day—Simon Beresford-Wiley, 28.11.2006 (Source: www.nokia.com).

4.4.2 Changes in Global Operational Structures

MNEs engage in foreign direct investments (FDI) and own or in some way control value-added activities in more than one country (Dunning and Lundan 2008). These value-added activities refer to value chain frameworks by Kogut and Kulatilaka (1984) and Porter (1995) as well as Baldwin and Venables (2011) created to examine organisation-, firm- and global supply chain-level value-added activities and their contributions towards developing greater value contribution by any advanced and/or emerging economy. Another consideration of value-added activities is made by Baldwin (2006, 2009), who divides international trade into two separate flows of trade: trade in goods and trade in tasks.

In the case of the Nokia Networks Business Group and later Nokia Siemens Networks, the firms' internal value-added activities, that is, different operations of the firm, have been distributed worldwide. Prior to the merger of Nokia Networks Business Group and carrier-related businesses of the Siemens Communications Nokia Networks Business group, research & development (R&D) operated in four countries in several geographical locations. Following the merger, R&D operations expanded to three new countries, Greece, Germany and Poland. Today, Nokia Siemens Networks has R&D operations in nine countries providing value-added services to the rest of the Nokia Siemens Networks operations around the world. The piloting and industrialisation of the products were separated from the main research and development activities.

The number of production facilities has varied significantly. Typically, these types of changes in numbers are related to their proximity to the final customer, to mergers and acquisitions activities and to outsourcing agreements. Table 4.2 presents the changes in numbers and also changes in geographical locations. According to Nokia's 20-F reports from 2006 to 2007, Nokia increased the number of its production facilities in China. This increase occurred because Siemens were forced to reclaim a plant in Shanghai, due to the Siemens earlier agreements with BenQ, a Taiwanese firm. The changes in a need of an additional capacity are visible in Table 4.2, which explains how much additional production capacity has been contracted to EMS. Typically, these same partners also manage after-sales services.

Table 4.2 Nokia Networks, Nokia Siemens Networks production and supply chain management from 2000 to 2010 (*Source* Nokia 20-F reports 2000–2010)

2000	2004	2007	2010
12 plants	*5 plants*	*9 plants*	*8 plants*
5 in Finland	3 in Finland;	2 in Finland;	1 in Finland;
1 in United Kingdom	2 in China	3 in China;	3 in China;
5 in China		1 in India;	2 in India;
1 in Malaysia		3 in Germany	2 in Germany
Outsourced > 60 %	Outsourced > 50 %	Outsourced > 20 %	Outsourced > 29 %

Indeed, strategic and operational agility become a necessity when these changes in the global business environment and respective operational structures are shared and communicated to the global supplier networks. Gaining a strong strategic and operational commitment from the global supplier networks is a must. Gained commitment then enables the whole supply chain to adapt changes in a more agile way as required by the business environment and global operational structures.

4.4.3 Communicating Change to Suppliers

Nokia Networks, currently Nokia Siemens Networks, typically communicated its new goals and respective performance targets related to changes in the business environment and in its global operational structures well in advance, so that the supplier had time to plan and execute these new goals and respective performance targets.

> Typically, Nokia Sourcing Organisation communicated the targets four years in advance. This means that 2004 targets were communicated in 2000; 2005 targets were communicated in 2001 etc. … a good example of such communication is that in 2006 low cost production targets were communicated meaning that 80 % of production needs to be in low cost locations by 2010 (A former Elcoteq employee).

Sometimes, there was sufficient time to effect these requested changes, but sometimes, there was not.

> I remember an occasion in 2002 that they asked us to shift more production towards China in the area of PCBAs, but also provided us a target of localising 80 % of the components value by 2005 … some such transfers were made only because of the target, but no real need. In some cases the production transfers from higher cost production location to lower-cost production location did not cause any cost benefits (A former Aspocomp employee).

According to Doz and Kosonen (2008), this systematic way of planning strategic and operational changed jointly with its supply chain, which began at Nokia during the period from 1993 to 1997. Later on, between 1998 and 2004, the systematic planning process was called strategic sensitivity and enhancing resource fluidity (Doz and Kosonen 2008).

Nokia Networks' acquisition of Siemens brought some problems for Nokia Networks in that communication, as Siemens used different suppliers from those used by Nokia Networks. Unlike Nokia Networks' suppliers, Siemens' suppliers were more independent and owned all rights to their components and technologies.

> As a Siemens supplier we were selling the same components and technology to another customer, but in Nokia Networks' case we could not … also the consolidation of the Nokia Networks and Siemens supplier base caused some additional delays (A former Elcoteq employee).

Because of these differences, the merger between Nokia Networks and Siemens stopped the implementation of such communication of changes in the business

environment and in global operations structures for two years. Two years later, following the merger, a similar communication strategy was employed.

4.4.4 Changes in Supplier Networks

During the period from 2000 to 2010, there have been five major disruptions to Nokia Networks and Nokia Siemens Networks' Finnish supplier network: (1) Global EMS companies, such as Flextronics and SCI-Sanmina, continued acquiring Nokia Networks' Finnish suppliers, such as Kyrel and Ojala; (2) Global technology companies, such as ADC, Remec and Powerwave, continued acquiring Nokia Networks' Finnish suppliers, such as Solitra and Filtronics; (3) the merger between Nokia Networks and Siemens; (4) the merger between Nokia Siemens Networks and Motorola and (5) the introduction of Asian suppliers, such as Fingu and Hon Hai.

> Flextronics and SCI-Sanmina acquired companies to gain access to Nokia Networks business, just as they did with buying ABB's and Ericsson's plants earlier … unfortunately, later on all the works from the Finnish plants were transferred away first to Western Europe and later to Asia (A former Scanfil employee).

The citation above describes the way in which large EMS and technology companies operated during that period. Later, in the mid 2000s, these EMS and technology companies encountered significant difficulties because they could not operationally or financially absorb the volume of assets they had bought. These companies have since made progress in this regard.

> Elcoteq faced a problem with NokiaSiemens Networks because NokiaSiemens Networks discontinued producing products that we were manufacturing. That was the end of that relationship … and at the same time Jabil bought Siemens' old plant with a load guarantee. It was then also disastrous for Flextronics and SCI-Sanmina (A former Elcoteq Employee).

In a business marked by constant, fierce competition, business deals such as mergers or contractual load guarantees can cause problems for suppliers. Furthermore, these changes are often so sudden that companies do not have enough time to adapt.

Similarly, in the mobile phone industry, Asian suppliers began to gain shares as parts of supplier networks. Surprisingly, in the mobile infrastructure industry, this gain began to happen much later, in 2006. Furthermore, during the same period, Nokia Siemens Network's Finnish suppliers began to operate at full speed even though they entered Asia much earlier, until suppliers ran on low loads. Since 2006, the move of operations from Finland to Asia has occurred at a much higher rate.

> Unfortunately, that is now the mode of operation in several Finnish electronics companies (A current Efore employee).

In parallel to these major changes in the business environment and global operational structures, there have been many minor changes, which are discussed in greater detail in the next sections of this chapter.

4.4.5 Tracking Offshoring and Outsourcing Strategies

> The trend is obvious! With the financial support of emerging economy countries and because of the markets being moved to Asia and India we were moving our operations as well (A former Alteams employee).

Alteams, Efore, Elcoteq,[2] Incap and Scanfil are outstanding examples of this ongoing transformation. Initially, these firms' exploration of investing and operating offshore dates back to late 1990s. Efore is a firm that followed outsourced offshoring strategy, which then resulted as investing to own operations.

> Our offshoring strategy was based on a partnership with SCI (currently SCI-Sanmina). The collaboration was started in 2001 … Our outsourcing partner offered us a lower risk entry to China, but also to Brazil as well. Later on 2003 we started to expand our own production and we established our own production unit in China (A current Efore employee).

The others implemented offshoring strategies by investing to own offshoring operations from the start.

> "Markets guide and markets force" Jorma Tenkanen.[3]
> We were forced to follow our customer to be able to keep the business, even that there were no business; otherwise Nokia Networks would have chosen a local supplier … we were there only to gain from the tax benefits that were offered to Nokia Networks (A former Scanfil employee).

Elcoteq was in China and India namely because of other customers

> Elcoteq was a supplier for both Nokia Networks and Siemens in the area of Electronic Manufacturing Services, but approximately one year later after the acquisition of Nokia Networks and Siemens Elcoteq delivered the final product from their manufacturing units (A former Elcoteq employee).
> Incap NokiaSiemens network business was ramped down in 2007 (A current Incap employee).

The new offshoring strategy for all of these firms started to affect the manufacturing jobs in Finland quite rabidly. Already, in early 2000, hundreds of manufacturing jobs were cut. Later on, all the manufacturing jobs were transferred away to locations like China and India. As production started to shift quite rabidly in early 2000, a few years later, the research and development started to follow.

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[2] Elcoteq filed for bankruptcy in 2011.

[3] Jorma Tenkanen's presentation at KISA-MET seminar 19th May, 2005; http://www.sc-research.fi/fi/uutiset/030605.htm (information retrieved 14.11.2011).

> We started to consider offshoring of research and development already in 2002 … in 2005 it actually happened, and we established a research and development unit in Suzhou, China (A former Efore employee).

Efore's transfer of research and development operations to China cannot be considered very successful, as the employee turnover rate was initially high. The turnover rate was eventually normalised, encouraging Efore to establish another research and development unit in Shenzhen in 2010.

> Only platform R&D is left here in Finland; all other work has been transferred away (A current Efore employee).

A complete transformation in research & development and production occurred between the late 1990s and 2010. Table 4.3 explains how the geography of different activities has shifted away from Finland to lower-cost locations, primarily in China, but later in India as well. However, there are variations in strategies between the firms.

This move from Finland to China was also affected by the commoditisation of technologies. Commoditisation led to that the product architectures were shifted from single-product architectures to more modular product architectures. The move towards modularity has also led to additional cost reduction requirements. Because Efore has built its business on commoditised technology, Efore have had no other choice than to transfer its operations to lower-cost locations and to localise their supply network. This change was made to follow not only the industry-wide transformations but also their competitors. Furthermore, in commoditised technology business, product life cycles are typically short and feature many product modifications. It is often such that in Efore type of a business firms do not own significant intellectual property rights. This is the case with Efore, in that they do not own specific intellectual property rights in relation to their products, unlike their major competitors. Having no intellectual property rights can currently be considered a major risk to Efore's business, especially in China. Consequently, China has begun to renew their intellectual property rights strategy.

> Efore is a too small as a company to create IPR and fight back if somebody comes and sues us (A former Efore employee).

The two examples of Efore and Alteams, with their focus on technology, provide evidence of how NSN Finnish suppliers have been transferring their

Table 4.3 Changes in geographic locations

	2000–2004	2004–2008	2008–>2012
Research & development	100 % Finland	50 % Finland 50 % Asia	Majority in Asia
Production	Finland 80 % Asia 20 %	Europe 50 % Asia 50 %	Europe 20 % Asia 70 %
Aftermarket services	Mostly in Finland	Mostly Europe	Europe 80 % Asia 20 %

research and development, production and after-sales service operations from advanced economies towards emerging economies. Furthermore, the other three examples, Scanfil, Elcoteq and Incap, which have an electronic manufacturing service focus, provide evidence on how NSN Finnish suppliers have been transferring their production operations from advanced economies towards emerging economies, but only one out of the three has survived. Today, Scanfil is considered to be vertically integrated from the production perspective, offering different types of services from prototyping to serial production. Closeness to Nokia Siemens Networks design in Oulu has definitely been one of the key assets of Scanfil to continue producing for Nokia Siemens Networks.

4.4.6 Measuring Success

The average employee cost can be treated as one of the key performance indicators to measure the success of firms' offshoring and outsourcing strategies. However, there exist other key performance indicators, for example, costs of employees per operating revenue and working capital per employee.

Table 4.4 presents Efore's and Scanfil's average employee cost figures.

In contrast to Efore, Alteams, another technology firm, has been able to lower its average employee cost from 39.714 to 14.219€ from 2001 to 2010 through its structural transformation. Furthermore, similar trends can be identified among firms in the service sector. Compared with Scanfil Elcoteq, another service firm, the average cost of an employee has continued at the same level over the last 10 years (17.020€ in 2001, 12.481€ in 2004, 11.548€ in 2007 and 13.471€ in 2010). Incap follows the same pattern. Among all firms, Nokia Siemens Networks, Efore, Alteams, Scanfil and Incap, wage inequality continues to be the driver of firms' relocation of their global operational structures. The average cost of an employee has reversed from decreasing to increasing, and China is no longer an attractive location featuring lower average employee costs. It seems that in the future, relocations will be in two directions west from China and south from Europe, if the average employee cost continues to be a performance indicator. The average cost of an employee has reversed from decreasing to increasing, and China is no longer an attractive location featuring lower average employee costs.

Table 4.4 Average cost of employees

	2001 (€)	2004 (€)	2007 (€)	2010 (€)
Efore	32,906	29,366	22,417	23,200
Scanfil	12,482	21,291	14,265	14,219

Source Bureau van Dijk Electronic Publishing (BvDEP), ORBIS database

4.5 Conclusions and Discussion

In this chapter, I have examined the changes and challenges of the high-tech business environment of Nokia Siemens Networks and the firm's supplier networks and supply chain. I have studied the changes in Nokia Siemens Networks: (1) business environment; (2) offshoring and outsourcing strategies; (3) operational structures and (4) supplier network. Furthermore, I have examined the integration and the causality, how these changes are translated into firms' offshoring and outsourcing decisions in global supply chains during the period ranging from 2000 to 2010 to answer my research question: *How have offshoring and outsourcing advanced in global high-tech business networks and supply chains?*

In reference to my earlier studies (Seppälä 2010, 2012), there were six major findings discussed in detail: (1) the changes in the business environment were not properly understood; (2) suppliers did not have a strategy and structure to manage their own strategic thinking; (3) there was no collaboration between suppliers; (4) suppliers were running out of the financial capital needed to further invest to meet customers' technology and service requirements; (5) suppliers lacked global brand recognition and (6) technology commoditisation occurred much more quickly than expected, causing extensive cost reduction requirements that suppliers could not fulfil.

Because changes in the business environment of Nokia Siemens Networks were much slower and the product life cycles longer in comparison with the case of Nokia Mobile Phones, the industrial business network had more time to adjust to any requirements set by the business environment and Nokia Siemens Networks. That said, and due to the dynamics in telecommunications infrastructure business networks, findings one, two, four and six seem to be irrelevant to this discussion. However, findings three and five continue to be relevant here.

Based on this examination, there are two new major findings. Furthermore, two other findings are discussed: (1) structural changes in global supply chains and (2) technology commoditisation; the two are reported in separate sections. First, offshoring research & development, industrialisation and production networks have not always benefitted firms, especially suppliers. However, to be able to continue to operate in global supply chains, suppliers were forced to follow their customers. The current supplier networks from advanced economies were used not only because of their knowledge but also to fulfil the localisation requirements set by authorities for the lead firm. Localisation of a supplier network was not possible with local supplier networks, as local suppliers did not have the technological knowledge required. Furthermore, the lead firm wanted to fulfil their contractual obligations to obtain agreed local tax benefits. Firms' average employee cost can be treated as one of the key measures to explain the success or failure of such changes in operational structures. By lowering their average employee costs, suppliers have been able to survive in a volatile market.

Second, outsourcing research & development, industrialisation and production networks have not dramatically changed. However, to be able to continue to

compete in global supply chains, firms were adapting new business models alongside their customers. In the case of the Asian delivery model to customers, for example, the following characteristic was implemented: no extra premiums were charged for R&D efforts. This offer was partially why firms were investing in new services similar to their original strategies. These new services then enabled firms to continue to compete against their Asian competitors.

4.5.1 Structural Changes in Global Supply Chains

The dynamics in industrial networks that cause the disaggregation of global supply chains continue to be one of the key operational strategies that MNEs implement. This condition implies that the knowledge transfer—catch-up effect is continuing to close the skilled labour gap between advanced market economies and emerging market economies. Furthermore, the cost disparities between advanced market economies and emerging market economies, together with decreasing market unit prices, drive firms to offshore both routine and nonroutine tasks and both tacit and non-tacit knowledge-related tasks.

> It started, our production, as customer service operations only; products were actually manufactured elsewhere in the Americas and Finland and then transported to China … The main reason of doing so was just to fulfil the localisation requirements set by the local authorities (A current Efore employee).

To attract more foreign direct investments and to be able to maintain the current level of foreign investments, countries are setting new requirements for firms to localise parts of their research & development, industrialisation and production capabilities, that is, nonroutine and tacit knowledge-intensive tasks. Typically, these localisation requirements entailed the greater involvement of local firms.

> The average sales price decreased throughout 2000 to 2008 tens of percentages; together with weak Chinese currency it then forced us to transfer all our production to China to be able to compete against the local firms (A former Elcoteq employee).
> The transfer of the production has caused the transfer of R&D because with lower production margins in absolute money, you cannot continue to finance high-cost R&D operations in a higher cost country (A former Efore employee).

To be able to respond to local threats and increasing price competition, the firms continue to offshore routine and nonroutine, tacit and non-tacit knowledge-related tasks. There appears not to be any force that can stop this shift of power from advanced market economies towards emerging market economies.

This finding confirms the observation by Grossmann and Rossi-Hansberg (2008) that a decline in a labour cost of task has effects much like factor-augmenting technological progress. This trend began with an industrial network in advanced economies and has now become an industrial network in emerging economies.

4.5.2 Technology Commoditisation

Labour supply shortages, together with technology commoditisation, seem to be another key driver for firms to relocate their global supply chains from advanced market economies to emerging market economies. Simultaneously, with solving the problems in labour supply, tacit and non-tacit knowledge began to be relocated to emerging market economies.

> It all started with technology commoditisation; that was the reason why production was offshored (A former Elcoteq employee).
> We needed floor space for new products to be produced in our Finnish facilities (A former Scanfil employee).
> It continued as a must; you must offer it from a low cost location, otherwise we do not accept your offer (A former Elcoteq employee).

After transferring the production in relation to commoditised technologies, the firms then realised and remembered the facts in relation to physical contacts and geographic proximity between research & development and production units. Quite often, the transfer of production then caused the transfer of the research and development operations on commoditised technologies from advanced market economies to emerging market economies.

> It further evolved as a model that most of the research and development, industrialisation and production-related tasks and processes are nowadays done by industrial business networks in China and India (A current Efore employee).
> Nowadays we are left with small research units in Finland – let us see when that becomes a commodity! (A former Remec employee).

This confirms Blinder's (2007a, b) observation of a dichotomy between activities that require physical contacts and geographical proximity. This phenomenon began with labour shortage and technology commoditisation, causing the offshoring of production and related industrial supply networks. These events led to a condition 10 years later in which most of the product life cycle phases and tasks are carried out in Asian locations for both commoditised and emerging technologies. The process of transferring activities and tasks appears to evolve increasingly quickly.

4.5.3 Parting Thoughts and Conclusions

> The nature of international trade has changed.[4]

Recent findings have indicated that global supply chains continue to operate even in a finer distribution of labour (Baldwin and Venables 2011). Furthermore,

[4] Grossman and Rossi-Hansberg (2006).

the increasing separation of tasks related to research & development, industrialisation and production-related tasks (i.e. disaggregation of firms' cost centres) from the headquarters activities (i.e. firm profit centres) are causing the separation of trade in tasks from trade in goods (Grossman and Rossi-Hansberg 2006). However, the separation of value capture and value creation must also be considered.

> Offshoring continues (a former employee of Elcoteq).

The disaggregation of global supply chains continues to play an important role in firms' strategic decisions. New industrial networks are being transferred from advanced economies to be rebuilt into emerging economies. The current economic environment in advanced economies is accelerating firms' offshoring of activities. Firms continue to search for an optimal breakeven point and maximum financial returns on investments to be able to manage fluctuations in current and future economic environments.

Furthermore, firms are making strategic decisions in moving from emerging market economies back to advanced market economies. This change is due to increasing transaction costs in coordination and logistics. In doing so, firms are breaking up the Asian dominance and control of industrial business networks and in global value and supply chains, which then means that labour-intensive phases of product life cycle and respective tasks are transferred back to Europe and the US from Asia.

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