

SECTORAL ACTIVITIES PROGRAMME

Working Paper

**Subcontracting in electronics:
From contract manufacturers to providers
of Electronic Manufacturing Services (EMS)**

Gijsbert van Liemt

*Working papers are preliminary documents circulated
to stimulate discussion and obtain comments*

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Preface

This research on the shift of companies from being contract manufacturers to providers of electronic manufacturing services (EMS) was commissioned as a background paper to provide inputs to the meeting on the production of electronic components for the IT industries (April 2007). It is based on published company information and other secondary sources. The author was fortunate enough to also have been able to discuss the subject of this paper with people active in the industry in Europe, the United States and Asia, as well as with some whose business it is to follow developments in the industry closely.

Every effort has been made to be as accurate as possible but the reader should keep in mind that this is a rapidly changing, highly competitive and extremely innovative industry. What is accepted wisdom today may be old hat tomorrow. Also, many industry players are reluctant to discuss their performance, strategies and problems with outsiders. Subcontractors are notoriously careful when discussing their business. Good relations with their customers are essential.

The author wants to thank Paul Bailey, Judy Glazer and Carin Håkansta for their comments. Needless to say that all remaining errors and views expressed are the exclusive responsibility of the author. Writing on this industry is by its nature work in progress. The author welcomes comments at gbvanliemt@compuserve.com.

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Glossary

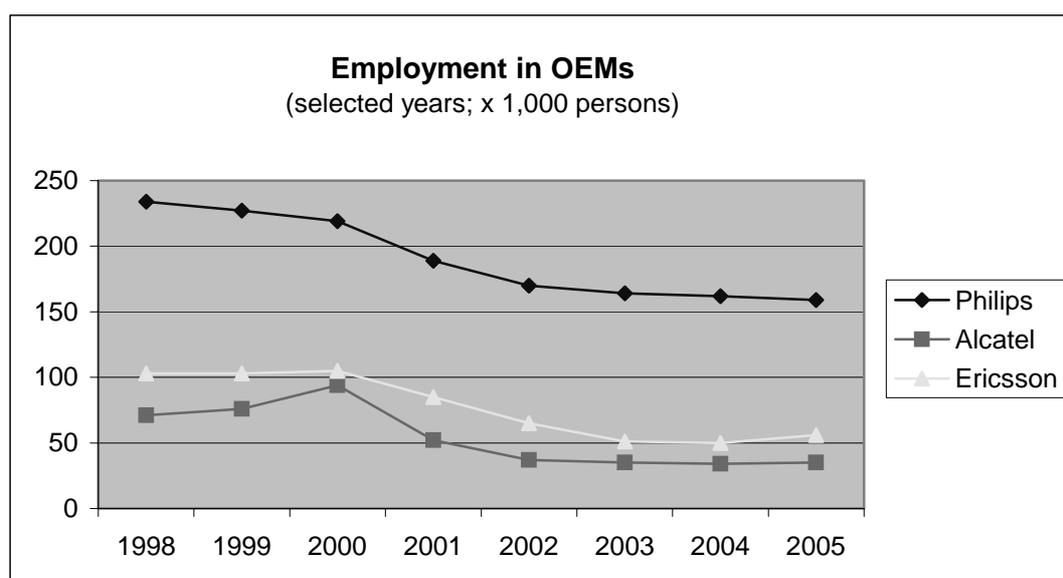
BTO	build-to-order
CDS	contract design services
CTO	configure-to-order
EMS	Electronics Manufacturing Services (a.k.a. contract manufacturers)
NPI	new product introduction
ODM	original design manufacturer (companies that design products and product platforms that are then sold to OEMs, system integrators and others who configure and resell them to end users)
OEMs	original equipment manufacturers(a.k.a. brand name companies; firms that sell finished goods under their own brand name without actually making them)
PCBs	printed circuit boards (are made of laminated materials and contain electrical circuits and connectors that interconnect and transmit electrical signals among the components that make up electronic devices).
RoHS	European Union Directive on Restrictions of Hazardous Substances (as a result of RoHS the use of lead and certain other specified substances in electronic products is prohibited in the EU)
WEEE	European Union Directive on Waste Electrical and Electronic Equipment

Introduction

When Serge Tchuruk announced in 2001 that he wanted *Alcatel*, the company of which he had been president since 1995, to become a company without fabrication plants (“une compagnie sans usines”) his remarks were met with indignation and disbelief. *Alcatel* had 120 production units and employed 110,000 people at the time. Yet, what Mr Tchuruk announced had been common practice in electronics’ companies’ on the other side of the Atlantic for many years. North American companies (such as *IBM* and *H-P*) had been outsourcing the manufacturing of their products to “contract manufacturers” both at home, and overseas in countries such as Brazil, China, Malaysia, Mexico, the UK as indeed France. Producers in Northern Europe (*Ericsson*, *ABB*) had started to do the same in the late 1990s. *Philips* and *Siemens* followed later.

The number of people employed by *Alcatel* more than halved between 2000 and 2004. At *Ericsson* the number also dropped by half in these years (see graph 1). In part, these declines were a reflection of the poor business environment of the early 2000s. But an important explanation for the steep decline in the numbers employed was also their decision to subcontract a growing range of activities, as indeed them selling off (“divesting”) to contract manufacturers entire plants including machinery, inventory and employees.

Graph 1



Source: Company information.

There are many contract manufacturers, but six stand out because of their size and international presence: *Celectica*, *Flextronics*, *Jabil Circuit*, *Hon Hai Foxconn*, *Sanmina SCI* and *Solectron*. These companies are the subject of this paper. Dubbed by some the best kept secret of the industry, they make mobile phones for *Ericsson*, *Motorola*, and *Nokia*; Ipods for *Apple*; printers for *Hewlett-Packard*; electronic games for *Microsoft* and hundreds of other electronic products for a variety of brand-names. They have factories all over the world; each had 2005 sales in excess of US\$7.5 billion. With over 50,000 workers each, they employ as many people as some of the well-known electronic brands they manufacture products for. *Hon Hai Foxconn* with over 200,000 people is the biggest employer of them all.

Faced with thin, shrinking (and sometimes negative) margins, the big contract manufacturers continually seek to expand or diversify into higher value added activities. They have broadened and deepened the range of services that they offer, in addition to branching out to other sectors, such as medical, automotive, space and aircraft. They now prefer to be known as providers of Electronic Manufacturing Services (EMS) to indicate just how their range of services offered has evolved. This paper will discuss their diversification and integration strategies. But as it is not always clear at which stage of this transformation process they are at any particular point in time (and given that for most contract manufacturing still constitutes the bulk of their business), we will be using the terms contract manufacturers and EMS providers interchangeably throughout the text.

This paper is organized as follows. We start in Chapter 1 with some brief remarks on the merits and demerits of outsourcing, as well as on its impact on the volume of international trade. Chapter 2 deals with contract manufacturing. It discusses why electronics and telecommunications OEMs (Original Equipment Makers, also known as “lead firms”, brand-names, or “production organizers”) make use of contract manufacturers (or Electronics Manufacturing Services-EMS- providers); how the industry has developed over time; and how the contract manufacturers distribute production among the many facilities that they operate around the world. Chapter 3 discusses the case of *Flextronics*, until recently the biggest EMS company. Chapter 4 briefly discusses some employment dimensions of contract manufacturing. The paper ends with a concluding section.

1. Subcontracting and International product fragmentation

1.1. Introduction: The trend towards outsourcing

Around the world, large companies try to become smaller in terms of employment (“downsizing”). Most companies now rely on others to look after their catering, cleaning, gardening and external security. Many have outsourced personnel management, IT services, logistics and transport. Everywhere, companies are focusing on their “core activities” (often ill-defined, and in practice subject to change over time).

Manufacturing was long seen as such a core activity. In a number of industries it still is. But in sectors such as clothing, automobiles or aircraft, with highly standardized production processes and great differences in the labour-, capital-, and skill-intensiveness of the different stages that make up these processes it is now common to outsource many of these stages. The more labour intensive stages are often the first. Branded companies (“lead firms”) increasingly focus on creating and marketing products.

Lead firms¹ resort to subcontracting because it helps them spread risks and lower costs. Subcontracting also enables them to gain access to key technologies, to reduce their need for working capital, and to adjust their levels of production more flexibly by passing on the burden of idle overheads to subcontracting firms. The advantages for subcontractors are that they can concentrate on production (sales are guaranteed within a set time span; no need to invest in marketing). There is a low risk of not being paid for the work (Van Liemt, 1992).

We will be using the terms subcontracting, outsourcing, and vertical disintegration interchangeably. The literature also uses different terms, depending on where the emphasis is being placed. “Offshoring” stresses the international dimension. Strictly speaking, “slicing up the value chain” and “production fragmentation” both refer to the phase preceding subcontracting: only after the production process has been split up in distinct activities can these be outsourced or subcontracted.

1.2. International product fragmentation and subcontracting

International subcontracting has been greatly facilitated by the easing of trade and regulatory barriers, together with cheaper and ever-improving international telecommunications infrastructure (especially the Internet), and standardization in international transport (sea containers being a prime example). To have certain segments of the production process done abroad can be challenging in terms of management coordination, quality control, intellectual property protection, tax treatment, and differences in legal treatment but it can be highly profitable as the examples of clothing, footwear, toys and sporting goods have shown.

¹ Or “production organizers”, which “decide what to produce, where, how and by whom, and from where to supply which market As the case may be, the production organizers sell brand loyalty; superior organization; their hold over the distribution network; access to a protected market; quality control (or a combination of these).” (Van Liemt, 1992, p. 312).

In economic terms, international production sharing introduces a new element in traditional trade models according to which countries specialize in final goods in which they have comparative advantage.

Production processes that permit fragmentation support a finer and more complex division of labour than those that do not. The various phases of production may now be spatially separated and undertaken at locations where costs are lowest. *Spatial dispersion of production allows the factor intensity of each component, rather than the average factor intensity of the end product, to determine the location of production.* The international division of labour now matches factor intensities of components with factor abundance of locations. (Arndt, et al. 2001, "Introduction", p. 2 in Arndt et al. – emphasis added).

1.3. International product fragmentation and the volume of international trade

International production fragmentation leads to expanding international trade flows because goods or goods in process cross multiple international borders in the course of their production sequence, generating international trade with each border crossing. The total amount of trade involving the goods while in process can be a multiple of the value added of that good (Athukorala et al., 2005). Yi (2003) gives the example of clothing. In some cases, American cotton is sent to Mexico, where it is spun into fibres. The fibres are exported back to the United States, where they are transformed into pieces of clothing. These pieces are exported back to Mexico, where they are sewn into clothing. And finally, the clothing is exported back to the United States. Clearly, international product fragmentation has contributed to the growth of world trade. The question is: but by how much? Several authors (Yi, 2003; Nordås, 2003; Athakorala et al. 2005) have addressed this question. The interested reader is referred to these sources.

The growth in international trade in parts and components gives some indication of the volume of international production fragmentation. World trade in parts and components increased from \$400 billion in 1992 to over \$1000 billion in 2003. Their share in total world manufacturing trade increased from 17 per cent to 23 per cent between those eleven years. Parts and components accounted for one-fourth of the total increment in manufacturing trade between 1992 and 2003 according to Athakorala et al. (2005). But parts and component trade provide only a proxy measure of fragmentation trade (Athakorala et al. 2005; Yi, 2003). On the import side, vertical specialization is just a subset of intermediate goods; it is those intermediates that are used to make goods for export. On the export side, vertical specialisation can include both final goods and intermediate goods. The concept is thus related to, but distinct from, intermediate goods.

Box 1

The growth of international trade and production fragmentation

Lower tariffs reduce the cost of foreign goods relative to domestic goods; imports and exports rise. This intuitive explanation is so simple and seemingly obvious that it hardly seems necessary to formalize it. Nevertheless, Yi (2003) who examined trade flows and tariff cuts in the last four decades of the last century sees two puzzles. First, since the early 1960s, worldwide tariffs have decreased by about 11 percentage points on manufactured goods, the dominant traded commodity. During this period, the world manufacturing export share of GDP has risen by a factor of 3.4, giving an elasticity of exports with respect to tariffs of around 20, which is much larger than what standard trade models would imply. The relatively small decline juxtaposed against the large increases in trade is a *quantitative* puzzle.

Second, the largest decline in tariff rates came early in the period, while the largest increases in trade relative to GDP growth came late in the period. the response of exports to tariffs has increased sharply since the mid 1980s. Between 1962 and 1985, the elasticity of trade with respect to tariffs was seven, whereas between 1986 and 1999 it was 50. This non-linear effect is a *qualitative* puzzle from the perspective of the standard models, because these usually imply little or no non-linear effects. Yi believes that vertical specialization is an important factor explaining the two puzzles. Vertical specialization could well account for about one third of the growth in trade in the last 20-30 years according to Yi (2003).

In sum, fewer and fewer goods are being produced at one single location. Standardization facilitates subcontracting. The Internet, lower trade and regulatory barriers, and cheaper and more efficient transportation make it feasible, attractive (if not imperative for staying in business) to have different components made, as indeed different activities performed at different locations around the world. Let us now take a closer look at the case of electronics.

2. Contract manufacturing in electronics

The pressure facing brand-name electronics companies has never been more intense. With ever-shorter product life cycles, speed and time are critical. Resources are scarce. The market is unforgiving. Our customers have to get it right the first-time, and get there fast. (Solectron AR 2002)

2.1. Introduction

The reasons for outsourcing discussed in the previous chapter (to spread risks and to lower costs) and the preconditions for doing so (the existence of clearly distinct stages in the value chain; global standardization of the manufacturing process) are valid for many parts of the electronics and telecommunications industry. In addition, the pressure on margins is great, competition is fierce, and market conditions are highly volatile.

From cell phones to Internet services to wireless applications, end users want more- but they're not necessarily willing to pay more for it. This forces brand-name companies to focus intensively on costs. (Solectron, AR, 2000).

Flexibility is at a premium. The days that production could be planned one year ahead are long gone. New products are being introduced at great speed. A product generation is measured in weeks and months rather than years, making production planning ever more critical but exceedingly difficult. Delivery times have become much shorter.

In 2001, the company Perlos, that makes handset covers for *Nokia* and *Ericsson* shipped these covers in a few weeks. Five years on, in 2006, the company had "one-tenth of the time we had then. From the time when we know what to deliver, we sometimes have as little as two hours to complete the delivery, sometimes as much as a week." says *Isto Hantila*, *Perlos'* CEO. Price setting has also changed. Selling a certain consignment of products used to be negotiated over for a week, says Hannu Savisalo, another Finland based telecom supplier. Today, the company has an hour to name a price. "The prices are negotiated constantly" (both quoted in Suominen, 2006)

The intensely competitive nature of the electronics industry, the ever increasing complexity and sophistication of electronics products, the pressure on OEMs (or brand names) to reduce costs, and the shorter product lifecycles have led to rapidly growing demand for advanced manufacturing capabilities and related services. In the past, brand-name companies could do it all themselves and remain competitive. Now, it takes too much time, money and energy to be an expert at everything. So OEMs focus on what they do best: develop innovative products and services, reach key markets and build brand loyalty.

Subcontracting to EMS providers allows OEMs to take advantage of the design, manufacturing and supply chain management expertise of EMS providers.

An outsourced manufacturing model enables us to access leading manufacturing technologies, leverage existing resources globally, lower costs, adjust quickly to market demand and decrease our investment in fixed capital. At the same time we retain in-house strategic management and overall control responsibilities associated with the supply chain including all customer interactions, customer service, order management, quality assurance, product-cost management, new product introduction and network solutions integration. (Nortel Networks, 2004 AR, p. xii)

2.2. The benefits of outsourcing in electronics

The benefits to OEMs of subcontracting to EMS providers can be summarized as follows. Subcontracting enables them to:

- reduce time-to-market and time-to-volume production for their products;
- lower operating costs, reduce capital investments and other fixed costs;
- improve inventory management;
- access world leading manufacturing technology, engineering and logistics capabilities;
- produce the same product on a global scale by making use of parallel production facilities;
- focus on core competencies;
- optimize supply chain management; and
- enhance purchasing power (EMS providers purchase large quantities of components and other raw materials and receive volume discounts and other more favourable terms from suppliers than their OEM customers would).¹

2.3. Development of the industry: From contract manufacturers to EMS providers

Since the early 1990s the leading contract manufacturers have greatly expanded their sales volume, the number of people employed, the range of services offered, as well as their “geographic footprint”, i.e. their presence outside of their country of origin, and in Asia in particular. At first, OEMs used contract manufacturers just to help them overcome supply problems when faced with a sudden surge in demand, especially in the assembly of Printed Circuit Boards (PCBs). Contract manufacturers generally only manufactured components or partial assemblies. Slowly, the cost advantages offered by outsourcing became more important. As industry-wide pressures to reduce costs intensified; more assembly processes were automated; and the capability of the contract manufacturers increased, OEMs started to rely also on contract manufacturers for more complex manufacturing services.

Forced by thin and shrinking margins in their traditional activities, the contract manufacturers for their part started to offer a broader range of services, particularly those that offered the prospect of higher levels of value added. They offered to purchase the needed components for customer firms, to engage in testing services, prototyping, new product introductions (NPI), repair services and end-of-life support.

With an eye to the higher margins achieved by the Original Design Manufacturers (ODMs – Taiwan, China based companies such as Arima and Compal), which in addition to assembly operations also take care of product design and development, and own the

¹ This can be a significant advantage. For certain products labour costs have dropped to 5 per cent of total costs due to automation. The cost of raw materials, on the other hand, can be as high as 80 per cent of the total (FEER, 20 Mar. 2002).

corresponding patents, the contract manufacturers began to also offer design services. Today, they want to be referred to as “providers of Electronics Manufacturing Services” (EMS) as this more accurately describes their ambitions and the broad range of activities that they offer. Leading EMS companies now want to manufacture and test complete systems; *manage the entire supply chains* for their customers; and offer *end-to-end services*, which include product design and engineering, volume manufacturing, final assembly and test, direct order fulfilment, after sales product service and support, and global supply chain management. They offer “green”, or environmental compliance, services to help customers comply with new environmental legislation including the EU’s RoHS and WEEE. This legislation and the compliance requirements impact the entire supply chain, causing operational, business and product-reliability challenges. They help OEM customers to address these compliance issues so that their products meet regulatory requirements.

2.4. Origin of the contract manufacturers

The big contract manufacturers come predominantly from the United States. SCI originated in the south-eastern part of the United States where it started life as a supplier of electronic equipment to NASA, the US space agency. In the 1980s it became a supplier to IBM’s personal computer (PC) program. *Flextronics* (see Chapter 3) and *Solelectron* started in Silicon Valley, California. *Solelectron* was set up by some former IBM engineers. The solar energy boom in the mid-1970s was a major influence in the creation of this company (*Solelectron* is a combination of “solar” and “electronics”). *Jabil Circuit* started in 1966 as a supplier to Control Data computers. Later it became one of the first contract manufacturers to also work for the automotive industry. *Jabil* also worked for IBM’s PC division early on. Toronto based *Celestica* is a spin-off of IBM. For years it was active as an “in-house” contract manufacturer to IBM. In 1993 it began to provide EMS services to non-IBM customers and in 1998 it was listed on the stock exchange (Lüthje et al, 2002, among others).

Among the leading non-US based contract manufacturers, Elcoteq, Europe’s leading EMS provider, started business in 1984 and was listed on the Helsinki stock exchange in 1997. Hon Hai Foxconn started in 1974 making plastic dials for black and white television sets. It was listed on the Taipei stock exchange in 1991 (see also box 2 on Hon Hai Foxconn).

Two key events have marked the growth and development of contract manufacturing. The first was the strategic decision in the early 1980s by IBM to use in its PCs only standard components (CPUs, motherboards, mice, disk drives, printers) produced by outside suppliers (Lüthje et al, 2002). “The PC created a mass market for personal computers as well as literally thousands of new producers of a diverse range of components, peripherals and applications” (Saxenian, 2006, p. 39).

The other was the decision by Cisco in the 1990s to outsource manufacturing on a significant scale. The company wanted to have as little to do with manufacturing as possible and concentrate instead on innovation and marketing. This strategy was initially derided in Silicon Valley where most companies had a strong engineering tradition, if they had not been founded by engineers. But when it became clear how successful Cisco’s strategy was, a shift in perception among its peers became evident. Pushed in no small

measure by the investor community, the status of ‘in-house’ manufacturing started to sink rapidly. Those companies which continued to do so had to explain why (Lynn, 2005).²

The contract manufacturing model has been advantageous for Silicon Valley start-ups, which lacked the resources to engage in vertically integrated manufacturing. In fact, today’s start-ups in electronics probably could not develop without the help of contract manufacturers. Lüthje et al (2002, p. 60) note that for venture capitalists in Silicon Valley it is standard to demand cooperation with contract manufacturers.

Contract manufacturers in turn see their expertise in e.g. prototyping and manufacturing process technology as a source of dynamism for the industry. Solectron notes that it is involved in developing products for emerging companies - typically in their embryonic stage – in a variety of markets.

Several global technology leaders ... started at Solectron as low-volume, embryonic OEMs, and have moved on to high-volume manufacturing and supply chain services We are proud to have been a strategic outsourcing partner from the beginning with such leading OEMs.

2.5. The big six

Among the many contract manufacturers, six stand out because of their size and global reach. *Sanmina*, *Celestica*, *Jabil Circuit* and *Solectron* had each around 50,000 employees in 2005; *Flextronics* had 92,000 employees, and Hon Hai Foxconn, the biggest of them all, over 200,000. They have in common that they have a large number of production facilities around the globe; and that they have grown rapidly. *Solectron* went from 11,000 employees in 1995 to 53,000 in 2005. In the same period, *Jabil Circuit* went from 2,600 to 55,000 employees. *Solectron* had sales of \$60 million in 1986; \$836 million in 1993 and \$8,400 million in 1999. *Flextronics*’ sales increased by a factor ten between 1997 and 2005 when it reached \$15,900 million (see graph 2 – also Chapter 3 on *Flextronics*). But whereas the others grew particularly fast in the 1990s, Hon Hai Foxconn grew fastest in the 2000s. It went from sales of \$2,800 million in 2000 to \$16,000 million in 2005 (or from sixth to first place in five years).

Box 2 Hon Hai/Foxconn

Hon Hai/Foxconn (HH/F) is both the biggest contract manufacturer and the least known. This company that describes itself as “the leading provider of joint-design, joint-development, manufacturing, assembly and after-sales services to global computer, communication and consumer electronics leaders” employs upward of 230,000 people and had estimated 2006 sales of \$27 billion.

HH/F’s chairman of the board (Mr Terry Gou) does not like nor seek publicity. The company publishes little up-to-date information about its operations. In fact, it actively dissuades people from writing about it and sues those who do with demands for compensation.

Hon Hai Precision Industry Co, that uses the Foxconn trade name, was founded by Terry Gou in 1974 with just US\$7,500 and a handful of employees to make plastic dials for black-and-white television sets. It has been listed on the Taiwan stock exchange since 1991. Its mobile phone subsidiary Foxconn International Holdings (FIH) is listed on the Hong Kong stock exchange. Mr Gou controls the group through a 25 per cent shareholding.

² A similar process occurred later with the relocation of manufacturing to China. In the late 1990s word was out that manufacturing in China led to huge cost savings. However, many OEMs considered investing in China as too risky. By encouraging contract manufacturers to start production in China for them they had the double advantage of reaping the savings of low cost production without risking any of their own capital (Lynn, 2005).

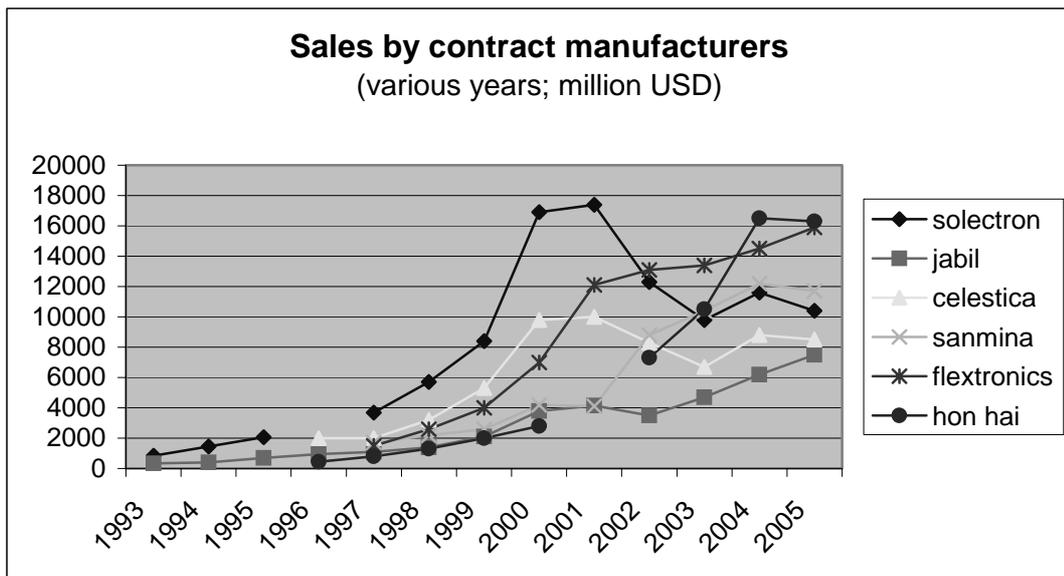
HH/F is headquartered in Tucheng, Taiwan, China. Its main manufacturing location is in Shenzhen-Longhua but it has several other industrial parks in China. Capacity outside China has grown through the acquisition of plants from major customers (e.g. H-P's desktop computer assembly plant in Australia; Motorola's mobile phone plant in Mexico), and by building new plants in e.g. Hungary, the Czech Republic, Scotland, the United States, and Brazil. The company claims to be the largest exporter from Greater China and the second largest exporter of the Czech Republic. FIH plans to open a mobile phone manufacturing plant in India.

Some of the world's best-known brands make use of its services. The company makes notebooks for Apple, Sony and Lenovo; desktop computers for H-P; Playstation consoles for Sony; mobile phones for Motorola and Nokia as well as printers, cameras, cable assemblies, enclosures, flat-panel displays, motherboards and servers for a variety of customers that also include Intel and Dell.

HH/F is a rarity in the EMS industry because it combines rapid growth with good profitability. How does it manage to do so? There is no unique answer to this. The company benefited from having started manufacturing in China as early as 1993. Other explanations include high levels of efficiency, employees working long hours, a strict, military management style, and a focus on a select group of big customers. Prick (2006) mentions its "seemingly unlimited devotion to serving its customers needs", and its "vertical-plus-assembly-plus-design" model. HH/F started as a component supplier and subsequently "integrated up" the value chain into modules, circuit boards and enclosures; and later into motherboard and systems assembly. He argues that the gross margins (of up to 30%) on its modules counterbalance the low margins on traditional assembly work (which are in the 6 to 7% range) making that HH/F "can offer quotes 10 per cent to 20 per cent less than its competitors".

Source: Company information (www.foxconn.com/SALES/serb.asp accessed on 15 Dec. 2006); Bloomberg; Business Week; Datamonitor; EMSNow; Far Eastern Economic Review; Forbes; Helsingin Sanomat; Pick, 2006; Taipei Times; Wang, 2005.

Graph 2



Source: Company information.

(Note: The above graph is based on different sources, with company information being the main one. Nonetheless, the information given should be treated with care as on occasion different sources give different sales figures. Even the companies themselves restate earlier figures in light of the consolidation of acquisitions, or the deconsolidation of spin-offs).

The OEMs make use of different contract manufacturers just as the contract manufacturers work for different OEMs (see also the introduction). For example, *Hon Hai Foxconn* counts among its clients: Apple, H-P, Intel, Dell, Lenovo, Nokia and Motorola. *Flextronics* works or worked for: Ericsson, Motorola, Siemens, Cisco, Microsoft, Sony, Casio, Nortel and Philips. *Sanmina-SCI* has among its clients Nortel, H-P, IBM and Alcatel; and *Jabil Circuit Marconi*, Philips, NEC and H-P.

2.6. Diversification

Traditionally, the contract manufacturers have been active in communications (including mobile phones and networking equipment), personal and business computing (including storage), consumer electronics (including playstations), semiconductor systems and testing (see also Chapter 3 on the case of Flextronics). In recent years they have tried to deepen the range of services that they offer (see above, section 2.3), to broaden this range, in addition to developing new markets. One of these promising areas is the automotive sector, perhaps no surprise given the high share of electronics in the value of today's automobiles. Automotive made up 3.2 per cent of sales at Solectron and 14 per cent at Jabil Circuit in 2005. Defence and aerospace have also been earmarked as growth sectors. This sector is particularly important for *Sanmina* since its 2001 merger with *SCI* (short for Space-Craft Inc.) that has been a supplier to the defence and aerospace industries since the early 1960s. Medical equipment has also been identified as an "underpenetrated target market". *Sanmina* is active in e.g. magnetic resonance imaging equipment, blood glucose meters, respiration monitors, ventilators, infusion pumps, thermo-regulation devices. Medical equipment makes up a large and fast growing part of *Jabil's* activities. *Jabil* believes that it is well placed for further expansion in the medical, instrumentation and industrial field.

Two critical market dynamics favour *Jabil* to capture customer in this specialized sector: regulatory mandates and company longevity and reliability. Strict regulatory mandates permeate the industry and *Jabil* has 21 plant sites in ten countries that hold certifications to manufacture products to these industry specifications. Every key aspect of our operations and processes are documented and traceable. Reliability is a critical issue for this industry and *Jabil* has a stellar track record of manufacturing execution, management longevity and financial stability" (*Jabil Circuit*, 2005 AR).

However, the problem with these "new" markets is that they do not grow as fast as computers and telecommunications; that the size of the markets is smaller; and that production volumes are lower than those at traditional markets (thus making them less suited for the contract manufacturing model).

2.7. Determinants of sales volume growth

The degree to which OEMs make use of contract manufacturers differs by company and by sector. Computers and peripherals, and (to a lesser extent) telecommunications make most use of subcontractors. American companies (Hewlett Packard; Apple; Cisco) make intensive use of outsourcing; European companies less (but this is growing) and Korean and Japanese companies very little (NEC and Sony are exceptions).

The main determining factors for contract manufacturing growth are:

- (1) *The dynamism (or lack of it) that OEMs encounter in their end markets.* Here it is useful to make a distinction between the period pre- and post-2001. The 1990s ("dot com boom"; "millennium hype") was a period of boundless optimism and high growth in the electronics business, which peaked in 2000. The years 2001 and 2002 were the dark years when demand and production declined. Since 2003 the industry has been growing but at a lower pace than in the 1990s.
- (2) *The degree to which existing clients continue to outsource production.* The weak economic environment of the early 2000s drove EMS customers to increasingly outsource their products in an effort to reduce costs and increase flexibility.
- (3) *The extent to which new clients in traditional or new industries start to make use of the outsourcing model.* Opportunities to win additional business from OEMs in certain

markets or industry segments that have yet to substantially utilize EMS providers are the Japanese market and the industrial, medical and automotive segments (see above).

- (4) *OEM divestures*. OEMs transfer entire manufacturing operations to EMS partners. Under these agreements, the contract manufacturer generally acquires the inventory, equipment and other assets from the OEM, and leases or acquires their manufacturing facilities, while simultaneously entering into supply agreements ranging from two to five years for the manufacturing of their products. In these divestitures, OEMs typically agree to purchase from the new owner their requirements for particular products in particular geographic areas and for a specific period of time but do not commit to purchasing minimum quantities of products. To contract manufacturers the divestitures can be attractive particularly when these enable them to access new customers, technologies and geographical markets, and to strengthen the implementation of their vertical integration strategy.
- (5) For the big contract manufacturers there is a fifth factor: *concentration*. In the past, the acquisition of other EMS providers has provided a significant contribution to their growth. This includes mega mergers (such as *Sanmina* taking over *SCI*; or *Solectron* taking over the electronic assembly operations of Singapore's *Natsteel* in 2000) as well as dozens of smaller-scale take-overs. As a result, concentration has kept increasing. In 1999, the ten largest EMS firms held 42 per cent of the market. By 2003 this share had risen to 70 per cent.

The contribution of each of these factors to the overall growth of the EMS providers naturally differs by company and by time period concerned. Jabil Circuit (AR 2005) quantified the contribution that different factors made to its 2005 sales growth as follows: "conversion to the outsource model" was found to be responsible for 51 per cent; new customers for 24 per cent; consolidation of outsourcing suppliers 20 per cent; and other 5 per cent.

All in all, the market for Electronics Manufacturing Services (EMS) grew rapidly in the 1990s (by 25 per cent per year on average). The 2001-2002 downturn created huge overcapacity in the EMS industry and led to much uncertainty and soul searching about what future growth prospects would be. Faced with numerous order reductions, reschedulings and cancellations, the industry was forced to restructure and cut capacity in the light also of continued pricing pressures. Customers' profits dropped precipitously, and many OEMs abandoned local manufacturing for lower cost sites.

These Original Equipment Makers (OEMs) made tens of thousands of people redundant so as to cope with the drastic slowdown in demand for their services. The impact on the EMS firms was ambiguous: on one hand they also made tens of thousands of people redundant. At *Celestica*, around 26,000 employees were made redundant in connection with the restructuring activities (70 per cent of the employee terminations were in the Americas, 25 per cent in Europe and 5 per cent in Asia). Over 40 facilities were closed or downsized. At *Solectron*, in three years around 27,000 full time positions were eliminated, primarily in the Americas and Europe. Overall capacity was cut by 25 per cent and staffing levels by 30 per cent (see also Chapter 3 on *Flextronics*). On the other hand, the crisis offered contract manufacturers many opportunities to buy up entire OEM plants identified for divestiture.

2.8. Internal International Division of Labour

The big North America based contract manufacturers have become increasingly international in their operations. Flextronics opened a facility in Singapore as early as 1981, but the main period of expansion outside North America was in the 1990s. *Solectron*

became active in Malaysia (Penang) in 1991. *Celestica* went from operating two facilities in North America in 1996 to operating 24 facilities in eight countries only two years later.

The period after 2000 saw an intensification of the movements towards Asia and to low-cost locations. The two movements overlap but they are not identical. The move towards “low cost geographies” has both a regional and a global dimension. From a regional perspective, it involves the move of the industry from the United States and Canada to Mexico, from north-western Europe to eastern Europe, and from e.g. Singapore to Indonesia. Globally, there has definitely been a move towards Asia and to China in particular. The following data illustrate these points.

When *Celestica* started its restructuring in 2001 it had 81 per cent of its facilities in “higher-cost geographies. Four years later, in 2005, the situation had been reversed: it had 80 per cent of its employees in “low-cost geographies”. By 2005 Flextronics’ net sales in the Americas, Europe and Asia represented 17 per cent, 35 per cent and 48 per cent of total net sales respectively. Tables 1 and 2 give the situation for Solectron and Celestica. A key competitive advantage of Taiwan’s *Hon Hai* is its presence in mainland China (see also box 2).

Table 1. Solectron: sales by main region (various years; %)

Year	US	Other America	Europe	Malaysia	China	Other Asia
1995	62			38		
2000	46	13	24	10	7	
2002	39	12	17	12	21	
2004	28	16	14	16	17	10

Source: Solectron, annual reports (various years).

Table 2. Celestica: sales by main region (various years; %)

Year	Americas	Europe	Asia
1996	100	–	–
2001	62	29	9
2003	46	21	37
2005	36	18	47

Source: Annual reports, various issues.

The Asian region is attractive because it is cost competitive, has a strong, well-developed supply base and has the world’s fastest growing consumer end market. It also has an ample supply of highly educated engineers at competitive costs. *Solectron* is expanding not only its Asian manufacturing capacity, but also its design, supply-base and post-manufacturing services there. *Sanmina* has design centres in Asia. *Jabil Circuit* has its product development headquarters in Shanghai, in addition to design centres in India and other locations in China. *Hon Hai* is opening a R&D centre in Tucheng (Taiwan, China) that will employ 3,000 people and will complement its other research centres in Tokyo (for precision machinery), Beijing (for nanotech research), and San Jose, California (Chung, 2004).

How do EMS providers distribute production among their many plants? Faced with small and declining margins and within the overall imperative of producing with short delivery times, EMS firms have to optimize the use of available capacity globally and

across regions. They also have to optimize the match between product mix and services offered on the one hand, and available skills and expertise at each location, on the other.

Many, partly interrelated, factors play a role. One key factor is to be close to the OEM's and their customers' end markets. A leading *Nokia* subcontractor commented on the move of its production facilities to Chennai, India where Nokia was opening a big factory: "the logistics cycle is so frenetically fast that we do not have the time to import products or components to India from abroad" (Suominen, 2006).

Low labour costs and closeness to supplier industries are also key factors. When closeness to the OEM is also critical, which of these factors will prevail? The relative weight of each (and thus the decision where to locate) may well change over time and over the product cycle. Take Mexico and China. When *Microsoft Corp.* was preparing to launch the Xbox, in mid 2001, it chose to centralize production for the United States market at Flextronics' Guadalajara facility so that its engineers could easily fly down for last-minute design tweaks. However, a year later Microsoft transferred production to two Chinese plants. The main reason according to *Microsoft's* manager in charge of Xbox hardware was that: "China is closer to our supply base. Most Xbox components come from the Far East". (quoted in Smith, 2003, p. 25).

With the contract manufacturers becoming involved in more and more complex activities (new product introductions; prototype development; repair services) and serving an expanding range of industries, their decisions where to locate which activity, becomes a sophisticated exercise. *Sanmina*, which manufactures products in over 20 countries on five continents, has located near customers and their end markets those plants that are focused on final system assembly and test, while its plants located in lower cost areas engage primarily in less complex component and subsystem manufacturing and assembly. *Solectron* (AR 2005) describes in detail how the company has organized its internal division of labour in the main regions where it operates.

Box 3
Global presence of Solectron

Our *US facilities* focus on higher-value added activities, such as design services; NPI; system integration and testing; product fulfilment; repair and logistics; as well as the manufacture of lower volume, highly complex products.

Our *facilities in Latin America* support the North and Latin American markets particularly for high volume products. Mexico's proximity to North America is useful for production of low cost and time to market, and/or geographical diversity are particular concerns for OEMs. We operate facilities that provide design, manufacturing, and post manufacturing services in the US, Canada, Mexico, Puerto Rico and Brazil.

Our operations in the *Asian* region offer high- and low-volume and basic and high complexity manufacturing to many geographic markets around the world. In addition to manufacturing, our facilities in Asia provide design services; NPI; system integration and testing; product fulfilment; repair and logistics.

In *Western Europe* we concentrate on higher value added services such as design; NPI; high-complexity, low-volume manufacturing; system integration and testing; product fulfilment; parts management; logistics and repair. Eastern European locations provide lower-cost, higher volume electronics manufacturing services for the West European market.

2.9. Global presence as a competitive advantage

The big contract manufacturers now have a presence around the globe. This enables them to manage the inflow of components worldwide, optimize production between factories and continually balance inventories with demand. *Celestica's* global network of facilities enables it to simplify and shorten its supply chain. In turn, this allows it to

significantly reduce the time it takes to simultaneously bring products to key markets. This has become a key competitive advantage.

Most of our customers compete and sell their products on a global basis. As such they require global solutions that include regional manufacturing for selected end markets, especially when time to market, local manufacturing or content and low cost solutions are critical objectives. (Sanmina, AR, 2005)

Thanks to the Internet, all relevant information can be accessed immediately when a contract manufacturer is producing at several continents. The ability to launch the same product in different parts of the world simultaneously can be a major competitive advantage. In fact, mobile phone giants such as *Nokia* demand that the contract manufacturers it works with are global just like *Nokia*. One reason for the ongoing concentration among contract manufacturers is that OEMs want to limit their partnerships to top-tier EMS providers with the scale, capital and global reach to provide comprehensive global solutions (*Jabil* AR 2001).

The competitive importance of the global presence is underscored by *Hon Hai*, which from a low-cost Chinese basis has been diversifying geographically by buying up facilities and building new plants in Europe and the Americas. In addition to China and Taiwan, China, *Hon Hai* has facilities in the Czech Republic, Hungary, Australia, Mexico, Brazil, Scotland and the United States (see also box 2).

2.10. Vertical integration vs. *virtual* vertical integration

As contract manufacturers take on more tasks and deepen the range of services offered, they become more vertically integrated. *Hon Hai* considers it to be a key factor in its success that it can make everything from components to finished products. By manufacturing many components on its own, it can work with fewer suppliers. As a result it can undercut its rival's prices by as much as 20 per cent – and generate better margins (BW, 20 June 2005). Another contract manufacturer (*Sanmina*) argues that “by manufacturing key system components and subassemblies ourselves, we enhance continuity of supply and reduce costs for our customers”.

But not all EMS providers believe in the virtues of vertical integration. *Celestica* (AR 2001) considers that by focussing on its horizontal service offerings (design, assembly, test and repair) it has the best capability and global scale to provide the most competitive and most flexible offering. Vertical integration would divert capital to non-core operations and lead to competing with its suppliers. “We feel strongly that our suppliers ... typically will have better scale, better focus or better deployment of what is a non-core service to us but core to them”. Instead it favours a “*virtual* verticalization” model that allows it to provide its customers with the best solution without owning those services.

Doubtlessly, there are more angles to the vertical vs. the virtual integration model. The strategy to become more vertically integrated is nonetheless an interesting one for EMS companies that owe their growth if not their existence to OEMs wanting to become less vertically integrated. It stands to reason that sooner or later, the vertically integrated EMS providers must also decide which are their core and which their non-core activities. Judging by some recent divestures among these EMS providers this process may well have already begun.

3. The case of *Flextronics*¹

Flextronics started in 1969 as a small business in Silicon Valley where it provided circuit board assembly (“board stuffing”) to local companies that needed extra capacity for periods of peak demand. Its customers provided both the raw materials of the printed circuit board and the components needed to be added. In 1981, it opened a facility in Singapore.

Today, *Flextronics* is one of the world’s largest contract manufacturing firms. In 2005, its worldwide sales were \$15,900 million with the Americas, Europe and Asia representing 17 per cent, 35 per cent and 48 per cent of total net sales respectively. In that year the company had 92,000 employees and total manufacturing capacity of approximately 12.8 million square feet in over 30 countries (see also Annex 3.1). It provides electronics manufacturing services (EMS) to original equipment manufacturers (OEMs) in:

- handheld devices such as cellular phones and personal digital assistants (PDAs);
- computer and office automation (incl. copiers, scanners, desktop and notebook computers, and printers);
- communication infrastructure (incl. wireless base stations, routers and broadband access equipment);
- consumer devices (including set up boxes, cameras and home entertainment equipment);
- information technology infrastructure (incl. servers, workstations, storage systems and mainframes);
- a variety of other industries such as the automotive and medical industries.

In 2005, *Flextronics*’ main customers were *Alcatel*, *Motorola*, *Siemens* and *Sony Ericsson* (for mobile phones, accessories, and telecommunications infrastructure); *Dell* (desktop computers); *Hewlett-Packard* (printers); *Casio* (consumer electronics); *Nortel* and *Ericsson* (telecom infrastructure); *Microsoft* (computer peripherals and electronic games); and *Xerox* (office equipment and components). Its top ten customers made up 62 per cent of sales in 2005, with two of these (*Sony-Ericsson* and *H-P*) accounting for between 10 and 15 per cent of sales.

Flextronics considers that its competitive strengths lie in its *global presence* and *extensive design and engineering capabilities*. The company designs, develops and manufactures components (such as camera modules) and complete products (such as cellular phones) for sale under the OEMs’ brand names; its *vertically integrated end-to-end solutions* enable it to design, build and ship a complete packaged product. It offers *low cost manufacturing services* (in 2005 more than 70 per cent of its manufacturing capacity was located in low cost locations such as Mexico, Brazil, Poland, Hungary, China and Malaysia); and *advanced supply management* (it purchased more than \$14 billion worth of components in 2005).

¹ Source: *Flextronics* 2005 AR and other company information.

Flextronics generates most of its revenues from *assembly and manufacturing* operations, which includes Printed Circuit Board (PCB) assembly and assembly of systems and subsystems that incorporate PCBs and complex electromechanical components. It also offers computer-aided testing services for assembled PCBs, systems and subsystems. It is an industry leader in high-density, multilayer and flexible *printed circuit board manufacturing*. It manufactures Printed Circuit Boards on a low-volume, quick-turn basis, as well as on a high volume production basis. Its quick-turn prototype service allows it to provide small test quantities to consumer's product development groups in as little as 24 hours.

With a global team of 6,000 *design* engineers the company offers a range of services from Contract Design Services (CDS), where the customer purchases services on a time and materials basis, to original product design and manufacturing services, where the customer purchases a product that is designed, developed and manufactured by *Flextronics*.

Its worldwide *logistics* services include freight forwarding, warehouse/inventory management and outbound/e-commerce solutions through its global supply chain network. Flexible, just-in-time delivery programs allow product shipments to be closely coordinated with customers' inventory requirements. Increasingly products are shipped directly into customers' distribution channels or directly to the end user. Its *inventory management expertise* enables it to achieve competitive cost reductions and reduce total manufacturing cycle time for its OEM customers. Its *after-market* services include product repair, remanufacturing and maintenance at repair depots, logistics and returns processing.

In its *industry parks*, third party suppliers of components are located in its immediate vicinity so as to reduce material and transportation costs, simplify logistics and facilitate inventory management (see box 4).

Box 4
Flextronics industry parks' concept ("campuses")

Flextronics operates fully integrated industrial parks in Brazil, China, Mexico and Poland. These are self-contained campuses in low-cost regions where it co-locates its manufacturing and logistics operations with its strategic suppliers allowing it to minimize logistics costs throughout the supply chain. Co-location also reduces manufacturing cycle time by lowering distribution barriers, improving communications, increasing flexibility, lowering transport costs and reducing turnaround times. Each park incorporates the manufacturing of PCBs, components, cables, plastics and metal parts needed for product assembly.

Flextronics' global *workforce* more than doubled between 2001 and 2005 to 92,000 people. In fact, the gross increase was 28,000 higher. That is the number of people made redundant during these years. The vast majority of those made redundant were active in North America and Europe. The company closed many facilities in a near-continuous restructuring exercise that saw a shift of operations from higher to lower cost locations and from the United States (and Europe) to Asia.

Annex 3.1

Flextronics Global Locations (July 2006)

Corporate Headquarters
Flextronics International Ltd
2 Changi South Lane
Singapore 486123

Africa	South Africa	Randburg
Asia	China	Beijing, Changzhou, Dongguan, Doumen, Gongming, Guangzhou, Nanjing, Qingdao, Shajing, Shanghai, Shenzhen, Xixiang, Zhuhai
	Hong Kong	Tsuen Wan
	India	Bangalore
	Japan	Aichi Okaya
	Korea, Rep. of	Gunpo
	Malaysia	Melaka, Penang, Senai, Shah Alam, Tampoi
	Singapore	Singapore
	Taiwan	Taipei
The Americas	Brazil	Manaus, Resende, São Paulo, Sorocaba
	Canada	Calgary, Montreal, Ottawa
	Mexico	Aguascalientes, Guadalajara
	United States <i>California</i>	San Diego, San Jose
	<i>Illinois</i>	Elk Grove Village
	<i>Massachusetts</i>	Boston
	<i>Minnesota</i>	Northfield
	<i>North Carolina</i>	Raleigh
	<i>Oregon</i>	Hillsboro
	<i>Tennessee</i>	Memphis
	<i>Texas</i>	Dallas, Houston
Europe	Austria	Althofen, Vienna
	Czech Republic	Brno
	Denmark	Skive
	Finland	Haapajarvi, Kuopio, Oulainen, Oulu, Sievi
	France	Montilliers, St. Etienne
	Germany	Boeblingen, Paderborn
	Hungary	East Hungarian Industrial Park, West Hungarian Industrial Park Tab
	Ireland	Cork, Dublin, Limerick, Shannon
	Israel	Eilat, Migdal-Haemek, Tel Aviv
	Italy	Milan, Treviso
	Netherlands	Venray
	Norway	Oslo
	Poland	Gdansk

Sweden	Gothenburg, Kalmar, Karlskrona, Linköping, Stockholm
Switzerland	Baar
Ukraine	Kiev, Vinnitsa
United Kingdom	Belfast, Northern Ireland; Birmingham, England; Bristol, England; Larkhall, Scotland; Linwood, Scotland; Lutterworth, England; Newbridge, Scotland; Slough, England; Warrington, England

Source: Flextronics.

4. The employment dimension

4.1. Introduction

Contract manufacturers are now responsible for a sizeable share of global electronics and telecommunications manufacturing. Their share of employment is significantly higher as it is their business to do the more labour intensive stages of manufacturing. For individual countries (Mexico, Hungary, the Czech Republic, China), where they have concentrated their activities, their significance is even higher.

The world electronics and telecommunications industries grew quickly up till the early 2000s to be followed by a slowdown and a modest recovery. The effect of these demand fluctuations on the contract manufacturers (or EMS providers) was twofold. On one hand they suffered from the slowdown in end-demand of the early 2000s just as the OEMs did.¹

On the other hand, they benefited from the accelerating trend among OEM companies to outsource production. Contract manufacturers also bought up many OEM facilities earmarked for divestiture. On balance, employment levels at e.g. *Flextronics* and *Jabil Circuit* more than doubled between 2000 and 2005 even though *Flextronics* alone made some 28,000 people- mostly in North America and Europe- redundant in that period. Some contract manufacturers now employ as many if not more people as the OEMs do (see table 3).

Table 3. Number of employees at OEMs and contract manufacturers (2005, selected companies)

Hon Hai Foxconn	230 000+*
Sony	150 000
Hewlett Packard	150 000
Philips	120 000**
Flextronics	115 000**
Nokia	58 000
Jabil Circuit	55 000
Solectron	50 000

Underlying the questions of which facilities to acquire, which to close, and where to open new ones is the ongoing strategic re-orientation of both the OEMs and EMS providers. The critical questions have become - where to situate the company in the value chain and what is a core activity and what is not - and not just for OEMs but also for EMS providers, as the latter seek to deepen the range of services offered, become more vertically integrated, look for ways to cut costs, and seek to establish a global presence.

In this strategic re-orientation, the geographic balance of production and sales of the big EMS companies has shifted towards the Asian region. Employment has naturally followed and a growing share of EMS jobs is now found in Asia and in China in particular,

¹ Lucent's employment dropped from 106,000 to 40,000 between 2000 and 2002 (FT 14 Sep. 2002). Motorola reduced its headcount by one third, or nearly 50,000 in that period (FT, 28 June 2002). At Alcatel the number of people employed dropped from 130,000 to 60,000 between 2000 and 2003.

where roughly one-third of all jobs in electronics are (ILO, 2007). In part, this move to Asia, where labour costs are often low, is a logical consequence of the focus on cost cutting that has become so all-important since the turn of the century. But there are other reasons too. The Asian region is home to some huge and fast-growing markets. The OEMs are establishing more and more production facilities there, virtually obliging EMS providers to follow. The Asian region's share of R&D is increasing. And the region offers highly skilled, educated and motivated workers at competitive costs. The assumption that only simple, assembly-type jobs were being relocated to Asia has long ceased to be valid.

4.2. The need for flexibility and the pace of production

The shifts in aggregate demand in end-markets and in the volume of production at the EMS providers are only one dimension of the demand fluctuations that the industry is facing. EMS providers have difficulty forecasting demand. Customers are reluctant to commit to long-term production schedules, making it difficult to schedule production and achieve maximum efficiency in manufacturing. In addition, anticipated orders from customers may fail to materialize and delivery schedules may be deferred as a result of changes in customers' business needs.

New products are being introduced at a fast pace. Some of these may fail to generate the demand expected. Others may be a great success with sales volumes far exceeding expectations. In both cases it is critical that production can be adjusted rapidly up or down. A product generation is measured in weeks and months rather than years, making production planning ever more critical but exceedingly difficult.

How to cope with demand fluctuations (and how to distribute production among their many facilities around the world) is a principal management challenge for the EMS providers. There is a premium on the capability to adjust production quickly to demand changes.

Producers expect their workers to play a key role in the upward and downward adjustment of production volumes through shift work, irregular hours, overtime and the use of temporary staff. Short-term contracts are being used to make it easier to adjust staffing levels. Lüthje et al (2002) found that temp agencies supplying over 50 per cent of the workforce in US contract manufacturers were no exception. Outside of the US, contract manufacturers also make intensive use of short-term contracts and temp agencies. One major contract manufacturer was found to hire 80% of its staff from temp agencies at one of its Mexican facilities.

4.3. Divestitures

The contract manufacturers play a major role in the global restructuring of the electronics and telecommunications industries. Thousands of new jobs have been created in Asia and Mexico. Nearly as many thousands of jobs have been lost in North America and Western Europe.

OEMs have sold ("divested") many of their plants to contract manufacturers. The contract manufacturers started by taking over some of the less glamorous and more labour intensive parts of production of North American electronics companies. They internationalized their operations when they were given the opportunity to take over some of the overseas facilities of these companies. Next came the taking over of plants owned by European telecom and electronics companies.

Once considered a “core activity”, the OEMs now prefer to own as few fabrication units as necessary. The pressure on prices, the capital costs, the speed with which demand can go up or down, and the associated logistical and inventory problems, made the OEMs decide to let the contract manufacturers do much, if not all the work for them.

For the workers involved the divestures often came as a rude awakening. From working for some of the more prestigious employers in the country (IBM, Ericsson, Philips), they suddenly had to deal with a new, previously unknown employer who believed that they could run their plant more efficiently and achieve a lower cost base. In the process, seniority rights were often placed in question, working time and pay arrangements reviewed. Not infrequently, the sale to a contract manufacturer was the prelude to massive job cuts and a cessation of activities after a few years.

The actual impact on individual workers is case- and location-specific. Seniority rights are typically important for older but less so for younger workers. The new owners often consider all employees in the acquired plants as new recruits (with clear consequences for holiday entitlements, promotions and dismissals). When there is an ample supply of alternative jobs in the local labour market, dissatisfied or redundant workers will find alternative employment without suffering great damage to their income levels or working conditions. Moreover, many shop-floor workers are not employed by the company; they have been hired in from temp agencies. Lastly, changes in pay and working conditions must also take account of the changes taking place elsewhere in the local labour market. The pressure on workers in terms of e.g. working time flexibility is up everywhere.

In high labour cost countries, it is not uncommon for the divested plant to close after two to five years, the period in which the previous owner had agreed to continue to source certain products from the plant. When this demand dries up and no alternative sources of demand are found (or because a sister plant elsewhere produces at lower cost) this may be unavoidable. In fact, between 2000 and 2005 the contract manufacturers together closed dozens of plants (mainly in high labour cost countries) making tens of thousands of people redundant.

Conclusions

This paper discussed how the top contract manufacturers in the electronics industry try to become providers of Electronic Manufacturing Services (EMS) by deepening and broadening the range of services that they offer and by diversifying into markets other than computing and telecommunications. Their names may be unfamiliar to the general public but collectively they make sure that personal computers, mobile phones, routers, game boys and a host of other electronic and telecommunication hardware are designed, manufactured and delivered to consumers around the world. It is difficult to say when or whether the contract manufacturers actually became EMS providers. Also, some started on this road sooner than others. That is why we used the two terms interchangeably throughout the text.

This paper has provided no more than a snapshot of a rapidly changing industry that is bound to see more drastic change. Yet the growing weight of EMS providers in world electronics output and employment and their role in the shift of output towards Asia and lower cost locations make the study of their strategies important for those active in the industry as well as for those in government responsible for innovation, employment, industrial and industrialization policies.

We discussed the “Big Six” EMS providers as if they were a fairly homogeneous group. Time and resource constraints did not allow us to discuss how their strategies differed, how they took different paths to often the same goal, nor how and why some were more successful than others. They work with small margins. Some are not profitable at all. Fast growth is no guarantee for high profits. Still, they have many things in common.

They grew rapidly in the 1990s but at a slower pace in the early 2000s (Hon Hai Foxconn is the exception: it grew at a fast pace in the 2000s). They grew because brand name holders decided to outsource more and a growing range of the activities that they traditionally did “in house”. The EMS providers have continuously expanded their “global footprint” with the big ones becoming true world players, active in all continents except Africa (but their presence in Japan and the Rep. of Korea is minimal).

Consolidation is a key factor behind the growing concentration in the EMS industry. This consolidation is in part explained by the desire of the OEMs (Original Equipment Manufacturers) to deal mainly with big players that have a global presence. Global presence has become a key competitive advantage because OEMs want to launch the same product in different parts of the world simultaneously.

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