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WP 04/2005

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On the Outsourcing Dynamics in the Electronics Sector:

The Evolving Role of the Original Design Manufacturer

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Abstract

Outsourcing of manufacturing and distribution operations has a longstanding history as a means of minimizing operational risk in a dynamic marketplace is a well-established strategy. In particular in fast-clockspeed industries such as electronics, we have observed how responsibility for manufacturing and distribution operations has increasingly been handed to third parties, such as contract manufacturers and external logistics providers. More recently, parts of the product development activities have been outsourced by the large original equipment manufacturers, a development which gave rise to the so-called 'original design manufacturers'. The emergence of these original design manufacturers in turn has led to a considerable shift in the dynamics of competition in the electronics supply chain, which will be investigated in this paper. Revisiting the motives for outsourcing as part of the wider supply chain strategy, we analyse the growth dynamics and market valuation of the key players in the electronics industry, towards a discussion on the present and future dynamics of the electronics industry. We conclude with a general framework on how to successfully manage the outsourcing decision by aligning supply chain strategy and product architecture.

Keywords: supply chain, outsourcing, manufacturing, electronics industry.

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1 Introduction

Outsourcing as a means to compete in dynamics environments is a well-established strategy, in particular in high-clockspeed industries where vertical integration alone does not provide sustainable competitive advantage as markets were changing rapidly and product life cycles were shortening (Saxenian 1996; Curry et al. 1999; von Braun 1990). Fast growing electronics manufacturers, such as Sun Microsystems, Cisco, Apple, Sony-Ericsson, Palm and Nokia, have followed a strikingly similar pattern throughout their growth phases: the necessarily high investments in business infrastructure were an undesirable option in dynamic markets, they started outsourcing their operations early on. Changing fixed to variable costs not only reduced the considerable risk associated with capital investment in manufacturing facilities, but also had positive impacts on their profitability in the short-term, and in the long run thus accelerated growth through better availability of working capital.

Large mobile phone manufacturers such as Nokia for example outsource a considerable proportion of their production to contract manufacturers around the world[1], and give responsibility for their distribution operations to specialised logistics service providers, which in some cases also take on added responsibilities for late configuration of products and handling of warranty claims. In addition to the outsourcing of manufacturing and logistics operations, the mobile phone manufacturers are increasingly outsourcing their design to third parties. In 2004 for example, Nokia was facing increasing pressure by not having a so-called 'clamshell' phone in their product range, a type of phone which is very popular in Asia, and thus limited Nokia's scope in these markets. As Nokia's phone line-up up to this point in

[1] This is not uncommon; Motorola and Siemens outsources c.30% of their manufacturing, whereas Sony-Ericsson is known to have outsourced the majority of their mobile phone production to contract manufacturers. In total c.40% of all mobile phone production is outsourced to contract manufacturers (Coker 2004).

time consisted of traditional 'candybar' models, it was decided to buy the complete product design from BenQ, a Taiwanese original design manufacturer. That way Nokia could both quickly patch the product line-up, while also reducing the investment risk related to the research and development that would have been needed to design the model in-house. The use of these so-called 'original design manufacturers' (ODM) is increasingly popular. Motorola for example extensively outsources design from Compal and BenQ (Economist 2004; Pick 2004), while Sony Ericsson uses Arima's services. Siemens had also used ODM's for some projects, while Nokia until 2004 has not been using these at all.

The strategic catch to using ODM's is that in addition to simply making the phones contracted out by the established manufacturers, BenQ for example is also offering its own products under its own brand, and has already emerged as the second largest manufacturer in the Taiwanese market. Thus, the recent emergence of these Original Design Manufacturers represent a further, considerable change in the organisational dynamics of the electronics supply chain, as these companies not only manufacture the products, but also design products – both for the large established manufacturers like Nokia and Motorola, as well as under the auspices of their own brands. Hence, they stand in direct competition with existing contract manufacturing companies (EMS) that offer their manufacturing services to the original equipment manufacturers (OEM) like Nokia *et al*, but ODMs also represent a direct competition to OEMs through their independently branded products. In 2005, BenQ, who had been working with Siemens on several projects, purchased Siemens' mobile phone business. This case illustrates, how the ODM business model can eventually expand into direct sales of branded products, with full control of branding, marketing and distribution. BenQ still contract manufactures phones for Nokia, Motorola and others, yet the takeover of Siemens' mobile phones marks a clear trajectory of increased future competition to the existing handset manufacturers.

In this paper, we will revisit the motives for outsourcing and strategic implications of the latter, using the current dynamics in the electronics industry as example. We will discuss the developments by analysing the developments of revenue and shareholder value for the five main players in each segment of the industry – the original equipment manufacturers (like Nokia), the electronics service manufacturers (or contract manufacturers, like Elqotec), the logistics service providers (like TNT),

and of course the emerging original design manufacturers (like BenQ). We believe that the electronics industry with its short life cycles, fast technological innovation and established outsourcing practices makes an ideal empirical framework for the general discussion of dynamics of outsourcing and offers valuable lessons for any other sector.

2 Outsourcing in the Electronics Industry

2.1 The Dialectics of Outsourcing

With the emergence of the concept of a 'value chain' (Porter 1985), and the notion that '…not individual companies compete, but entire value chains' (Christopher, 1992), supply chain management (SCM) as new field within the production and operations management community emerged (Houlihan, 1985; Davis, 1993; Cooper and Ellram, 1993). Effectively joining the manufacturing and logistics paradigms under the umbrella concept of a "supply chain", the core thrust behind the research was the notion that improvement was limited by the performance of the up- and downstream tiers in the system, and changes in the competitive realm. The supply chain focus also opened the way into new business models, in particular for the electronics manufacturers, where vertical integration alone did not provide sustainable competitive advantage, since markets were changing rapidly and product life cycles were shortening (Saxenian 1996; Curry et al. 1999; von Braun 1990). Fast growing OEMs, such as Sun Microsystems, Cisco, Apple, Sony-Ericsson, Palm and Nokia, have followed a strikingly similar pattern throughout their growth phases: the necessarily high investments in business infrastructure were an undesirable option in dynamic markets, they started outsourcing their operations early on. Changing fixed to variable costs not only reduced the considerable risk associated with capital investment in manufacturing facilities, but also had positive impacts on their profitability in the short-term, and in the long run thus accelerated growth through better availability of working capital.

A key question hence is whether "to make or buy", a question that is directly related to the core competence of the organisation (Prahalad and Hamel, 1990). The key argument in their seminal study was that the degree to which a function was contributing to the overall competitiveness of the organisation should also determine

whether this function could (or should) be outsourced. This argument was taken further by Fine and Whitney (1996), who argue that the wider industry dynamics determine both product structure and the degree of outsourcing. Illustrated in the famous "double helix" model, they argue that integral products and vertically integrated industries are unlikely to outsource to the point where either markets or technological advances lead to a modularisation of the product and a horizontal industry structure that enable (and favour) outsource. This cycle reverses with the advent of new technologies, until these also are commoditised, and restart the dynamics. The general advantages and disadvantages of outsourcing however remain unchanged, regardless of the prevailing industry dynamics – risk management due to conversion of fixed into indirect cost on the one hand, and the risk of losing core knowledge and functions to emerging competitors. Yet, as Venkatesan (1992) summarises, oursourcing can also aid in sparking innovations in the organisation, both through freed resources as well as new competitive pressures.

2.2 Outsourcing in the Electronics Supply Chain

The electronics supply chain underwent considerable change in the early 1980's with the increasing use of contract manufacturing companies by the OEMs. For example, meeting the challenge of increasing and volatile demand of consumer electronics, as in the case of Atari videogames as well as IBM PCs, were largely enabled by the rigorous use of contract manufacturers (Handfield et al. 1999). The use of TPL services developed in parallel; OEMs were starting to recognise the cost saving potential of rationalized and outsourced distribution operations, which included transportation as well as warehouse management. In most of the cases the outsourcing of distribution enabled fast growing companies to have a presence in all key markets – without the need for an (often risky) investment in a distribution infrastructure.

Starting in the late 1990's, a second wave of outsourcing could be observed that emanated from the laptop industry in Taiwan, where contract manufacturers evolved into ODMs by developing design capabilities. The main thrust behind this development was the incentive of higher profit margins on products sold under their own independent brand, as well as the ability to produce products throughout the

entire life-cycles, rather than parts of it. A second step in this development was for ODMs to offer their own developments to OEMs. Purchasing both a complete design and the manufacturing service from an ODM has several advantages for the OEM. First, it enables the OEM to extend their product lines without investing in product development, and second, provides a high degree of flexibility in terms of adjusting product life cycle to the wider product portfolio. Third, it allows manufacturers to offer products that are missing in their portfolio without incurring the development lead time, as is widely rumoured that Finnish manufacturer buying a 'clamshell' model from BenQ, a Taiwanese ODM in 2004, to complement its line-up (Dennis 2004; Wang and Shen 2004; Pick 2004). The disadvantage comes with increased dependency on the ODM, as well as an adverse impact on product knowledge, since the development was not done in-house. Interestingly, the ODM bears almost all development risk in this case, since final products are frequently developed without the early involvement of OEM. Since its conception, the ODM model has been spread extensively in the laptop sector, and increasingly can be found in the mobile phone market.

The centre of gravity in the current electronics supply chain resides still with the original equipment manufacturer (OEM) that designs and markets the end products, and that has a wide range of options for outsourcing: apart from electronics manufacturing service companies (EMS), which are commonly also referred to as "contract manufacturers", third party logistics providers (TPL) have been charged with the distribution and after sales service of equipment. EMS companies are specialised on providing efficient manufacturing services for existing designs to OEM companies, often also taking over existing manufacturing equipment in the process (Hilmola, 2001; Helo, 2001). In this case, the product is exclusively designed by the OEM, and the EMS simply takes the responsibility of production at any point in the product life cycle.

Third-party logistics providers (TPL) on the other hand are concentrating on the product distribution, although a trend away from the classic logistics and warehousing operations towards simple assembly type of operations can be observed (Bowersox 1990; Berglund et al. 1999; Skjoett-Larsen 2000). This expansion is further enabled by the modular product architecture of electronics products, which allow for

postponing the final product configuration to the very last stages in the supply chain – a task commonly undertaken by the TPL in the local warehouse.

Original Design Manufacturers (ODM) on the other hand typically concentrate their efforts on a specialized field of application or technology, based on accumulated knowledge and a constant learning that would be difficult to sustain on a broader knowledge base. For instance, Wistron in Taiwan provides design and manufacturing services for the laptop industry all over the world, including for companies like Dell. The Luxemburg-based Microcell (whose operations are mainly located in Finland) on the other hand is able to provide a 'one-stop shopping' service – from design of a mobile phone, to prototyping, manufacturing services, and even distribution. Several ODM companies have extended their services into distribution operations, and thus induced two-sided competition with both contract manufacturers and logistics providers.

The advent of the ODM companies has changed the competitive realm considerably. As the model shows, established manufacturers have good reasons to outsource not only manufacturing and distribution, as common today, but also to outsource the product design. As a result, a considerable overlap of the competencies and aspirations of the various players develops, as illustrated in Figure 1. Most commonly, logistics operations are almost entirely outsourced, thus OEM and TPL operations rarely overlap, yet OEMs commonly have their own manufacturing sites operating alongside those of the contract manufacturers they employ to produce a certain range of products. The OEM's product development and purchasing organisations are hence directly "competing" with ODM and contract manufacturers. Nevertheless, given the considerable risk taken by ODMs with their product development efforts, contract manufacturers and logistics operators take a more conservative approach to risk management (Agrell et al. 2004). Few EMS-OEM collaborations include the include contract manufacturer taking over purchasing responsibility – day-to-day procurement and as well as supplier base management – despite the fact that is it is rather common for an EMS to sell its entire capacity to one or limited number of OEMs. A similar kind of development was noticed in the logistics sector, where responsibility and ownership of inventory remains largely at OEM level, and only in exceptional case inventory responsibility is transferred to the

third-party logistics operator, who is compensated as the product is delivered to the final customer.

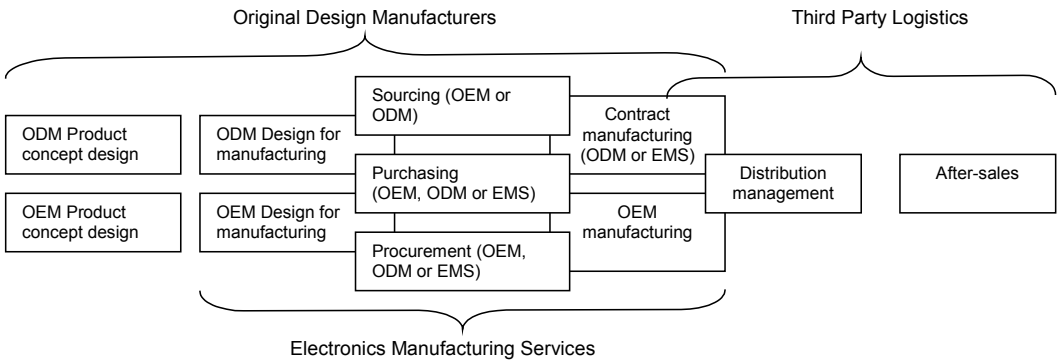

Figure 1. Overlapping Responsibilities in the Electronics Supply Chain.

Since the tasks covered by the ODM are overlapping in particular with the space traditionally occupied by contract manufacturers, and to a lesser extent also with that of logistics operators, we have observed ODMs expanding initially into the manufacturing of low-volume prototypes, "0-series" and the manufacturing of products in early phase of their life-cycles, a remit traditionally only occupied by OEMs. As a reaction to the ODMs expansion, contract manufacturers are themselves aiming to participate in the design process at the OEM in order to secure future production volumes in. Logistics operators in turn are moving towards final phases of production, like assembly and packaging, which overall provides for very a dynamic realm of competition in the industry.

2.3 Outsourcing and the Product Life Cycle

Outsourcing strategies in general are commonly linked to the product life cycle. The electronics sector is am inherently "high-clockspeed" industry (Fine 1998) – technological advances and fashion-driven markets require manufacturers to cope with short development lead-times, short production runs, and volatile markets. The life cycle of electronic products in sales can range from few months (e.g. laptop computers, mobile phones) to a decade (e.g. industrial electronics, lift controllers, power distribution controllers). The shortest life cycles are emerging where fast changing technologies are involved with integrated product architecture, in other

words products with miniaturization such as laptops, pocket PCs, mp3 players, and mobile phones. Generally, the trend shows shrinking life cycles (von Braun 1990), whereby mobile phones and laptop computers are manufactured for only 2 to 13 months prior to changing over to a new model. In slower pace products, such as industrial electronics, the product life cycle may be between 5 to 15 years. In order to cope with short life cycles, in particular in the mobile phone and computer sector, companies selectively outsource over the life cycle of the product. Table 2 illustrates how different parties are involved in product life-cycle phases.

Product Life-Cycle Stage	ODM	EMS	TPL
1. Product Development	+++		
2. Start-up	++	+	++
3. Growth	+	++	+++
4. Maturity		+++	+++
5. Decline		+	+++

Table 1: Typical involvement of different parties over product life-cycle

Our research shows that the life cycle stage of the product has considerable influence on the selected outsourcing type. In the early stages of development, original design manufacturers have emerged as the key players. This is particularly prevalent where the timing requirements are critical for the new product introduction while the OEM might not have the resources available for completing the project internally. The ODM charged with the development may also be involved in the start-up of production, and less likely, also with the production during the growth phase.

Contract manufacturing companies (EMS) on the other hand are rarely used in the start-up phase of the life cycle where volumes are still low, yet at ramp-up, EMS with distributed international production facilities can offer a global ramp-up of a product, thus reducing the overall time to market. Contract manufacturers are literally the feeding force for products in the growth stage. Also, in a product's maturity and decline phases contract manufacturers can often offer greater efficiency than the OEM's internal production facilities, and thus supply the majority of mature products. For EMS, the main source for revenue is at this stage, using their ability to match

regional demand changes cost-efficiently across their global production network. In the final stages of the life cycle, a curious phenomenon can be observed, whereby OEMs in cases take the product back in house, and produce the final low-volume batches prior to phase-out.

Third party logistics operators are the most independent in terms of the impact of the product's life cycle. Typically, contracts are not made on product level, but based on larger service. TPL companies may offer after-sales type of support, which is most intensively required in early stages, in terms of product returns and software updates; but also in the mature stage of product - recycling and remanufacturing services.

3 Method

In our study of the dynamics of outsourcing, we have selected the electronics industry for various reasons: first of all, it is very dynamic industry, that features fast product changes, rapidly developing markets, and thereby offering chances to study multiple product introduction over a short period of time. Furthermore, the products are largely modular and thus allows for outsourcing. Also, the task-knowledge boundaries are well spread across industry players. Few industries feature such variety of independent design houses, contract manufacturers, original equipment manufacturers, and third-party logistics companies.

The study comprises of two main parts: in the first part, we have interviewed senior operations staff and site visits at original equipment manufacturers, original design manufacturers, and contract manufacturers. Between 1997 and 2005, a total of 9 semi-structured interviews with original equipment manufacturers in Finland and Ireland were conducted, as well as 7 with contract manufacturers in Finland, Estonia, Hungary, and Russia. For confidentiality reasons the companies cannot be named, but the nonetheless it is important to note that the sample was selected on the basis on supplier relationships between the case companies. Companies provided data in three forms: plant visits by the authors, in person and telephone interviews with senior operations and design managers, and proprietary performance data. We started by visiting plants to discuss our proposed research and the type of metrics we were interested in collecting. While non-disclosure agreements bar us from presenting

specific evidence from these interviews, this qualitative phase was nonetheless instrumental in providing the contextual background for our analysis.

In a second step, we analysed the financial information of the last five years in the four main categories (OEM, EMS, TPL, ODM) with regards to the companies' financial performance revenue growth and share price development. We evaluate the relative evolution of the various players on two dimensions – overall revenue growth, and the evolution of shareholder value. These two dimensions are used as proxy to measure the relative movement of the segments in the market – first, to determine whether the shifts in outsourcing have resulted also in a shift in overall revenues by segment. Second, we evaluate the development of the share price for the four segments as a proxy for the market valuation (and thus perceived future prospects) of these segments.

For the purpose of the quantitative comparison of the sectors, we have selected the five companies of each of these segments with the highest turnover, in order to provide a balanced reflection of the electronics supply chain, as shown in table 2.

	Description	Typical Tasks	Companies selected for this study	Net Revenue 2003 in million US$
OEM	Original Equipment Manufacturer	Design and manufacturing of electronic products; branding and marketing.	Nokia	37,104
			Ericsson	16,364
			Motorola	23,155
			Samsung	36,409
			LG Electronics	16,927
EMS *(also abbrev. as "CMS")*	Electronic Manufacturing Service Company	Contract manufacturing of electronic components and finished products	Flextronics	13,379
			Solectron	11,014
			Sanmina-SCI	10,361
			Celestica	6,735
			Jabil	4,730
TPL *(also abbrev. as "3PL")*	Third-party Logistics Service Provider	Transportation, warehousing, inventory management, and distribution	TNT Logistics	4,705
			Exel	8,897
			Wincanton	1,781
			Tibbett & Britten	2,915
			UPS	34,610
ODM	Original Design Manufacturer	Design and manufacturing of electronic products	Wistron	2,287
			Compal	4,773
			Arima	772
			Inventec	2,400
			BenQ	3,198

Table 2: Electronics Supply Chain Players selected for this study

4 The Evolution of Growth

Having highlighted the motives for outsourcing and the responsibilities that contract manufacturers, logistics operators and ODM's take over the life cycle of a product, we will now take a time-series perspective of the growth dynamics of the key actors in the system. We measure the development of sales revenue, as a proxy for the overall growth of the company, and the development of share price, as a measure of shareholder value and as a proxy for overall profitability of the company, for the period of 1999-2003. For each category, we analysed the major companies, as outlined above, all of which are publicly listed and thus had financial reports in the public domain. The companies represent the core operators in the field of electronics in terms of turnover. While the fragmentation of the industry did not permit for a comprehensive analysis of all players involved, we are confident that the sample gives a reasonable representation of each sector. We will discuss the developments of all four segment in turn.

4.1 Original Equipment Manufacturers

A key question that needs to be addressed before addressing the relative cross-sector dynamics of outsourcing is how the wider electronics section developed over time. To this effect, we have analysed the evolution of share prices of the five largest original equipment manufacturers, and compared these to the Standard and Poor 500 index, as a measure of the wider stock market development over that time.

Figure 2 shows the *relative* share price and S&P500 index over time; as one would expect, the aftermath of the e-bubble can still be seen in today's share prices of the large manufacturers, which to date still significantly lag behind the value of 2000. Nonetheless, a consistent upward trend can be observed, starting from 2003 onwards.

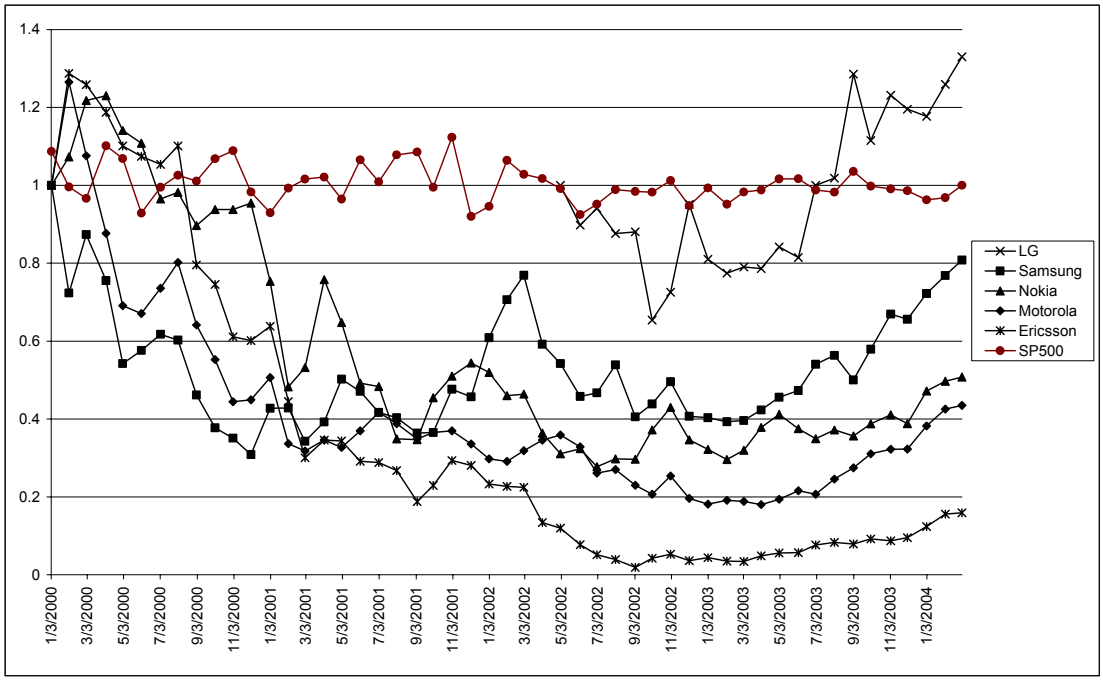

Figure 2: Share price development of the original equipment manufacturers

While no immediate conclusions can be derived from this chart, two things should be noted: first, the stock market as a whole has not shown considerable movements, whereas the electronics sector as a whole is still on the rebound. Second, for the results of 2003 onwards, one would expect a parallel upward trend in share price for the related players in the electronics sector, i.e. the contract manufacturers and ODM's, and to a lesser extent also the logistics operators, which tend to serve multiple sectors and thus are less sensitive to individual industries.

4.2 Electronics Manufacturing Service Providers

The activities of a contract manufacturer (EMS) are manufacturing-centric bu nature. A typical roadmap for a growing EMS company could include the following stages: from pure capacity selling, it may over time be integrated to responsibility on inventories, first on procurement level and then on purchasing activities. Thereafter, the process may be enhanced to design for manufacturing types of operations. The service may include also after-sales operations and in some cases responsibility for warranty. A typical "roadmap" of business development at an EMS company would be from solely selling manufacturing capacity sales, to taking on inventory

responsibility and procurement, involvement in the sourcing decisions, consulting services for Design for Manufacturing (DFM), advising manufacturers on supplier selection, and providing after-sales services.

As the revenue development of EMS companies is closely correlated to the global consumer electronics consumption, their annual sales changes can be quite drastic. For example, in one-year period (1999-2000) the total revenue of the 100 largest EMS companies nearly doubled, but the industry was affected by global recession in 2001-2002, when sales fell by nearly 20%. The recent market volatility sparked a merger wave in 2000 and 2001, when 14 mergers among the 50 largest companies were observed (Solakivi and Hilmola 2004).

The EMS sector is skewed towards large players, the five largest of which account for half the total revenue of the EMS industry (c. 38 billion euros in 2002, Electronic Business Magazine, 2003b). Currently Flextronics is the largest EMS company with annual revenues of 10.9 billion euros, followed by Solectron (9 billion euros) and Sanmina-SCI (8.5 billion euros). Celestica (5.5 billion euros) and Jabil Circuit (3.9 billion euros) follow these three top companies. As shown in Figure 6, only Sanmina-SCI and Flextronics have been able to show high growth track since base year. However, in recent years the source of growth has been mergers and acquisitions rather than organic growth.

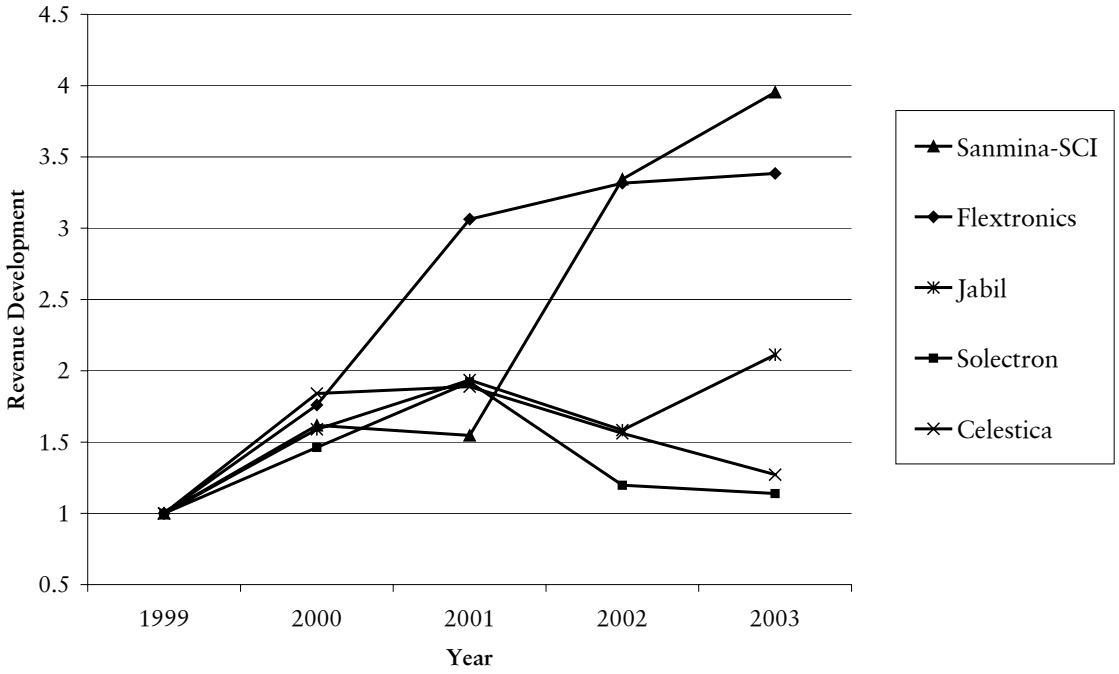

Figure 3. Relative development of revenue at selected contract manufacturers (base period =1; source: proprietary information).

According to the analyses by Solakivi et al. (2004) and Helo (2001), the largest EMS companies account for considerable inventories in their assets, and common inventory turns are around 5 to 10. Labour productivity has been steadily increased in five-year observation period, and currently top companies turn over $200-400,0000 per employee. Gross profit margins are generally low in comparison to other players in the electronics indusrty, i.e. a few percent of total revenue, yet as the total assets are considerably lower than at OEM level, the industry is able to show high ROI ratios in growth periods.

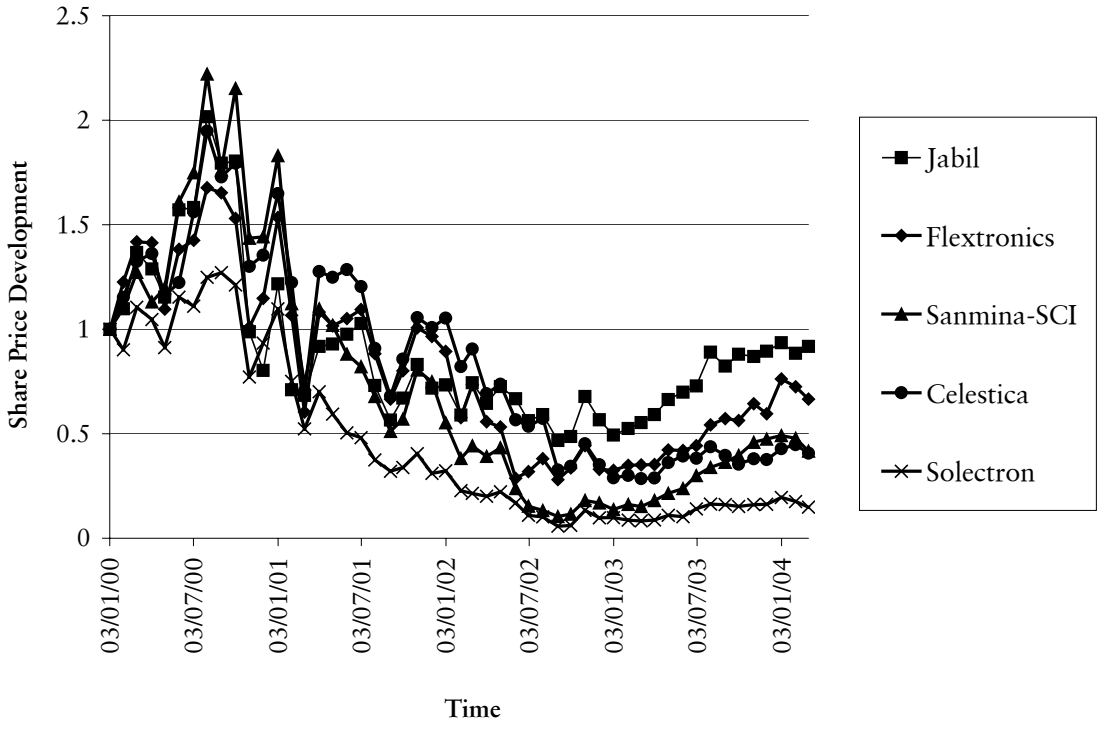

Figure 4. Relative share price development of selected contract manufacturers (base period = 1; source: proprietary information).

Following the high-growth years of the late 1990's, share price development of the five most important EMS companies has been poor (see Figure 7). During March 2004, only Jabil was near to level of at the base period of January 2000. The common perception that Sanmina-SCI and Flextronics would be able have to hedge their sales development with M&A activity did not materialise, as their market valuation still lacks significantly behind base period. Worst performing from all of these companies has been Solectron, which is producing consumer electronics, inter alia, for Sony.

4.3 Third Party Logistics Providers

Third party logistics companies such as TPG logistics, UPS Supply Chain Solutions, Exel, Tibbett and Britten, and Wincanton offer whole range of distribution related solutions for many high tech companies. However, it should be stressed that their customer base is highly diversified, including companies from food and

beverage sales to car manufacturing. Examples of TPL operations usually include building a network of distribution services, outsourcing assembly operations and running spare-part service. For example, UPS has built the supply chain operations for Cisco in Europe. The actual operations executed include cross-docking, fulfilment and customer clearance, with the key processes and services of transportation, warehousing, packing, assembly, as well as after-sales services such as product returns and recycling.

Due to the diversity of the customer base it is rather challenging to name the most important third party logistics operators in the electronics sectors, which is further compounded by the fact that many operators are integrated into large conglomerates (like DHL into Deutsche Post, Schenker into Stinnes Logistics, UPS Supply Chain Solutions into UPS, and TNT and TPG logistics into Royal TPG Post, The Netherlands). An ongoing trend is that these larger entities are aggressively seeking mergers and acquisitions to enhance their geographical coverage and efficiency. It should also be stressed that some of the third party operators extensively outsource transportation operations themselves, and investments in physical assets can be relatively low. It is also common for logistical companies to have their roots in the shipping operations, and they have thereafter enlarged operations including warehousing and road transportation (e.g. DFDS and Maersk). Interestingly, in Asia the trend seems to be opposite. For example, most logistics service providers in Singapore seem to have their roots in warehousing operations, and only thereafter included transportation services into their portfolio.

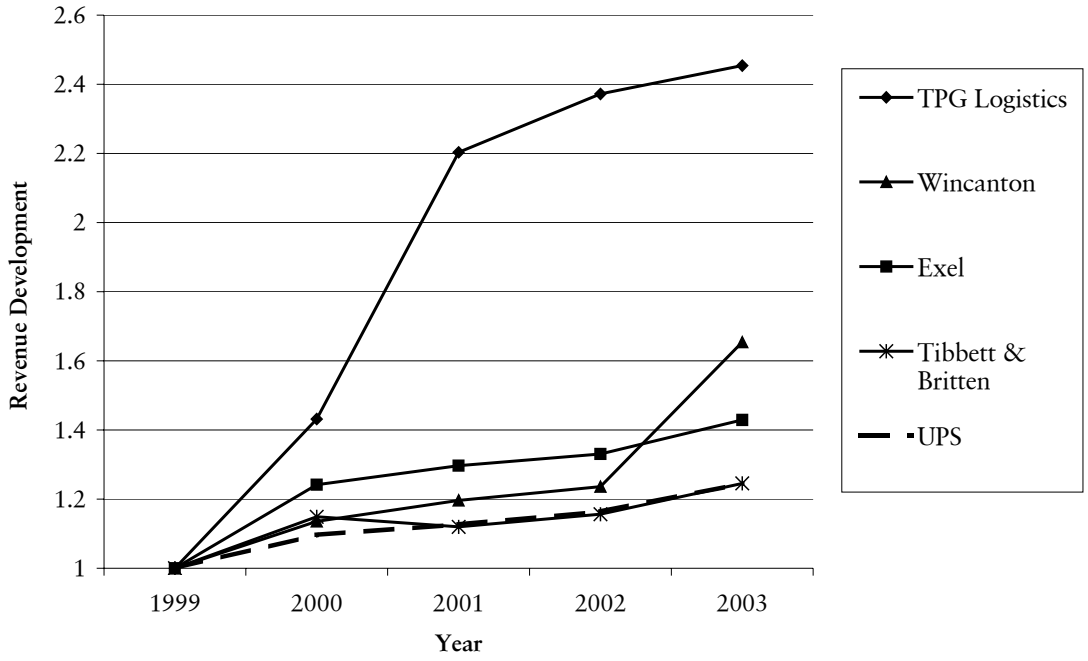

Figure 5. Relative revenue development of selected third party logistics operators. (base period =1; Source: proprietary information).

The revenue development of selected five TPL operators has shown steadily increased development (Figure 4). It could be concluded that all the others than TPG Logistics and Wincanton (reflecting their revenue increase of 2003) have faced relatively conservative revenue increase (the figures for UPS include those for the whole corporation). Despite the aggressive growth shown by TPG Logistics, which achieved a revenue of 3.74 billion euros in 2003, it is still nearly 50 % smaller than Exel with a revenue of 7.49 billion euros in 2003. Both Tibbett and Britten (revenue of 2.45 billion in 2003) and Wincanton (revenue of 1.5 billion in 2003) are far smaller players in the field.

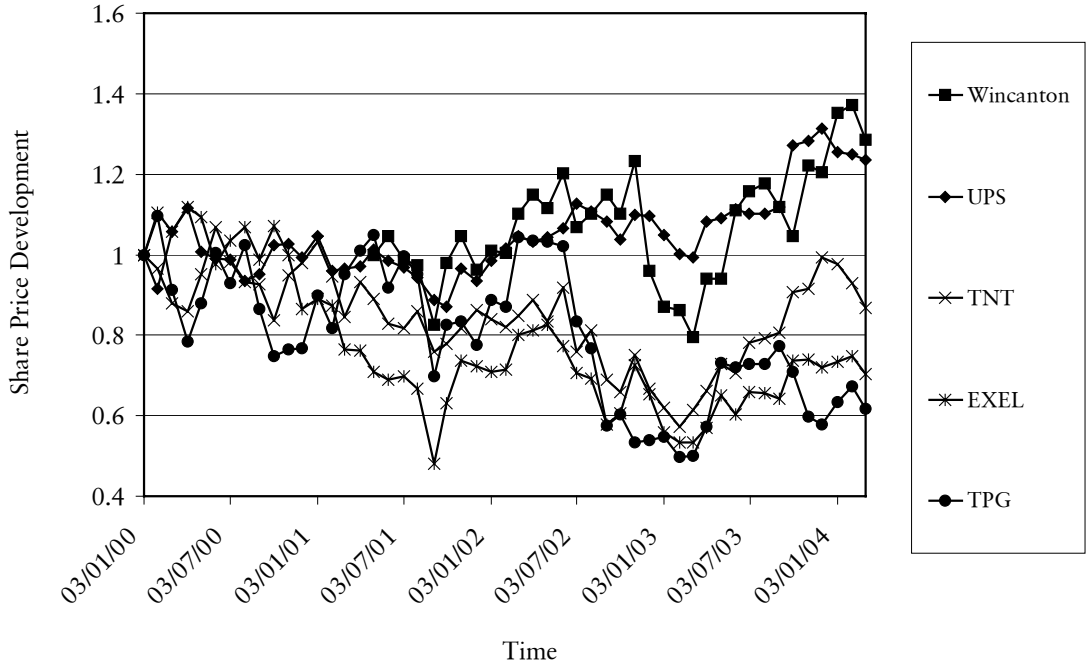

Figure 6. Share price development of selected third party logistics operators. (base period = 1; Source: proprietary information).

As the revenue development of TPL companies has steadily increased, the market valuation of these companies has shown similar trend. As could be noticed from Figure 5, Exel and Tibbett and Britten have lost 30-40 percent from their market valuation in four years time; this only shows how critical revenue growth is for this industry. The market valuation of TPG logistics cover the whole of TPG, and its development is rather similar to the two lowest performing companies. However, it should be stressed out that two highest performing companies have only been able to constantly improve their market valuation in the longer term. Thus, currently Wincanton and UPS have only 20 percent higher valuation than in the early parts of year 2000.

4.4 Original Design Manufacturers

ODM companies are similar to EMS companies in their strategic intent. Geared at manufacturing consumer electronics and traditionally located in Asia, companies such as Arima, Inventec, Wistron, Compal Electronics, BenQ, and Foxconn are producing laptop computers and mobile phones. Manufacturing operations are largely located in China, and so far many ODMs do not have the global presence that EMS companies enjoy. ODM companies have developed a core competence in design engineering, and are thus generally more specialised than EMS companies. Often fairly modular product platforms and designs are used that can "recycled" from one product to another, i.e. show a high carry-over of components and modules. ODM companies are vertically integrated and can offer both manufacturing of complete products, as well as components, such as enclosures, plastics, and cables (Coker 2004). The business model of the ODM is based on licensing technology and intellectual property, as well as the thrust towards establishing their own brands for consumer products. So far, the revenue gathered from these independent brand operations is a minor part of their overall revenue, yet it has created a noticeable pressure on OEMs. OEMs use these design services in various ways: in mobile phone business, Motorola for example extensively outsources design from Compal and BenQ (Economist 2004; Pick 2004), while Sony Ericsson uses Arima's ODM services. Siemens uses ODMs for some projects, and Nokia has not been using ODMs until 2004. Overall though the ODM segment still represent a small fraction of the market. One of the leading mobile phone ODMs, Cellon, announced its achievement of a cumulative mobile phone production of 14 million units in 2004, which compares to an annual world production of 500 million handsets.

From a financial point of view, the publicly listed companies have performed well in the period analysed (see Figure 7), although, as the five-year development reveals, revenues fluctuate quite strongly. In the recent years Compal, BenQ and Inventec have shown positive developments. Arima on the other hand shows the volatility of the market, as total sales halved from one year to the next in 2000 and 2001. Despite the fact that the ODM business model is still developing, the total sales of these companies amounted to nearly 11 billion euros in 2003 (Compal had the highest revenue, above €4bn). Because of intellectual property nature of business, the companies are investing approximately 1.5% per year into their R&D efforts. The

gross profit levels are 5 - 12%, albeit unstable due to sales fluctuation. Inventory turns vary between 6 and 15.

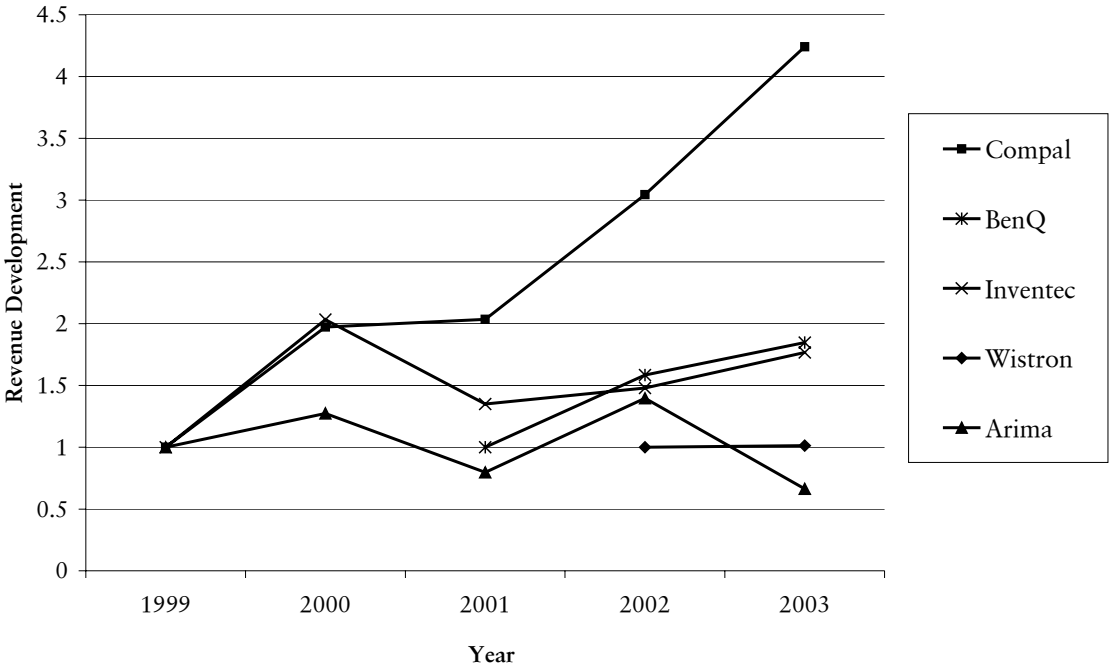

Figure 7. Relative revenue development of selected ODM companies (base period =1; source: proprietary information).

Compal and Arima (despite the high fluctuation in sales) have been able to create shareholder value with their business models; Compal's share price has increased strongly, in March 2003 it was valued 40 times higher than in the year 2000, while Arima enjoys "only" 3.5 times higher level compared to the base year. However, the other two titles are lower performing stocks, yet even Inventec and Winstron have generally been able to show positive development in recent years too.

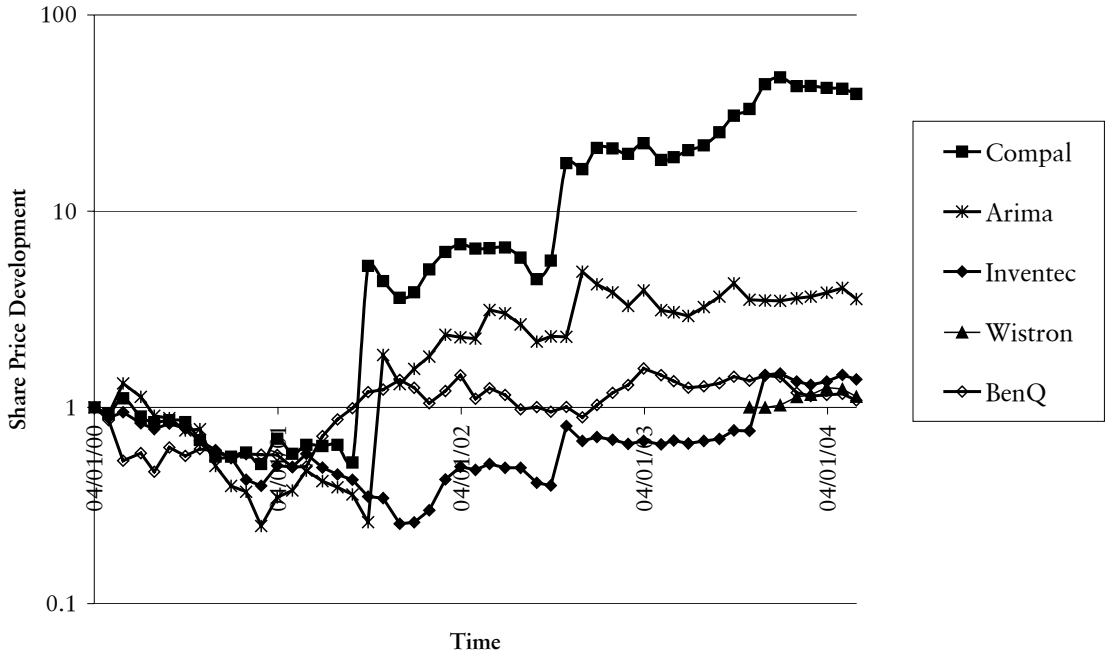

Figure 8. **Relative share price development of selected ODM companies (base period = 1; source: proprietary information). Please note the logarithmic scale.**

5 Harnessing the Dynamics of Outsourcing

5.1 The Outsourcing Dynamics in the Electronics Industry

Overall our analyses of the relative revenue and share price developments of the major contract manufacturers, logistics operators and ODM companies show, (1), that the ODM segment has been growing in a very similar fashion as the EMS sector, and (2), that ODM's have experienced a counter-cyclical share price increase, despite a general slow rebound of the shares of both large established manufacturers and contract manufacturers. More interestingly, this share price evolution cannot be explained by the revenue growth alone, and according to our interviews, relates to a much larger extent on the market potential of these companies. EMS companies are increasingly experiencing competition from emerging ODM's, and albeit still small, recent takeovers by BenQ (Siemens mobile phones) and Levono (IBM laptops) also point towards a clear ambition of ODM's to enter the 'branded' space in the market.

As a result, contract manufacturers are increasingly forced to merge and acquire in order to sustain sales levels, while ODM companies on the other have been largely able to create organic growth and establish their position in electronics industry.

Across our interviews with industry executives, there was little doubt that the ODM business model will continue to grow in the future, being driven by a general need at OEM level to meet the increasing demands for novel products at short intervals. On the other hand, the revenue development over the five years has also shown that the ODM segment is still minor part of the overall electronics contract manufacturing sector, and not exclusively growing at the expense of the EMS market share. Comparing the profitability of EMS and ODM sectors however, the situation is very different. EMS companies enjoy revenue stream of their manufacturing contracts with the OEM's, while ODM's rely on profits generated from their early life cycle services. If one linearly extrapolates the revenue data for the last three years however, the EMS sales revenue will decline by 8%, whereas the ODM industry is likely to increase revenue by more than 90%.

The ODM business model has a further interesting connection to supply chain issues, since early life cycle purchasing, inventory management and manufacturing are part of their portfolio, which are out of reach of contract manufacturers and also third party logistics operators. This new situation creates pressures for contract

manufacturing, and the growth of the sector is a main concern to EMS companies: Will ODMs and TPLs take their business from two different sides of value chain?

5.2 Towards an Integrated Framework

The outsourcing decision is a strategic one that manufacturers have to take in relation to industry and market developments. In the electronics industry, decreasing product life cycles and increasing demand for diversity put significant pressure on the resources of manufacturers like Nokia, and drive the various degrees of outsourcing. Overall, the key advantages and disadvantages to the manufacturer that need to be considered are:

Outsourcing to:	Advantages	Disadvantages
ODM	▪ Increasing product range ▪ Responsiveness to shifts in demand ▪ Reduced investment in product development	▪ Loss of design capabilities ▪ Direct competition with ODM
EMS	▪ Volume Flexibility ▪ Global presence ▪ Reduced investment in manufacturing structure	▪ Reduced learning opportunity at the design-manufacturing interface ▪ Increasing dependence on EMS services
TPL	▪ Ability to configure to local customer needs ▪ Reduces investment in distribution infrastructure	▪ Loss of control of the customer interface

Table 3: Key advantages and disadvantages of outsourcing

Understanding the strategic and financial decisions resulting from the outsourcing decision is however not quite as straightforward, as such a static list of advantages and disadvantages would make one believe. In order to describe the dynamics of outsourcing, we have developed a soft systems model that explains the causal loops that centre around the generic outsourcing decision. Individual industries may well have slightly different dynamics, however we do believe that the key forces are pictured.

The outsourcing decision is initially driven by environmental uncertainty, generally arising from uncertain demand (both in terms of volume and product range),

as well uncertain geographical distribution. Key questions here will be: What product range does the customer demand? How will demand spread across the key markets?

In the light of these uncertainties, which induce risk, the OEM will have to three take strategic decisions to manage this risk. The first one regarding the outsourcing of their design (to ODM), of their manufacturing (to EMS), and of their distribution (to TPL). These choices will have two main effects – in the short term, they will negatively impact (i.e. reduce) on the operating expenses, or in other words, provide the envisaged cost reduction. Outsourcing also frees up capital, thus positively assists future growth, as the investment can be made into strategic projects, rather than into building infrastructures and the like. Also, investment in general poses a risk, and one that can be mitigated with increased outsourcing.

The overall caveat of course comes with the potential of generating future competition by outsourcing to companies with the potential of becoming direct future competitors. In the short term, this will not be an issue, yet beyond operational outsourcing of manufacturing and logistics, the decisions whether to outsource design or buy ready-made designs, needs to take this element into account. Here, a critical difference exists between outsourcing to EMS and TPL operators, as here the negative strategic implications are limited learning by not manufacturing in-house, and potentially a loss of control of the customer interface by outsourcing distribution. Only in the case of design outsourcing however is there a direct, time-lagged conflict between growth potential and future competition, as illustrated below. Eventually though, all outsourcing decisions impact on three elements: investments, risks, and ultimately, on the overall profitability and therefore share-holder value.

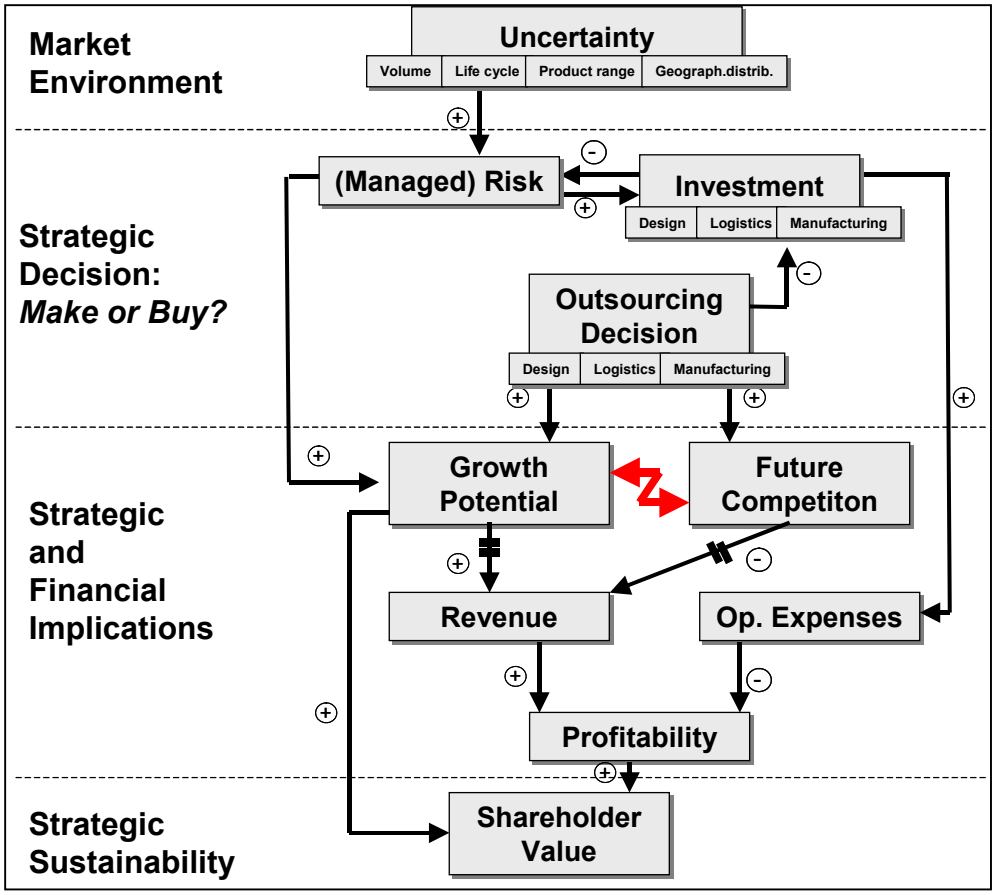

Figure 8: A Soft Systems Model of the Outsourcing Decision

Although derived from our research in the electronics industry, we believe that this framework can be equally applied to other sectors. The electronics industry is special in as far as it features a wide range of design houses, contract manufacturers, OEM, and independent logistics companies and thus provides a fruitful arena for out study. In sectors like automotive however, despite increasing outsourcing of responsibility for modules and systems to suppliers, there are few low-scale examples so far where suppliers assemble entire vehicles. Our results should hence be considered as a reference point when analysing similar patterns in other industries.

5.3 Conclusion

In this paper we have provided an overview of the motives and dynamics behind the outsourcing trend in the electronics industry. We have shown that the advent of the "original design manufacturer" (ODM), as a fairly recent phenomenon in the supply chain, has considerably changed the dynamics of competition. Our

analysis suggests that mainly contract manufacturing companies have lost out in this development, and the widely diversified logistics operators have been much less affected by this development. However, in this paper we also argue that these logistics operators will not be entirely unaffected due to their increasing desire to expand their operations into manufacturing, i.e. phone assembly or late configuration of phones.

Our analysis suggests that ODM's are indeed shaping future competition in the supply chain, a fact further amplified by the fact that product development resources and capabilities are an increasingly critical element of competition in this high-clockspeed sector. It is evident that the traditional contract manufacturing and third-party logistics business models will exist in the future, but their operations are likely to be increasingly affected by the growth of ODM's. Large EMS companies are already reacting to this trend by acquiring design capabilities: for example, Sanmina-SCI acquired 2003 Newisys (Sanmina-SCI, 2003), a computer design company; in the same year Flextronics acquired Microcell, a Finland-based ODM; and Elcoteq announced a partnership with Cellon in 2003, a mobile phone design house.

While we believe that the current levels and forms of outsourcing will sustain for the near future, we argue that the key to understanding the future developments will be the product architecture of the product (Fine and Whitney, 1996; Ulrich 1995). The product architecture holds one key towards future manufacturing and design operations. A modular, platform-based design (as increasingly common in mobile phones) has been the nemesis of IBM in the computer industry (which was sold off to a contract manufacturer in 2004), and is equally likely to affect the mobile phone sector. Furthermore, most of the current product functionality of mobile phones is being implemented with software. Maintaining leading user interface design and software structure in all different user sectors, business users, high-end phones, low-end phones, may be too expensive for even the largest OEMs, and it will be seen whether the mobile phone industry will follow the computer industry, where software development has been separated from electronics design. Future research on outsourcing decisions should therefore also consider the linkage between a changing product architecture and the supply chain strategy adopted, as we believe that in conjunction one can explain the rapidly evolving future dynamics of competition in the electronics industry.

Acknowledgements

We are very grateful to Professor Daniel Sheu of the National Tsing Hua University, Taiwan, for his kind support of with our research concerning the Taiwanese manufacturers, as well as Dr. Hongze Ma of the Turku School of Economics and Business Administration, Finland, for the help with the Chinese translations. The research was kindly supported by the Cambridge-MIT Institute's Centre for Competitiveness and Innovation.

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