Optimising Product Value Chains

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Abstract

This paper illustrates how Nokia, the well-known Finish multinational, rides on three major competitive forces, namely the predominance of knowledge–based activities, an increasing propensity for velocity and the creation of unique value for specific final customers. This is investigated with respect to the mobile phones which represents a particularly successful product familly for the company. Strategic actions undertaken by Nokia will shape, at least to certain extent, the future of wireless devices.

Introduction

Catalyzed by the improvements made to the national and global information infrastructures (NII/GII), the current economic effervescence leads the way to major structural changes within our society. Many have described this revolution as the rise of the information society (OECD, 1997), the knowledge-based economy (Neef, 1998) or the global networked economy (Mansell, 1993). Since transactions, information exchange and business activities are increasingly relying on electronic means, the terms digital economy (US Government, 1999; Tapscott, 1998) or virtual economy (Lefebvre and Lefebvre, 1998) have been recently put forward. The business press usually refers to the "new economy". Regardless of the name that will be sanctified by history, a consensus exists among most authors: the emerging economic order has imposed changes to the very way companies are doing business.

In this paper, it is argued that three overlapping major competitive forces, namely the predominance of knowledge–based activities, an increasing propensity for velocity and the creation of unique value for specific final customers shape this new economy. These three imperatives have lately gained momentum due to technological catalysts such as Internet–based tools, ERP (Enterprise Resource Planning) systems and supply chain management software. This will be demonstrated by the empirical evidence obtained from the detailed case study conducted on Nokia, the well known Finish multinational and a major international player in the telecommunications industry.

The three competitive forces

This section briefly discusses a number of points and main issues related to the above mentioned forces.

The predominance of knowledge – based activities

The very basic rules of competitiveness have changed: knowledge is now considered as the most important economic input (Morck and Young, 2000) and "the most strategically

significant resource of the firm" (Grant, 1996: 375). In fact, "knowledge plays today in all its forms a crucial role in economic processes. Intangible investments are growing more rapidly than physical investment. Individuals with more knowledge get better paid jobs, firms with more knowledge are winners on markets, and nations endowed with more knowledge are more productive" (OECD, 1996). At the firm level, the value-added to products (manufactured goods or services) is derived mainly from intelligent, brainpower or knowledge – based activities. Even manufacturing firms, that are obviously involved in physical activities such as assembly, are increasingly relying on knowledge – based activities which typically accounts for 65 % to 90 % of the value delivered to the final customer (Quinn, 1992)

Knowledge–based activities fall "in the virtual world made of information" (Rayport and Sviokla, 1995) and thus rely extensively on electronic integration both internally and externally. First, they require within firms an optimal and efficient use of information technologies, an information sharing capacity among the functional managers and employees (for instance, with enterprise wide systems such as ERP) and in the case of larger firms, the presence of an intranet. In fact, the ERP market has been booming whereas the intranet market is growing at annual rate of 49 %. Second, high levels of electronic integration between firms are also required by the emergence of value networks, where business partners (suppliers, subcontractors, manufacturers, sellers, buyers, distributors, …) pool together the core competencies in order to bring added value to the final customer. These virtual value networks, networks of competencies or virtual enterprises (Lefebvre and Lefebvre, 1998; Venkatraman and Henderson, 1998) manage all the activities along the entire product value chain (i.e. activities related to sourcing, production, transportation and delivery of a final product) as well as the flow of goods, information and services from the suppliers' suppliers to the customers' customers (Kalakota and Winston, 1997). Value networks are therefore centered on the product which becomes the new unit of analysis. Their competitivess is critically dependent on the knowledge-based activities required to cope with this complex web of commercial and non-commercial interactions.

As the world economy integrates itself, global value networks recruit best-in-world competencies to realize their intellectual activities (Quinn, 1992). Each activity of a product value chain can therefore be accomplish by a world class supplier owning the very best know-how in a specific field of expertise. Value networks achieve an undeniable competitive advantage as they become consortiums of best-in-world suppliers of competencies.

Thanks to the Internet and other inter-organizational integration tools like Supply Chain Management (SCM) software, the electronic interactions among business partners in the product value chain are now a reality. These technological tools, that enable the knowledge-based activities to be accomplished and coordinated in a virtual manner, have become more and more accessible and reliable (Duarte and Snyder, 1999; Lipnak and Stamps, 1997). Consequently, the cost of coordinating decentralised product value chain activities has significantly decreased and real-time international collaboration can be realized on global open networks.

An ever increasing propensity for velocity

Time-based competition has been around for sometime (Blackburn, 1991). The recent emergence of value networks entails a new meaning for speed or, better termed, velocity. Velocity can be defined as the optimal speed at which physical and virtual interations are set

in order to reach the market at the customer's desired place and time (Magretta, 1998a, 1998b). Velocity is a self-reinforcing phenomenon which leads to increasingly higher customer expectations. Today's customers anticipate a "Dell-like" 24 hours quick response for any of their online or offline request.

In order to meet the velocity challenge, business partners in value chain need to optimize their interactions. The velocity of a supply chain appears to be function of four dimensions: time-to-market, order cycle time, inventory turnover and time to next line of product. First, time-to-market is a traditional concept which corresponds to the time period required to identify an opportunity, create a new product, ramp it up and bring it to the market. Second, order cycle time is the period between the moment the customer places the order and receives the product. Third, inventory turn over, also a well known concept, refers to the number of replenishments during a given period. Finally, time-to-next line of product represents the overall time required to empty the supply chain pipeline of a certain product line so that it does not cannibalize the introduction of a new line. These four dimensions boost the velocity of a product value chain and bring competitive advantages to the business partners involved. For example, Dell Computer has recently shown excellent profitability while competing on velocity: the turnover of its inventory is only 11 days, it offers very short order cycle time and introduces new products on an average of 69 days sooner than its competitors without cannibalizing its former product lines. (Magretta, 1998a; APICS, 1999)

Velocity as described above is also based on the product itself which constitutes the unit of analysis for improving velocity.

Creation of unique value for specific final customers

Customers are not satisfied with speed only, they want quality and low costs and look increasingly for personalized products and interactive services that suit their own needs, requirements and personalities (Feitzinger and Lee, 1997). To fulfill these expectations, it is critical that the process that leads to the realization of a product or a service be conceived in such a manner that it could produce hundreds, even thousands, of different variations of a specific product or service.

However, customized offerings should not be done at the price of loosing economies of scale normally associated to mass production. This is the reason why business partners within a same product value chain have to integrate their inter-organizational processes in order to implement and sustain the concept of mass customization. Successful mass customization relies on the capacity of all business partners to constantly maintain a focus on each client's specific needs and to introduce these needs at each stage of the product value chain. In sum, mass customization reinforces the product centric orientation of the new economy.

Once again, Internet-based tools play a major role as they reveal the true potential of mass customization. For example, Cisco and Dell are two of the best practitioners in this field by providing their clients a web interface that allows them to customize the product they wish to acquire.

Empirical evidence: Results and discussion

Before moving on to the main results, some the methodological issues are presented.

Methodology

This study introduces the product as the new unit of analysis and examines the relative importance of the three competitive forces mentioned earlier. Empirical evidence from a case study conducted on one family of products in the Nokia Group is discussed. The case study approach appeared to be the most appropriate research strategy. In fact, the phenomena associated to the product value chain are new, complex and in constant evolution. The multiple interrelations between business partners along the entire product value chain require extensive field work to uncover the intricacies of the relationships. Moreover, very few empirical studies have to date focused on the product as the new unit of analysis. The nature of the research was therefore exploratory.

The choice of the Nokia Group was motivated by several factors:

i) the Nokia Group is a leader in electronic and mobile telecommunication industry. The Finnish multinational has experienced an impressive growth in the last decade. In 1998, net sales totaled 15.7 billion USD and the Nokia Group displayed the best performance of the industry. At the end of 1998, Nokia owned 44 research and development centers scattered in 12 countries and had more than 47 000 employees throughout the world.

Figure 1: Nokia's performance in 1998

	MOTOROLA	ERICSSON	NOKIA
Sales in 1998 *	$ 29,4	$ 23,3	$ 15
Annual growth	- 1,35 %	+ 10 %	+ 50,6 %
Operating profits *	$ - 1,37	$ 2,3	$ 2,4

* Billions of USD

Source : Nokia, Ericsson and Motorola annual reports

ii) the case study investigate a product or better termed a well defined family of products that relies extensively on value networks. The Nokia Group manages four distinct families of products : mobile phones; network equipment (both fixed and mobile); multimedia terminals and PC monitors. Mobile phones are a "success story" for the Nokia Group and represent 60% of the group's total sales. Nokia is the largest manufacturer of mobile phones, with point of sales in more than 140 countries around the world while their complete product line of cellular terminals covers all of the major market segments. Nokia is a leader in the development of the 3rd generation technologies for mobile telecommunication.

iii) Nokia Mobile Phones is also considered one of the world leaders in demand-supply chain management (Ranta 1998; Oltus et al., 1998). This unique and distinctive expertise had led the company to a tight integration and optimization of the mobile phones' value chain where price erosion and velocity are critical dimensions.

The case study relies on diverse yet complementary sources of empirical evidence. Secondary data were gathered from technology and industry related literature. Several on-site interviews were conducted with industry specialists, policy makers, Nokia's

representatives and business partners. Interviews were held in six different countries: US, Canada, Finland, Sweden, Germany and Belgium.

Riding the three competitive forces : Nokia's ways of doing business

Does the Nokia group undertake strategic actions with respect to the three competitive forces? Some elements of answer to this question will be proposed by analyzing the empirical evidence obtained for one specific product family namely the mobile phones.

Knowledge-based activities: Focus and coopetition

Nokia concentrates its business efforts on knowledge–based activities. Research and development represents a top priority for Nokia where the R&D workforce represents more than 15 000 employees. More than half of research and development is conducted outside Finland, partly due to fact that the organisation employs far more engineers than the Finish universities can train every year and mostly due to strategic imperatives since Nokia tends to go where the best competencies are (see next section). In order to motivate R&D employees, many entrepreneurial initiatives are undertaken. For instance, "internal start-ups" allow employees with a good idea to elaborate a business plan and eventually move from the research center to a business unit where they receive all the needed support from experienced entrepreneurs to turn their project into reality. Nokia excels in technology (software engineering, electrical engineering, miniaturization, software and design ergonomics, …) and in the management of technology (technology forecasting, technology integration, management of software complexity, …), which are knowledge intensive activities. As one of the world leaders in demand-supply chain management, Nokia detains the key competencies to manage the entire mobile phones' product value chain. Nokia is able to optimise and integrate the logistics from the suppliers' suppliers to the final customer with just in time delivery and procurement systems, real time product tracking systems, a global network of transport services, and close to market manufacturing sites.

Nokia outsources several less knowledge intensive activities, such as mass manufacturing or distribution. For instance, Nokia has a strategy of collaboration with specialized organizations, called EMS's (Electronic manufacturing services), that manage a flexible, modular and reconfigurable assembly system for short and fast production cycle. Nokia has therefore a strategic alliance with Elcotech, a leading EMS, for the realization of some activities of the mobile phone product value chain such as purchasing, manufacturing, and after sales service. Distribution is also outsourced: both retail outlets and network operators around the world sell mobile phones' to final customers. However, Nokia sells directly online to final customer's accessories, such as chargers, covers, batteries, head sets, etc. Finally, also outsources some knowledge intensive activities, such as the development of several applications, to Celesta, a company that develops software tools and integration solutions with information systems (SAP R/3, Lotus Notes, etc) for digital mobile devices.

Nokia practices the art of competition : there is a high degree of collaboration between Nokia and its direct competitors which is necessary for achieving technological interoperability through the establishment of common standards, technologies and protocols such as 3G technologies, EPOC 32, WAP and Bluetooth. Nokia is therefore working very closely with its competitors, namely Ericsson, Motorola, Qualcomm, with network operators like NTT DoCoMo in Japan and with international agencies such as the ITU (International Telecommunication Union) to develop the 3G technologies that will allow wireless

transmission speeds going up to 2 Megabytes per second (Mbps). 3G technologies will provide a wide range of possibilities: from narrowband voice up to wideband multimedia services; messaging services such as a the universal mailbox (voice mail, fax and e-mail); real-time audio/video applications such as videophone, videoconferencing, audio music and specialized multimedia applications; subscription to information services such as news, weather, traffic, etc; remote wireless access to the Internet and corporate Intranets; and electronic commerce applications. The first deployment of 3G technologies is expected in Japan as soon as 2001.

Three standards for wireless operating system are competing: Microsoft's Windows CE, Symbian's EPOC 32 and 3Com's Palm OS. Nokia is involved in Symbian, a joint venture of industry leaders including Ericsson, Motorola, Panasonic and Psion. Symbian's mission is to set the standard for mobile wireless operating systems (EPOC 32) to enable mass market for wireless information devices. According to some observers, the main objective of the joint venture is to prevent the adoption of Windows CE as the dominant design in the mobile phones market. Obviously, this strategy was adopted to avoid the actual trend in the PC market where hardware manufacturers have seen their margins shrink while Microsoft's profits continue to grow. With more than 90% of the operating system PC market, Microsoft can control the evolution of the industry by dictating the actions of the various computer manufacturers. Moreover, Nokia and Palm Computing have recently joined forces to introduce the Palm OS standard in future wireless devices. As a result, Nokia positioned itself on two competing standards EPOC 32 with Symbian and Palm OS with Palm Computing to avoid the risk of being excluded and, to benefit from product ecologies derived from these two standards.

Nokia is also very active in the development of the standard WAP (Wireless Application Protocol) whose objective is to provide Internet-based communication and advanced telephony services on digital mobile devices. More than 100 companies from the telecommunication, information technology and content industries have joined the WAP Forum in order to develop a common protocol that will allows users with wireless devices to access the WWW (World Wide Web) seamlessly. The upcoming Nokia 7110, nicknamed the "Matrix" for its similarities with the mobile phone shown in the well-known movie, will have a larger screen than usual, a sliding cover and will be one of the first mobile phones to be equipped with WAP.

Finally, Nokia develops in collaboration with Motorola and Ericsson a radio link industry-standard called Bluetooth that will enable various types of devices, including mobile devices, personal digital assistants, personal computers and printers, to transmit and receive large amount of information from distances up to 32 feet. Nokia is participating in designing an integrated circuit for Bluetooth that will be at the heart of what is commonly called today a "personal area network".

Propensity for velocity : Death of distance ?

With the rise of the Internet and other electronic tools, transactions, financial and technical data had never traveled so fast between business partners. Physical interactions are now the bottleneck in many product value chains. Since time-to-market and order cycle time are the critical success factors, clusters of business partners have to be located as close as possible to the market. Price erosion in the mobile phone industry being so high, one cannot afford the costs of weeks of transport before the products reach the market.

Nokia's business partners involved in the mass production of mobile phones are clustered in three highly strategic agglomerations. The first cluster is located on the coastline of the Gulf of Finland where knowledge-based pre-mass manufacturing is accomplished in Salo and Helsinki, while mass manufacturing is performed 100 km away in Tallinn (Estonia) where labor costs are much lower. The second cluster is in southern United States where pre-mass manufacturing activities are conducted in Forth Worth (Texas, USA), while mass production is done in Monterey (Mexico). The last cluster is located in Southeast Asia, where some production sites are located in western China. This pattern tends to repeat itself since Nokia and its partners has recently announced major investments to create similar clusters in Germany and Hungary.

Physical clusters thus prevail when two or more activities such as pre-manufacturing and mass manufacturing require a certain level of physical interaction but also occur when critical knowledge-based competencies are at play. In fact, Nokia's research centers are also close to best-in-world and unique competencies. The location of each research center has been driven by a specific set of imperatives that are outlined in table 1. Eleven research centers are involved in Nokia mobile phones' product value chain, each research center detaining a specific set of areas of expertise. Although Nokia's research centers are geographically dispersed, they can share their expertise by collaborating in virtual teams. In fact, the eleven areas of expertise have to interact in real time in order to bring rapidly to the market next generations of mobile phones.

Table 1 Location of Nokia Mobile Phones' research centers.

City, Country	Areas of expertise [1]											Imperatives
	1	2	3	4	5	6	7	8	9	10	11	
Beijing, China									■			Located in the He Ping Li's industrial park
Bochum, Germany		■										Near University of Bochum and Siemens
Boston, United States	■		■	■			■					Near Massachusetts Institute of Technolgy (Media Lab)
Budapest, Hungary			■									Abondant skilled labor in software engineering Hungarian language is similar to Finnish
Dallas, United States	■	■				■						Near University of Texas and Texas Instruments
Helsinki, Finland	■	■	■			■	■	■	■		■	Home based Near Helsinki University of Technology
Kista, Sweden			■	■								Located in Kista Technopolis to recruit former Ericsson employees
Oulu, Finland		■	■						■			Located in Oulu Technopolis near the University of Oulu
San Diego, United States					■							Located in San Diego Science Park near University of California in San Diego
Tampere, Finland		■	■					■		■		Near University of Tampere and other public research laboratories
Toyko, Japan	■	■							■			Located in the Yokosuta Research Park near NTT Docomo

[1]The areas of expertise are as follows :
1) Radio communication
2) Electronics
3) Software engineering
4) Multimedia
5) Radio frequencies
6) Cellular networks
7) Communications system
8) Voice recognition system
9) Third generation (3) standardization
10) Video technology
11) Digital signal processing

Even in the case of intangible interactions such as the exchange of ideas, expertise and know-how, physical proximity still matters to a certain extent. Being able to pool together a critical mass of top research professionals in one specific geographic region remains an overriding concern (Table 1), although it is acknowledged that high performance global networks allow electronic interactions between regions. Moreover, rapid feedback requires physical proximity between pre-manufacturing sites and R&D centers. This is particularly evident for the Salo and Forth Worth plants.

Enhancing specialized value propositions to the final customer

Nokia is well known for its know-how on design and ergonomics. With locations all around the world, including San Francisco, Milano and Paris, the capital cities of fashion, Nokia uses virtual mock-ups to develop in real time fashionable mobile phones. Engineering specifications for mobile phone and their design not only reduce time to market but also allows for mass customization. Customers have the possibility to configure and personalize their phones. Like car manufacturers and clothes designers, the company introduces many new models every year. The customers can change the colors of their Nokia phones according to fashion and customize their appearance with clip-on covers. To acquire and maintain this knowledge on design and ergonomics, Nokia dedicates part of its activities to consult experts from the fashion and public relations industries.

With an emphasis on mobile phones as fashion-items, Nokia invests enormous efforts in marketing. The organization capitalizes on brand making, subdivides the market into specific niches and anticipates the needs of its customers. It tries to sell the "product image"

of mobile phones while positioning it as a high-tech item. Operating in a country with the highest world-wide use of mobile phones Nokia detains a large competitive advantage over its competitors since it receives on-going feedback from very knowledgeable Finnish customers who can be considered as lead users.

Competitive advantages derived from mass customization can become even stronger since specialized companies are focussing on content applications. For, instance, WAP IT shares Nokia's vision that the mobile phone will soon become a portable PC. The company already provides some 250 different services such as access to information on stock markets, news, weather updates and bus schedules. Nokia's customers can therefore own a personalized portable device that suits their very particular needs.

Conclusion

Nokia has built a strong value network around one of its product line, namely the mobile phones. This is largely the key of its success. Since, Nokia has learn to focus on its core competencies while partenering with best-in-world players in selected areas to bring the best customized mobile phones to the market, as quick as possible and at the lowest price. Activities along the product value chain are performed by organizations detaining the very best know-how and expertise. The overall coordination and optimization of the product value chain is however the ultimate responsibility of the Finnish manufacturer.

Nokia seems to ride rather smoothly over the three competitive forces since the company demonstrates :

(i) a strong focus on knowledge-based activities while practicing the art of coopetition;
(ii) an on-going concern with velocity that results in a balancing act between the importance of physical proximity while relying on electronic means for virtual activities performed in geographically dispersed regions;
(iii) a well thought market strategy where the mobile phone is positioned as a high-tech, high fashion and personalized device which brings to the final customers specialized customized services.

The Finish company performs well in a highly dynamic environment. It has already shaped to a certain extent the future of the mobile devices (and consequently PCs). Will its leadership position be challenged within the next decade? Competition among industry leaders will undoubtedly be fierce.

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