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BUILDING EUROPEAN COMPETITIVE INDUSTRIES

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Abstract. The world technology scene changes constantly and the intercontinental migration is fast. In the past, Europe has been losing some major industries, such as the camera and the watch industries, but recently it has gained new foothold in the new emerging technologies. The massive applications of the *mobile communications* are today in the hands of the Finns and Swedes, while the Germans and the French hold the mass use of *chip card applications*. These cases hold promise to change the perception of Europe as a perennial loser in the technology warfare. What were the reasons for a success in building up these new industries? Will Europe be able to maintain its leading position in the new, emerging technologies? How will these new fields fertilize the technology infrastructure? These questions will be analysed in some depth.

Key words: camera industry, watch industry, mobile communications, smart card.

1. LOST EUROPEAN INDUSTRIES

1.1. The camera industry

Greek philosophers first discussed the *camera obscura* in the 5th century BC, and by the 4th century BC, both the Chinese and the Greeks described the camera and suitable principles of optics in detail. In 1553, Giovanni Battista Porta published details of the design and structure of the *camera obscura*, and some 73 years later, Joseph Nicephore Niepce made the first successful photographs. The real camera industry can be traced back to year 1888, when Eastman started marketing the Kodak cameras and roll film in the USA.

Prior to World War II, several companies started marketing low-cost optical gadgets, specifically Leitz and Zeiss of Germany and Nippon Kogaku of Japan. The fundamental development of fine optics was the principal reason, why the camera developed further in Germany and became a powerful industry, paralleled with the development of simpler models by Eastman Kodak in the USA. In this period, the Japanese developed cameras based on the designs of their main competitors.

However, the Japanese introduced the automatic camera and focused on product improvements, technical advances and quality, based on low-cost engineering and sheer competitiveness in production. The Germans were still the masters of quality optics, but intense cost pressure eroded the fundamental markets, an effect that was not properly noticed by the self-satisfied Germans. An additional effect to the erosion of European added value was the outsourcing of a number of key mechanical, optical and mechatronic components to the Far East, which slowly but efficiently taught the Japanese to master the production of these key technology elements [1].

The continuous price reduction of quality cameras brought upon a dramatic change of customer behaviour. Earlier, the camera was a valuable piece of equipment, inherited from the father to the sons. Now it became a fashionable present, a popular cheap commodity item. This increased the sales of cameras under a price war situation, thereby further strengthening the decline of the German camera industry. What followed was a typical reaction of the market economy, the loss of the strength of the infrastructure which led to a rapid destruction of the German camera industry in just a few years.

This process is clearly outlined in Fig. 1. It shows the increased European imports, the German retreat to market niches, the loss of European competitiveness, and the explosive growth after the subsequent change in the markets. In just a few years, the whole European camera industry was gone, leaving a few million employees redundant. It also eroded the main technology base, the German fine mechanics competence.

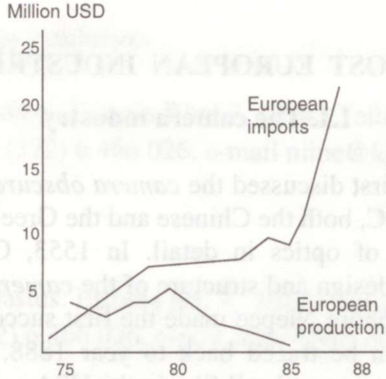

Fig. 1. Dynamics of the camera industry.

1.2. The watch industry

The history of clocks and watches began in the early 15th century. Since about AD 1400, the cathedral of Geneva had a clock. Some portable watches for the royal were also made in Geneva during the beginning of the 15th century. During the puritan Calvinistic reformation years, a series of edicts regulated the life and behaviour of people, and wearing of jewellery became strictly forbidden. Since the basic skills needed for making watches were in many ways similar to those needed for making jewellery, this gave birth to a new profession for the now redundant goldsmiths, especially in Switzerland, Southern Germany, and Eastern France. At the end of the 18th century, Switzerland acquired a global dominance in the watch industry, and the mass production began with the introduction of the compact mechanical wristwatch. The main anchor for stabilizing the location became the local skills in fine mechanics.

The first electrical watches were produced in the United States in 1952. A dramatic change happened in 1969, when Texas Instruments introduced the first affordable wristwatches based on quartz timekeeping and an LED display. As a result, the electronic watch industry migrated to the USA.

In the advent of mass production, the mechatronic design principles evolved in Japan in 1965, because of skills gained in production of VHS video tape recorders, and the Japanese became excessively competitive, along with the camera production (Fig. 2). Companies like Seiko, Citizen and Casio dominated the market [2,3]. In this process, watchmaking started to resemble jewellery again, as the most expensive component of a watch was the case, and the designs developed towards fashion orientation.

As a migration effect, manufacturers in Hong Kong began watch production in 1976 and concentrated on the mass production of cheap watches in automated factories [4]. This trend propagated swiftly also to other ASEAN countries, i.e., Korea, Malaysia, and South-East China. Today, the watch industry is strongly in the hands of the Far East corporations, even when a re-established Swiss entrant, the Swatch, feverishly tries to regain the Swiss market posture with its recent negligible world market share [5–7].

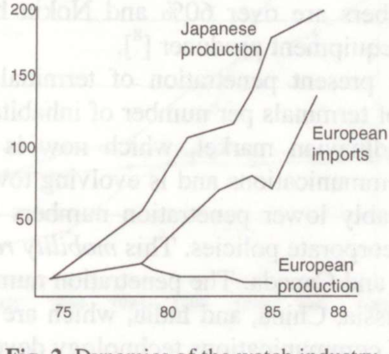

Fig. 2. Dynamics of the watch industry.

2. NEW EMERGING MARKETS

2.1. Digital mobile telecommunications

The new emerging market of digital mobile cellular communications shows a relentless growth which continuously breaks all foreseeable record limits. This seems to be caused by an intense simultaneous spiral development of modern telecom innovations and a continuous reduction of costs. This development is further promoted by the fashionable trend towards mobility.

Walkie-talkies were originally developed for short-haul tactical communications for the military during World War II. They found extensive use during and after the war, followed by analogue mobile telephones based on various local standards, such as NMT, AMPS, and TACS. First, when the concept of digital cellular networks materialized, true mobile communications for masses became a reality. Europe grabbed the possibility by developing a Pan-European digital cellular system standard, GSM, called so after its standardization committee, ETSI "Groupe Spécial Mobile". Although the original target was to develop just a Pan-European standard, the system gained huge worldwide popularity and is on the way of becoming a global 2nd generation standard. It has so far been implemented in about 70 countries, including a large number of countries in Far East, Africa, and South America. The US was delayed in the application of the digital cellular telephony because of unnecessary and ill-founded disputes over the relative merits of frequency and code division.

Presently, the mobile terminal market grows at a staggering speed and is dominated by two Scandinavian producers, Nokia of Finland and Ericsson of Sweden. Together, they cater for well over half of the terminal market, and for most of the cellular infrastructure, i.e., the base station and switching market. The development in Northern Europe can be explained by impeccable cultural acceptance of mobility, as Scandinavia traditionally already has the most advanced wire-bound structures and telecom networks in the world. This, however, is not the case in Southern Europe. The second reason is the pioneering work in analogue mobile communications with the NMT mobile standard. Quite recently (December 1998), Finland broke the world record by becoming the first economy in the world to have mobile penetration over 50%. The present (early 1999) penetration numbers are over 60% and Nokia has become the world's largest mobile telecom equipment producer [8].

Figure 3 shows the present penetration of terminals. "Penetration" is here defined as the number of terminals per number of inhabitants. It shows a dramatic leadership of the Scandinavian market, which now is strongly in the second generation of mobile communications and is evolving towards the third. Southern Europe shows considerably lower penetration numbers because of lower social acceptance and stricter corporate policies. This *mobility revolution* has also caught fire in Japan, Australia, and Canada. The penetration numbers are expected to rise especially rapidly in Russia, China, and India, which are expected to try to jump over two generations of communications technology development at once.

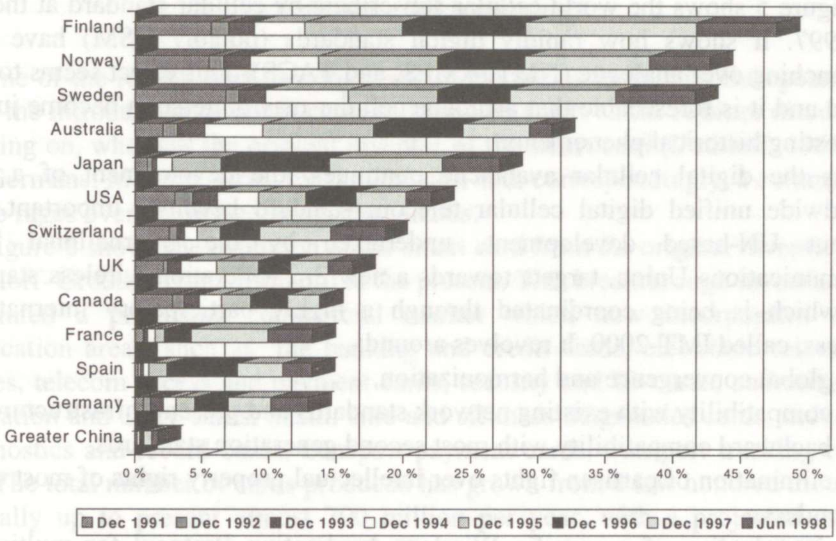

Fig. 3. Mobile terminal penetration.

At the end of 1997, the total world market was around 100 million terminals and the number is believed to rise dramatically this year. It will also be considerably larger than the combined sales of personal computers and passenger cars, which are around 80 million and 34 million, respectively (Fig. 4). According to the telecom operators, the number of cellular subscribers is estimated to be slightly over 200 million today.

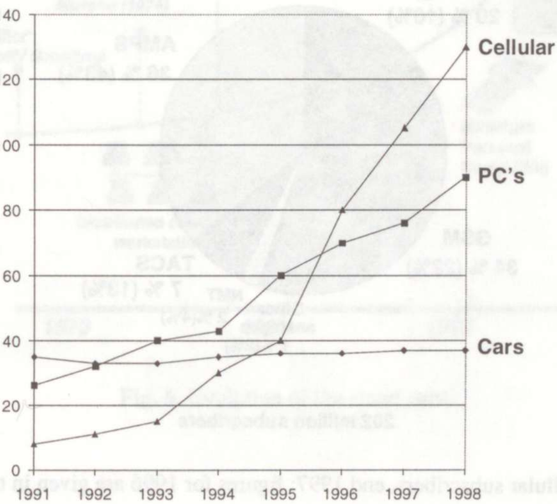

Fig. 4. Dynamics of the annual world sales volumes of cellulars, PCs, and cars (in millions).

Figure 5 shows the world cellular subscribers by cellular standard at the end of 1997. It shows how rapidly digital standards (notably GSM) have been avalanching over analogue (NMT, AMPS, and TACS). This effect seems to gain speed and it is foreseeable that analogue cellular may quite soon become just an interesting historical phenomenon.

As the digital cellular avalanche continues, the development of a truly worldwide unified digital cellular telecom standard becomes important. The present UN-based development, undertaken by the International Telecommunications Union, targets towards a new 3rd generation wireless standard [9], which is being coordinated through a highly participatory international process, called IMT-2000. It revolves around:

– global convergence and harmonization,
– compatibility with existing network standards and present infrastructure,
– backward compatibility with most second generation standards,
– elimination of partisan fights over intellectual property rights of most of the contenders,
– introduction of a specific Wireless Application Protocol for multimedia terminals and Bluetooth connectivity.

The new standard is based on a powerful new technology, WCDMA, and contains harmonization/compatibility between IS-41, UTRA, UMTS, and GSM-MAP and regionally based standards like cdma2000 and IS-95. It is being supported by the global communications community, including Alcatel, Ericsson, Matsushita, Motorola, NEC, Nokia, Nortel, Siemens, and Sony.

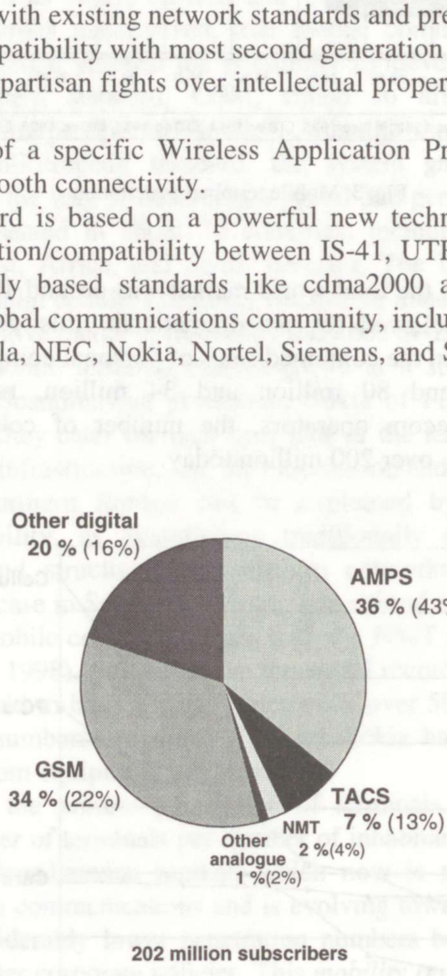

Fig. 5. World cellular subscribers, end 1997; figures for 1996 are given in the parentheses.

2.2. Smart card technology

One of the recent main developments in the life of individual Europeans has been the introduction of credit cards followed by smart cards. A bitter discussion is going on, who was the original inventor of the smart card (Dethloff, 1966, for the Germans; Moreno, 1974, for the French), and, correspondingly, a commercial battle rages over the respective market shares.

Figure 6 shows the evolution of the smart card from the original inventions of Dethloff–Groettrup (and Moreno) to the present. This breakthrough invention has generated a promising commercial market which now incorporates many application areas, such as the banking and credit cards, electronic reloadable purses, telecom access and payment cards, security and ID cards, authorization, validation and entry cards, health care and sickness diagnostics cards, industrial diagnostics and record cards, transport payment cards, transport tracking cards, etc. The total number of cards produced has grown from a few hundred thousand annually up to present almost 700 million per year, with a projected annual compound growth rate close to 100%. The smart cards represented in 1997 about 2% of the total production volume of all semiconductor chips and are heading towards the futuristic concept of *a-full-mainframe-computer-on-a-single-chip*. The most interesting recent development has been the contactless remote reading of the cards.

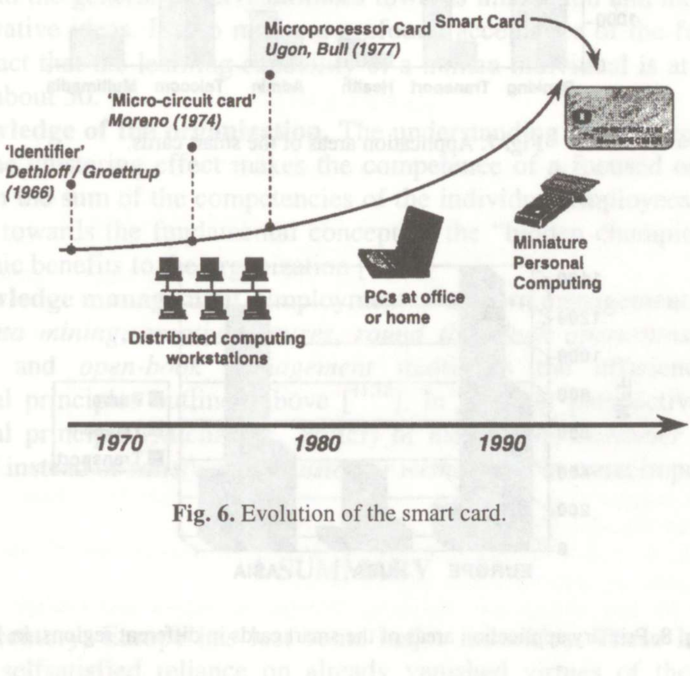

Fig. 6. Evolution of the smart card.

Figure 7 shows the various global application areas of the smart cards. This is just a snapshot, as new applications are introduced on a monthly basis.

Figure 8 shows the primary application areas of the smart cards in different regions. Europe seems to lead in the acceptance of the cards in everyday functions. The fundamental concept is unlimited as far as applications are concerned. This then leads, of course, to so many possible applications that complete application quantities cannot be available. The main producers/users are Bull CP8 (France), Giesecke & Devrient and Siemens (Germany), and some others. The total annual volume produced (rough estimate, 1997) is about 210 million in France and roughly the same in Germany. The main application countries are Spain, Germany, France, UK, USA, Canada, Brazil, and Mexico. The Far East numbers have not been published. It seems that this technology is relatively well in the hands of the Europeans.

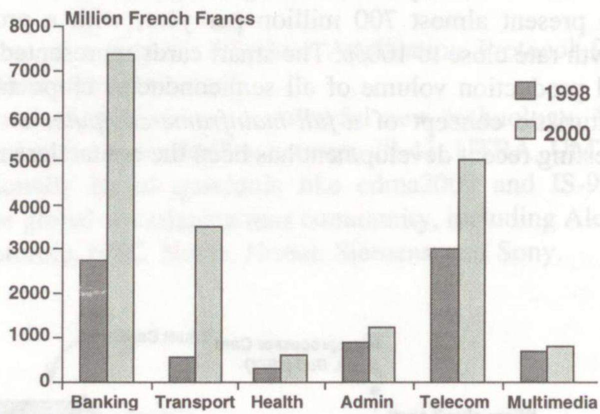

Fig. 7. Application areas of the smart cards.

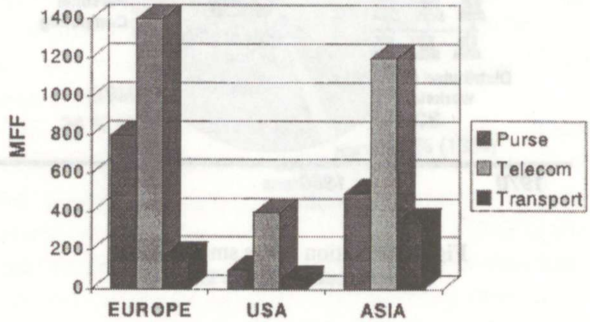

Fig. 8. Primary application areas of the smart cards in different regions, in 1998.

Large credit card operators, especially Visa, Europay, MasterCharge, and American Express have been extremely interested in the application of the smart cards because of the inherent security aspects. The present chip technologies used are EMV (for computerized applications) and B0 (for older credit card applications). The production numbers for Visa in 1997 are as follows:

– 4 million reloadable Electronic Purses,
– 4 million disposable Electronic Purses,
– 13 million Visa credit cards,
– 150 000 recent multiapplication Java cards.

Smart cards are characterized by expansive growth of innovative applications, application-dependent architecture and cost reduction projects, and aggressive layout-specific development. It is foreseeable that the present costs will be halved on the average annually for at least the coming 3–4 years.

3. MIGRATION OF TECHNOLOGY

Technology seems to wander around astonishingly easily. As can be seen from above, the main ingredient in this process is neither the size of the economy nor the culture itself, but the knowledge. In the modern world, the most important factors are the following.

1. Knowledge and skills of the individuals. They can be enhanced with conscious national policies, as in the states of Singapore or Finland. The most important aspects are a general national acceptance of the concept of *lifelong learning* and the general positive attitudes towards innovation and income based upon innovative ideas. It also means a profound acceptance of the fundamental scientific fact that the learning capability of a human individual is at its peak at the age of about 50.

2. Knowledge of the organization. The understanding that in organizational learning, the clustering effect makes the competence of a focused organization greater than the sum of the competencies of the individual employees. Then, the preference towards the fundamental concept of the "hidden champions" brings the economic benefits to the organization [10].

3. Knowledge management. Employment of modern management principles, such as *data mining*, *creative centres*, *round the clock operations*, *balanced scorecard*, and *open-book management* multiplies the efficiency of the fundamental principles outlined above [11,12]. In a longer perspective, the new fundamental principle (Michael E. Porter) of *making the customer selectively dissatisfied* instead of *satisfying all customer wishes* may become important.

4. SUMMARY

In this century, Europe has lost some major industries. These losses were caused by selfsatisfied reliance on already vanished virtues of the industrial society with no sensitivity for weak signals of coming changes. For a moment it looked as if the Far East had taken over the initiative and the leadership. However, the founding of the European Union, the common currency EURO, and the numerous many-faceted development actions of the EU have given Europe a new innovative posture which shows itself in innovative industrial activity using the possibilities available in modern emerging technology. Two new technologies, i.e., the *mobile communications technology* and the *smart card technology*, seem to have replaced the lost industries with interesting growth potential.

In the long run, the home of these technologies is not necessarily permanently fixed in a given country or continent. After they broke out to public knowledge as the mainstays of emerging new technologies, a fierce competition over these new promising themes has broken out. The situation is further volatilized with new understanding of the main competitive factor, the *competence*. It is not dependent on the scale factors of size and economy. We may watch the development in the time frame of some 20 years. Those investing in these growth opportunities may face an uphill battle, but may be rewarded in the near future.

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EUROOPA KONKURENTSIVÕIMELISE TÖÖSTUSE LOOMINE

Matti OTALA

Maailma tehnoloogiline kaart muutub pidevalt ning tehnoloogia kontinentidevaheline migratsioon on kiire. Euroopa on kaotanud domineeriva positsiooni fotoaparaatide ja kellade tootmisel, kuid on olnud edukas mobiilse telekommunikatsiooni ja tarkade kaartide valdkonnas. Artiklis on antud analüütiline ülevaade nimetatud protsessidest.