

Competitiveness Policy in Denmark

Telecommunication Cluster in Northern Jutland

Case (A)

All of the Nordic countries had several major information and communication (ICT) clusters with different specializations. Sweden and Finland were amongst the most specialized countries and had several strong ICT-clusters and well-known multinational companies such as Ericsson and Nokia. Denmark also had several strong ICT-clusters and was nearly as specialized as the other Nordic countries but had no large and well-known ICT-multinationals.

The relatively high proportion of rather successful ICT clusters in the Nordic countries had to be founded in a rich and well-educated population, a high concentration of computers and mobile phones and easy Internet access. Furthermore, the Nordic countries had invested heavily in ICT education and research and many companies had utilized the possibilities of the Internet to new business models. Also e-government was widespread in the Nordic countries.

The Nordic countries were amongst the first countries in the world to introduce a common trans-national standard for mobile phones. In 1981 the Nordic Mobile Telephone operators launched the first cross-national public mobile telephone system, the (NMT).¹

Denmark had three ICT clusters of some magnitude. The largest ICT-cluster was located in the Greater Copenhagen area with about 60.000 employees followed by the ICT cluster in the second largest city, Aarhus, with about 20.000 employees in the ICT sector.

The third largest ICT cluster was located in Northern Denmark with approximately 10.000 employees. The Northern Jutland ICT cluster had been specialized in telecommunication just like the largest Swedish and Finnish ICT-clusters. The companies in the Northern Jutland ICT cluster had been able to compete with the largest multinationals in developing the technology behind the first version of 1G and 2G mobile phones, despite the

¹ A prototype of AT&T's 1G AMPS system was tested in 1978 Chicago, but due to a series of complications, mainly rooted in the ongoing anti-trust case against AT&T, a 1G system was first launched commercially in the US in 1983.

fact that it was a small cluster, and had also been involved in developing the first versions of 3G.

While the Northern Jutland cluster had been successful in competing on ICT research and development it had failed in commercialization and production and therefore hadn't been able to create any large companies. On the other hand the cluster was housing a large number of small and advanced technology companies and had been able to attract a large number of the world's leading ICT multinationals (e.g. Motorola, Ericsson, Nokia, Intel, Siemens, Flextronics and Texas Instruments).

The region had been dominated by primary industries but also had strong positions within metal industries, shipyards, cement and other building materials. The employment in these sectors was declining but the sectors still played an important role in the region.

Even though Northern Jutland had traditionally been grounded in these sectors the region had been able to do well in high tech and in the last three decades the region had gradually found its way into high tech and had been able to foster a remarkable number of small advanced high tech companies.

In the mid 1970s the capital of Northern Jutland, Aalborg, got its own university. From the beginning, the university had a rather large department for telecommunication and in the mid 1980s, when the Northern Jutland ICT cluster started to take shape Aalborg had a critical mass of researchers in wireless telecommunications.

Gradually a relative strong telecommunication cluster paved the way for related IT companies and the telecommunication cluster evolved over the years into a broader ICT cluster.

The consolidation of the mobile phone industry had restructured the ICT-clusters all over the world and also in Northern Jutland. The final outcome of this consolidation was yet to be seen, but the development in the previous thirty years of the telecommunication cluster in Northern Jutland made an interesting object for studying clustering and the importance of policy.

The beginning of the ICT era in Northern Jutland

In 1948, SP Radio, a producer of consumer electronics to the Danish market was established in Northern Jutland. As the radio market and other markets for consumer electronics saturated in the 1960s SP Radio switched its focus to marine radio communication equipment especially to small vessels.

It was the local market for marine radios that made it interesting for SP Radio to focus on this area. Northern Jutland had a large fishing industry and many small fishing boats.

Furthermore, the region was a tourism region with long coastlines and many harbours and yachts.

In 1965, the legislation of safety on board became tighter due to IMO's fourth SOLAS convention² and claimed for better equipment on fishing boats and yachts, which provided SP Radio with a relative big and growing local market for radios and communication equipment to small vessels. Denmark had played an active role in the different working groups under IMO and several key persons from the Northern Jutland cluster were active in several of the working groups together with other of the industries leading companies. The driver of the Danish involvement in the working groups under IMO had been the National IT and Telecom Agency under the Danish Ministry of Science, Technology and Innovation.

SP Radio became a leading company on the local market and rather fast SP Radio also had global success and became one of the world's leading producers of maritime communications equipment to small vessels. From 1965 to 1980 SP Radio went from 110 employees to more than 300 employees.

The success of SP Radio was remarkable and several spinoffs from SP Radio were the first step in creating a wireless communication cluster in Northern Jutland. In 1973 engineers from SP Radion founded the company Dancall and later on Simrad Shipmate. In the 1980s the three companies, SP Radio, Dancall and Simrad Shipmate, were the largest radio communication companies in the region.

In 1974 Aalborg University (AAU) was established with three academic disciplines, science, humanities and social science. The university also integrated an engineering college, which was specialized in electronics. The university was expanding fast and especially science and engineering grow rapidly, which resulted in a large number of engineers graduating from the AAU. The university decided very early to focus on wireless communications and the University had a very well respected department for communication technology. In year 2000 AAU had 12.000 students in total and 4.000 students in science alone.

In 1981, mobile operators in the Nordic countries introduced the first trans-national mobile telephone network in the world. The mobile network was based on the Nordic Mobile Telephone System also known as the NMT-Standard, which became the beginning of a new technological life cycle. The system was the first full automatic mobile phone system and the first mobile system in the world that made it possible to travel between different countries and still use the mobile phone. Beside the Nordic countries the NMT system covered the Netherlands, Switzerland and some of the East European countries³.

² IMO, International Maritime Organization, is a United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships. IMO is the agency behind the International Convention for the Safety of Life at Sea (SOLAS). SOLAS is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The first version was adopted in 1914, in response to the Titanic disaster, the second in 1929, the third in 1948, the fourth in 1960 and the fifth version in 1974.

³ The Danish Postal Museum (<http://www.ptt-museum.dk>)

The NMT system became a commercial success in terms of user penetration, which called for significant international attention. The main producers of the equipment were Swedish Ericsson, which was the leader in infrastructure investments and Danish company, Storno, located in Copenhagen, being strong in terminals. Storno tried to strengthen the companies positioned on the mobile phone market by trying to take over the Finnish company MobiraOy, at several occasions during the 1980s without any success. MobiraOy was the result of a merger between Nokia and another Finnish company, SaloraOy, in 1979. In 1984, Nokia bought SaloraOy and the company's telecommunication branch changed name to Nokia-MobiraOy and in 1989 the name was changed to Nokia Mobile Phones.

The requirements for making cell phones in this period were rather low, which attracted new companies, among these were the Aalborg company Dancall, a company which had started out as a spinoff from SP Radio and originally produced maritime equipment.

Dancall succeed in having the company's first 1G mobile phone ready for the market at the same time as Ericsson, Nokia and Storno. The 1980s became the decade of the first generation of mobile telephony and Ericsson, Nokia, Storno and Dancallall experienced strong growth.

The business opportunities appeared promising but the competition increased. Prices and size of the terminals decreased and new technology possibilities emerged but the small Northern Jutland telecommunication cluster grew in spite of the challenges and at the end of 1980s Northern Jutland was visible as an NMT region and foreign companies started taking interest in the region. In mid 1980s the first Alcatel terminals were developed in North Jutland by T-com a spin off from Dancall, which was acquired by the Korean company, Maxon, in 1991.

In 1989, a new incubator and science park, NOVI opened next to Aalborg University. The intention was to raise the level of technology in the business communities in Northern Jutland by ensuring a better interaction between industry and university. NOVI became the birthplace of several new high-tech companies and large foreign companies like Ericsson and Nokia decided to locate research and development centers in NOVI.

From NMT to GSM – 1990 to 2000

The NMT standard was a success but not a lasting. NMT was an analogical technology and in mid 1980s the possibility of a digital solution became more and more obvious. Inspired by the success of NMT, European telecom operators decided to collaborate on a common European standard based on digital technology. The process was given strong political support and a Pan-European telecommunication system became a EU "flagship-project".

The Standardization process of the common European standard, GSM was taken over by a new organization, The European Telecommunication Standards Institute. It was decided that the common European standard (GSM) should be operational from 1991.

GSM represented an entire new technological life cycle. The Infrastructure had to be rebuilt with new antenna and base station in the landscape and new GSM terminals⁴.

The decision of establishing GSM started an international race when many international telecommunication producers had seen the commercial opportunities harvested by the big NMT actors Nokia, Ericsson and Storno⁵.

The introduction of GSM was so challenging and risky that some of the major multinationals formed alliances for developing parts of the equipment. Nokia formed an alliance together with Alcatel and AEG in the ECR900 consortium in order to develop GSM infrastructure technology. Ericsson cooperated with Siemens in order to fulfil a contract of building the Deutsche Telekom's G2 infrastructure.

The transition to a new digital standard was a big challenge for the relative small mobile phone manufacturers in Northern Jutland. At the time when it was decided to make the new European standard, there were four mobile phone manufacturers in Northern Jutland: Two local companies, Dancall and Cetelco both spin offs from SP Radio and two companies from outside the region, Storno and AP Radio, which had set up mobile phone production in Northern Jutland.

It was NOT in any way obvious that the small North Jutland firms could handle the transition to GSM, which would require the development of a new chip, a new circuit board and new software.

The Pro-rector at Aalborg University invited the regions four mobile phone manufacturing companies to discuss the possibility of working together to develop the basic technology for GSM terminals.

The two largest companies, Storno and AP Radio, declined collaboration and decided to develop GSM mobile phones themselves. Both Storno and AP Radio failed and do not exist today.

The two local companies, Dancall and Cetelco decided to collaborate and formed a joint development company, DC Development. The company was located on neutral ground at the newly founded Aalborg University science park, NOVI. The location in NOVI gave an easy access to important knowledge from the Department for Electronic Systems at Aalborg University.

DC Development and the Department for Electronic Systems collaborated with the standardization organization, Danish Standard and participated in the international GSM standardization and specification process, since the specifications were determined in parallel with the development of the terminals.

⁴In telecommunication the terminal is the user part (in the mobile area the handhelds) and the infrastructure the network of basic stations that controls the telephones.

⁵From 1981 Storno was no longer Danish but sold to General Electrics and in 1986 to Motorola.

The development project was co-financed by government aid and The National Telecom Agency participated in testing of the new terminal equipment.

The joint development company, DC Development was based on trust between the companies and a common understanding that both companies could use the developed technology and later on compete on design and functionality. There were no formal agreements regarding IP-rights between the two companies or with the university, but the collaboration between Dancall and Cetelco was made easier because both companies were relatively small with a market share of approximately 1 percent each of the - at the time - limited mobile phone market. Dancall had 1.500 employees when the company peaked in the beginning of the 1990s.

DC Development was successful in the sense that the collaboration led to a functional GSM terminal. At the top, DC Development had 30 development engineers from the two companies. The companies GSM terminal was presented at the CEBIT fair in Hannover, Germany in 1992 together with only a handful of other companies including Ericsson, Motorola and Nokia.

A new generation of mobile phones could be predicted, but the NMT market was however still growing. The competition was increasing and the prices falling. These squeezed profits in the NMT market and together with the development costs in DC Development it drained the relative small companies financially. The companies behind DC Development could not raise money and had to sell shares to foreign companies with an interest in entering the emerging mobile market.

Dancall sold shares to the major British telecommunications company, Amstrad and Cetelco sold shares to the large German telecom company, Hagenuk. Even though both Dancall and Cetelco had to give up the majority stake in DC Development the work continued and the first version was completed. The DC Development mobile phone was unique in the sense that it was the first mobile phone without an external antenna.

After the completion of the first version the collaboration was encumbered by difficult negotiations regarding IP rights and, not least, because of interference from the new partners Amstrad and Hagenuk.

Dancall and Cetelco continued the project for a period but ended up selling their shares. Dancall was taken over by Bosch, who later on sold the company to Flextronic and Siemens while Cetelco was taken over by Italian Telital.

There was a widespread fear that the sale of Dancall and Celecto and closing down of DC Development would be the end of the mobile phone era in Northern Jutland.

During the 1990s, all production of mobile phones in Northern Jutland was stopped but this also happened later on in other high cost regions.

Research and development continues. Instead of disappearing the group of development engineers from Dancall and Cetelco managed to start a survival process both through existing companies and by spinoffs, which in the end made the region a development hub for GSM terminals. At the peak, there were seven companies developing GSM equipment in Northern Jutland, mainly for foreign companies.

At the same time the first private GSM operator, Sonofon, decided to build its main operations in Aalborg,⁶ and Aalborg University research profile in telecommunication was consolidated by a new research Centre for Personal Communication, which became an important international player at the research scene in wireless technologies.

This signalled a rapid growth and the contours of a wireless-communication cluster took form. Several firms entered the cluster as spinoffs or as inexperienced entrants and several start-ups work in wireless-communication technologies other than mobile or maritime communication technologies.

Foreign companies also increased their focus on the region and established research and development labs. One of the US leaders in chipsets for mobile phones, Analog Devices, opened an affiliate in Aalborg in 1997. Analog Devices delivered chipsets for two of the local terminal developers and wanted to be present at the now thriving GSM development hub. In 1999, Texas Instruments bought the GSM developer; ATL and Infineon bought a small GSM developer, DWD.

At the end of the decade the GSM developers moved into technologies with faster data-communication performance indicating the early beginning of the next technological life cycle, 3G.

In 1999 Nokia and Ericsson founded 3G development units in Northern Jutland. The number of firms in the telecommunication cluster increased and in the year 2000 there were 40 firms employing 4.200 persons, which was about half of the total employment in the ICT cluster.

From 2G to 3G (UMTS) – 2000 to 2010.

When the IT bubble burst in year 2000 the Northern Jutland ICT cluster got hit but not nearly as hard as several other ICT clusters since the dot.com companies never had filled much of the Northern Jutland ICT cluster.

In the beginning of the new century the Northern Jutland cluster retained its position as the hub for many firms doing GSM development and several companies expand there R&D in 3G labs including Siemens (350 employees), Ericsson (125), Maxon (105), Shima (60) and Condat (20).

⁶ The European telecom regulation required at least two nationwide operators in each country.

However, the complexity and cost of developing UMTS increased and demanded huge R&D resources. At the same time the competition from emerging economies increased. The higher complexity and higher cost, the competition from emerging economies and the resulting consolidation in the communication industry forced many companies to form global alliances and focus their R&D in larger units.

As a result all the large foreign mobile operators closed their R&D labs in Northern Jutland, which of course hit the cluster quite hard. In 2007 alone, seven percent of the employees in the North Jutland ICT cluster lost their jobs.

However, several small local development companies remained in business and develop 3G technologies to market-leading mobile phones including smart phones. At the same time the demand for an increased number of functionalities of 3G handsets open new opportunities for specialization, which had been exploited by several companies also new start-ups.

The net result of the evolution was that the development of the basis 3G technologies did not take place in the Northern Jutland to the same extent as in the initial GSM phase a decade earlier. But the downsizing of telecommunication industry in the Northern Jutland in the second half of the 2000s had been counteracted by increases in other parts of the IT industry, and after a few years shrinking the total employment in the Northern Jutland ICT cluster had been restored.

Today, the ICT cluster Northern Jutland included about 260 companies with a total 10.000 employees.

The cluster was involved in four technology areas:

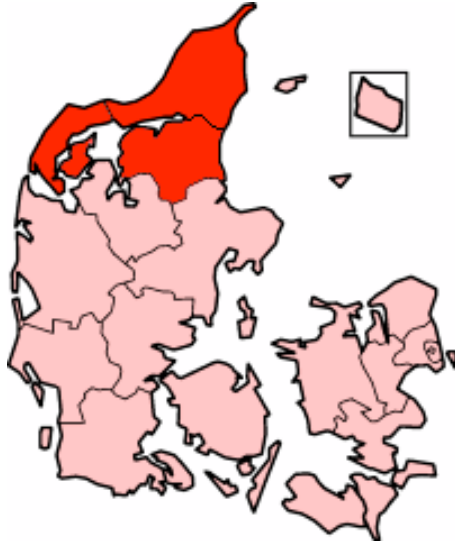
1. Wireless devices, blue tooth and software development.
2. Embedded software systems.
3. Data management and handling of large amounts of data.
4. Usability design and interfaces.

Around half of the value added was generated in IT service companies who were doing consulting, and customized software. The original telecommunication sub cluster accounted for 10 to 15 percent of the cluster's total value added and the same counted for digital health and data management.

New interesting areas in the cluster might have been green IT or smart grid and digital experiences, also called art & technology. Green IT and digital experiences both contributed with around five percent of the cluster's total value added. Another interesting emerging areas could have been intelligent transport systems.

Exhibits

Exhibit 1: Northern Jutland



Northern Jutland was an outskirt area in Denmark with nearly 600.000 inhabitants.

References.

This case was written based on interviews with the leading key persons from in the region that played an active role in relation to the concrete case. Thank you for taking the time for the interviews. Without your help, it would not have been possible to write this case study and we would not have been able to write about the valuable insights from your work.

Andersen, Jørgen Bach. Aalborg University (former Pro-rector)
Gelsing, Lars. Associated Professor, Aalborg University
Jensen, Lars Horsholt. Cluster Manager, Brain business ICT-North Denmark
Nøhr, Birgit Pia. Special Consultant, Aalborg University
Rauff, Erik. Blue Star (former CEO Dancall)
Tøfting, Svend. Project Director, The North Denmark Region

Articles:

Bent Dalum, Christian Ø.R. Pedersen og Gert Villumsen (2005), *Technology Life-cycles – Lessons From a Cluster Facing Disruption*, European Urban and regional Studies 12(3) 229-246.

Bent Dalum, Michael S. Dahl og Christian Ø.R. Pedersen (2003), *Entry by Spinoff in a High-tech Cluster*, Danish Research Unit for Industrial Dynamics, DRUID Working Paper No 03-11.