

Falch, Morten

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Copenhagen as a centre of excellence for mobile and Wireless communication - the interplay between supply and demand

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21st European Regional ITS Conference

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Morten Falch

**Copenhagen as a centre of excellence for mobile and Wireless communication –
the interplay between supply and demand**

Key words

Mobile and wireless communication, Mobile industry, Copenhagen capital region, National systems of innovations,

Abstract (150-300 words)

The aim of this paper is to analyze the potential of the Copenhagen capital region to maintain a leading position in development and provision of mobile technologies. The paper presents empirical data on the mobile sector in the capital region in order to identify strengths and weaknesses of the Capital Region of Copenhagen.

Denmark is as the rest of Scandinavia considered to be among the leading countries with regard to mobile and wireless communication. This position has been confirmed in a long series of benchmarking analyses comparing e-readiness in countries and regions. Denmark is also doing well with regard to connectivity of broadband and Internet access, and Denmark has also developed an advanced market for mobile services.

The major share of the Danish mobile sector is concentrated in the capital region. In relative terms the mobile sector is largest in Northern Jutland, but in absolute terms the capital region is more

important – especially if Scania on the Swedish site of Oresund is included. In this case the capital region of Copenhagen constitutes of the most important centres for mobile communication.

Morten Falch, Associate Professor Aalborg University Copenhagen falch@cmi.aau.dk

Introduction

The aim of this paper is to analyze the potential of the Copenhagen capital region to maintain a leading position in development and provision of mobile technologies. The paper will use systems of innovation (Edquist, 2005) and the ICT ecosystem (Fransman, 2007) as a general framework for describing the point of departure and possible policy actions.

Denmark is as the rest of Scandinavia considered to be among the leading countries with regard to mobile and wireless communication. This position has been confirmed in a long series of benchmarking analyses comparing e-readiness in countries and regions. Denmark is also doing well with regard to connectivity of broadband and Internet access, and Denmark has also developed an advanced market for mobile services. This position has been combined with a strong position within the mobile and wireless industry. This has been achieved in spite of the fact that Denmark never has hosted any of the major players within the IT and telecom industries.

However, this position has been challenged within the past few years. Denmark still is doing well with regard to usage, but the position among producers of ICT services and products is declining. This paper will provide a brief overview of the Danish mobile and wireless sector, and discuss the reasons for decline and the potential for future growth in sector.

In terms of conceptual framework, the paper takes its point of departure in the literature on systems of innovation (see e.g. (Edquist, 2005)). The reason is that the literature on the innovation side has examined a larger range of factors determining the development of innovations than the literature on diffusion has done regarding the factors determining diffusion. The literature on diffusion is traditionally confined to examining factors determining demand, while the literature on innovation often includes supply as well as demand and a wide range of technological, organisational and institutional elements.

More specifically, the paper aims at examining a sector (the mobile and wireless industry) or parts of a sector (new technologies and services). As such a sectoral systems of innovation approach can be used as a starting point (see e.g. (Malerba, 2005)). However, the aim of analyses of sectoral systems of innovation is mostly the comparison of different sectors and their systems of innovation within a geographical setting. Our aim is however to analyze a specific sector and analyze its potential within a specific region, as it is done in national systems of innovations (Lundvall, 2007).

The Danish position as an information society

There exist several lists that rank countries and regions with regard to their abilities as information societies. Usually Denmark as well as the other Nordic countries is positioned at the top of these lists. Two examples are networked readiness and e-readiness indexes. In the latest ranking (2009-2010) from the World Economic Forum (WEF) Denmark is positioned as number three, and in the two previous years Denmark was in the lead and has been so for the past few years (World Economic Forum, 2009). In the Economist Intelligence Unit (EIU) 'E-Readiness Rankings 2010', Denmark is number two after Sweden, while it was number one followed by Sweden in the previous year (Economist Intelligence Unit, 2009).

Table 1 Top ten countries in Network e-readiness and Digital economy rankings

Rank	The Networked E-readiness	Digital economy rankings 2010
1	Sweden	Sweden
2	Singapore	Denmark
3	Denmark	United States
4	Switzerland	Finland
5	United States	Netherlands
6	Finland	Norway
7	Canada	Hong Kong
8	Hong Kong	Singapore
9	Netherlands	Australia
10	Norway	New Zealand

Sources: World Economic Forum: The Global Information Technology Report 2009-2010, The Economist Intelligence Unit Limited 2010: Digital economy rankings 2010 Beyond e-readiness.

The readiness indexes provide a generalized overview of a wide range of factors relating to the development of information and communication technologies (ICT). The WEF index, for instance, is based on 68 parameters relating to environment components (market environment, political and regulatory environment, and infrastructure environment), readiness components (industrial readiness, business readiness, and government readiness), and usage components (individual usage, business usage, and government usage). The emphasis is thus more on the environment, readiness, and usage than on the production of ICT products and services.

The conclusion that can be drawn from these benchmarking exercises is that Denmark is among the most advanced information societies in the world. In spite of this, national ICT development Denmark is subject to a critical debate in the Danish media.

One reason is that the ranking tend to overestimate the Danish capacity as an information society. A study on how OECD countries perform with regard to broadband penetration gives clear indication of this. In this study Denmark is ranked as number 1, but if demographic and economic endowments are taken into account, it ranks as number 23 (out 30).

Another reason is that some negative trends can be observed in the most recent data. For instance indicate CapGemini's eGovernment Benchmark that the Danish position in usage of ICT application within the public sector has declined from the top to around average within a few years.

In 1994, the Danish Government published a new IT strategy called Info2000 plan in 1994. The Danish plan differed from many other similar national plans by its focus on public sector applications of ICT. The idea was that the public sector should play a leading role in transforming the Danish society into an information society. But since then the lack of a renewed political vision has implied that the adoption of IT services in the public sector is slower than in other countries (CIO innovation forum).

Usage and IT competencies are often evaluated by use of the number of access lines or other similar easily quantifiable measures. The problem is here that the high penetration rates for various ICT services and products are caused by demographic factors rather than well developed skills in using ICT.

It is no surprise that a high penetration can be found in a country with a high and fairly equally distributed personal income per capita. But this is not necessarily an indicator of high ICT skills, as it does not require more than the most basic skills to use the Internet for simple services.

On the contrary, recent surveys indicate that as much as 38% of the population do not possess basic skills in ICT, and what is more worrying this share is foreseen to increase to two thirds within a few years. Also with regard to availability of professional competencies within the ICT area, there are good reasons to be worried about the Danish position. The Danish economy benefits from having a well educated labour force, but the overall level of education has stagnated within the past decades. Moreover there seems to be a limited interest in ICT among students, and the number of IT graduates is below the OECD average.

In contrast to Sweden and Finland, Denmark is not the home base of any large ICT manufacturing company. And, the Danish incumbent telecom operators is not among the world's largest and leading telecom companies, which applies to the Norwegian operator Telenor and the Swedish-Finnish operator TeliaSonera. However, on the usage side and with respect to use-related factors, Denmark is and has traditionally been well positioned.

However, this does not apply to all parameters. With respect to the speed of broadband connections and regarding prices for broadband access, Denmark has mostly been positioned in the middle or in the group of less well-performing countries. This will be reported in the paper. The aim is not to explain these facts but to report on them as accurately as possible and to put the development in Denmark in perspective by comparing with other countries.

The aim of the paper is to present an empirical account of the broadband development in Denmark. Denmark has for a number of years figured at the top of international comparisons of broadband penetration. According to OECD broadband statistics, there were 36.7 broadband subscribers in

Denmark per 100 inhabitants in mid 2008, followed by the Netherlands, Norway, Switzerland and Iceland.

Manufacturing

Official trade and production statistics do not offer data for the production of mobile and wireless equipment, but international comparable figures for telecom equipment and for ICT in total (including telecom as well consumer electronics, computers etc.) are available.

It follows from the table below that Denmark has a major deficit in trade in ICT equipment, while trade in telecom equipment is almost in balance. This position has been quite stable since 1990 and up to 2006. This is a remarkable position as the production has undergone major structural changes within the past 20 years. Today a major part of the production is concentrated in a few countries, and only a few have a trade surplus. Sweden and Finland are those having the largest comparative advantage in telecom equipment, but in contrast to these countries none of the major equipment manufacturers are of Danish origin.

Table 2 Revealed comparative advantages in selected countries

Year	2000	2006	2006
Country	Telecom equipment	Total ICT	
Denmark	1,06	0,89	0,51
Finland	6,63	5,5	1,29
France	1,3	0,87	0,54
Germany	0,87	0,75	0,65
Japan	0,77	0,28	1,31
Korea	1,48	2,33	1,85
Sweden	4,46	2,09	0,76
United Kingdom	1,89	4,33	1,39
United States	1,08	0,84	1,11

Source: data extracted on 26 Aug 2010 12:48 UTC (GMT) from OECD.Stat

In spite of the fairly stable position, also the Danish telecom industry has undergone major structural changes. From being mainly home market oriented and focused on fixed terminals and network facilities, the industry is now export oriented and with focus on mobile networks and services.

In the early phase Denmark was among the leading countries in mobile communication and two out of the four first mobile phones were developed in Denmark. The two others were created by Nokia and Ericsson. This was partly due to a common Nordic initiative, which resulted in the launch of the first a cross-national public mobile telephone system in the world (NMT). The Danish expertise in this area originated from provision of maritime communication. The two Danish leading mobile

manufacturers were located in each part of the country: Dancall in Northern Jutland and Storno in Copenhagen and the mobile industry is still centered around these two areas. In spite of rapid growth in both companies they never developed to become large international players at the telecom market comparable to Ericsson and Nokia.

Especially the industry cluster in North Jutland has been subject for an extensive number of industry studies. The technical expertise within mobile communication has led to creation of a wide range of small and medium sized enterprises and in the late 1980's the region became a leading center for mobile communication. In the late 90's the ownership structure changed from being mainly Danish owned to be dominated by development units for major foreign telecom companies such as Nokia, Motorola, Siemens and Ericsson.

Within the past two year the Danish position within telecom equipment has deteriorated and the revealed comparative advantage was in 2009 only half of what it was in 2006 (OECD database). This is the result of the current financial crisis, which has implied that telecom manufactures has concentrated they activities. In such a situation Denmark is especially vulnerable due to an industry structure dominated by small and medium sized affiliates of large multinational companies.

Table 3 Mobile subscribers per 100 inh. in selected countries

	1996	1998	2001	2003	2005	2009	3G subscribers in %3G
Denmark	25	36	74	84	101	125	23.9
Finland	29	55	80	91	102	143	34.6
Sweden	28	46	81	98	101	131	38.7
USA	16,6	25,6	45,1	54,5	71,8	89,3	32.9
Canada	11,5	17,7	34,9	41,8	51,64	67,0	20.2
France	4,2	19,2	62,6	67,7	76,71	94,4	26.6
Germany	7,1	17	68,3	78,5	96,04	124,6	21.7
Italy	11,3	35,6	87,1	97,6	122,16	138,6	21.7
UK	11,6	21,9	77,1	89,2	106,26	124,8	30.9
Japan	21,4	37,4	58,8	67,9	75,51	85,8	87.9
South Korea	7	30,2	61,4	70,1	79,39	98,9	72.0

Sources: OECD: *Communication Outlook various issues*, (OECD, 2007)(Salz, 2009; Salz, 2010)

Penetration of telecom services in general has traditionally been high in the Nordic countries, and the Nordic countries were the first to achieve a wide penetration of mobile services. Especially Sweden and Finland have had an early adoption. One of the reasons for this was as described above the adoption of a common Nordic standard.

Following the introduction of GSM as a common European standard many European countries achieved similar penetration rates and Europe became a clear leader in mobile communication. The

successful implementation of one common standard for 2G telephony throughout Europe created a mass market for terminals and enabled roaming in most parts of Europe. Europe dominated the top ten list for penetration of mobile phones and GSM became the dominant world standard for 2G. Up to 1998 the penetration of mobile phones was lower within the EU than in US, but in 1999 the EU penetration was increased to 39.6 per 100 inhabitants compared to 31.5 in the US. In 2000, the EU penetration jumped to 63.4. Thereby the penetration became much higher than in Korea and Japan – the leading countries in the Asian market (OECD 2003).

While NTT DoCoMo was successful in their implementation of i-mode at the turn of the century, Europe was far from successful in their introduction of data services based on the European WAP standard at the same time. South Korea has been another early adopter of mobile data services, which now in many ways are more advanced than in Europe. Already in 2005 an overwhelming majority of the subscribers in South Korea had switched to 3G, and in Japan 50% of the subscribers had done the same. At that time most European countries had not yet introduced 3G at all, and only in Italy and Austria the penetration of 3G was more than 3 per 100 inhabitants. Although the penetration of 3G is increasing rapidly in Europe, the development is still far behind Japan and Korea.

In Denmark the issue of 3G licenses was delayed due to a political debate about the procedures. First the intention was to have a beauty contest as one of the first countries, as this was seen as the best way to facilitate 3G development. However, the huge incomes generated through 3G auctions in UK and Germany implied that the Danish Government wanted to use this allocation method as well. This delayed the implementation with at least six months.

With regard to introduction of new mobile services, Denmark lacks behind the other Scandinavian countries. This is closely related to the lack of innovative international operators at the Danish market. Today the dominating mobile operators at the Danish market are TDC, Telenor and Telia.

In the 90's Denmark was among the most advanced markets for mobile telecom services. This was partly a result of a deliberate policy attracting foreign investments in this area through an early liberalization. This policy was successful as France Telecom made their first major foreign investment in Denmark, and their affiliate Mobilix (later renamed Orange) made an important contribution to development of innovative services. Denmark was as a small, but advanced market seen to be the ideal place to test new services and applications. However France Telecom had difficulties in creating a profitable business in Denmark. Therefore they scaled down activities, and eventually they sold the affiliate to Telia.

Compared with Telia and especially Telenor, The incumbent operator TDC has not been very successful. As documented by William Melody, TDC has after its privatization been owned mainly by investors with more focus on short term profit than on long term investments and development (Melody, 2007). Before the privatization TDC had, in line with many other telecom companies, international ambitions and TDC made substantial foreign investments in Belgium, Switzerland in the Nordic/Baltic area. When the company was fully privatized, it was decided to sell a major part

of the shares to a strategic investor (Ameritech) in order to ensure that the company became a part of a global network.

However this internationalization strategy was far from successful . Ameritech was bought by another American operator one year after the privatization, and the new owners did not have an interest in developing their new Danish affiliate, and since then the international ambitions has been reduced and most of the foreign operations sold.

This develop is very different from what has happened in the other Nordic countries, where the incumbent operators Telia and Telenor has been much more successful in becoming more internationalized and achieving high growth rates.

The Norwegian mobile telecom market benefits from having a telecom operator – Telenor, which is very successful and innovative. Today Telenor has more than 100 mill. Subscribers all over the world. Telenor is also present on the Danish market, but although Telenor is an innovative operator on the Danish market, they tend to prefer to test new services in Norway before they are introduced in Denmark, and with regard to availability of mobile services the Norwegian market is definitely more advanced than the Danish.

The Copenhagen Capital Region

Most international comparisons are made at the national level, but a few studies on the position of specific regions have been made. mWatch Europe prepared in 2006 a benchmark of selected regions with regard to their readiness in mobile technologies(*A survey on mobile readiness in the city of øresund and its regional context*2006). Their mobile readiness index includes 18 different parameters including usage, penetration, innovative climate and management capabilities. The Capital Region of Copenhagen in this survey is well positioned in this benchmark, but Finland, Sweden and Norway all have regions, which are considered to be more advanced than the Copenhagen area.

A more recent study is prepared by Povl A. Hansen and Göran Serin (Hansen & Serin, 2010a; Hansen & Serin, 2010b; Hansen & Serin, 2010b) . This study provides an overview of selected ICT clusters in Europe. According to this study, the ICT cluster in the Copenhagen generated in 2007 an employment of 68,500 or 5.4% of the total employment of the area. If the Swedish side of Oresund is included the ICT employment is 91,000 or 5% of the total employment. In terms of size the region is far behind the leading European clusters. On the other hand the Copenhagen cluster is larger than neighboring clusters in Hamburg, Berlin, Oslo and Helsinki.

The Copenhagen cluster is studied in more detail in a separate report. It follows from this report that more than 60% of the employment is generated within the sub-sector ICT service and consultancy. Telecom generates around 10,000, but the employment has decreased by 15% from 2004 to 2007. Telecom employment has declined in other European regions as well. For instance in the Stockholm county where the employment in the has declined with 10% within the same period.

Discussion and Conclusion

Denmark is as the rest of Scandinavia considered to be among the leading countries with regard to mobile and wireless communication. This position has been confirmed in a long series of benchmarking analyses comparing e-readiness in countries and regions. Denmark is also doing well with regard to connectivity of broadband and Internet access, and Denmark has also developed an advanced market for mobile services.

The major share of the Danish mobile sector is concentrated in the capital region. In relative terms the mobile sector is largest in Northern Jutland, but in absolute terms the capital region is more important – especially if Scania on the Swedish side of Oresund is included. In this case the capital region of Copenhagen constitutes of the most important centres for mobile communication.

This position has been combined with a strong position within the mobile and wireless industry. This position is remarkable as Denmark has never hosted any of the major players within the IT and telecom industries. Denmark has created many innovative ICT companies combining available technologies in new ways. However none of these companies have developed to be a major player on a global scale. But, many international companies have established affiliates in Denmark in order to benefit from the innovative Danish environment combining advanced markets for ICT services and applications with the availability of a work force with high ICT skills. Some of these companies were first established as Danish start-up companies, which later have been taken over by one of the global players.

With regard to introduction of new mobile services, Denmark lacks behind the other Scandinavian countries. Apart from the incumbent operator TDC, The Danish market is dominated by the two Nordic operators Telia and Telenor. Both of these concentrate their innovative activities in their respective home countries, and new services are usually introduced in Denmark only if they have proven successful in Norway, Sweden or Finland.

Moreover Sweden and Finland benefit from having both a reasonable successful incumbent operator (Telia), and with a strong position among mobile manufactures (Nokia and Ericsson).

With regard to hardware development, Denmark has suffered from centralization and relocation of research departments to low cost countries in Asia. The relocation of research departments to e.g. India or China affects employment of researchers engaged in ICT development all over Western Europe, but especially Denmark is in a vulnerable position in this context as the employment is concentrated in a number of affiliates owned by foreign companies. In combination with the financial crisis this has resulted in a severe reduction in ICT related R&D in Denmark. Ericsson has more or less closed down its research activities in Denmark, and Motorola has reduced their staff by 50%. This has left Nokia as the only major international manufacturing player with significant research activities located in Denmark.

If Denmark is to maintain its leading position as an IT nation it is important to take initiatives, which can secure development of new ICT competencies and a high penetration of advanced ICT services. Apart from the Nokia research department with about 1,400 employees, the Danish ICT

sector lacks big players, which can drive the development. At present there is a large number of small and middle sized companies concentrated in two clusters located in the Capital Region and in Northern Jutland, where Aalborg University is located. Due to the dispersed character of the sector there is therefore an urgent need networking and collaboration, if a fertile environment is to be maintained in the capital region.

In view of the current trends within the industry it seems reasonable to focus on advanced services and applications of mobile and wireless technologies, as recommended by the High Speed Commission (The High Speed Commission, 2010).

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