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Incremental versus radical change – The case of the Digital North Denmark program

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1 Introduction

The paper discusses the intended versus realised implications of the Digital North Denmark IT program, DDN. The analysis is partial in the sense that it is focused on whether and how the program may have long-term consequences for the development perspectives for the regional Information and Communications Technology industries (ICT).

DDN was a regional IT program running 2000-2003 in North Jutland County in Denmark with national government support of € 23 million. The Danish government initiated the program with the aim of further strengthening regions with an already proven ICT capability (Dybkjær and Lindegaard, 1999, p.96-100). The declared approach was to build on the existing competencies in industry as well as at universities. The national government chose two regions - Ørestaden, a new concentration of knowledge-based institutions near Copenhagen Airport, and North Jutland. The Copenhagen program was basically concentrated on, literally, construction of a new IT University, a new neighbouring science park and a new media centre for the public broadcaster, Danmarks Radio. DDN was, on the other hand, organised as a large-scale experiment based on project-offers within four themes. The code words were to create a 'network society and a 'learning region' - i.e. a much wider level of ambitions, but also a more loose kind of wording, with a certain amount of 'hot air' involved. The participants - meant to be project consortia of ideally private firms, public or private organisations as well as regional and municipal government bodies - could get a maximum national government support of one third of the total project sum.

The point of departure of the paper is the theories of regional innovation policy based on localised change and user-producer interaction. Innovation policy is public action aimed to influence technical change and other kinds of innovation (Edquist, 2001). An ICT policy program is 'localised', if it is targeted to create incremental change in a region. It aims to reproduce and strengthen existing structures, but does not necessarily imply following deterministic trajectories, since unpredictable changes may

occur (Dosi et al., 1988; Boschma, 2004). Likewise is new variety mainly directed and channelled by the existing environment. The challenge is to support the (positive) development path of the regional production system, while avoiding technological and institutional lock-in. It is not sufficient only to learn, but also important to unlearn at the firm as well as at the policymaker level (Lorenzen, 2001). The literature on innovation systems emphasizes interaction between different organisations as crucial in learning processes that lead to innovation. User-producer interaction is important to avoid unsatisfactory innovation (Lundvall, 1985; Lundvall, 1992; Edquist, 1997; Lundvall, 2002). Regional policies on localised change require willingness to learn as well as unlearn and to keep a 'double focus' on both users and producers. Regional policies have tended to focus mostly on either one of these, which has reduced the chance of success.

The North Jutland region was chosen as 'IT-lighthouse' due to several reasons. It was considered to have a great ICT potential; it was well known for network cooperation between firms, university, science park and public organizations; it had experienced a process of structural change from being a crisis area in the 1980s to an ICT growth area in the 1990s and it was home of a successful international visible wireless communication cluster, NorCOM. The local university was considered to have been an important actor in the transformation process of the region and was intended to become a key player in building the 'IT lighthouse'. The region had since the 1980s been supported several EU programs and the county administration had proved to be quite experienced in organizing support programs based on project offers. The proven capability of cooperation between private and public organizations, the wireless cluster firms and the university were considered as key features.

However, during the implementation of the program this profile was significantly changed. The wireless cluster firms and the university were largely missing as participants and some of the large projects revealed a lack of cooperation between firms and public organizations. Dramatic external events also influenced the results. DDN was presented in 1999, when the ICT sector was booming, but implemented from late 2000, when the ICT crisis had begun.

The paper analyses the design and implementation of DDN with focus on the actors, their involvement and change of interest over time as well as the current results of the program. The discussion will focus on the duality between incremental and radical change in the rhetoric of the programme versus what has been realised so far. The paper contains in section two a discussion of our theoretical approach to the analysis of the effects of public innovation policy. Section three presents an analysis of the structural change in North Jutland in the 1990s with an emphasis on the ICT sector. Section four analyses the history of DDN and the shaping of its final profile, while section five deals with the actual implementation. The results of DDN and its influence on the development perspectives of the ICT sector in North Jutland are presented in section six with a discussion of the large projects on digital TV, e-business and IT infrastructure. Finally, the conclusions are presented in the last section.

2 Incremental versus radical change in regional innovation policy

A variety of regional policies have in recent years been used as tools for development of peripheral regions in Europe. The role of regional policy and its effectiveness has been debated in the literature (see e.g. Cooke, 2001; Lorenzen, 2001). One of the main issues is whether it is at all possible to create more fundamental change in the development trajectory of a region through public policy or whether

the only realistic aim for policies is to improve existing structures and avoid lock-in, as stated by Edquist (1999):

".. 'lock-in' failures imply a role for policy in adapting to shifts in new technologies and demand. This means that a key issue is the choice between supporting existing systems (with their historically accumulated learning and knowledge bases) and supporting the development of radically new technologies and supporting systems" (Edquist, 1999, p.17)

Innovation is a complex phenomenon, embracing products, processes and services. It includes technological as well as organisational innovations (Edquist, 1999). Innovation is a pervasive phenomenon, which penetrates all aspects of economic life, and is a result of on-going processes of learning, searching and exploring (Lundvall 1992).

Radical innovation is major change that represents a new technological paradigm. Radical change implies that the codes developed to communicate a cumulatively changing technology will become inadequate (Rogers, 1995). The producers that follow a given trajectory will have problems understanding and evaluating the potentials of the new paradigm (Lundvall, 1992, p. 58). Radical change creates a high degree of uncertainty in organisations and industry. It also sweeps away significant parts of previous investments in technical skills and knowledge, designs, production techniques, plants and equipment (Utterback, 1994, p. 200). The change is not necessarily delimited to the supply side. It may come from a change at the demand side and in the organisational or institutional structure. *Incremental* innovation, on the other hand, is gradual and cumulative. Incremental innovations are only small changes in technology, organisations, processes, products or services.

Boschma (2004) distinguishes between two ideal types of aims for regional policy: 'localised' versus 'structural' change. *Localised* change is following the development trajectory based on the existing structure in the region. The change is location-specific and determined by the past, which define the limits. It is incremental and cumulative and reproduces and strengthens existing structures. The (positive) cumulative change and path dependence may, however, result in a lock-in, which at a later stage may produce negative effects. When a region is facing technological and institutional lock-in, it becomes vulnerable to external changes in the economy.

Each region has according to Maskell et al. (1998) a set of capabilities that consist of the institutional background, the structure of industry, natural resources, knowledge and skills. These have been developed through a historical interactive process. Further evolution relies on the creation, utilisation and reproduction of knowledge. Public and private organisations in the region are interconnected and interact. The organisations effect the regions through localisation and through creation and demand of skills and knowledge. But the organisations are also outcomes of the existing structure and institutions in the region (Storper, 1997). New variety is thus mainly directed and channelled by the existing environment. Localised change is cumulative and path dependent, but not deterministic and predictable, and bound to end in a lock-in situation (Boschma, 2004).

Structural change is more dramatic. It is based on technological, organisational and institutional transformation and relies on creative destruction (Boschma, 2004). It implies a shift of the regional development trajectory. A lot of uncertainty is related to the structural change. The outcome is less predictable. The element of chance is high, since small historical events may be reinforced by agglom-

eration economics and spinoffs. Such processes are well known from the studies of regional industrial clusters (Krugman, 1991; Porter, 1998; Klepper, 2001). But, as argued by Boschma (2004), the speed of change is not necessarily high. Structural change is not immediate, but new trajectories emerge and develop gradually. Structural change points at transformation of the industrial structure of a region. But new trajectories develop gradually or incrementally in most cases. It could be expected that many incremental changes may accumulate a structural change over time.

The goal of policy programs can target 'long-run' structural change or focus on localised change. This distinction is, however, often blurred in reality – i.e. behind the rhetoric of the program declarations. The notions of incremental versus radical innovation are easier to distinguish and to make operational. A policy program based on experiments can exemplify this. When initiating a program, it is possible for the policy makers to outline a goal and set a frame for the experiments. If it is based on project offers, as the DDN program turned out to be, the outcome is partly defined by the applicants. The policy makers can set some requirements in the tender material and carry out selection among the applications. This makes the potential outcome of the program uncertain. The individual projects also have a higher degree of uncertainty, and some are likely to fail. Variety is created in the regional system since the organisations are involved in different search strategies. A localised policy program based on firm-level experimenting would contain some projects focused on incremental and others on radical change. The latter are novel and could introduce new technologies or consumption patterns etc. Some of these could change the development trajectory for parts of the region and, over time, lead to a structural change.

If we look at policies for structural change there is a difference between national and regional policies. At the national level policies are associated with creating new industries (becoming first mover) or catching up, and usually not directed towards specific regions. Public procurement appears to have been the most successful (Lundvall, 1992; Edquist, 1997; Edquist, 2001). That instrument can also be effective at regional level, where a boost from public demand or a clear expression of will/support can reduce uncertainty related to innovation. The effect is of course not known *ex ante*, since the evolution is still uncertain. But as argued by e.g. Mowery and Nelson (1999), there have been successes as well as failures in public policies targeting radical changes in industry structure.

Regional innovation policies are sensitive to the regional endowment, trajectories and context. Localised policies should take regional variety as a point of departure, and be based on a bottom-up strategy attuned to the regions needs and resources (Maskell et al., 1998; Cooke, 2001; Boschma, 2004).

3 The North Jutland region – from lagging behind to catching up

The North Jutland County is located at the northern tip of the peninsula of Jutland, the part of Denmark connected to the European continent. The population is around half a million people, slightly less than one tenth of the Danish total. Total employment was 246,500 persons in 1999, of which the private sector share was 163,500. The largest municipality is Aalborg, the fourth largest city in Denmark, with 163,000 inhabitants. The region has traditionally been characterized as peripheral and lagging behind with an unemployment rate among the highest in Denmark. The industry structure has been dominated by more traditional industries, such as agriculture and food processing, fishery, tourism, shipyards, textiles, tobacco and cement. However, during the late 1980s and the 1990s the region

has experienced a process of structural change with jobs moving from the traditional sectors to the service and the high-tech sectors. Although the firms in North Jutland are still specialized in the primary sector (i.e. an above national average employment share) and the metal product industry, they are also specialized in especially mechanical engineering as well as in electronics. The latter has been among the features, which indicates that the region has caught up. The industry structure is at present in line with the average Danish 'non-metropolitan' counties. The two 'metropolitan' regions are the greater Copenhagen area and Aarhus. The region has undergone a structural change, but still has structural problems, and has an above average unemployment rate and a below average income compared to the Danish average (Dalum et al., 2002, p.9-10).

Aalborg University (AAU) plays an important role in North Jutland. It was established in 1974 and has today 13,000 students and 1,700 employees in Humanities, Engineering, Natural Sciences and Social Sciences. AAU was until 2000 the one of only two universities in Denmark that offered the M.Sc. in engineering (5 years) and in the 1990s approximately fifty percent of the Danish M.Sc.'s in engineering graduated from AAU. From its establishment AAU has been very active in cooperation with private firms and it participates in many networks and joint research projects (Dahl, 2003). Almost 40% of the total number of graduates from the university got their first job in the region. (Nielsen et al., 2002, p. 81).

The region has from 1986 been supported with several EU Programs due to the crisis in North Jutland especially in fishing, shipbuilding from the last half of the 1980s and the structural problems with a high unemployment rate¹. Especially the Objective 2 funds for Industrial Reconversion have been used to promote the structural change in the region². In the period 1986-1999 the region was supported with € 210 million from the EU, which generated additionally € 247 million in support from Danish public organizations and € 302 million from private firms. In comparison the DDN program was financed by € 23 million in public support and the current Objective 2 EU program running 2000-2006 has received € 246 million in public support. The evaluation reports indicate that the overall effect of the EU programs has been positive for the region, but due to their fragmented nature, the direct effect in terms of employment and indirect effects e.g. creation of networks is difficult to measure³. The direct effect of DDN is expected to be smaller than Objective 2. The North Jutland County administration has been the administrator for the EU programs i.e. organizing the project offers, putting together the financing, attracting external partners etc. Through this work the County Administration has built up competencies, which were useful in the DDN program and created a wide network to the different participating actors.

3.1 The ICT sector in North Jutland before the DDN program

The ICT sector in North Jutland had experienced high growth during the 1990s. Employment grew with 63.5% from 1992 to 1999 compared with a growth of 33.7% at the national level. Total ICT em-

¹ From 1980-1992 the average unemployment rate in North Jutland was 2.5-3 percentage points higher than the national average (Ministry of Industry, 1994).

² The programs have been quite broad in their objects e.g. the Objective 2 program for Industrial Reconversion has supported projects with physical investments in private companies, knowledge building projects in private companies, knowledge building projects with soft framework conditions, infrastructure, education in firms and education with soft framework conditions.

³ <http://www.nja.dk/serviceomraader/erhvervogarbejdsmarked/euprogrammer/resultaterafnordjyskeuprogrammer.htm>

ployment⁴ was 8,300 in 1999, but the region has however not been specialized in ICT employment. The specialization indicator increased from 0.7 to 0.8 during the period. The region has been catching up from a rather low level. The structure of the ICT sector in North Jutland is different from the overall Danish structure, since 45% of the employment was in manufacturing compared to 25% for Denmark.

Specialization in ICT manufacturing increased during the 1990s from 1.05 to 1.5 concentrated on two segments, telecommunications equipment and electronic components. Table 1 reveals that especially telecom hardware has been outstanding with an increase from a three to nearly six times larger employment share compared to the national average. Denmark was internationally specialized in exports in manufacturing of telecommunication equipment.

Table 1 The structure of the ICT sector in North Jutland

	North Jutland						Denmark		
	Specialization 1992	Specialization 1999	Employment (persons)	Share of ICT (percent)	Development 1992-99 (1992=100)	Change (persons)	Share of ICT (percent)	Development 1992-99 (1992=100)	Export specialization (1998)
Manufacturing	1.05	1.51	3,731	44.9	150.3	1,248	25.3	104.3	0.52
Office machinery	4.33	6.81	288	3.5	116.1	40	0.4	73.7	0.15
Computers	0.70	0.36	52	0.6	48.1	-56	1.5	94.4	0.41
Electronic components and wire	1.55	1.14	511	6.2	81.2	-118	4.6	110.2	0.21
Telecommunications equipment	3.13	5.92	1,936	23.3	207.3	1,002	3.4	109.5	1.14
Consumer electronics	0.27	0.89	467	5.6	392.4	348	5.4	120.1	0.78
Electro medical	0.48	0.42	193	2.3	84.3	-36	4.7	95.5	1.70
Instruments etc.	0.41	0.55	284	3.4	131.5	68	5.3	98.1	0.94
Services	0.53	0.63	4,573	55.1	176.2	1,978	74.7	147.7	-
Wholesale trade	0.33	0.35	846	10.2	137.6	231	24.5	127.9	-
Telecommunications	0.62	0.99	1,777	21.4	200.8	892	18.4	125.2	-
IT services & software	0.67	0.63	1,950	23.5	178.1	855	31.9	190.1	-
Total ICT sector	0.70	0.85	8,304	100	163.5	3,226	100	133.7	-

Note: A positive change in employment or specialisation above 1 is marked in bold. Instruments etc. are instruments and equipment for detecting, measuring, checking and controlling physical phenomena or processes. The export specialization is based on trade by commodities statistics for OECD (23).

Source: Statistics Denmark and OECD (2000) *International Trade by Commodities Statistics*, No. 1.

The region has not been specialized in ICT services where specialization only increased from approximately 0.5 to 0.6 1992-99. The employment in ICT services grew 76% in the period compared with 48% at national level, but this segment is still rather weak in North Jutland. The ICT service consists of three parts: Wholesale, Telecommunication service, and IT service & software. The latter is the largest segment in Denmark and North Jutland. It contains most of the new IT firms of the 1990s, but despite of a high employment growth the specialization in North Jutland declined from 0.67 to 0.63. However in telecom services the region was at the national average, which otherwise was concentrated in the two 'metropolitan' regions. The ICT sector has a tendency to concentrate around the large cities, including Aalborg, and in particular, the 'metropolitan' regions of Aarhus and the Copenhagen area (Dalum et al., 2002).

⁴ The ICT sector is defined as NACE/DB93: 3001, 3002, 3130, 3210, 3220, 3230, 331020, 331030, 331090, 3320, 3300, 514320, 516410, 516520, 6420, 713310, 72

A special feature of the ICT sector in North Jutland is the presence of a wireless communication cluster mainly consisting of firms working with mobile communication equipment and equipment for maritime communication and navigation. In 1999 the cluster consisted of 30 firms, which employed more than 40% of the employees in the ICT sector and a large share of these were related to R&D activities (for a detailed analyses of the development of the cluster see Dalum et al., 2002; Dahl et al., 2003). The cluster had grown out of a few maritime communication firms from the late 1970s and had in the 1990s experienced high growth. It attracted many subsidiaries of large multinational companies. The cluster is thus an important part of the entire ICT sector and it also attracted a lot of attention at national level due to its success and international profile.

4 The history of DDN and the shaping of the profile

The early formation of DDN program, until the first project offer in June 2000, can be divided into the invitation from the government and the response from the region. The concept behind DDN was changed considerably within a period of six months.

4.1 Why North Denmark? The ministers invitation and The Digital Denmark report

At the 25 year anniversary of Aalborg University in September 1999 the Minister of Research and Information Technology invited the region of North Jutland to build an 'IT Lighthouse'. The program was a part of the government's ICT strategy on 'The Digital Denmark'.

The strategy was further described in a report in November 1999 from the ministry "*The Digital Denmark – conversion to the network society*" on how Denmark should evolve from an information society into a network society (Dybkjær and Lindegaard, 1999). One of the policy measures to achieve the goal was the creation of two IT lighthouses: one in Copenhagen and one in North Jutland. While the program in Copenhagen was focusing on creating infrastructure the DDN program was to be an experiment (Dybkjær and Lindegaard, 1999, p. 90-93). The rhetoric was very ambitious about creating international visible IT lighthouses that should be a 'cornerstone' of the network society, and 'light up and show the way' for the rest of Denmark. They were inspired by international ICT growth areas, and believed that focused public policy had played an important role in the development of these. The purpose of DDN was to strengthen and further develop the strong growth in the ICT sector from the 1990s.

"An IT lighthouse should be established in Northern Jutland on the basis of the very positive co-operation which has already been established between enterprises, Aalborg University, Northern Jutland's Science Park (Nordjyllands Videnpark – NOVI) and central political decision makers in the area." (Dybkjær and Lindegaard, 1999, p.90)

The government wanted to build an IT lighthouse, but did not define directly what it was. A clear description of an IT lighthouse cannot be found in the background report for the policy program. Although the rhetoric of the report makes parallels to Silicon Valley, Kista and Oulu it would be wrong to conclude that they intended to create radical change by building a new Danish Silicon Valley. But it

seems clear that they wanted to support incremental change of the existing strengths in the ICT sector i.e. the wireless communications cluster. The goal of incremental change is also supported by their argument of building on the existing network cooperation between public and private organizations.

“The purpose of a large-scale experiment in Northern Jutland, an IT lighthouse, is to promote development in an area which has already shown that it contains great IT potential, with private enterprises, Aalborg University and NOVI as driving forces. The large-scale experiment should promote IT development and IT use and, via concrete projects, kick-start life into the network society. The concrete projects should reinforce the electronics infrastructure, competence development, e-commerce, efficiency and service in the public sector, the democratic dialogue and opportunities for the individual citizen to exploit the potential of the network society.” (Dybkjær and Lindegaard, 1999, p.91)

The Minister stressed, when giving the invitation in September 1999, that it was required that the public organizations, the university and private firms cooperated on designing a program and building the IT Lighthouse.

“In a large-scale experiment, Northern Jutland could be Denmark’s first IT lighthouse via the activities which have already been commenced and via a number of prioritised initiatives which should be formulated in partnership between the Government, decision-makers in Northern Jutland and the private enterprises in the area” (Dybkjær and Lindegaard, 1999, p.91)

Given that the proposal was presented at the university anniversary it was a common belief at least among the university employees that the program would get a strong research profile based on joint research projects with private firms. The fear was that the DDN project would be used to support many fragmented small projects like a traditional development programs for less favoured regions.

4.2 The response from the region

In September 1999 it was believed that a quick response was needed to show that North Jutland was able to fulfil the task. The county administration established a regional interim board consisting of the county mayor, the mayor of the municipality of Aalborg, the mayor of the municipality of Hjørring, the rector of Aalborg University and representatives from the Danish Trade Union Congress, the Confederation of Danish Industries and the Danish Employers' Confederation.

After six weeks the result was a report on why North Jutland should be an ICT lighthouse, a vision of how it should be build and a roadmap for the further work. The vision for North Jutland consisted of ten points (The North Jutland County, 1999, p.36-38, www.detdigitalenordjylland.dk):

- North Jutland should become a learning region
- North Jutland should have a strong and coherent educational system that is in the front in Denmark
- North Jutland should have high level research within IT
- North Jutland should have education and continuing education for the future worker

- North Jutland should have a strong service industry
- North Jutland should have leading development and sales firms within IT
- In North Jutland all citizens should have direct or indirect access to a computer and the Internet
- In North Jutland use of e-business and e-services should be widespread among the citizens
- North Jutland should provide good framework conditions for private firms.
- North Jutland should have a public sector that is the most open in Denmark with good service accessible 24 hours a day

Almost every 'political correct' goal was included. The bullet points did not express any clear selection or choice. The list included both objects of radical and incremental change, and even some points that already was fulfilled (e.g. leading development and sales firms within IT). However a new focus on improving the efficiency and quality of the public sector had been included. The effectiveness in the private sector was also stressed.

By fulfilling the 10 points it was believed that the productivity in the private and public sector would increase. The rationale was that the technological development would not result in rationalization and increase in productivity in itself, without a joint effort with education and organizational development. IT was not considered a goal, but as a mean to build the lighthouse. To create positive synergies it was stated that the forthcoming experiments should be large and comprehensive in order to 'make a difference'. The selected experiments should be able to reach and be important for a large proportion of the citizens of North Jutland (The North Jutland County, 1999, p.42).

It was specified that an important part of the vision was North Jutland as a learning region. There was however no clear definition of this concept, although the keywords were ability and will among citizens, firms and other organizations to change, renew, innovate, learn, cooperate and to build new capabilities, networks and supporting institutions (The North Jutland County, 1999)⁵. These are the principles underlying structural change, but the means were of an incremental nature. The profile of DDN had thus begun to change from having a focus on research, industrial development of the ICT sector and networks between university and firms to become broadly user-orientated with a wider purpose of IT education, application and diffusion.

The DDN organization should consist of a board of directors with the responsibility to select the themes of the program in cooperation with the ministry. It should also appoint⁶:

- The project groups connected to each theme
- The board of executives with the responsibility of the practical implementation
- The project groups with the responsibility to select the winning projects
- A secretariat with responsibility of all the practical work.

⁵ Dybkjær and Lindegaard (1999, 2000) do not use the term learning region.

⁶ In addition they wanted to nominate an independent participatory research group consisting of university researchers to carry out research in relation to the DDN. The present authors are members of this group.

The interim board of directors was almost identical in the new DDN organization. The editors of the report⁷ were to be a part of the board of executives (The North Jutland County, 1999, p. 48). The board of directors included a wide selection of interest groups to secure a broad acceptance in the region, especially among the municipalities. The specific selection of actors in the two boards strongly influenced the DDN profile.

The wireless communications cluster and the university had almost not been included in the plans for DDN⁸, but the building of the lighthouse could still offer opportunities for these actors.

5 Building the lighthouse

The discussions of the Digital North Jutland became intensified after the region's response in November 1999. In the report it was stated that the final profile still could be changed. As a result various ideas of the implementation of the program flourished. The report on DDN had described a roadmap for the building of the lighthouse. The board of directors should decide upon four themes and the profile and then appoint four project groups to select the projects. DDN was organised as project of-fers within the four themes.

Three different profiles were competing for dominance in the large-scale experiment (see also Bruun, 2001):

1. The industry innovation orientated profile that stressed the importance of industrial development through innovation and cooperation with the university.
2. The research-orientated profile that had a point of departure in the university research projects with industry
3. The user-orientated that focused on extensive use of IT.

5.1 The planning phase and the final program

The board of directors was officially appointed in February 2000. Their first task was to specify the four themes further and appointment of the four projects groups. But this work had already begun previously. During December and January the themes were specified and enrolment of actors to the project groups and mobilization of actors to create ideas and projects had begun.

The director of the Lighthouse Secretariat joined the board after her appointment in the spring 2000. The board thus included a wide selection of groups to secure a broad acceptance of the program and to mobilize as many actors as possible. The selection was, however, dominated by political and organisational interests, and the interest of the ICT industries was given low priority.

The profile was, however, not definitely decided upon in mid-January. The heads of the county and the university administrations, both members of from the board of executives expressed opposing views publicly. They admitted that the 'fight' could be whether the money should be used broadly for IT experiments for the population of North Jutland or more narrowly in targeted research. The head of

⁷ The editors were the clerk to the county council and the university director.

⁸ In the report had the phrases of 'development of the ICT sector' and networks with the university' been toned down.

the university administration also argued that the funds should be used to increase the present high level of the ICT sector while the head of the county administration argued that the funds should only be invested in projects with a (short-run) return⁹.

In January 2000 the four themes were selected¹⁰:

- IT infrastructure
- IT industrial development
- Qualification and Education
- Digital Administration

A project group was attached to each theme which should participate in the selection of winning projects from the forthcoming project offers. Their first task was to work on a project strategy and frame. Based on these each group should select the best projects, and the board of directors would afterwards appoint the winners. A professor from the university was selected as chairman for the first theme. A managing director from a private firm was selected for group two, a chief executive from a municipality for theme three and a director from the county administration became chairman for theme four. The four groups consisted of up to nine members and had a strong influence of public organizations. The groups worked in April-June on the description of the four themes in the project offers.

In February 2000 the Ministry of Research and Information Technology approved the DDN program. Although no project offers had been held, the work continued on the sidelines. In mid-February several forthcoming DDN projects appeared in the media¹¹. The head of the county administration argued e.g. for a project that included a PC for all the public sector employees in North Jutland. This idea was, however, never turned into a specified proposal.

The DDN secretariat was also established in spring 2000 and a head of the secretariat was hired, with a background in Humanistic Informatics from the Aalborg municipality administration¹². She represented the broad user-orientated profile of DDN that became dominant. The appointment also clearly indicated the direction of DDN. The profile had been changed from the original idea described in the Dybkjær and Lindegaard (1999) report and in the minister's speech in September 1999. The profile was not specified to build on the existing industrial and research strength in region, but to broaden the use of IT to lift the entire region and create a learning region. The project should not focus on one sector but all sectors and not concentrate on one problem or area, but 'cover it all' (The Lighthouse Secretariat, 2000, p. 5).

The allocation of funds to the four themes in the first round of project offers also underlines the user-orientated profile¹³:

⁹ Thorhauge, Claus "Nordjysk IT fyrtårn leder efter ideer" Computerworld 14/1 2000

¹⁰ The names of the themes are a bit different in January, but they are covering the same areas: Infrastructure, E-business and technological framework conditions, IT in the public sector, and Qualification and Education.

¹¹ Special supplement to Computerworld 28/2-2000

¹² The core themes in the human informatics education are that of building competencies among the users and the construction of user-friendly systems (Bruun, 2001).

¹³ Of the total project sum on € 23 million were € 21 million allocated to projects, whereas the rest were to cover administration, participatory research and evaluation. Approximately 50% of the funds were to be spent in the first project offer.

- IT infrastructure received € 2 million
- IT industrial development € 2 million
- Qualification and Education € 4 million
- Digital Administration € 2.7 million.

5.2 How the university was put on the sideline and the missing participation of the wireless cluster firms

In spring 2000 the Ministry of Finance decided that the national government should not pay more than the 1/3 of the total project sum. This meant special rules for public financed organizations and organizations who wanted to use EU objective 2 funds for the DDN projects. As a result the university could not use regular funds or let the employees participate in the project as a part of the 2/3 of the funding that had to be self provided. To participate the university had to use external funding for the projects or let the potential project partners pay the total funding. It was believed by many university people that this put an end to university participation in DDN projects and clearly influenced its profile.

The funding rules did stop many project ideas, but the university still managed to become partner in some projects through special arrangements. But DDN did not become as research-orientated as the university believed it should have been. Analysis of the timing of events and processes however indicate that the user-orientated profile of DDN already was determined, and that the university was put on the sideline before the ministry decided on the rules for funding. Researchers from AAU participated in 15 % of the DDN projects (The Lighthouse Secretariat, 2003). In terms of university research groups the participation had moved away from the more technical disciplines to the more 'soft' research fields.

The missing participation of the wireless communications cluster firms became evident during the project offers. They only participated in 6 of the total 90 DDN projects. The main participants were the service provider Sonofon and L.M. Ericsson, while other cluster firms only participated in two small projects. There were no representatives from the cluster or the ICT sector in the regional interim board of directors who wrote the initial DDN report. Later on a member from the cluster was included in the board of directors, but as a representative for the local Confederation of Danish Industries.

The DDN profile did clearly not encourage the cluster firms to participate. IT infrastructure theme was focused on the fixed network and the IT industrial theme was mainly looking at e-business. Why the cluster only was sparsely involved in shaping the DDN profile is still unclear. But it could be related to the boom in the industry in 1999-2000. The main problems within the cluster were the increasing wages and the lack of qualified labour. The cluster firms had plenty of projects with a higher priority than DDN. However, before the first round of project offers the cluster association arranged meetings to mobilize members to participate in the DDN program. The cluster association wanted to secure that the DDN policy program did not become a failure that could have negative reputation effects for the region.

Although only six DDN projects had participation by cluster firms there was a group of projects that included mobile e-business and diffusion of the mobile phone platform to various industries. These areas were in the periphery of the focus of the wireless communications firms.

5.3 What determined the broad user-oriented DDN profile

Bruun (2001) analysed the initiation and the first steps of implementation of DDN as a process. He described five determinants in shaping of the broad user-orientated profile:

- Strong commitment from the leadership of influential public organizations
- The composition of the DDN organization
- Formal mode of operation
- Ministry rules for funding
- Appointment of the director of the lighthouse secretariat

These five factors were not mutually independent. It seems that the strong commitment from the leadership of influential public organizations lead to the broad user-orientated profile. The ministry rules for funding have weakened the 'university preferred' research-orientated interpretation, but it seems as if the user-orientated profile already dominated when the ministry issued the rules. The appointment of the director of the lighthouse secretariat with a profile that supported the user-driven DDN interpretation is more a consequence and underlining of the already selected DDN profile¹⁴.

A possible determinant is somehow missing in the list. The ICT sector was booming and there was a widespread fear that the public sector was lagging behind. The solution to this problem could be to diffuse ICT broadly in society and to upgrade the use of ICT in the local public administration and other public organizations. This fear combined with the strong commitment from the public sector and the exclusion of representatives from the ICT sector seems to have outlined the final DDN profile.

5.4 The winning DDN projects and the shift from radical to incremental change

Many of the first round projects in Autumn 2000 were 'high profiled', i.e. large projects with many participants and high ambitions. They were mainly focusing on radical change. The enrolment of many public organizations had clearly created a bulk of applications since they needed to participate, but also other organizations felt that they had to be a part of DDN due to the commercial value and to avoid that the program became a failure. The prestige attached to DDN also attracted participants.

The DDN secretariat received 118 project-application and 44 projects were selected as winners in the first round (The Lighthouse Secretariat, 2001). The € 11 million in support generated a total project sum of € 50 million¹⁵. The distribution was:

- The IT infrastructure theme received 10 applications, 4 winners was selected.
- IT industrial development received 33 applications and 12 winners.

¹⁴ The director had been involved in the writing of the initial report, but it is unclear to what extent, see Bruun (2001).

¹⁵ The funding given to each theme varied slightly from the expected amount, in this paper the expected amounts are noted.

- Digital Administration received 24 applications and 7 winners.
- Qualification and Education received 51 projects applications and 21 winners.

The aims of the projects were very diverse and could be characterized as let a thousand flowers bloom. Among the high profile and ambitious projects were:

- The Digital County Administration and The Open Municipality on digitalizing the county administration and the administrative procedures in the municipalities.
- North Jutland Netforum planning an optical fibre based infrastructure ('fibre to the home').
- TV2 Nord Digital broadcasting digital TV with interactive services among the first in Europe.
- Personal Mobilized Broadband Services using front line technology and creating and testing the future home mobile broadband services.
- The Digital Mall which should be the electronic shopping site on the Internet preferred by citizens of North Jutland .
- E-business between private companies and the North Jutland county administration, a full scale e-business solution .
- Digital Villages in North Denmark, an effort to maintain and develop the rural districts as vital enterprising and viable local communities and to attract new inhabitants to the villages.

Many of the 'high profile' projects later on had to adjust their goals and change methods to complete the projects, e.g. since they couldn't get the necessary equipment and when they got it, it couldn't do what it was supposed to. The international crisis in the ICT sector also had a major influence because it fundamentally changed the beliefs on what was possible and what not.

In the later rounds of project offers the winning projects were more focused and specific than the first projects i.e. more focused on incremental than radical change. The themes were more specific in the following projects offers (The Lighthouse Secretariat, 2002):

- Qualification and Education with a focus on democracy, children and young persons, and adults with weak IT competencies in the spring 2001 (€ 3.6 million).
- Digital Administration with a focus on the healthcare system in the summer 2001 (€ 3.4 million).
- IT industrial development with a focus on competitiveness in small and medium sized firms in the summer 2001 (€ 2.4 million).
- Qualification and Education with a focus on art, culture and IT in the network society in early 2002 (€ 0.9 million).

But although the themes in the later projects offers became more coherent and the type of projects changed it doesn't change the basic picture of DDN as a very wide range of projects.

Due to the large variety in the projects it is hard to compare the success rate of the first round projects with the other rounds to see if the more focused projects were more or less successful than the 'high profile' projects. The latter were however focused on radical change. The projects on digitalizing the county administration or the hospitals sector could potentially have a huge effect on the public sector and could, when completed, be a success factor for DDN. Also projects on creating the Digital Mall, broadcasting interactive Digital TV and planning (and building) a fibre based infrastructure for the entire North Jutland can be important parts in making DDN a success. Especially the latter project on planning fibres to the home would - if implemented - make the IT infrastructure in North Jutland the most advanced in Denmark and in most of Europe. This would create a visible and lasting effect of DDN.

6 The development perspectives for the ICT sector and the results of DDN

In this section we focus on the results of DDN so far with special emphasis on the development perspectives for the ICT industries and some of the 'high profiled' projects on digital TV, a digital mall and the IT infrastructure. DDN generated 90 winner projects with a total sum of € 90 million, which was considerable more than the expected minimum sum on € 64 million, i.e. the government funding of the projects was on average less than $\frac{1}{4}$ (The Lighthouse Secretariat, 2003). The projects were initiated during 2000-2002 and have been finishing continuously until end of 2003.

On the positive side the DDN program created lots of ideas, initiated many projects and represented a large commercial value for the region for a rather modest government support compared to the objective 2 funds. The interviews performed reveal that the program seems to have created networks between firms and public organization that may contribute positively to the development perspectives for the ICT sector in North Jutland. There were some success stories of small local IT service firms who benefited from the program, and many projects where participation has been considered positive.

ICT firms participated in many of the 90 projects, e.g. as project partners or suppliers of software services and hardware. The influence of DDN on the development perspectives of the ICT sector in North Jutland is blurred, since the ICT firms participated in different ways and not all of the participants were located in North Jutland. Participation was not restricted to the North Jutland region. It is also important to distinguish between ICT firms that participated as suppliers of standard software and hardware and firms that developed software and services that were more specific towards the project. The latter group could experience a competence enhancement and externalities that could affect the development perspectives more positively than the pecuniary effect on sales. The project descriptions reveals that ICT firms were participating in more than 40 projects, but the scope of the projects are varying and the level of competence building in these firms are not possible to assess without more thorough analysis that is beyond the scope of this paper. The analysis in this section will focus on the interaction between the ICT sector and the large DDN project on IT infrastructure, Digital TV and The Digital Mall.

6.1 The development of the ICT sector in the early phase of DDN

DDN was planned when the ICT sector was booming, but when the first round of project offers was initiated, the dot.com bubble burst and the ICT sector went from boom to crisis. However, it took almost a year before the crisis hit the mobile communications industry. In spite of the crisis, the employment in the ICT sector in North Jutland grew 1.7% (143 persons) during 1999–2001. But the growth rate was considerably lower compared to the average annual growth rates of 6.3% in 1992–1999. Table 2 reveals that the ICT sector in North Jutland performed worse than the national average, which had a considerable higher growth rate in 1999–2001 on 6.5%. The ICT sector in North Jutland seems to have lost momentum and the specialization declined marginally from 0.85 to 0.82. The overall increase in ICT employment during the crisis might seem surprising, but the numbers hide an increase in 2000 and a decrease in 2001¹⁶.

Table 2 The development of the ICT sector in North Jutland 1999–2001

	North Jutland						Denmark	
	Specialization 1999	Specialization 2001	Employ- ment (persons)	Share of Development ICT (percent)	Change 1999-01 (1999=100)	Change (persons)	Share of Development ICT (percent)	Share of Development 1999-01 (1999=100)
Manufacturing	1.51	1.10	2,512	29.7	67.3	-1,219	22.4	94.2
Office machinery	6.81	0.25	2	0	0.7	-286	0.0	19.0
Computers	0.36	0.46	60	0.7	115.4	8	1.3	89.8
Electronic components and wire	1.14	1.44	468	5.5	91.6	-43	3.2	73.4
Telecommunications equipment	5.92	4.81	1,211	14.3	62.6	-725	2.5	77.9
Consumer electronics	0.89	0.63	322	3.8	69.0	-145	5.0	98.0
Electro medical	0.42	0.41	189	2.2	97.9	-4	4.5	101.0
Instruments etc.	0.55	0.43	260	3.1	91.5	-24	5.9	119.8
Services	0.63	0.74	5,935	70.3	129.8	1,362	77.6	110.6
Wholesale trade	0.35	0.44	937	11.1	110.8	91	20.9	90.7
Telecommunications	0.99	0.92	1,747	20.7	98.3	-30	18.6	107.5
IT services & software	0.63	0.83	3,251	38.5	166.7	1,301	38.2	127.7
Total ICT sector	0.85	0.82	8,447	100	101.7	143	100	106.5

Note: A positive change in employment or specialisation above 1 is marked in bold. Instruments etc. are instruments and equipment for detecting, measuring, checking and controlling physical phenomena or processes.

Source: Statistics Denmark

The picture of an increase in employment in 2000 and a drop in 2001 is a bit more blurred at the more detailed level; some of the segments, such as telecommunications equipment, were shrinking in 2000 as well as in 2001. Manufacturing of ICT experienced a drop in employment, whereas the service segment experienced high growth. This trend was most outspoken in North Jutland where manufacturing dropped with almost 33% and services grew with nearly 30%. North Jutland was however still specialized in manufacturing (1.10).

The total employment in the mobile communications cluster was almost stable with a small decline, although the cluster experienced a turbulent period with high entry and exit (COWI, 2002; Dahl et al., 2003). This turbulence might explain some of the shift in employment from manufacturing of telecommunications equipment to IT services & software, since the new firms could have been 'mis-

¹⁶ The employment data for 2002 are not yet available from Statistics Denmark

placed' in NACE activity codes related to the IT services & software. The development in this segment has been very positive with an increase in employment of 66.7% (1,300 persons). North Jutland is not specialized in this segment, but had an increasing specialization indicator from 0.63 to 0.83.

The employment performance of the entire ICT sector during the beginning of DDN was worse than the national average and slower than the pre-DDN period. The latter part of this can be explained by the crisis in the ICT sector, but why the ICT sector in North Jutland has performed relatively worse is harder to explain. DDN can be said to have been a success, since the strongly represented segment in the program, IT services & software, had a high growth. Both these interpretations of the data are still quite speculative and uncertain due to the timing of the DDN projects, the crisis and the data. A possible positive employment effect can hardly be seen in the 2001 data, since most of the projects started during 2001 and early 2002. The possible employment effect would probably reveal itself as a lesser decrease in employment instead of an increase because a decline may be expected for the sector at the national level.

6.2 The cases of Digital TV, The Digital Mall and IT infrastructure

The projects on Digital TV and the Digital Mall were two winning projects in the first round. Both can be characterized as being 'high profiled' and ambitious. The Digital TV project intended to transmit digital TV with interactive services among the first in Europe. The Digital Mall should be the electronic shopping site on the Internet preferred by citizens of North Jutland. The IT infrastructure project wanted to design local optical fibre based network solutions, which would bring 'true broadband' to local government organisations as well as to private firms and consumers. These large projects could have had a larger and more visible impact on the region than the many diverse smaller DDN projects. They clearly contained elements of radical change from the outset.

6.2.1 Digital TV¹⁷

In 2001 the local affiliate in Northern Denmark of a national public service TV broadcaster, TV2 Nord, founded a new company with the purpose to begin broadcasting terrestrial digital TV. It had been accepted and supported with € 0.8 million, which was less than 1/6 of the total amount of the project, which also received support from the European Objective 2 funds. There were several partners, such as a TV station, which should supply the employees, a large bank interested in the possibilities for e-commerce via digital TV, a science park that wanted to support the local activities in the digital TV industry, the local municipality and several content providers. The project was planned to begin in early 2001 and the first broadcasting in late 2001. Terrestrial digital TV was known from other parts of Europe, but not with transmission of enhanced content or other interactive services based on the open Multimedia Home Platform (MHP) standard. Terrestrial digital TV consists of video, audio and enhanced content, but the combination of the three is the challenging part.

In the early phase the development of applications for games, betting, e-business and home-banking etc. was given a lower priority. Instead the focus was on creating enhanced content. They found that the promised technical possibilities in digital TV are many and widespread, but there were also many limitations in the MHP standard and the existing equipment. Especially the set-top box

¹⁷ Based on Pedersen and Dalum (2003b) and on interviews with participants in the project.

that, connected to the TV, allow the user to receive the digital TV. Although the project progressed fairly slowly, it attracted a lot of attention from other TV stations, whereas interest from the large equipment manufactures was sparse.

A panel group has tested digital TV with enhanced content for six months and a new group has received digital TV with interactivity (backward link through a modem) and a small hard disk. The results of the first round of test are still being processed, but the first preliminary results show that the users have been more positive than expected, in spite of some technical errors and omissions. TV2 Nord Digital has been running many tests on their systems and has subsequently gained a lot of experience in building and running a digital TV station. It is running fully digitalised and in the evenings it is unmanned and controlled by an employee working from home on a laptop¹⁸. Many foreign TV stations have visited TV 2 Nord Digital to gain inspiration and advice. The TV station has also begun some consultancy business. The broadcasting equipment was not supplied by the big equipment manufactures, but compiled from many smaller suppliers combined with own solutions. It was possible to buy a complete system from the big equipment manufactures, but the price was too high. The test of equipment has also attracted some manufactures and some degree of cooperation has taken place.

The project has been a success and has applied for an extension of the test period. The TV station has also been rather active in cooperation with Danish hardware manufactures regarding the set-top box and has been trying to get the university involved in research related to digital TV, which seems to have happened on the content side.

The experiment in North Denmark cannot create competitiveness for the local industry in itself, but can provide some guidelines for the companies, especially if the Danish government had decided on a full-scale implementation of digital TV. Since the two major TV stations in Denmark are public service channels financed at least partly by license fees, an ambitious plan for a fast transition from analog to digital TV could have created some interesting perspectives on the role of advanced demand and social experimentation. However, the Danish government decided in 2003 upon a less ambitious plan, which may undermine the entire experiment in North Denmark, especially if they are not allowed to continue the transmission after the test period.

Denmark is likely to have lost the opportunity to become first mover or even to among the first, although the diffusion of digital TV has been slow all over Europe. Although the project has turned out to be a success in terms of technology and users, the future of the project is still highly uncertain due to the missing boost in demand caused by the slow transition from analog to digital TV in Denmark.

6.2.2 The Digital Mall¹⁹

The Digital Mall was a DDN project with a mobile communications service provider, a regional bank, a logistics company, a supermarket chain, and a software company. The mall was intended to attract 'Business-to-Consumer' (B2C), 'Business-to-Business' (B2B) in the industrial sector and to be the site where the national government organisations, county and municipalities would undertake their purchases.

¹⁸ The live transmission is supplied from the 'mother' TV station.

¹⁹ Based on Pedersen and Dalum (2003a) and on interviews with participants.

The Digital Mall was developed with a focus on North Denmark but later the concept could be extended to the remaining country. The philosophy was: Think big and keep expanding your market continuously - with a focus on a future use of the Mobile Internet. It was planned to enable mobile access and mobile payment. The main idea was to create a common portal where different shops were collected. To overcome some of the problems with e-commerce, such as trust, payment, return policy etc., they wanted a single standard payment system and common return system. They also wanted a common complaint procedure. The idea was to signal that e-commerce is simple, the partners and the payment system could be trusted upon and if anything went wrong the return policy was shared and easy. They wanted well-known brands and high security.

The project however ended shortly after the start, basically because a 'focus group' approach based series of interviews with potential customers clearly indicated that consumers were not willing to pay the extra costs for the new services. One of the problems is that the revenue on groceries is quite low since the market is very competitive and although the potential customers would like to use the Digital Mall and also pay extra for the service, the expected revenue was not sufficient to make the project profitable. Other problems were related to creating a high volume to cover the marketing costs, which did not seem possible in the short run without a combined effort in the region from both public and private organizations.

The volume of the project was too small to be commercially viable, and it seems that a boost from a large supermarket chain or the public sector is necessary to carry out a complete e-business solution like the Digital Mall, since a chicken-and-egg situation emerges with the costumers waiting for many shops and goods on the site before buying, and the shops are waiting for the demand before joining the e-business site. The county administration was considering joining the project or using the e-business solution, but decided to build a separate e-business solution as a part of the Digital County Administration. A group of municipalities including the large municipality of Aalborg also decided to create separate e-business solutions as a part of DDN. If these projects had merged it could maybe have been possible to create a commercial sustainable digital mall, since the joined effort could have created a large volume and a lot of publicity, but cooperation, a common will and vision were not established to the necessary extent.

6.2.3 The IT infrastructure²⁰

North Jutland Netforum and KMD Netbroker were had the purpose to plan the long term IT infrastructure in North Jutland and initiate the building of an IT infrastructure based on optical fibres²¹.

The rapid technological development in the optical fibre industry combined with falling prices has made fibres direct to the home a real alternative as an Internet connection. Optical communication (transmission with light signals) has usually only been used in the Internet and telecommunications backbone, but the increasing demand for data capacity, i.e. speed in the network for the ordinary users, has made it clear that the best development path in Internet connections is to pull an optical fiber cable directly to each home. The broadband connections can also be used to transmit digital TV sig-

²⁰ Based on Pedersen and Dalum (2003a), Dalum et al (2002) and on interviews with participants in the project.

²¹ Netforum of North Denmark is an independent organization established in cooperation between Aalborg University, a bank, the County of North Jutland, the municipality of Aalborg and an IT firm. The KMD Netbroker is a commercial organization established as part of KMD A/S in collaboration with the municipalities of Brønderslev, Hals, Frederikshavn and Sæby.

nals. Sweden has been among the lead countries in the use of fibres direct to the home. In Denmark the construction of an optical fibre network has been delayed because of the lack of political support and commitment. The idea is to design an optimal network according to the existing infrastructure, households, firms and public organisations and coordinate the digging to an overall plan, when firms are laying down cables, sewers etc.

The information infrastructure should be regarded to be as important as the more traditional physical infrastructure, such as roads and power. This standpoint has however not been shared by the public authorities. As a result has the planning of the information infrastructure been uncoordinated and uncontrolled. This lack of coordination is creating a significant waste of resources since nobody knows who are laying down fibres, when and where. The price of laying down the cables is mainly determined by digging costs. With an empty plastic tube it is possible to lay down extra fibres when the capacity is needed, without digging, since the cable can be 'blown' through the empty tube. Especially in the cities, the digging is very expensive. By planning an optimal infrastructure and coordinate the digging activities it is possible to build a complete fibre network at an affordable reasonable price. The coordination requirement is that whenever telecommunication firms, power plants, district heating firms, public sewer service etc. are digging, there should be put down empty tubes as well.²² By planning the IT infrastructure with the goal of connecting every household²³ in Denmark with optical fibres, the combined demand will drive down prices on each connection and also allow for households and firms in the rural districts to get a true broadband connections.

To fulfil this plan it is necessary to get public and private organizations to cooperate and coordinate. The public sector is especially important to boost the project, to coordinate and also decide that this is the vision for the future IT infrastructure and to join the plan. DDN began the planning process for three small rural municipalities and has subsequently been trying to expand the planning, but the project has been suffering from a lack of cooperation between firms and public organizations. Several municipalities in North Jutland County are trying to create an initiative to expand the planning and initiate the building of IT infrastructure, but need a more committed the backing from the county authorities.

In the three-year period the project has been running many actors have been interested in entering the market for broadband Internet connections. Especially the power suppliers have been interested in entering and in North Western Zealand in Denmark the power supplier has begun offering optical fibres direct to the home to its customers²⁴. At present they only offer fibres to customers in the cities and only in neighbourhoods with a sufficient number of interested customers. They are building a network consisting of several local city networks combined with a larger backbone. The customers can choose between several subscriptions depending of the services they want, such as Internet, telephony and TV. The former monopoly service provider TDC is planning optical fibre Internet connections to the most of the Funen County or at least the easiest accessible areas including the third largest city in Denmark, Odense. The price for each connection is however several times higher than the calculated price of each connection in the DDN project.

²² See also <http://www.nordjysknetforum.dk/>

²³ Using other technologies like Fixed Wireless Access (FWA) could connect the most isolated household.

²⁴ <http://www.nve.dk>

While the North Jutland County has been very slow to react, Danish counties especially Viborg and South Jutland County have been faster. In cooperation with North Denmark Netforum, they have created similar organisation, Western Denmark Netforum, with a wider geographical scope. The counties have already begun making the initial preparations to begin planning of the future IT infrastructure, such as collecting information on the existing IT infrastructure and putting down empty tubes, whenever digging.

The DDN infrastructure project opened unique opportunities of creating field experiments with an optical fiber based local infrastructure that also contains extensive possibilities for a combination with other technologies. One of the derived effects of the project is the foundation of a Centre for Tele Infrastructure (CTIF) at Aalborg University joining the research competencies within the wireless technologies with research in the wired infrastructure (Dalum et al., 2002). The DDN project also opened unique opportunities for planning and building the best IT infrastructure in Denmark, but other regions are catching up and even forging ahead. The County of North Jutland seems at present to have missed the opportunity of becoming a 'lead user' in this field.

6.3 The future of DDN

DDN was running from 2000 to 2003 and the last projects have been finalized in the spring of 2004. The project has not been officially evaluated yet. There are at present no announced plans to continue the large-scale experiment after the end of financial support from the government. The original DDN report stressed the necessity that the experiment not just faded away after the end of financial support. To avoid this it appeared necessary to collect the experiences by a continuous documentation of the results (The North Jutland County, 1999, p.48).

However, from the beginning of the DDN project period in late 2000 the expectations have apparently been that the program would end with an evaluation. This lack of a future vision could be the result of many years' of structural problems as a peripheral region and reliance on outside financial support. This could be due to a kind of 'clientism-mood' in the region, where one financial support program currently has been substituted by the next. DDN could then have been conceived to be yet another program that was going to bring money and activity to the region. A possible rationale for a region that previously suffered from this kind of 'clientism' could have been to use the money to create some activity, hope that the positive experiences would remain in the region, evaluate the program and sit back and wait for next support program. Such an interpretation appears exaggerated in the DDN case. The 'clientism-mood' of the region is on its way out, but has apparently not disappeared sufficiently yet.

A group of public organizations formed in early 2003 a think-tank named North Jutland Innovation Forum to evaluate and create initiatives related to the future development of the region. It is, however, not evident that this forum in reality has the political momentum to carry on the positive initiatives created by DDN. The vision described by a group of managers from the ICT sector and university researchers in January 2002 (NOVI, 2002) on a continuation of the DDN program after 2003 by making North Jutland a large-scale field experiment has not really been adopted in the region.

7 Conclusion

From the outset, the original government vision of DDN appeared to have been a radical change of North Jutland towards a 'network society'. But the means proposed – although they were never clearly formulated - appear to have been rather incremental in terms of building on what was already achieved in the region, which undoubtedly referred the progress of the wireless communications cluster during the 1990s. The means were conceived as a 'localised' policy program focusing on incremental change. Apart from all the rhetoric and 'hot air' on the transformation to a network society and a learning region, the main purpose was to build on the existing strong capabilities of the ICT sector.

In North Jutland the wireless communication cluster was an important part of the ICT sector, but these firms were not successfully mobilized in DDN. The university was only partially integrated in the program. It played an active role in DDN, but the technical research groups that probably are the most important for a major part of the ICT sector have not been active in to any significant extent in DDN.

The profile became broadly user-orientated as a result of a deliberate strategy among the dominant actors at the very early stage of the program. The strong commitment from the leadership of influential public organizations and the missing representatives from private ICT firms lead to the final profile. On the other hand the industry side could, perhaps, be blamed for not being sufficiently active in this process. The strong growth in mobile communications industry – up until 2001 - was likely to make them less interested in participation. The business opportunities were plenty at the time.

The goals of DDN were multiple and somehow lost focus. It could be characterized as let a thousand flowers bloom, which proved to be problematic since 'people who don't know where they are going usually end up somewhere else'²⁵. The initial idea of localised change following the development trajectory of the ICT sector was replaced with a more chaotic framework. The goals of DDN contained a lot of radical-change-like rhetoric. The winner projects within the IT industry theme included a mix of radical as well as incremental change oriented projects in many different sectors, and at different levels. But the large and 'high profiled' radical-change-like projects have not been realised at a sufficient scale. From an ICT industry perspective DDN appears to have been too broadly formulated – the effects to have been too scattered.

DDN was supposed to make the ICT environment in North Jutland stronger and better equipped to be an IT lighthouse of an international standard. The profile of DDN program when it was initiated, was however much softer and broader than proposed by the Minister, mainly targeting the public sector and many widespread smaller projects. The profile became broadly user-orientated, instead of oriented towards industrial R&D and innovation and public research, which at no surprise affected the profile of the program significantly.

It appears on the other hand fair to state, that there has been a series of positive results from DDN in a business development context. There are several success stories of small and medium sized local IT service firms who have benefited from the program, and many projects where the participation has been positive for the participants, but with no significant impact on the development of the ICT sector

²⁵ Another phrase related to the lack of a clear specified goal in DDN is 'all roads are right if you have no destination' (Alice in Wonderland).

in North Jutland *per se*, at least so far. DDN has created a focus on the ICT sector in the region and has represented a certain commercial value. The program seems to have created many networks between and among firms and public organization - often brilliantly catalysed by the IT Lighthouse Secretariat - that may contribute to the future development perspectives for the ICT sector in North Jutland. Whether the effect will be higher than a more narrow Keynesian multiplier effect is hard to tell yet and the overall and lasting effects on the region remain still to be seen.

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