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The Digital North Denmark Programme - Promoting Regional Change?

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1   Introduction

The Digital North Denmark (DDN) was an IT programme running from 2000 to 2003 in the North Jutland County in Denmark with national government support of € 23 million. The Danish government initiated the programme 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 programme 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. The North Denmark programme was, on the other hand, organised as a large-scale experiment based on project-offers within four themes. 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 chapter is the theories of regional innovation policy based on localised change. Innovation policy is public action aimed to influence technical change and other kinds of innovation (Edquist, 2001). A policy programme 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 and new variety is mainly directed and channelled by the existing environment (Dosi et al., 1988; Boschma, 2004). 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 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 organisations; 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 by several EU programmes and the county administration had proved to be quite experienced in organising support programmes based on project offers. The proven capability of cooperation between private and public organisations, the wireless cluster firms, and the university were considered as key features. The policy programme, however, faced some tension in the formulation of a goal: Could the successful cluster be used to develop other parts of the ICT sector, or should the programme be used to promote development broadly in the region?

During the implementation of the programme 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 organisations. 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 purpose of this chapter is to analyse how the shift from incremental to radical change has affected the programme and whether and how this shift may have had long-term consequences for the development perspectives for the regional ICT sector.

This chapter investigates how the profile of the programme changed from focusing on localised change targeting the producers of ICT in the region, to be initiated as a radical change project focusing on the users. In addition to the more historical accounts for DDN the actual implementation will also be analysed. The analyses of development perspectives for the regional ICT sector will focus on the participation of the university and the cluster.

The chapter contains in Section 2, a discussion of our theoretical approach. Section 3 presents an analysis of the structural change in the 1990s with an emphasis on the ICT sector. Section 4 analyses the history of DDN and the shaping of its final profile, while Section 5 deals with the actual implementation. DDN's impact on the development perspectives of the ICT sector are presented in Section 6. 'After DDN' is analysed in Section 7. Finally, the conclusions are presented in the last section.

2   Incremental versus radical change in regional innovation policy

A variety of regional polices 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). It is also 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). Thus innovation is a powerful explanatory factor behind differences in performance among regions. Regions with a successful innovative activity prosper while less innovative regions are lagging behind. Therefore, regions that want to catch-up must increase their innovative activity (Fagerberg, 2005).

Freeman and Soete (1997) classifies innovations according to how radical they are compared to the existing technology by the terms incremental and radical. This approach can also be applied to the change in industry structure. These are then classified according to how radical they are compared to the current structure.

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. Subsequently *incremental* change refers to continuous improvements and changes in the current industry structure.

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 affect 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 agglomeration economics and spinoffs. Such processes are well known from the studies of regional industrial clusters (Krugman, 1991; Pedersen, 2005). But the speed of change is not necessarily high (Boschma, 2004). 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. However, the more radical the change is the greater the possibility that it may also require improvements of infrastructure, and organisational and social changes to succeed.

The goal of policy programmes can target 'long-run' structural change or focus on localised change. This distinction is, however, often blurred in reality – i.e. hidden in the rhetoric of the programme declarations. The notions of incremental versus radical innovation are easier to distinguish and to make operational. A policy programme based on experiments can exemplify this. When initiating a programme, 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 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 programme 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 programme 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. The radical and structural change are sometimes argued to be the most important for changes in the industry structure, while others argue that the cumulative impact of incremental changes are just as great and therefore the continuous incremental changes leads to structural change over time.

If we look at policies for structural change there is a difference between national and regional policies. At the national level polices 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 in this respect (Lundvall, 1992; Edquist, 1997; Edquist, 2001). This 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. Lundvall and Borrás (2005) points at some limits for the public sector competence in technology policy. They argue that technology policy might be pursued where the public sector

operates as a major or lead user, while it should be more cautious when it comes to developing specific new technologies for the market.

There is some tension between policy support of diversity and scale in an innovation system. The more open an innovation system is for impulses from outside, the less chance to miss promising new development paths that emerge outside. Thus it is important for policy makers to keep the innovation system open and to avoid lock-in in the innovation activities due to path-dependency (Fagerberg, 2005).

Innovation policy must take point of departure in the existing innovation system. The analytical basis of the innovation policy is a combination of what is good practice and what are the characteristics of the innovation system (Lundvall and Borrás, 2005). Therefore the innovation policy is often incremental since policy makers are more likely to take point of departure in existing development trajectories. Regional innovation policies are sensitive to the regional endowment, trajectories and context. Localised polices 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). However, it is also necessary to mobilise the actors in the system to participate and interact to develop socially relevant and clear policy programs that can be implemented successfully (Lundvall and Borrás, 2005, p. 614).

In summary, the theories state that there is a difference between regional policies targeting incremental change, and radical change. The incremental change policy aims at strengthening the existing structure, while the radical change policy aims at changing this structure. However, from a regional policy perspective it is necessary to take point of departure in the regions needs and competences, and to mobilise users and producers. There is no simple policy solution or recommendation, but initiating incremental change requires mobilisation of the targeted actors, while radical change involves more risk taking and requires willingness to change, but still implies mobilisation of regional actors.

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 city is Aalborg, the fourth largest in Denmark, with 163,000 inhabitants. The region has traditionally been characterised 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 specialised in the primary sector (i.e. an above national average employment share) and the metal product industry, they are also specialised 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., 2005).

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 MSc in engineering and in the 1990s approximately fifty percent of the Danish MSc'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. Almost 40% of the total number of graduates from the university got their first job in the region (Nielsen et al., 2002, p. 81).

From 1986 the region has been supported with several EU Programmes 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 rate[1]. Especially the Objective 2 funds for Industrial Reconversion have been used to promote the structural change in the region[2]. In the period from 1986 to 1999 the region was supported with € 210 million from the EU, which generated additionally € 247 million in support from Danish public organisations and € 302 million from private firms. In comparison the DDN programme was financed by € 23 million in public support and the current Objective 2 EU programme running from 2000 to 2006 has received € 246 million in public support. The evaluation reports of the EU programmes indicate that the overall effect 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 measure[3]. The direct effect of DDN is expected to be smaller than Objective 2 due to the difference in size. The North Jutland County administration has been the administrator for the EU programmes, i.e. organising the project offers, putting together the financing, attracting external partners, and other related tasks. Through this work the County Administration created competencies and established a wide network to the different participating actors, which were useful in the DDN programme.

3.1 The ICT sector in North Jutland before the DDN programme

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 employment[4] was 8,300 in 1999, but the region has not been specialised in ICT employment. The

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[1] From 1980 to 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 programmes have been quite broad in their objects, e.g. the Objective 2 programme 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/resultaterafnordjyskeeuprogrammer.htm

[4] The ICT sector is defined as the following industrial classification codes NACE/DB(93): 3001, 3002, 3130, 3210, 3220, 3230, 331020, 331030, 331090, 3320, 3300, 514320, 516410, 516520, 6420, 713310, 72

specialisation 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. Specialisation 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 employment growth in telecom hardware has been outstanding with an increase from a three to nearly six times larger employment share compared to the national average.

Table 1 The structure of the ICT sector in North Jutland

| | Specialisation | | North Jutland | | | | Denmark | |
	1992	1999	Employ-ment (persons)	Share of ICT (%)	Development 1992-99 (1992=100)	Change (persons)	Share of ICT (%)	Development 1992-99 (1992=100)
Manufacturing	**1.05**	**1.51**	3,731	44.9	**150.3**	1,248	25.3	**104.3**
Office machinery	**4.33**	**6.81**	288	3.5	**116.1**	40	0.4	73.7
Computers	0.70	0.36	52	0.6	48.1	-56	1.5	94.4
Electronic components and wire	**1.55**	**1.14**	511	6.2	81.2	-118	4.6	**110.2**
Telecommunications equipment	**3.13**	**5.92**	1,936	23.3	**207.3**	1,002	3.4	**109.5**
Consumer electronics	0.27	0.89	467	5.6	**392.4**	348	5.4	**120.1**
Electro medical	0.48	0.42	193	2.3	84.3	-36	4.7	95.5
Instruments etc.	0.41	0.55	284	3.4	**131.5**	68	5.3	98.1
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:. The specialisation indicator is the share of ICT employment of the total employment compared with the national average. A value above 1 indicates an above average employment share - i.e. the county is specialised. Specialised industries and a positive change in employment is marked in bold. The data is from November that year.
Source: Based on data from Statistics Denmark.

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 total number of 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, 2005). The cluster had grown out of a few maritime communication firms from the late 1970s and had experienced high growth in the 1990s. It attracted many subsidiaries of large multinational companies. The cluster was 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 during the last half of 1990s.

3.2 DDN, innovation system, innovation policy, and the ICT sector

The basis for innovation policy is analysis of the innovation system with point of departure in the existing knowledgebase, institutional context, regional industry specialisation, and how the system

produces and reproduces knowledge and competences. Thus deliberate innovation policy is often focused on incremental change by following the existing trajectories.

The terms radical and incremental change are classified according to how radical they are compared to the current structure. Therefore a programme targeted at the ICT sector in North Jutland would be incremental if it focused on cumulative improvement of the existing structure including the cluster. Radical change implies a shift of the regional development trajectory. To promote this the focus could be on the more dispersed, but promising activities in the ICT sector The radical and incremental change could both be supported by the university since it provides a supply of qualified labour and have top-level research groups in knowledge bases that are not or only a little present in the existing industrial structure. The radical change could then stem from the university through spinoffs or joint projects.

The DDN programme was to be an experiment, based on project-offers, and not necessarily include local ICT firms (due to competition rules). These three features are important, since the first implies a higher degree of failure, the second increases the uncertainty profile and outcome, and the third lessens the effect on the regional ICT sector, unless the non-local firm are attracted and opens an affiliate.

4 The history of DDN and the shaping of the profile

The early formation of DDN programme prior to 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 minister's 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 programme 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 programme in Copenhagen was focusing on creating infrastructure the DDN programme 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 develop the strong growth in the ICT sector from the 1990s further.

> *"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 programme. Although the rhetoric in the report makes parallels to Silicon Valley, Kista and Oulu it would be wrong to conclude that the intention was to create radical change by building a new Danish Silicon Valley. But it seems clear that the purpose was 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 the argument of building on the existing network cooperation between public and private organisations.

> *"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)*

When giving the invitation in September 1999 the Minister stressed that it was required that the public organisations, the university and private firms cooperated on designing a programme 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 programme would get a strong research profile based on joint research projects with private firms. The fear was that the DDN programme would be used to support many fragmented small projects like a traditional development programme 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 were 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 rationalisation and increase in productivity in itself, without a joint effort with education and organisational 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 organisations 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.

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

The DDN organisation was to consist of a board of directors with the responsibility to select the themes of the programme in cooperation with the ministry. It was also to appoint[6]:

- Project groups connected to each theme

- A board of executives with the responsibility of the practical implementation

- Project groups with the responsibility to select the winning projects

- A secretariat with responsibility of all the practical work.

The interim board of directors was almost identical in the new DDN organisation. The editors of the report[7] 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 selection of specific 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 DDN[8], but the building of the lighthouse could still offer opportunities for these actors.

5   Building the lighthouse

The discussions of the DDN programme 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 programme flourished. The report on DDN had described a roadmap for the building of the lighthouse. The board of directors was to decide upon four themes and the profile and then appoint four project groups to select the projects. DDN was to be organised as project offers 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 programme

The board of directors was officially appointed in February 2000. Their first task was to specify the four themes further and appoint the four projects groups. But this work had already begun in

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[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.

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

[8] The phrases of 'development of the ICT sector' and networks with the university' had been toned down in the report.

advance. During December and January the themes were specified and enrolment of actors to the project groups and mobilisation 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 programme and to mobilise as many actors as possible. The selection was, however, dominated by political and organisational interests, and the interest of the ICT sector 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 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 the university administration 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) return[9].

In January 2000 the four themes were selected[10]:

- IT infrastructure

- IT industrial development

- Qualification and Education

- Digital Administration

A project group was attached to each theme, which was to participate in the selection of winning projects from the forthcoming project offers. Their first task was to create a project strategy and frame. Based on this 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 organisations. The groups worked from April to 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 programme. Although no project offers had been held, the work continued on the sidelines. In mid-February several forthcoming DDN projects appeared in the media[11]. 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.

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[9] Thorhauge, Claus "Nordjysk IT fyrtårn leder efter ideer" Computerworld 14 January 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 February 2000

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 administration[12]. 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 was not to focus on a single sector but all sectors and not concentrate on a single 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 assists the user-orientated profile[13]:

- 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 must not pay more than a third of the total project sum. This meant special rules for public financed organisations and organisations that 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 as a part of the two-thirds 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 technical disciplines to the more 'soft' research fields.

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[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 costs, participatory research and evaluation. Approximately 50% of the funds were allocated to the first project offer.

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. The IT infrastructure theme was focused on the fixed network and the IT industrial theme was mainly directed 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 mobilise members to participate in the DDN programme. The cluster association wanted to secure that the DDN policy programme 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 organisations

- The composition of the DDN organisation

- Formal mode of operation

- Ministry rules for funding

- Appointment of the director of the lighthouse secretariat

These five factors seem, however, not to be mutually independent. It seems that the strong commitment from the leadership of influential public organisations 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 profile[14].

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

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 organisations. 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   DDN 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 organisations had clearly created a bulk of applications, but also other organisations felt that they had to participate due to the commercial value and to avoid that DDN became a failure. The prestige attached to DDN also attracted participants.

The DDN secretariat received 118 project-applications 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 million[15]. The distribution was:

- The IT infrastructure theme received 10 applications and 4 winners were selected.

- IT industrial development received 33 applications and 12 winners were selected.

- Digital Administration received 24 applications and 7 winners were selected.

- Qualification and Education received 51 projects applications and 21 winners were selected.

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

- The Digital County Administration and The Open Municipality on digitalising the county administration and the administrative procedures in the municipalities.

- North Jutland Netforum planning an optical fibre based infrastructure.

- TV2 Nord Digital broadcasting digital TV with interactive services among the first in Europe.

- Personal Mobilised Broadband Services using front line technology and creating and testing the future home mobile broadband services.

- The Digital Mall was to 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.

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[15] The funding given to each theme varied slightly from the expected amount, the expected amounts are noted.

- 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. Some of the projects shifted from radical to incremental change. 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 also more specific in the later 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 does not change the overall 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 incremental projects were more or less successful than the radical projects. The projects on digitalising 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 radical change projects from the first round on creating the Digital Mall, broadcasting interactive Digital TV and planning (and building) a fibre based infrastructure for the entire region could be important parts in making DDN a success. 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.

The Digital Mall wanted to be the electronic shopping site on the Internet preferred by citizens of North Jutland. It, 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. 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.

The Digital TV project intended to transmit digital TV with interactive services among the first in Europe. 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 and the project has turned out to be a success in terms of technology and users. However, the Danish government decided in late 2003 upon a less ambitious plan to begin broadcasting from April 2006, which partly undermined the project.

The IT infrastructure project wanted to design local optical fibre based network solutions, which would bring broadband to local government organisations as well as to private firms and consumers. The project could - 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. The public sector was important to boost the project. However, the North Jutland County has been very slow to react, while other Danish counties have been faster. The County of North Jutland have left the initiative to private actors and seems to have missed the opportunity of becoming a 'lead user' in this field.

6   DDN and the development of the ICT sector in North Jutland

DDN generated 90 winner projects with a total sum of € 90 million, which was considerable higher than the expected sum of minimum € 64 million, i.e. the government funding of the projects was on average less than one fourth (The Lighthouse Secretariat, 2003). The projects were initiated during 2000 to 2002 and have been finishing continuously.

On the positive side the DDN programme created lots of ideas, initiated many projects and constituted a large commercial value for the region for a rather modest government support compared to the objective 2 funds. Interviews with participants conducted during 2002 and 2003 reveals that the programme has formed networks between firms and public organisation 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 programme, and many projects where participation has been considered positive, but with an uncertain overall effect.

ICT firms participated in many of the 90 projects as project partners or suppliers of software services and hardware. The impact 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 create externalities that would affect the development perspectives more positively than the pecuniary effect on sales. The description of projects reveals that ICT firms participated in more than 40 projects, but the scope of the projects are varying and the internal competence building is not possible to assess without more thorough analysis that is beyond the scope of this chapter.

The Danish ICT sector has had a remarkable growth in employment and number of firms from 1992 to 2000. The growth in ICT stopped in 2000 when the sector went from boom to burst and

employment declined[16]. Especially the ICT manufacturing was hit hard in this period while ICT services performed less badly, except for wholesale trade. The crisis in the worldwide ICT sector does not appear to have hit Denmark as severely as other countries. The impressive growth in Danish ICT employment stagnated in 2000-2001 and decreased in 2002-2003. These external events influenced the results of DDN. It was presented in 1999, when the ICT sector was booming, but implemented from late 2000, when the ICT crisis had begun.

From 2000 to 2002 ICT employment in North Jutland decreased with 5.6% compared to 7.7% in Denmark. Therefore the effect of the crisis from 2000 to 2002 appears to have been less negative in North Jutland. However, this can also be partly explained by composition of the ICT sector in North Jutland. The major share of the region's ICT employment is within wireless communication that was hit later by the crisis. Most of the cluster firms were very R&D intensive, owned by foreign firms, or R&D subsidiaries of well-known multinational companies. The crisis affected the cluster and caused problems. Some firms downsized and some moved away from the region. Meanwhile other local firms hired most of these engineers and new firms entered. The employment of engineers in R&D has been fairly stable, but large downsizing in manufacturing and mobile communication service have made the total employment decline. This turbulence somehow made the policy makers' attention turn away from the cluster and focus on other areas.

The NorCOM cluster is still a visible high-tech cluster in a peripheral region. It is still the strength of the ICT sector even taking the recent turbulences into account. A look at the NorCOM history reveals that the cluster has experienced many crises for the entire cluster and individual firms. The doom of the cluster has been foreseen many times, when prominent firms went bankrupt or when multinationals chose to close down their division in the cluster. But somehow it has proven to be very hard to extinguish because of the self-augmenting processes. When companies exited spinoffs entered. Employment declined from 4,300 in 2002 to 2,800 in 2006. In June 2004 Flextronics decided that a major mobile phones manufacturing plant in North Jutland was to be closed down. In 2003 at its peak it employed 1,700 persons in Pandrup, North Jutland.

The development perspectives for the ICT sector in North Jutland is related to the development perspective for the cluster and the other interesting technological knowledge bases that also holds good performing firms, such as biomedical, logistics software, electromedical etc. and a knowledge base. But these do not produce many spinoffs and lacks critical mass of firms before the self-augmenting processes potentially could create a process of further growth in number of firms. (Pedersen, 2005) Specialisation by clusters creates vulnerability and lock-in effects in terms of dependency of a single technological knowledge base, but it is also a sign of strength. That is, NorCOM makes the ICT sector more vulnerable for shocks in markets and technologies, but it has also been the growth driver of the sector. It has created visibility, attracted firms and funds, and more importantly generated a large pool of highly educated qualified labour in a peripheral region. The possible lock-in could create long-run negative effects with lower innovative activity and revenues etc., and it could raise a debate of how to destroy clusters when they have outlived its performance.

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[16] The worldwide crisis in the ICT sector 'started' with the burst of the dotcom bubble in March 2000 when the share prices at the stock markets started dropping. During 2000-2001 the economy-wide business cycle also experienced a downturn, starting in USA and quickly spreading to Europe and the rest of the world. This reduced the end-user demand for ICT equipment and services, which added to the crisis (Fransman, 2002)

However, then it should be possible to measure the point when the negative effects of the cluster were larger than the positive.

6.1 After DDN: Sustaining regional change?

The overall DDN project was evaluated by Danish Technological Institute. The evaluation report was published in October 2004 and it was essentially positive and stressed the importance to continue the development. Radical and incremental change is an ongoing process, however, there are some in-built problems in DDN like many other programmes in relation to sustain the processes started by the programmes, after the end of financial support. This creates some tension between to end the support or continue with a new program until the processes are self-sustaining. Likewise Lundvall and Borrás note:

> *"Many evaluations end up addressing users of the programs with questions about the efficacy of the program. Not surprisingly, such studies often end up reporting that the program was very good and that more of the same would be welcome." (Lundvall and Borrás, 2005, p. 611)*

Although 'more of the same' seems to be a frequent conclusion in evaluations it could be a fair conclusion if the goal is long-term 'radical' change. However, the continuation of DDN and sustaining process of change were not planned initially.

DDN ran from 2000 to 2003 and the last projects was finalised in the spring of 2004. When the projects ended there were no announced plans to continue DDN as a 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 programme would end with an evaluation.

A group of public organisations 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 was, however, not evident that this forum in reality had the political momentum to carry on the positive initiatives created by DDN. However, in February 2004 it decided to form a regional digital taskforce financed by the County and Municipalities of North Jutland, to continue the work on digital administration and competence building in the public sector that DDN had started for one year. This period was prolonged after the evaluation of DDN in October 2004 when the Minister of Science and Technology supported the initiative with € 1.2 million. As a result the new Centre for use of IT (CITA) was founded in 2005[17]. CITA was to have a broad profile like DDN, but focused on: digital administration, e-learning and competence building (mainly use of IT in the public sector). CITA was

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[17] The profile of CITA was supported by the composition of the board of directors. It consisted of the former director of the DDN secretariat, four from the administration of various municipalities, one from the university and one from the IT sector.

also to coordinate other projects, such as the € 5.6 million DEMO-net project on e-democracy financed by the EU.

In December 2004 the IT infrastructure project gained support from the North Jutland County. The North Jutland Development Fund decided to allocate € 9.3 million from EU Objective 2 funds to initiate the building a fibre-based infrastructure in the Objective 2 municipalities in North Jutland. However, the project soon faced several problems and was finally closed down in May 2005 when they found out that the Objective 2 funds could not be used for that purpose.

During the election camping in January-February 2005 the government decided to support the North Jutland region with € 26.7 million since it had suffered from the closing-down of several large companies. The North Jutland Innovation Forum was closed down and a temporary Growth Forum was founded in May 2005 to initiated projects that could generate growth and employment in the region. The forum had 20 members of which 1 were from the ICT sector. It supported 20 projects within the following themes: the experience economy, the service, manufacturing and food sector, and high technology and growth capital. In April 2006 the temporary forum was replaced with a new Growth Forum. One of its tasks is to produce a business development strategy for four 'clusters': construction materials, food, health technology, and ICT.

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 programme 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 mobilised in DDN. The university was only partially integrated in the programme. 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 programme. The strong commitment from the leadership of influential public organisations 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 characterised as let a thousand flowers bloom, which proved to be problematic since 'people who do not know where they

are going usually end up somewhere else'[18]. 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.

The role of DDN and its impact on the development perspectives of the ICT sector could also be more broadly sketched in a user-producer interaction in a system of innovation approach. The demand side of the NorCOM cluster is global. Likewise the users of IT services are a part of a global system. The local market for wireless communication equipment is very small[19], while the some of the IT service solutions still have a Danish specificity. The global market for these parts of the ICT sector puts additional requirements on the advanced users and user-producer interaction, since the pecuniary effect of the local market is small.

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 programme 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 programme 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 programme, and many projects where the participation has been positive for the participants, but with no significant impact on the development of the ICT sector 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 programme seems to have created some contacts among firms and public organisation that may contribute to the future development perspectives for the ICT sector in North Jutland. The DDN programme was not a large financial support programme compared to the EU structural funds. However, it had a possibility to strengthen the cluster or to focus on developing other segments of the ICT sector, but became too broad and unfocused. Unluckily, it was launched at the worst possible time by coinciding with the worldwide crisis in ICT. The broadly user-orientated profile seems to have started a positive process of use of IT in the public sector in North Jutland. DDN has had some positive effects, but it does not appear to have left a visible lasting fingerprint on the development perspectives for the ICT sector in North Jutland.

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[18] A quote related to the lack of a clear specified goal in DDN is: Alice came to a fork in the road. "Which road do I take?" she asked. "Where do you want to go?" responded the Cheshire cat. "I don't know," Alice answered. "Then," said the cat, "it doesn't matter." (Lewis Carroll, Alice in Wonderland).

[19] Measured in sale of terminals. Some of the cluster companies have customers within the cluster.

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