

Policies to stimulate collaboration on innovation **– examples from Denmark**

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By

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1. Introduction

The importance of collaboration, co-operation and networking (ccn) in innovation has been much emphasised in recent economic thinking as well as in empirical work on innovation. Thus, the work in the OECD-project on National Innovation Systems, focus group on ccn, has drawn our attention to this. Since long it has been recognised that firms rely heavily upon external partners in innovation activities. However, it is now widely believed that recent changes in the economy as a whole and more specifically in the way innovations are undertaken, has meant an enhanced role for ccn in innovation. It is reasonable to expect this trend to continue and be reinforced in the future. The arguments for this are several. It should here only be pointed to the fact that production is increasingly dependent upon knowledge, but not just any knowledge. Economists and sociologists alike have come to the agreement that tacit knowledge is becoming still more important. This is in turn caused partly by the wide, easy access to information in general. When everybody have access to codified knowledge, then a leading edge in the competition must depend upon a unique knowledge not as easily accessible by others; it must depend on tacit knowledge. Tacit knowledge is, however, rarely produced in isolation and it is above all transferred in an interaction with the user of this information. Therefore, collaboration on developing and transferring useful knowledge for innovation is likely to increase.

Given the fact that ccn is key in tomorrows industrial development, it becomes interesting to know how ccn is stimulated. In other words, this becomes a major policy issue. However, the precise design of policy measures to stimulate ccn must be considered carefully. Although we may comply with the general conclusion that ccn benefit innovation, then not all ccn is beneficial and there are no linearity's or even just regularities in the outcomes stemming from a certain amount of increased ccn (if such outcomes were possible to measure precisely). Thus, ccn requires resources and productive learning may be much stronger with some partners rather than others (who may even contribute counter-productive). Therefore, it is a challenge for policy makers to think carefully about the design of policies and what quantitative measures are appropriate to apply to spur ccn and innovation. A further argument why policy formulation in this area should not be too simplistic is that National innovation Systems are rather different, even between countries, which are much alike in many other respects. Ccn-policies should therefore be adapted to the environment in which they are to operate.

One strategy for policy learning within this field is to increase exchange of cross-country experiences. This is already taking place at the level of national civil servants studying ccn-schemes in other countries. However, the processes are fragmented and to some extend constrained by e.g. language differences. The process could benefit from studies of systematic, research-based foundations.

Following the argument above this paper presents selected examples on Danish policies targeted at stimulating ccn. The specific examples are deliberately chosen to illustrate different ways of stimulating ccn. The first case, Centerkontrakter (Centre Contracts) is a scheme designed to enhance collaboration between universities, semi-public research institutions and industry. All three types of parties must take part and it is explicitly formulated that long-term competence building is one of the objectives. This scheme may be seen as giving

incentives to backward linking with knowledge institutions and it is heavily oriented towards *development* of relatively radical innovations. The second, Innovation Incubators, is a special form of incubator scheme. Again, it is meant to stimulate collaboration on innovation, but not necessarily radical innovations. In addition, the scheme is designed not only to stimulate development of new products but also to the commercialisation of the products. This is reflected in the parties involved, which includes e.g. venture capital firms. Finally, a scheme is discussed which may be seen as more traditional in its design. It is called Business-to-Business scheme and is aimed at stimulating horizontal ccn, as opposed to the two other schemes. The scheme is interesting in the present context because it is required that ccn takes place cross-border. This section is more focused upon the impacts of the scheme rather than structure, eligibility etc.

As mentioned the whole range of innovation policy instruments in Denmark will not be reviewed¹. Nevertheless a few of the other instruments relevant for promoting ccn-innovation will be mentioned along the way. During the description of the schemes the approach will be to try to give a neutral presentation, although the cases will be put in the context of ccn/innovation policy instrument more generally. The materials to be used are primarily publicly available information from The Ministry of Industry, evaluations and (to a lesser extent) own assessments of the schemes.

2. Case 1: the Centrecontract-scheme

It has been a general trend in Danish innovation policy to turn focus away from single, isolated elements of the conditions for innovation, and in stead enhancing the coherence of the different elements in the innovation system. The Centrecontract-scheme is an important example on such policies as it gives incentives to bring together key actors in the system. Thus, the **objective** of the Centrecontract-scheme is to intensify the corporation between universities, private companies and the Authorised technological service institutes.

The Centrecontract-scheme was introduced in 1995 and is basically a government co-financing of the costs of Authorised Technological Service Institutes (up to 75%) and research institutions (up to 100%) in participating in a strategic collaboration with private firms on process or product development. The Government **funds** available for the scheme is approximately 13 million EURO a year in recent years – in 2000 85 mill.DKK (app.11 mill. EURO). This should be compared with the total budget of the contracts which for the first 20 contracts were around 60 million EURO. Of this sum private firms financed 50%, the Authorised Technological Service Institutes 35% and research institutions around 17%. On the average the subsidy for The Authorised Technological Service Institutes in the first

¹ One should perhaps expect the Danish Network Programme to be included in the present review. However, although this programme is rather famous and has been copied in other countries like Portugal and the U.S. (see review of content and the process of copying the programme in the U.S. by Rosenfeld, S. A. in *Research Policy* 25 (1996), 247-263, "Does cooperation enhance competitiveness? Assessing the impacts of inter-firm collaboration"), then the final evaluation of the programme turned out rather negative (The Ministry seems to be not at all proud of this evaluation, which subsequently has not been announced in the press (as is usual with other evaluations) and is not as easily accessible as other evaluations).

20 centre contracts was app. 80%² while the research institutes were refunded 72% of their costs. Private firms are supposed to finance their participation by themselves.

Although this may vary a lot then the typical centre contract involves 3-4 private firms, 1 Authorised Technological Service Institute and 2 research institutes. They typically last 3-4 years. Compared to the population of firms in general the firms participating in centre contracts are most often large. This may be explained by the fact that a formalised ccn require a substantial amount of resources. In addition, the firms must be at a certain scientific level if The Authorised Technological Service Institutes and research institutes are to find the firm an attractive partner for collaboration.

The Authorised Technological Service Institutes are not only the key ccn-partner and driving force behind establishment of the majority of Centre contracts, but also important intermediaries in the general knowledge transfer in the economy. As they often spur ccn among firms, they are described separately in the box at the end of this section 2.

Impact

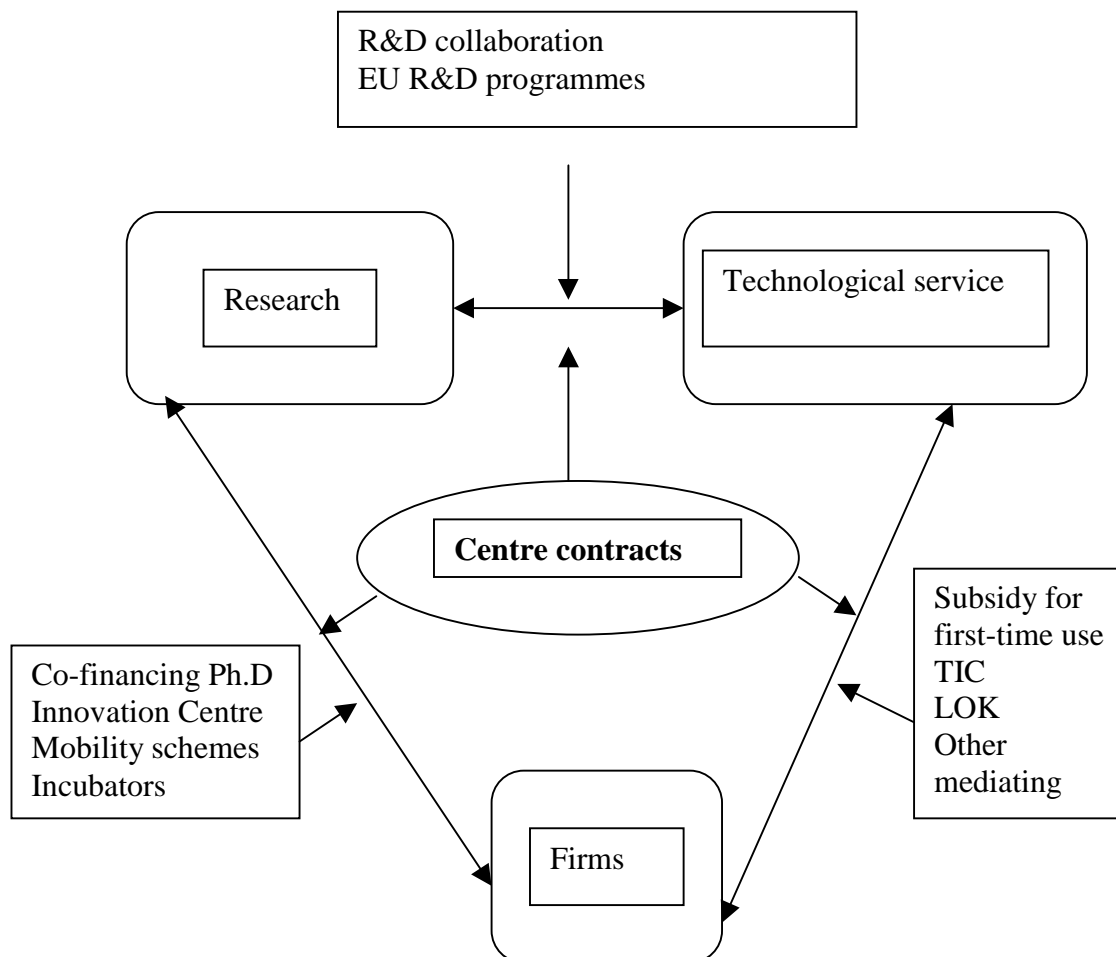
In general, the scheme is seen as successful in its impact, even if the one completed evaluation of the scheme has been rather early to encapture all effects³. The aim with the scheme is that the specific impact should be three-fold. First, there is an (expected) effect on innovation. On this point the firms participating have strong expectations to improved or new products/processes will result from the collaboration. Only 12% of firms do not expect direct effects on product- or processinnovations. Second, the aim with the scheme is to increase competencies, especially in the GTS-institutes. Most of the participating institutes and research institutes express the opinion that indeed such a competence building has resulted. One could, though point to the dilemma between making the centre contracts too narrowly focused upon specific technologies versus the generic use of competencies afterwards. Furthermore, only a few of the firms had any formulated strategy for making use of and how to spread within the firm the knowledge generated. In other words competences are build but are not spread as much as it could have. This is, however, a general problem that could not be blamed upon the scheme. The third effect expected from the scheme is a pure network effect. It is explicitly formulated that the scheme is intended to stimulate networking among the partners not only during the centre contract but also on a longer term. The collaboration between the parties is of very different intensity and frequency. To transfer tacit knowledge – which is one of the sub-objectives of the programme – a certain personal interaction is required. This takes place in most cases, as some of the key workers are even located with their partner for a period of time. However, in other cases the interaction is too much based on electronic communication and could be intensified. Problems are especially severe if the partners are not equal in terms of what knowledge they can offer to the common efforts.

² One of the criteria for getting this co-financing is that the building-up of competencies should not be exclusively confined to the single contract, but must be of use when the GTS-institute in the future collaborate with other customers.

³ The first evaluation was published in beginning of 1998. A second evaluation is currently on its way. A contract has been signed with a consultancy firm and results of the evaluation is expected to be delivered mid-january. The scheme is subject to evaluation every three years.

The overall assessment is that the scheme is an adequate measure for bridging different elements in the innovation- and knowledge system. It is often a problem to ensure productive collaboration between different types of partners because they have different incentives. These differences are well-described in the literature on university-industry collaboration. The centre-contract scheme is an effective means of ensuring incentive compatibility and facilitating the transfer of knowledge between different parts of the innovation system.

It is illustrated in figure 1 that the scheme is placed in between different types of actors in the national innovation system, and is meant to be an important mechanism for transfer of competencies. Other programmes are likewise meant to stimulate collaboration between different elements of the innovation system. A selection of these are mentioned in the figure. However, the centre contract scheme is unique in the sense that it brings together all three parts of the system, not just two of them as in the other schemes.



Authorised Technological Service in Denmark

In total, there are 12 Authorised Technological Service Institutes (GTS institutes) in Denmark. Altogether, the institutes have 3,050 administrative and technical/scientific employees. The institutes had a total turnover of DKK 2.2 billion in 1999. Of this, support from Government amounted to DKK 240 million, or 11.2 per cent of turnover

The technological service institutes are independent institutions with a management that is responsible for the individual institute's financial and professional development. The institutes sell their services on normal commercial terms in Denmark and internationally and are thus market-oriented. They do though, have non-profit objectives and therefore the government co-funds some of their activities as well as abstain from demanding taxes. Authorisation means that the institutes can apply for co-funding of competence-building activities that will enable them to supply the latest technological knowledge to enterprises. The government co-funding is thus not meant to be an operating grant that can be used to reduce the price of the institutes' commercial services.

The GTS institutes sell technological consulting services to private and public organisations. They are supposed to acquire, build-up and develop technological competence and communicate this knowledge to Danish businesses. They are encouraged to pay special attention to small and medium-sized enterprises and these enterprises are receiving a financial subsidy of their first-time use of one of the GTS-institutes. The institutes vary greatly with respect to size and scientific/technical scope, and there are large differences of activities both within the single institute and among different institutes. Some are very R&D-intensive, while others emphasize scientific/technical activities, such as consultancy, testing, establishment and maintenance of standards, etc.

The GTS institutes are an important element of Denmark's research, technology and innovation system and a vital industrial policy instrument. They are monitored by the Council for Technological Service (RTS) and Danish Agency for Trade and Industry. The Council's vision for technological service is described in "Strategy for Technological Service in Denmark". (www.efs.dk/publikationer)

The GTS institutes are evaluated every three years by an external expert panel. The panel's recommendations are usually included in the institute's strategy plan, which is prepared after the evaluation. The strategy plan is the basis for authorisation and for the three-year performance contract, which the institute enters with RTS on co-funding selected scientific/technical activities.

3. Case 2: Technology Incubators⁴

Six technology incubators were established in recent years. They are **regionally dispersed** and operate in close co-operation with universities or science/research parks. The incubators

⁴ This section draws heavily upon an evaluation of the Technology Incubator Scheme which was undertaken by a consultancy firm, PLS Consult, in cooperation with the English consultancy firm Segal Quince Wicksteed. The evaluation was commissioned by the Danish Agency for Trade and Industry, and was carried out during the period October 1999 - January 2000.

offer state-financed seed-capital to entrepreneurs in combination with counselling and training, premises and administrative services.

The **objective** is to bridge research environments, innovative entrepreneurs and finance companies in order to develop and transfer research and innovative ideas to commercially sustainable innovative projects and enterprises.

The Ministry of Trade and Industry **supports** these incubators, and in the period 1998-2000 a sum of DKK 310 million (EUR 42 million) has been assigned for this. After a positive mid-term evaluation in late 1999-beginning of 2000 the scheme was recently prolonged for another three years.

The special thing about Technology Incubators as opposed to traditional science parks or Business Innovation Centres is that they provide both knowledge and capital for innovative entrepreneurs. Thus, the overall purpose of the Technology Incubators is to support new, small innovative companies in Denmark by securing a closer interaction between innovative entrepreneurs, research and capital about the development of new products and services.

The **target group** of the Technology Incubators is innovative entrepreneurs with a knowledge-based idea of a commercial potential. Established companies are not eligible to receive support from the Incubators. The Technology Incubators offer knowledge, advice and seed capital to companies during the initial phase of development; i.e. before the company has developed an actual concept, product, or service. After this phase the Technology Incubators may assist the company in procuring capital, e.g. through the state-owned fund, Business Development Finance, from venture capital companies and/or individual private investors.

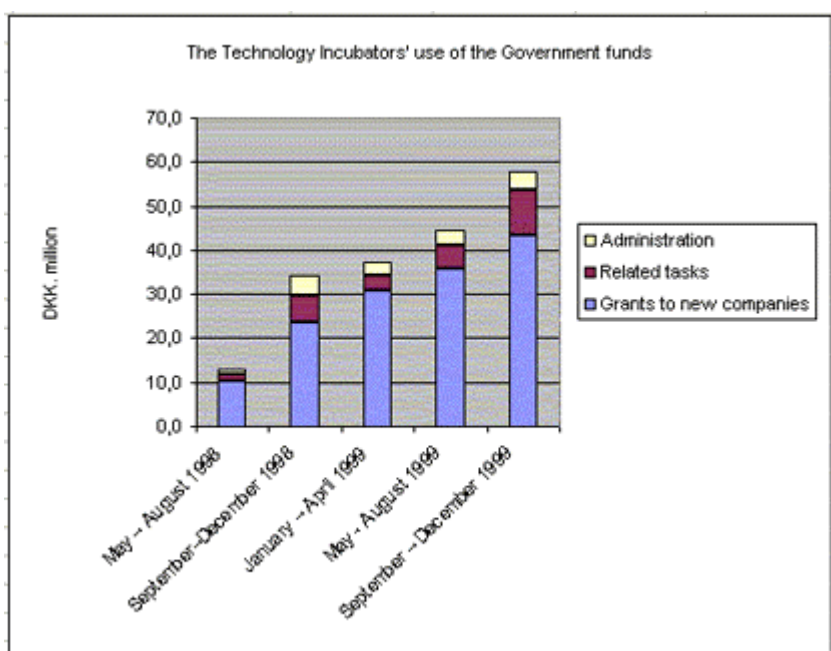
The majority of the projects are placed in high growth industries. IT and other electronic products, biotechnology and medico/health account for more than half of the pre-seed capital projects. A large share (25%) of the entrepreneurs comes from universities or other research institutions, but the majority, 59% of the entrepreneurs, were most recently employed in the private sector. According to the statistics on types of projects there is an overweight of business-oriented projects (62%) compared to the research oriented projects (38%).

The Danish Agency for Trade and Industry is responsible for the **administration** of the scheme. It receives reports from the Technology Incubators three times a year. On the basis of an evaluation of the results, The Danish Agency for Trade and Industry grants an annual framework of DKK. 100 million (1998-2000) to the six Technology Incubators. In this way the state is actually delegating the hands-on distribution of subsidies. This is relatively new in Danish business development policy. It reflects the fact that ccn is often embedded in the local environment when it comes to the less radical innovations on a small economic scale. Thus, the network of the incubator is extensively used as a window of opportunities with respect to potential collaboration partners.

On the basis of the applications from the entrepreneurs the Technology Incubators may choose to carry out preliminary research of a maximum cost of DKK. 50.000 per project. If the preliminary research has a positive outcome the Technology Incubators may assist the entrepreneur in the establishment of a company. In this phase, the Technology Incubators

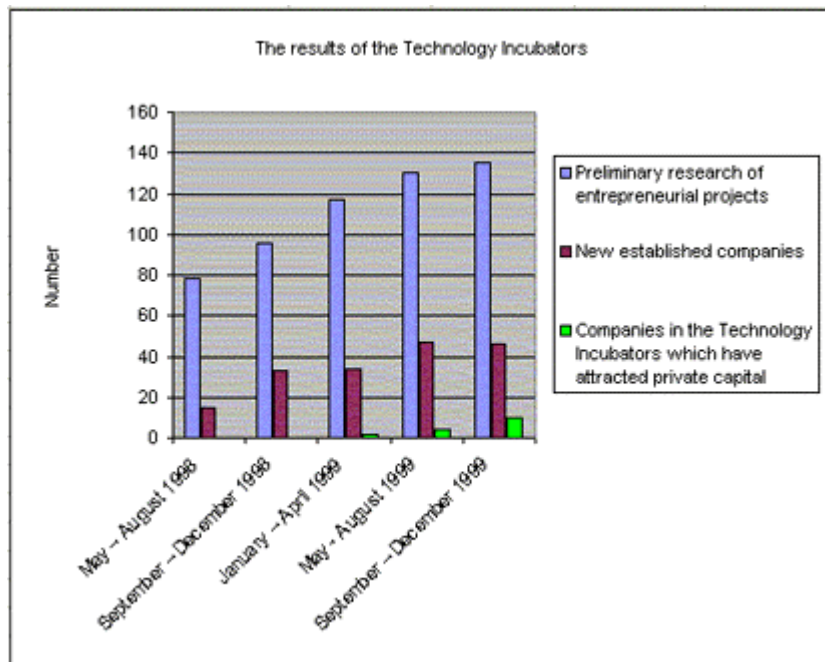
may contribute a maximum of DKK. 750.000 (EUR 100.000) to one company either as grant, loan or equity capital. Grants, loans or equity capital must amount to at least 75% of the total Government allocation for this scheme. The remaining 25 %, the Technology Incubators may spend on administration (maximum 8%) and related activities (a maximum of 17% for the costs of research in educational institutions and the development of education and training for the entrepreneurs).

The **activities** in the T.I.'s have increased during the period in which they have been in operation. This is illustrated in figure 1 and 2. First, figure 1 shows the use of Funds in 5 four-month periods. It is clear from the data that activities have increased rapidly during the short period in existence.



Likewise figure 2 shows that the number of project proposals assessed has increased, and the number of newly established enterprises has reached a steady level around 40. Only a few of the firms have yet managed to attract other investors. This is, however, to be expected given the short time for developing the firms in the incubators.

The activities of the incubators have reached a level that exhausted the available pre-seed capital. The budgeted means for the present year were only sufficient to carry the incubators through to August 2000. Therefore, the Government has now (august) extended the means in the present period of operation and made the scheme more or less permanent thereafter.



Impact

During the period 1998 to 1999, the incubators have contributed to the establishment of 172 innovative companies founded on new, knowledge based project ideas. Approximately 100 of these project ideas are patented. The projects are the result of a large number of proposals from potential entrepreneurs, researchers, students and others who are interested in establishing their own businesses. The incubators have registered a total of 2.631 proposals, which have resulted in the initiation of 549 feasibility studies of which 176 pre-seed capital projects resulted during the first two years of the initiative.

The incubators have invested a total of 125 Mio. DKK in pre-seed capital projects. Almost 10% of the initiated pre-seed capital projects have been continued with other means of funding - all during 1999. In an international comparison a continuation of 10% of the pre-seed capital projects with external funding is a satisfactory result considering the fact that the initiative was initiated less than two years ago. Add to this that the incubators had a relatively slow start, as the necessary administrative apparatus had to be built from the ground. Due to this the majority of the incubators were not operational until mid-1998.

According to the recent evaluation, 49% of the entrepreneurs claim that they would not have been able to initiate their project without the assistance of the incubator. In addition to capital, the T.I.'s add relations to other financing sources and advice on typical start-up problems. The incubators are most needed in relation to research based projects, as 60% of these projects – according to the entrepreneurs – would not have been realised without the intervention of the incubators. These results indicate that the incubators have contributed to a commercial exploitation of innovative project ideas, which otherwise would not have taken place.

Critical issues/assessment

Although there are considerable differences among industries the pre-seed capital from the incubators is generally not sufficient to develop the projects to the stage of commercialisation. This emphasises the need for venture capital. However, the pre-seed capital provided by the incubators (maximum amount 750,000 DKK) is generally sufficient to develop the project to a stage where the project can be provided the necessary capital from external investors. This is, however, a critical point. Indeed an intensive use of ccn is required in this phase.

It is obvious that availability of capital is only part of a well-functioning national innovation system. It is, however, an important part and it has been claimed that financial institutions to a large extent is the glue in national innovation systems as they bind together different types of agents in the NIS and are the selection mechanisms of business opportunities. Likewise it is important to have a range of adequate institutions within the financial system. The incubators are among the most risk-taking sources of finance in the Danish financial system. The incubators function as the first link in an intertwined system of financial institutions such as the Business Development Finance (VækstFonden), venture capital investors, Business angels, and institutional investors. The incubators offer funding as well as advisory services to projects at the seed or pre-seed capital stage, where the need for capital is relatively limited, but where the financial risk is too high for other investors to be interested in investing in the projects.

An important characteristic of the incubator initiative is the delegation of the administration of public funds for promoting innovative activities to private institutions. The delegation of public funds to private institutions is known from foreign incubators in e.g. the USA. The delegation of funds implies that it is possible to establish a closer relation between the entrepreneurs and the mediator of the capital, both in the approval phase and in the actual project phase. At the same time it implies that it is possible for the incubators to develop different profiles with regards to target group, in-house competencies etc. Thus, it is possible to obtain a broader aim with the initiative compared to a centrally administered incubator fund. Finally, the delegation of the administration of the public funds for promoting innovative activities to private institutions supplies the initiative with a commercial aspect, as the incubators eventually are to be assessed based of the financial returns of their project investments. Thus, there is a range of positive outcomes from delegating the administration of funds for promoting innovative activities to private institutions, compared to a central administration of the initiative.

Ideas for further developing of the T.I.'s should be focused upon the ccn aspect, in particular improving the science-industry link. It has been discussed if funds should be allocated to a network-based information campaign targeted at universities and research institutions, as well as potential investors and to make the incubators co-operate with patent offices at the universities and research institutions. Furthermore, a closer co-operation between the T.I.'s should be established especially regarding the procurement of capital for the continuation of pre-seed capital projects.

4. Case 3: The Business-to-Business scheme⁵

Description

The Danish Ministry of Trade and Industry initiated in 1994 the business-related sector programme Business Development in Central and Eastern Europe. The sector programme comprises three sub-programmes. The Business-to-Business (BtB) programme has been the main sub-programme of the business-related sector programme. The BtB programme has been operational in the period from 1994 to 1998.

The overall **objective** of the BtB programme is to support the development of a strong private sector in Estonia, Latvia, Lithuania, Poland and the St.Petersburg region (program countries) with a focus on strengthening the SME-sector.

More specifically the programme aims at:

developing the capacity of SMEs in programme countries to work within market economic conditions;
transferring know-how, e.g. in management, technology and marketing, from Danish enterprises to the programme country enterprises; and
contributing to increased trade between Denmark and the programme countries through establishment of commercial collaborations between participating enterprises.

The BtB programme is a subsidy programme, which provides co-financing in order to facilitate the establishment of commercial collaboration between companies. It has been an implicit assumption of the BtB programme that the establishment of co-operation with Eastern European companies involves a considerable element of risk. Thus, BtB projects are:

- Innovative, developing new business activities;
- Developed under risky, uncertain and unstable economic and Political conditions.

Impact

An evaluation of the scheme concluded that generally the BtB programme has contributed to developing the business competence and capacity of the Eastern European companies. The Eastern European companies have gained experience and knowledge on how to do business under market economic conditions, which has contributed to the consolidation and strengthening of the private sector. In other words, the BtB programme has met its overall development objective in a satisfactory way.

More specifically the aim of the BtB programme to establish business-to-business collaboration has in a short period - and quite successfully - contributed to the development of commercial relations between Danish and Eastern European companies. 85 per cent of the

⁵ This section is based upon publicly available information on the scheme from The Agency of Trade and Business Promotion, and an evaluation of the scheme published by the same agency (www.efs.dk).

BtB projects have resulted in the establishment of a commercial co-operation with the Eastern European partner and some 90 per cent of the Danish companies expect that the commercial co-operation will continue in the next years to come.

Among the BtB projects, which have resulted in a commercial co-operation, 8 out of 10 participating Eastern European companies report that they have improved their knowledge and know-how, and 6 out of 10 companies actually changed one or more business procedures, for example:

- Technological improvements have taken place and a process is initiated to target the implementation of advanced technology in the years to come.
- Working procedures have been changed and productivity has increased.
- Management systems have been implemented and management attitudes are changing.

Knowledge and know-how are important factors in doing business, but commercial benefits are essential for staying in business. 8 out of 10 Eastern European companies have gained economic benefits as well as a positive impact on the employment.

These direct results and benefits are essential for developing and maintaining BtB collaboration, but also enabling the Eastern European companies to enter into a business relation with other domestic or foreign companies.

Of the Eastern European companies, almost two thirds also indicate that the co-operation with the Danish company has been essential in ensuring the commercial viability of their company. 6 out of 10 Eastern European companies have experienced, as a spin-off of the BtB project, the establishment of commercial co-operation with other international companies. This indicates that the Eastern European companies will be integrated in the international business environment to an increasing extent.

Direct dissemination of experience based on the BtB programme to other Eastern European companies has not been initiated. However, Eastern European companies participating have informally transferred knowledge and know-how through the chain of production to other local companies in terms of requirements and obligations to become a sub-supplier or a trading partner.

The BtB programme has also had an impact on the structural development of the Danish industry. In a globalisation perspective, the BtB programme has enabled Danish companies to outsource labour intensive production to Central and Eastern Europe where labour costs are considerably lower. The outsourcing of labour intensive productions has contributed to strengthening the competitive edge of the Danish companies. On the other hand, outsourcing of production gives no conclusive indication of a negative employment impact for the Danish companies. On the contrary, there are indications of changes in contents of the production activities in Denmark such as more technologically advanced productions as well as

more knowledge demanding jobs. The BtB programme has enabled Danish companies to strengthen their international profile by entering the Eastern European market.

In addition, the evaluation revealed a number of specific benefits for the Danish firms. For example,

- The Danish companies have invested 5-6 times more in the BtB projects than the grants they have obtained through the BtB programme;
- Almost 50 per cent of the Danish companies have increased their production and only 10 per cent report a decrease;
- About 60 per cent of the Danish companies have increased their import from Eastern Europe;
- As a result of the BtB projects some 60 per cent of the Danish companies have been able to maintain jobs that would otherwise have been lost;
- New jobs have been created in some 30 per cent of the Danish companies;
- Through participating in the BtB projects, Danish companies have widened their market orientation and strengthened their ability to deal with the increasing internationalisation of the markets and globalisation of the production structures.

Assessment

The scheme is interesting in an OECD/FG-ccn context for several reasons. First, it shows that it is possible to stimulate cross-border ccn with positive outcomes. Secondly, it shows that partners in ccn do not necessarily have to be equal in terms of development stage or competencies, unlike in R&D-co-operation where equal or high competencies are essential. This scheme shows that benefits could be complementary: the parties may have different benefits from the ccn. Thirdly, although one should generally not push firms to ccn with partners they have not chosen themselves, or would have collaborated with had there been no subsidy, then the scheme does show that it is possible to gain from ccn subsidy. In particular, as was the case in the two schemes described earlier in this paper, stimulating ccn with different types of partners may be efficient for long-term competence-building, but many also involve direct, positive effects.