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**Monitoring and analysis of policies
and public financing instruments
conducive to higher levels of R&D investments
The “POLICY MIX” Project**

Country Review DENMARK

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Introduction and Policy mix concept

This report is one of the 31 country reviews produced under the project “Monitoring and analysis of policies and public financing instruments conducive to higher levels of R&D investments” (Contract DG-RTD-2005-M-01-02, signed on 23 December 2005).

The project is run by a consortium of 7 partners:

- UNU-MERIT (The Netherlands), consortium leader
- Technopolis (The Netherlands)
- PREST – University of Manchester (United Kingdom)
- ZEW (Germany)
- Joanneum Research (Austria)
- Wiseguys Ltd. (United Kingdom)
- INTRASOFT International (Luxembourg).

The role of country reviews is to provide a first exploratory analysis of the current policy mixes in place in all countries and detect most important areas of interactions between instruments as well as new modes of policy governance that are particularly adapted (or detrimental) for the building of policy mixes. A horizontal analysis of these country reviews will lead to the identification of typical policy mixes, to be related to particular NIS characteristics.

The country reviews are based on the methodological framework produced by the consortium to frame the “policy mix” concept. They have been implemented on the basis of expert assessments derived from the analysis of NIS characteristics and policy mix settings, using key information sources such as Trendchart and ERAWATCH reports, OECD reviews, and national sources, among which the National Reform Programmes.

In this work, the “policy mix for R&D” is defined as: **“the combination of policy instruments, which interact to influence the quantity and quality of R&D investments in public and private sectors.”**

In this definition, policy instruments are: “all programmes, organisations, rules and regulations with an active involvement of the public sector, which intentionally or unintentionally affect R&D investments”. This usually involves some public funding, but not always, as e.g. regulatory changes affect R&D investments without the intervention of public funds.

Interactions refer to “the fact that the influence of one policy instrument is modified by the co-existence of other policy instruments in the policy mix”.

Influences on R&D investments are: “influences on R&D investments are either direct (in this case we consider instruments from the field of R&D policy) or indirect (in that case we consider all policy instruments from any policy field which indirectly impact on R&D investments)”.

The report examines the following 10 questions:

1. What are the main challenges of the National Innovation System, how did these challenges change over the last ca. five years, and what are their impact on R&D activity?
2. What are the main objectives and priorities of R&D policy in the country, and how did they change over the last ca. five years?
3. Is there a gap between the challenges and the main objectives and priorities?
4. Which policy instruments are in place today aiming at affecting R&D activities in the private and in the public sector? What are the instruments outside the R&D domain which are of particular relevance to R&D activities and the development of R&D expenditures?
5. Is there a gap between the main policy objectives and priorities, and the instruments in place?
6. Which group(s) of actors are targeted by the various policy instruments?
7. What are the most important policy instruments that affect R&D expenditures?
8. How did the set of R&D policy instruments arrive?
9. How does the governance of the system of R&D policy instruments take place, and is there a form of co-ordination between R&D policy and policy instruments from outside the R&D domain?
10. Is there any evidence for interactions among the policy instruments in place with respect to affect R&D expenditure?

The last section includes case study proposals, which will form a base for the decision on coverage of case studies in the next phase of the study.

1. National Innovation Systems Challenges

The first and most obvious Danish R&D challenge with respect to R&D intensity is linked to the Barcelona objective. The Danish Government has committed itself strongly to this objective, and has on April 4, 2006 with its "Welfare Initiative" (Velfaerdsudspil) presented a funding plan where the Minister of Science, Technology and Innovation promised an additional DKK 10.9 billion to R&D for the period of 2007 to 2010 (EUR 1.5 billion). The government sees it as a major challenge to improve the R&D system in scope as well as efficiency. Prior to the presentation of the funding plan a number of key stakeholders expressed concern with the current level of funding and the lack of long term perspectives - in particular in relation to the funding of public R&D – but after the presentation most critics seem to be satisfied with the promised level of funding for the coming years.

Nevertheless, the current overall R&D investments in Denmark are modest compared to the Barcelona objective. It has, accordingly, been questioned whether it makes sense to try to reach the stated objective within such a short time period, since the gap between the actual level of funding and the desired level still is considerable – both with regard to the public and the private investments in R&D.

The most recent figures show that Danish R&D in 2004 experienced a decrease in investments for the first time since 1977. The total share of GDP fell from 2.60% to 2.48%, which in effect moved Denmark even further away from the Barcelona objective. However, the total decrease hides the fact that the public part of the investments in R&D has experienced an increase for the fifth year in a row. This means that the public research institutions have increased their R&D activities from 0.75% of GDP to 0.80% of GDP. It is in particular the universities which have increased their R&D activities, while the other public research institutions taken together have experienced a decrease.

The explanation of the total decrease of the Danish R&D investments therefore has to be found in the R&D investments of the private sector. The R&D activities of the private sector fell from 1.77% of GDP in 2003 to 1.69% in 2004 (Dansk Center for Forskningsanalyse).

All in all there is accordingly still a considerable gap between the actual funding and the 2010 objective, and it has been questioned whether the needed substantial increase in funding can be absorbed by the existing Danish R&D system in the coming years without creating bottlenecks or lowering the quality.

The planned increase in funding creates a number of challenges which have to be met if the society as a whole is to gain full benefit of the investments in the R&D domain.

1. First of all a precondition for the expected societal benefit of the increase in investments is a clear vision of how the funding should be allocated and put to use. There is, however, currently considerable uncertainty linked to the question of how the broad political objectives, which have been presented recently by the Danish Government, actually will be implemented and funded. A major political task still lies ahead before the above mentioned funding plan becomes a reality, as the negotiations

of the funding has been linked to a number of far-reaching welfare reforms. The coming political negotiations will decide the exact outcome of the proposals. A main challenge for the Government is therefore to successfully implement the many recent reforms and objectives and thereby create a well-functioning coherent and coordinated national research and innovation system, which can absorb the planned substantial increase in funding.

2. If the coming political negotiations lead to a strong and coherent policy mix a second challenge will be to meet the demands of an increased supply of researchers and other employees of the research system and the broader innovation system. This challenge is linked to both the public and the private sector. The Danish economy is doing very well at the moment and there is already a fear of overheating and signs of bottlenecks in the supply of labour. These tendencies will be further accelerated when the investments in R&D are raised in the coming years. There will be an increased demand of highly educated and qualified personnel and even though the investments in research-education have been raised lately, there is a growing concern with respect to this issue – in particular in relation to the engineering and technical sciences. The universities have raised the uptake of ph.d. students from 1200 in 2003 to 1300 in 2004 but critics argue that this is far from meeting the future demands. However, the Government aims to reach between 2200 and 2400 per year within a few years according to a recent quote from the Danish Minister of Science, Technology and Innovation (Børsen, 21/8-2006).

However, the challenge is not limited to the education of ph.d's. It is seen as a main challenge to improve all levels of education. This is a challenge that has been identified by a number of national as well as international actors; most recently OECD has emphasised this challenge (OECD, 2005). Under the headline "Enhancing human capital and using it better" it is concluded that a key weakness in Denmark is the surprisingly slow progress in human capital formation. Despite large public investments in early childhood care and compulsory education, Denmark seems to have substantial difficulties mobilizing the talent of all young people, and a large share - including many second-generation migrants - seem to be lost during school, leaving with only limited literacy skills. According to Innovation-Monitor, another major weakness of the Danish education system is that too few Danes go on to further education - and many of those that do don't necessarily get an education orientated to business. Among the 25-34 year olds, only 86% have at least upper secondary education, compared with 89%, 91% and 95% in Finland, Sweden and Norway respectively. Also the culture of delaying tertiary studies has been mentioned as a part of the challenge. In general, skill formation is not sufficiently effective for a high income country.

3. A third challenge if the Barcelona objective is to be reached in time is the investments of the private sector in R&D. As mentioned above the private sector has in 2004 experienced decreasing investments in R&D for the first time since 1977 and there is still quite a way before the 2% target is reached. This is however a development that the Government can not directly influence, even though there are a number of indirect possibilities. So far the Government has primarily relied on collaborative R&D programmes.

4. Finally, and this is a minor issue compared to the above mentioned, it is seen as a challenge to improve the ability of Danish R&D actors to attract EU-funding. In order to reach the 1 percent objective for public research Danish public research institutions have to attract significantly increased EU funds. Whether this is realistic is unclear.

2. Objectives and priorities of R&D policy

In the last couple of years R&D policy has moved to the forefront of the Danish political agenda. As a consequence policy objectives have been put forward as a distinct theme in a number of key policy documents in the period since 2001, where the current Liberal-Conservative Government was elected for the first time. With regard to the agenda of the Lisbon Strategy it is clear that the overall objectives of the Lisbon Strategy also to a great degree fit with the overall objectives of the current Danish Government.

In general, the objectives and priorities of the Danish R&D policy have not changed substantially over the last five years. They have, however, been given higher priority and great efforts have been put into operationalising the objectives.

The latest example of this tendency has been the presentation of the so called Danish Globalisation Strategy (Statsministeriet, 2006). The work of this strategy took its departure when a number of ambitious overall innovation policy objectives were presented following the early 2005 election in a so-called [Government Platform](#). In this document the Government announced that it planned to draw up an ambitious, holistic and multi-year strategy to make Denmark a leading growth-, knowledge- and entrepreneurial society. The plan had four key points:

- Denmark as a leading knowledge society: The objective is for public and private sector enterprises to jointly boost efforts in the area of research and development so that Denmark by 2010 reaches a figure exceeding three per cent of gross domestic product.
- Denmark as a leading entrepreneurial society: The objective is for Denmark, by 2015, to be one of the societies in the world where most growth enterprises are launched.
- World-class education: The objective is for pupils in primary and lower secondary school to be among the best in the world in reading, mathematics and science. The Government want all young people to complete post-secondary education, at least 85 per cent by 2010 and 95 per cent by 2015, and at least 45 percent to complete further education by 2010 and 50 per cent by 2015.
- The most competitive society in the world: the objective is for Denmark to be the world's most competitive society by 2015.

It was acknowledged as a comprehensive, national task to achieve these goals and it was therefore perceived as necessary that all parts of the Danish society would support this project. As a first step the Government appointed a [Globalisation Council](#) with broad representation from relevant sectors of society to assist a high profile minister committee chaired by the Prime Minister in formulating a precise strategy.

The result of this process, the final Globalisation Strategy (Fremgang, fornyelse og tryghed, Statsministeriet, 2006), was presented in March 2006. The main objective of the strategy is to make sure that "Denmark is to be among the countries where it is best to live and work – also in a ten to twenty years time." The strategy argues, that

Denmark is to achieve this goal by developing a strong competitive edge and a strong "coherent power", with a strong interaction and collaboration among stakeholders. These objectives are to be achieved by developing a (1) world class educational system, (2) strong and innovative research, (3) more entrepreneurs and (4) more innovation and change. The strategy contains 350 specific initiatives, which together entail extensive reforms of education and research programmes and substantial improvements in the framework conditions for growth and innovation in all areas of society, including entrepreneurship and innovation policy. A large part of the proposals aim at strengthening the quality and governance of education and research, promoting entrepreneurship and innovation and increasing the number of young people, who complete an upper secondary education programme and take a higher education. The strategy focuses on improving the efficiency of public spending on education and research, in particular by allocating more public funds in open competition, and on increasing competition and internationalisation in the Danish economy as a whole. It is a central objective that research and development should amount to 3 per cent of GDP by 2010.

Some of the most important objectives are listed in the following, where the greatest emphasis has been put on the initiatives targeting the R&D domain directly:

(1) World class educational system:

- Basic school pupils to be among the best in the world in reading, math, science and English
- All young to complete a secondary education
- As a minimum 50 percent of the young are to go through tertiary education. The studies are to be relevant for society and industry.
- First year university teaching is to more well structured and transparent. Students are to finalize their studies more quickly.
- Life long learning is to be strengthened
- Top quality in all educations

(2) Strong and innovative research:

- The basic funding of universities is to be distributed according to the quality of research, meaning that universities that deliver high quality research will get more funding
- From January 1 2008 basic funding of universities is to be based on an evaluation of the institutions' ability to reach objectives given in a development contract (i.e. the funding contract between the university and the ministry).
- The quality of university research is to be evaluated by international, independent, expert panels.
- University education is to be evaluated and controlled by a new external accreditation institution. The ministry will no longer give criteria for university courses.
- The number of Ph.D scholarships and so-called "industry Ph.D's" is to be doubled, especially within areas like natural science, technical development, ICT and health studies.
- University teachers are to be better at teaching. Ph.D. students are to take courses in education. Good teachers are to be rewarded financially.

- The universities are to be given more flexibility as regards recruitment of researchers (cf. salaries, the number of professors and the possibility of recruiting "super professors" with their own budget).
- Universities are to develop concrete goals as regards the use of R&D in society.
- The universities are to compete annually for large, long-term, research projects.
- The research councils are to give priority to large investments in infrastructure, especially facilities that are used by several institutions.
- More public funding is to be allotted to strategic research of importance for the development of society, e.g. in the areas of the environment, energy and health. Private co-funding will be encouraged.
- As much as 50 percent of public R&D funding is to be competitive by 2010 (as opposed to 1/3 today). Moreover, this funding is to cover all costs, overhead included.
- Sector research (meaning applied, target oriented, research in government institutes) is to be integrated into the universities.
- Public R&D investments are to reach 1 percent of GDP within 2010. The private sector is expected to provide 2 percent of GDP.
- There is to be established a "quality barometer" for Danish research, based on internationally acknowledged indicators.
- The research councils will be allowed to fund international R&D co-operation, including support for industry and research institution participation in the EU Framework Programme.
- The funding of collaboration between research institutions and industry is to be gathered in one pot. This includes innovation consortia, high tech networks, Jynsk-Fynsk IT support and regional technology centres. The 150 percent deduction scheme is to be abandoned. The funding for the GTS institutes is to be more competitive.
- The government will establish a new centre for e-business within the GTS system.
- There is to be one coherent program for user driven innovation. Consortia may compete to become the national research environment for user driven innovation. This consortium is to be trans-disciplinary and develop knowledge on user needs and the correlation between technological possibilities and the needs of users.
- The government will establish a new electronic market place for the sale of licences and intellectual property.

(3) More entrepreneurs

- Entrepreneurship is to be part of primary education
- Denmark to be among the European countries where most new enterprises are established
- Denmark to be among the best in the world measured by the number of growth-entrepreneurs

(4) More innovation and change

- Danish enterprises and public institutions to be among the most innovative in the world

- Within 2015 Denmark is to be the most competitive society in the world.
- There is to be a partnership between public authorities, industry, organisations, universities, schools etc. on how to take part in and develop relevant projects and initiatives
- The level of competition in Denmark to be at the same level as the OECD-countries

After the launch of the strategy the Danish Government has been criticised of failing to prioritise between the many objectives put forward. It has been argued that it is necessary to focus on a few critical areas and put all energy into these rather than trying to target all relevant areas.

It should also be mentioned again, that the realisation of these objectives depends on a series of coming political negotiations. This process will be a real challenge for the Government. For example the ambition to allocate 50% of all public R&D funding through competition appears to be difficult to reach since the opposition and the normal support party of the Government already prior to the coming negotiations has opposed the idea.

The Globalisation strategy has been complemented by the Government's recent welfare strategy. The Government welfare strategy was presented in April 2006 (*Fremtidens velstand og velfærd*) and the challenge of securing sufficient supply of labour in the future is a pivotal point in this group of reforms. The Government wishes to increase the number of years at the labour market for all individuals by reducing the delays before entering the labour market, and by increasing the age of retirement. With regard to reducing the delays before entering the labour market, most of the proposals are linked to the reform of educational system described above, but there are also additional proposals. The most important of these proposals are targeting the incentives to start and finish education as fast as possible. It is proposed that the public support of students to a higher degree becomes dependent on age, when the education is started. Furthermore, the support system should create incentives not to delay the duration of education.

With regard to the issue of retirement, the government's proposes to increase the age thresholds for early retirement by three years and the age pension by two years for citizens younger than 50 years today followed by an indexation of the retirement age to life. In addition to these proposals, the Government also aims at improving the access to the labour market for the groups currently out of job – a number of these efforts are not least targeting a large group of people with a non Danish background, where unemployment rates are alarmingly high. Finally, the Government also proposes to improve the access of foreign well educated highly qualified to the Danish labour market. Among the proposals is an improved Green Card system.

Also here the coming political negotiations will decide the exact outcome of the proposals.

3. Coherence between NIS challenges and R&D objectives and priorities

The Danish main objectives and priorities related to the R&D domain are closely linked to an analysis of the challenges of the current system carried out by the Government. With the Globalisation Council, Denmark has recently gone through a process, where a main aim has been the identification of current and future challenges for the national system of innovation.

The challenges identified in this process are in general in line with the challenges described in section 1 of this report. The objectives and priorities put forward as a result of the Globalisation process are accordingly an attempt to target these challenges. However, it has been argued that the role and the needs of the Danish SME's have been neglected somewhat at the expense of advanced technology areas.

4. Composition of the policy mix for R&D

Currently, the Danish R&D policy is made up of a broad mix of measures. However, the R&D policy mix including the instruments indirectly influencing R&D is a very complex system, which makes it impossible to present a complete overview within this limited framework. The R&D system is mediated by social norms, by contracts and rules, by policies and procedures; and by the mechanisms created to articulate goals, monitor agents and apply the incentives needed. A key objective for the political system is to ensure, that the funds allocated to the research system are used in the best possible way. From the point of view of the politicians, there are two elements in this; not only should the R&D policy assure that the research is conducted with a high degree of productivity and integrity, it should at the same time make sure that the funds are allocated to the areas, where the greatest societal outcome is yielded (Guston, 1996). A wide range of instruments are put to use in the Danish system to achieve these objectives:

Planning and monitoring by the use of:

- Budgeting
- Statistical indicators
- Policy advice
- Expert reviews
- Foresight-processes
- Strategy-planning (at institutional, sectorial and national level)
- Evaluations ex post & ex ante (including) : Publication-measures, Benchmarking processes, Accounts of patents and other quantitative and qualitative measures
- Contracts with specifications of goals, results, publications, patents and collaborations etc.

Steering by:

- Ministerial orders
- Calls for proposals

Funding by:

- Public funding (free funding or programmatic funding)
- Special funding-foundations
- Program-funding such as: Frame programs, Centers with or without bricks, Collaboration across boundaries, institutions, sectors and borders, Networks of excellence and Integrated projects
- Other short-term programs, projects and initiatives

Design of frameconditions through:

- Management principles at different levels
- Wage-systems
- Position-structures
- Taxation-models
- Ownership-models of institutions
- Short-term management at national level and institutional level

And these instruments are only the R&D specific ones acting directly on the R&D domain. From a number of other policy areas there are instruments which influence the R&D domain indirectly through their action on Innovation, Human Capital and Finance Domains.

Table 1: Policy mix for R&D in Denmark

Policy categories	Policy instruments: short description and target group
R&D Domain	
R&D policy generic	<ul style="list-style-type: none"> • University Act 2003 – strengthened management • Basic funding - Discretionary institutional funding for R&D projects (e.g. block funding to universities). Non activity related • External funding - Competitive R&D project grants allocated primarily through 4 different funding organisations • Support for R&D infrastructures • Selective support for centres of excellence • Structural reform of Public Research Institute sector • Structural reform of universities
R&D policy sectoral	<ul style="list-style-type: none"> • KINO (Creativity and Innovation, New modes of Production and Entertainment Economy: The Danish Strategic Research Council has initiated a program supporting research in Creativity and Innovation, New modes of Production and Entertainment Economy. With the creation of strategic research centres and with support of smaller strategic research projects is it a main objective to strengthen development and growth in creative, knowledge-service enterprises, service enterprises etc. Budget for 2006-2008: 10.400.000 EURO • The Danish National Advanced Technology Foundation 2004 to strengthen growth and employment and support of strategic high tech research and innovation
R&D / Innovation policy – Linkage	<ul style="list-style-type: none"> • Proof of Concept: The measure aims to strengthen technology transfer from public research to private enterprises. Main objectives are: to facilitate the process from research to business; to facilitate the attraction of risk willing investors; and to stimulate cooperation between public research institutions, innovation incubators and other relevant partners. The measure is a pilot project, and the experiences from this initiative, will decide whether it will be continued. Budget for 2006-2007: 1.6 Million Euro • Regional technology centres: The main objective of the measure is: to strengthen knowledgebased growth and development in the regions outside of the larger cities. Regional Technology Centres focus on regional competencies and act as intermediaries between regional research and SMEs. Experiences from the former Regional Growth Centres initiative guide the establishment of these centres. The regional Technology Centres aim at strengthening the collaboration between the regional business-environment and relevant knowledge-institutions in relation to research, innovation and technology development. The collaboration is based on business strength positions within a limited geographic area outside the capitol area. The Government has earmarked 8.5 million Euro for 13 Regional Technology Centres during the coming 4 years. 7 of the Centres are new, while the remaining seven Centres build on existing Regional Growth Centres. Budget: 2006-2009: 8,533.000 EURO • Innovation accelerating research platforms: As a new measure from the

	<p>Strategic Research Council The Innovation accelerating research platforms are attempts to create research-areas where high quality research can be combined with business strengthpositions. The objective is to secure that research leads to innovation with international perspective and business-development. Accordingly, the Innovation accelerating research platforms are expected to contribute to interplay between competences and knowledge-areas - internally in the public research-system as well as between the public and the private sector. The first round of applications are currently in the process of evaluation.</p> <ul style="list-style-type: none"> • High-tech Networks: The objective of the measure is to create lasting relationships between private enterprises and knowledgeinstitutions. 2.640.000 EURO for 2005 • Innovation Consortiums: The aim of Innovation Consortiums is to strengthen co-operation between companies, public research institutions and technological service to develop new generic technology platforms for the coming 5-10 years product and service development in Denmark. Enterprises must contribute with 50% of the funding. Typically a consortium has a total budget of 2.500.000 - 5.500.000 EURO and lasts 3-4 years. • Approved Technological Service Institutes (GTS-Institutes): The main objective of the approved technological service institutes is to support and promote innovation within business and industry located in Denmark. This is done by collecting, developing and creating new advanced knowledge and by ensuring that companies have access to advice and knowledge transfer. The GTS-institutes receives an annual basic funding, which in the last couple of years has amounted to around 35 million Euro, corresponding to 10-12 per cent of their turnover. • “Knowledge relocate” – path to high tech regions 2004 Government Regional development Regional Technology Centres and Regional Knowledge Pilots • Other collaborative R&D programmes • General support for Science Parks and other co-location schemes • Support for University Liaison Offices • Support schemes for spin-offs
R&D / Innovation policy – IPR	<ul style="list-style-type: none"> • Act on technology Transfer on Public Research Institutions: The measure originates from the 2003 Action plan 'Strategy for Public-private Partnership on Innovation' (Nye veje mellem forskning og erhverv - fra tanke til faktura). The Strategy focuses on how to improve co-operation between education, research and trade and business. The goal is that more enterprises, especially SMEs, shall have faster and easier access to knowledge. The act has resulted in a number of specific initiatives
R&D specific financial and fiscal policy	<ul style="list-style-type: none"> • Tax Liability of visiting researchers • Risk capital for R&D measures • Loan and equity guarantees for R&D investment
R&D specific education policy	<ul style="list-style-type: none"> • More PhDs 2004 Government Increase from 1000 to 1500 PhDs per year Economic support + new PhD programme Especially Industrial PhDs • Promoting talent (EliteForsk): The Government wish to promote talented researchers • Support for ST&E post-docs
R&D specific employment policy	<ul style="list-style-type: none"> • Subsidies for hiring R&D personnel • R&D mobility schemes such as the Knowledge Pilot programme
Finance Domain	
Financial and fiscal policy	<ul style="list-style-type: none"> • Public procurement 2000 Government Efficient public use of private and public service / innovation “udbudsportalen.dk” Call for tender of public “services” • Risk capital measures supporting innovative companies (including start-

	<ul style="list-style-type: none"> • ups) • Loan and equity guarantees supporting innovative behaviour
Macroeconomic policy	<ul style="list-style-type: none"> • Sustainable growth oriented strategies • Measures to ensure low interest rates • Measures to ensure price stability
Human Capital Domain	
Education policy	<ul style="list-style-type: none"> • Efforts to make S&T more attractive to students • Entrepreneurship training schemes • Support for life-long learning • To improve efficiency and quality of education at all levels
Employment policy	<ul style="list-style-type: none"> • Support for flexible labour markets • Support for earlier entrance to the labour market for young people • Incentives to postpone retirement • Strong focus on integration to increase the labour force
Innovation Domain	
Innovation policy generic	<ul style="list-style-type: none"> • Business Development Finance (VækstFonden) supports Danish companies by helping to finance R&D, internationalisation and skills development projects. This support is organised through an institution operating under the legal form of a private venture capital company. With a capital base of 300 million Vækstfonden is one of the largest Danish VC players. Vækstfonden is a state backed investment company, which provide funding to fast-growing Danish companies and act as a fund-of-funds investor in the private equity sector in the Nordic region. The fund invests in early stage ventures mainly focusing on Life Science/Med Tech and High Tech, and provide mezzanine financing to a broad range of industries. It is part of the strategic objectives to work actively to facilitate access to international venture capital and drive the development of an internationally competitive private equity environment in Denmark. • The Entrepreneurship Fund: The Government has established a Venture Fund to increase innovation through private – government Partnership • Technology diffusion schemes • Innovation management support schemes • Innovation Incubators: 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.
Innovation policy sectoral	<ul style="list-style-type: none"> • 2006 Act on support for innovation Strengthen market based innovation and commercial Exploitation. Support to SMEs innovation but only in the food, agriculture and fishery sectors
Other policies - industry	
Other policies - trade	
Other policies - defence	
Other policies – consumer protection	
Other policies – health and safety	
Other policies - environment	<ul style="list-style-type: none"> • The Danish Ministry of the Environment has presented an action plan in support of environmental technologies. The plan is based on an analysis carried out by FORA(Ministry of Economic and Business Affairs' unit of business economic research and analysis), which seeks to identify environmental technology areas where Denmark potentially could create new strongholds, if strategic and binding collaboration involving companies, knowledge institutions and government authorities is carried out. A total of 420 environment companies with 60 000 employees are identified, along with 46 knowledge institutions that focus on environmentefficient technologies. The environment cluster is one of Denmark's largest business clusters. The cluster is divided into sub-

	clusters based on the environmental challenge faced by the company or knowledge institution. A total of eight subareas are identified. The action plan has 9 concrete initiatives. Among them are: Partnerships of Innovation; Strengthened and targeted support of export; Research and technology development and an effort to strengthen the use of environmental efficient technology in EU.
Other policies – regional development	<ul style="list-style-type: none"> Structural reform of the Danish regions and local authorities: The main purpose of the reform is to benefit from efficiency gains from larger units and to create governance structures more suitable for the future
Other policies - competition	<ul style="list-style-type: none"> Based on a benchmarking approach the Danish Government seeks to monitor how Denmark's competitiveness compares to that of other OECD countries in a number of areas that are particularly relevant for the country's overall international position vis-à-vis its peers. An annual report identifies strengths and weaknesses and attempts to quantify a number of objectives. In future, similar analyses will be carried out each year to establish whether Denmark is making progress towards the objectives. The report addresses a total of 14 broad objectives, including education, research, entrepreneurship, coherence, flexibility and competition. At the competition area it seeks to establish a number of indicators to measure the current Danish performance and to quantify its progress towards meeting the government's target of becoming one of the top OECD countries with regard to competition.

However, the Danish system is in a process of rapid transition. New instruments are suggested and many existing instruments are changed. The setting up of think tanks and various funding and advisory councils has been the most dominant recent tendency and the emphasis has to a very high degree been on the identification of strengths and weaknesses as the foundation for the formulation of strategies that will give Denmark a competitive advantage in the coming years. Almost all elements of the Danish system are accordingly being restructured at the moment. The recent reforms have targeted the university-sector, the public research institutions, the technology service system, the advisory and funding structures and the regional system just to mention the most important. At the same time new strategies and action plans have been formulated regarding national and regional growth, collaboration between the public and private sphere, knowledge development, strategic research etc., etc. In addition to this a new very ambitious innovation strategy has very recently been launched in accordance with the so-called Globalisation Council as described above. This strategy points at further changes on almost all innovation related areas, but the exact outcome will be decided in an already running political negotiation process. The strategy will not be negotiated as a whole, but rather in a series of independent negotiations.

Measures to ensure integration and improved efficiency and quality have also been adopted at the institutional level, where the Danish government recently has initiated reforms concerning the government research institutions and the university sector. The aim has been to sharpen up the profiles of individual institutions and to increase collaboration across sectors and disciplines. The problem of low interaction between the actors of the research and innovation system has been a common theme of the reforms carried out in this sector in recent years, exemplified by the new claims put

forward for universities to formulate goals and strategies for cooperation with trade and business and by the introduction of external members in the boards of various knowledge institutions. Furthermore, as a new element - in addition to research and education - an active role in knowledge exchange, technology transfer and mobility has been added to the university mission. The new Bill on National Government Research institutions as well as amendments regarding the individual institutions was presented in early 2003 and the new University Act has come into effect in the beginning of 2004.

5. Coherence between main policy objectives and priorities, and policy instruments

While there seems to be coherence between the challenges identified by the Government and the formulated objectives and priorities, it is still unclear whether there is coherence between the proposed instruments and the objectives. The planned initiatives and instruments have not yet been implemented and the political parties have not yet reached an agreement on the exact allocation of the funding for the Globalisation strategy.

In general, the challenges mentioned in this document have also been identified by the Danish Government. If there is a gap, it is primarily related to the fact that the instruments and priorities not yet have been fully decided and implemented. It is accordingly still unclear exactly how the initiatives to meet the identified challenges will be designed and how the promised future funding will be allocated.

However, it has been argued that there could be a gap between the rhetoric of the objectives on the one side and the instruments in general and the funding in particular designated to achieve these objectives on the other. The Government has world class ambitions on practically all R&D and innovation related areas, but the planned funding does not match the objectives, some critics argue. The best example is the ambition to create world class universities, but with much lower funding than the highest ranked universities in the world. This does not necessarily imply that it is the wrong instruments that the Government has chosen, but rather that these instruments alone are perceived as insufficient to reach a set of very ambitious objectives.

Another potential gap could be related to the balance between autonomy and control. A number of the new initiatives targeting the R&D sector seem to strengthen the control elements and the accountability perspectives at the expense of autonomy and freedom. This could have serious consequences with tendencies towards risk reduction behaviour and tendencies to stay inside well-defined fields and disciplines instead of encouraging transdisciplinarity. However, the initiatives have not yet been fully operationalised, so it remains to be seen if the fear is justified.

6. Policy mix instruments and target groups

Pretty much all actors of the Danish R&D system are targeted by the various policy instruments affecting R&D directly or indirectly. The instruments target all types of research institutions - including universities and sector research institutions and they target private enterprises as well as different types of linking organisations between the public and the private sphere. Furthermore, the instruments are not only targeting the institutional level but also the individual level with incentives for individual researchers as well as managers etc.

However, in general it must be concluded that the newest instruments in the Danish R&D policy mix have their main focus on science based sectors and 'high technology research' in fields such as nanotechnology, information-technology and biotechnology, while other modes of innovation relevant for small and medium sized enterprises in low tech branches have received much less attention. The recent Globalisation Strategy, for instance, is to a large degree focused on R&D for large, high tech, companies and not to the same degree on low and medium tech companies dominating the Danish innovation system.

It has been argued that this strategy fails to take the uniqueness of the Danish innovation system sufficiently into consideration. One explanation of this tendency is to be found in some important changes in the organization of innovation policy following the 2001 election. The Ministry of Research and Information Technology got the dominating responsibility for innovation while the Ministry of Industry that had so far been leading in that area, became more focused on creating good general conditions for private firms and promoting 'entrepreneurship' and supporting start-up firms. As a consequence, the majority of current measures are focused on making research more relevant and accessible to industry. It has for example resulted in a university reform that should bring universities closer to users in industry. Several measures aim at strengthening the interaction between universities and the small minority of science-based firms. As an example a new fund for 'high technology research' using incomes from the sale of the North Sea oil rights has been established (Lundvall, 2005).

There is accordingly a strong focus on the universities as deliverers of new ideas and new inventions, and little on the innovative capabilities of firms and their need for research based competences. When there is a discussion on user-needs, the main focus is on how to adapt university research to company needs, not on research as part of company competence development in the broad sense. The dominating focus on science-based innovation and on technical innovation – and the relative neglect of innovation in low tech and service sectors seem to remain for some time even if there are some counteracting tendencies (Lundvall, 2005).

One of these counteracting tendencies is a proposal of establishing a centre of user-driven innovation. The point of departure is that in many Danish enterprises, innovation results from interaction with customers and suppliers. The government therefore intends to develop a special programme for user-driven innovation and

dissemination of knowledge based on market demand in fields where the enterprises locally and regionally have special competences. There has also been a stronger interest in understanding and developing the ‘knowledge-based economy’ but also here there appear to be a bias in direction of formal knowledge and too little understanding of the importance of learning by doing, using and interacting. All in all, there is still a clear overweight of new instruments in favour science-driven high tech innovation.

Table 2: Policy instruments and broad routes to increase R&D investments

Policy categories	Policy instruments	ROUTE 1: promote establishment of new indigenous R&D-performing firms	ROUTE 2: stimulate greater R&D investment in R&D-performing firms	ROUTE 3: stimulate R&D investments in firms non-performing R&D	ROUTE 4: attract R&D-performing firms from abroad	ROUTE 5: increasing extramural R&D carried out in cooperation with public sector	ROUTE 6: increase R&D in public sector
R&D Domain							
R&D policy generic	- University Act - Basic funding - (e.g. block funding to universities). - External funding Competitive R&D project grants - Support for R&D infrastructures - Selective support for centres of excellence - Structural reform of Public Research Institute sector - Structural reform of universities					xx x x	xx xx xx xx xx xx
R&D policy sectoral	- KINO (Creativity and Innovation, New modes of Production and Entertainment Economy - The Danish National Advanced Technology Foundation		xx			xx	xx xx
R&D / Innovation policy – Linkage	- Proof of Concept - Regional technology centres - Innovation accelerating research platforms - High-tech Networks - Innovation	xx xx x xx xx	xx xx xx xx	x x		xx xx xx xx xx	xx xx xx x

	Consortiums - Approved Technological Service Institutes (GTS-Institutes) - Collaborative R&D programmes - Support for Science Parks and other co-location schemes - Support for University Liaison Offices - Support schemes for spin-offs	xx xx xx xx	xx xx x x	xx x x		xx xx x	x xx
R&D/ Innovation policy - IPR	- Act on technology Transfer on Public Research Institutions	xx	xx	xx		xx	
R&D specific financial and fiscal policy	- Tax Liability of visiting researchers		x				
R&D specific education policy	- More PhDs - Promoting talent (EliteForsk) -Support for ST&E post-docs		x x x	x x x		x x x	x x x
R&D specific employment policy	- R&D mobility schemes					x	
Finance Domain							
Financial and fiscal policy							
Macroeconomic policy	- Sustainable growth oriented strategies - Measures to ensure low interest rates - Measures to ensure price stability						
Human Capital Domain							
Education policy	- Efforts to make S&T more attractive to students - Entrepreneurship training schemes	x xx					x

	- Support for life-long learning						
Employment policy	- Support for flexible labour markets						
Innovation Domain							
Innovation policy generic	- VaekstFonden - Business Development Finance - Entrepreneurship Fund	xx xx	xx x				
Innovation policy sectoral	- 2006 Act on support to SMEs innovation in food, agriculture and fishery	xx	xx	x		xx	
Other policies - industry							
Other policies - trade							
Other policies - defence							
Other policies – consumer protection							
Other policies – health and safety							
Other policies - environment							
Other policies – regional development							
Other policies - competition							
Other policies – social security							

7. Balance within R&D policy mix

The funding system as a whole is of course a key instrument with respect to R&D expenditures.

In terms of volume of funding to R&D the most important instrument is the allocation of basic appropriations to the public research institutions – in particular to the universities. Denmark has a two-tier system for resource allocation to research. The first tier is the basic grants allocated by the different ministries directly to the institutions. However, the Government has a limited direct influence on the use of these funds. Instead they increasingly attempt to rely on indirect instruments to influence this funding. Most notably, the management structures of the universities have recently been changed.

The basic research grant is allocated as a lump sum to the institutions. The level of the basic grant is to a very large extent calculated on an incremental basis and the basic grants are free in the sense that they are not earmarked for specific research purposes. Contrary to most of the other grants and sources of income of the universities, the basic grants are therefore allocated as a predominantly non-activity related grant. The distribution of the grants between the universities is relatively permanent and based on historic aspects. The budgets are in general characterised by considerations to freedom of research, budget stability and historic traditions.

As already mentioned the current situation is characterised by a great deal of uncertainty related to the future funding of innovation and research activity, which means changes in the proposed priorities and funding should not be ruled out. For example, the Government has already announced that a significant greater part of the university funds in the future will be allocated through competition rather than as basic funds. However, the opposition as well as the normal support party of the Government has already opposed this suggestion, and at the moment it looks like it will be difficult for the Government to find the necessary support to the change.

Another important instrument is the external funding of research institutions. This second tier of R&D funding comprises resource allocation from the National Research Councils, strategic research programmes, special foundations, R&D funds from the individual ministries, and private funds and firms.

Through this set of instruments the universities have considerable revenues in addition to the basic grants and the taximeter grants (the latter is a performance based funding system of education). These revenues are dependent of performance in the sense that the size of these revenues is directly related to the ability to attract subsidies from external sources in competition with other research institutions and the ability to sell services on market terms. The grants of the second tier are given for shorter periods of time, partly on the basis of project proposals, partly by tender for research activities specified by the granting institutions. Grants are given predominately to individual scientists or to research groups. In Denmark most

researchers, who wish to conduct research on an international level, are forced to seek funding from the second tier in the two-tier system, where competition is fierce.

A central part of the second tier is the research council system which plays an important role in the external funding of the Danish universities (Ministeriet for Videnskab, Teknologi og Udvikling, 2004, L 142). The research council system has since 2004 been driven either based on the so called “bottom-up” principle – implemented by the Danish Councils for Independent Research and the Danish National Research Foundation - or by top-down, politically prioritized subjects – implemented by the Danish Council for Strategic Research and the Danish National Advanced Technology Foundation.

The Danish Research Council for Independent Research is the governing body of five research councils. Each of these councils consists of 15-20 members, which are recognized researchers, appointed by the Minister of Science Technology and Innovation.

The Danish Council for Strategic Research is headed by a board of 8 members with the majority being recruited from the private sector. The council’s main objective is to ensure the implementation of research in politically prioritized areas. The board does not have competence to allocate grants. Instead the council works through ad hoc programme committees for each strategically chosen programme.

The Danish National Research Foundation is an independent foundation, which aims at strengthening Danish frontier research. The Foundation’s primary strategy is to set up and fund Centres of Excellence. Since 1991, the Foundation has supported Danish research environments with more than 3 billion DKK.

Finally, The Danish National Advanced Technology Foundation supports research and innovation based on public-private collaborations and have a special focus on nanotechnology, biotechnology, ICT or the border-areas between these fields. The majority of the app. 30 million Euros, allocated by the foundation this year, will be directed to large high technological initiatives, while a smaller proportion of the funds will be directed to initiatives including small and medium-sized companies.

In addition to these sources of external grants, funding can also be achieved from private funds, firms and organisations. In 2003, app. 10 percent of the total research funding came from private funds, firms and organisations (Analyseinstitut for Forskning, 2003).

Instruments targeting private investments in R&D

With regard to the most important instruments targeting the private sector the national policy to promote research, development and innovation focuses on supporting both innovation actors and innovation projects advancing cooperation between knowledge institutions and companies. The national policy can be divided into four main areas (Source: http://www.globalisering.dk/multimedia/Factsheet_innovation1.pdf):

1. Commercialisation of public research

Similar to a number of other countries, the commercialisation of public research in Denmark is centred on the research institutions and the associated science parks.

Ownership of intellectual property to public research inventions is accorded to the research institutions, of which most have developed professional units for technology transfer. Furthermore, a legislative act has recently permitted Danish universities to establish subsidiary companies for technology transfer to promote the commercial transfer of patents and licences to trade and industry. Also, the state finances seven innovation incubators, which every year conduct 300 preliminary analyses of the scientific and commercial potential of innovative ideas, inventions and research. On this basis, the incubators contribute to the start-up of approximately 60 new innovative and knowledge-intensive companies.

Business development finance (Vaekstfonden) is a government-sponsored investment fund with a capital base of EUR 300 million. The fund invests in early stage ventures focusing mainly on Life Science/Med Tech and High Tech, and provides mezzanine financing to a broad range of industries. Together with its portfolio funds, Vaekstfonden represents 26% of the total capital under management in Denmark in 2005.

Most recently the Danish Agency for Science, Technology and Innovation has set up a new committee with a task to facilitate negotiations and contracts on IPR issues between public research institutions and private enterprises. The initiative reflects the growing focus on patents and the natural conflicts of interests between public research institutions and private enterprises with regard to patent rights questions.

2. The GTS Institutes

The GTS (Authorised Technological Service) Institutes construct and develop commercially oriented knowledge and technology, and make it available – on market terms - to the Danish authorities and business sector. A particular obligation of the institutes is the development and accessibility of technological knowledge to the SMEs. The Danish network of GTS Institutes consists of seven institutes. The institutes uphold a staff of approx. 3,000 employees and have an annual turnover of more than EUR 300 million (2004). The public grants to the GTS Institutes constitute approx. 11% of the turnover.

3. The access to highly educated labour

The employment of highly educated labour is one of the most important channels for diffusing knowledge from research institutions to private companies. Today, about 50% of all graduates are being employed in private companies. In order to spur this way of disseminating knowledge, the Industrial PhD Initiative grants financial support to companies employing researchers. Furthermore, through the Knowledge Pilot (Videnpilot) Initiative, subsidies are granted to companies with less than 100 employees when engaging a highly educated employee for the first time.

4. Cooperation between research institutions and companies

Cooperation between research institutions and companies is another important means of diffusing knowledge. The state supports a number of development projects, which are carried out in syndicates consisting of both companies and knowledge institutions. Two examples are the Danish National Advanced Technology Foundation and the Innovation Consortia. Funding is also provided for the establishment of networks, such as the Net-works of High Technology and the Regional Technological Centres.

Table 3: Assessment of ‘importance’ of R&D policy instruments

Instruments	Funding	Criteria				
		a	b	c	d	e
Basic funding to public R&D institutions			x	xx	xx	
Funding from the Danish Council for Independent Research		x	xx	xx	xx	
Funding from the Danish National Research Foundation			x	x	x	
Funding from the Danish Council for Strategic Research		x	x	xx	x	
Funding from the Danish National Advanced Technology Foundation.		x	x	xx	xx	
Business development finance		xx	x	x	xx	
GTS-institutes		xx	xx		x	

The importance of policy instruments are indicated separately according to the following dimensions:

- a) overall contribution to increase of private R&D expenditures
- b) impact on specific aspects of the NIS or R&D performers (when possible)
- c) public attention/attention by policy makers
- d) volume of public funding involved
- e) beneficiary of a shift in public funding

8. Emergence of R&D policy mix

The Danish R&D policy mix has traditionally been viewed as the result of a series of more or less independent decisions. To use the phrase of the methodological report the Danish policy mix has predominantly been seen as an *ex post* “product” rather than *ex ante* “construct”. The policy mix has been an “emergent phenomena”: not always planned but rather emerging from various, loosely or not at all connected policy decisions of different actors.

However a more coherent approach has been used recently, where the formulation of a future policy mix to a larger degree has been approached as a “construct” with the aim of ending up with a policy mix resulting from an intentional combination of policy instruments with the intention of optimising the joint effects of interacting instruments. The future Danish policy mix has been partly shaped *ex ante* by policy-makers, while however there has of course been a large degree of path dependency. In other words; previous decisions have framed the possibilities for change.

Before this recent process started, Denmark had no tradition or fixed frequency of policy reviews of the overall innovation policy mix. But the last couple of years, and in particular the last year with the work of the Globalisation Council, have seen a number of systematic attempts to review the innovation system as a whole. This process has so far resulted in a number of far reaching recommendations of a new policy mix. However, the future policy mix is not yet fully decided and will depend on the coming political negotiations.

The Globalisation Council was set up in April 2005 with representatives of all sections of society with the task of advising the Government on a strategy for Denmark in the global economy. The Council has 26 permanent members: 21 high level representatives and 5 key ministers, including Prime Minister Anders Fogh Rasmussen (chairman) and Minister for Economic and Business Affairs Bendt Bendtsen (deputy chairman). But in addition to the permanent members the council has held discussions with 111 representatives of organisations and other individuals specially invited to the meetings. The Globalisation Council held 14 meetings with contributions from 48 international and Danish speakers. Thematically the first two meetings in May and June 2005 addressed the challenges of globalisation for Denmark and from August 2005 to February 2006, the Council held a total of nine theme-based meetings on education and training, research, competitive power and innovation.

It was stated as a main aim of the government to have an open and transparent process for formulating the Globalisation Strategy, and to ensure a public debate along the way. All material for Council meetings was made available beforehand for the press and the general public on a special website. But in spite of the ambitions of the Government it has been argued that the process has been (too) tightly administered by the Government. Even though a large number of key stakeholders have taken part in the discussions of how to prepare Denmark for the challenges of Globalisation, all of the background-material, the process as a whole, the program and content of the

meetings, and the invited speakers have been decided by the Government. This means that the strategy presented in April 2006 by the ministerial committee of the Globalisation Council with a vision and strategy of developing Denmark into a leading growth, knowledge and entrepreneurial society has an ambiguous status. On the one hand this is a document that is presented as the result of the work of the Globalisation Council. On the other hand it is a public document in most part written by the involved ministries and blessed by the most relevant ministers, de facto turning it into an official policy document. In the Danish newspaper “Politiken”, one of the Council members Nina Smith, argues that the Government and its civil servants have controlled the Council discussions and that the document must be considered a Government product only (Politiken March 16 2006).

This process has been a further institutionalisation of a traditional Danish approach. In Denmark policy objectives and to some degree also policy instruments have traditionally been defined during a parliamentary process by members of parliament, political parties, governmental officials and stakeholders. However, the Government has always had a decisive influence on this process, as it has the initiative and the entire administration at its disposal in the preparation of reforms or bills.

As a result of the most recent process the Danish Government has presented a comprehensive strategy for Denmark in the global economy – “Progress, Innovation and Cohesion”. The aim is to enable Denmark to maintain its position as one of the wealthiest countries in the world and as a country with strong social cohesion (see description of content in section 2).

9. Governance of the policy mix

The national Danish R&D system was for many years criticised of being too fragmented and uncoordinated. Even though a number of initiatives were taken to strengthen the function and coordination of the system; in particular in the period following 1993, where the first Danish Ministry of Science and Technology was founded, the dissatisfaction among central stakeholders remained throughout the last decade and led to a number of more recent initiatives. It was argued repeatedly that the system was too fragmented to act as a coherent framework with efficient use of research and innovation resources. It was also emphasized that a significant weakness of the Danish research and innovation system was a low level of interaction between trade and business and knowledge institutions e.g. universities, public sector research institutions and technological service institutes. The latter was documented in a recent study in which Danish innovation and innovation policy was benchmarked against other OECD countries.

However, following the change of Danish government at the end of 2001 a Danish Research Commission was established to review the relevant legislation with a view to enhancing the efficiency of the entire research system. The results of this appraisal were presented in September 2001 (www.videnskabsministeriet.dk - Commission Report, The Danish Research Commission, 2001). Based on the Commissions recommendations the Parliament and the Government embarked on a reform of the entire public research and innovation system in 2002, when a new Act on Technology and Innovation was passed.

As a consequence Denmark has been undergoing a major restructuring of its whole research and innovation system in the last 4 years and this process has been further speeded up in 2006 by the presentation of the Danish Globalisation Strategy. There is a clear shift towards integration of research and innovation Policy. The overall aim of the various reforms and initiatives in the Danish system has been to create institutional changes and governance structures better suited for coordination of and cooperation between the different actors of the national innovation system; with the overall responsibility for the research and innovation policy concentrated in the hands of the Ministry of Science, Technology and Innovation. The responsibility for both research and innovation has for the first time been placed within a single ministry. Innovation related policies and measures have been transferred from the Ministry of Economic and Business Affairs to the new Ministry of Science, Technology and Innovation. At the same time part of the competence of the former Ministry of Trade and Industry regarding trade and business services and innovation related policies has been placed with the Ministry of Science, Technology and Innovation. Similarly, the administration of the university sector has been transferred from the Ministry of Education to the Ministry of Science, Technology and Innovation. In effect, this reorganisation has allocated practically all innovation related policies to the Ministry of Science, Technology and Innovation.

The Ministry of Science, Technology and Innovation is presently in the process of a further restructuring. The Ministry was previously divided into two departments but

with effect from May 2006 this structure has been changed. In practice this means that some functions are to be moved out into separate directorates under ministerial control.

The main objective of the reorganisation has been to improve goal-setting and prioritisation of resources by the creation of a simpler organisation. According to the Ministry, the new structure is characterised by:

- A small department with a central policy-center
- A stronger integration of research and innovation
- A strengthening of the ICT area
- A stronger administrative platform at the university area

Furthermore, a new body, the Council for Technology and Innovation, has been set up to assist implementation of the new legislation. The council advises the Minister of Technology, Science and Innovation and is authorised to make decisions on a number of specific appropriation affairs (amounting to approximately DKK 525 (EUR 70) million in 2004). The council, whose members are appointed by the minister, is put together so that it represents those competencies deemed essential for a viable innovation system. According to the inter-governmental foundation the Minister for Science, Technology and Innovation has the co-ordinating role in matters related to innovation policy.

At the moment the Ministry of Science, Technology and Innovation allocates app. 75 percent of the governmental appropriations to research and innovation. Other ministries with substantial research budgets are the Ministry of Food, Agriculture and Fisheries, the Ministry of Culture and the Ministry of Education. In general co-ordination between sectoral ministries is done on an informal basis under the initiative of the Ministry of Science, Technology and Innovation. According to the inter-governmental foundation the Minister for Science, Technology and Innovation has the co-ordinating role in matters related to innovation policy.

Coordination also takes place with various stakeholders and other actors (and has been improved lately) to make sure that different initiatives work together. Again, the work of the Globalisation Council is an example of an effort to treat innovation as a cross-cutting theme influencing the policymaking in a number of ministries. In general, the coordination mechanisms and efforts have been greatly improved since 2001, and in particular 2005 has seen the most systematic and coordinated attempt to create a coherent innovation policy. In the work of the Globalisation Council all relevant ministries and most key stakeholders have joined forces to formulate a long term strategy for the development of the Danish society – with innovation policy as one of the pivotal points.

All in all the Government expects that these initiatives will contribute to a strengthening and improved co-ordination of innovation policies in Denmark. So far, there seems to be a higher degree of satisfaction than previously with the institutionalisation and functioning of the innovation-system among central stakeholders.

10. Interactions between policy objectives and instruments

The current Danish approach to the creation of a policy mix is of a recent nature. Previously the instruments were the results of less coherent processes and the questions of interactions among policy instruments were not given high priority. As already mentioned the Danish system was criticised for lacking overall management and coordination. However, a main aim of the most recent reform of the appropriations system was accordingly to attain a simplified, strengthened and better coordinated structure. Whether this objective has been achieved yet is disputed (cf. Kalpazidou Schmidt 2006a & 2006b).

This means that so far there has been limited evidence of positive or negative interactions among instruments, but recently a clear political demand for more evaluations and greater overall coherence has been voiced.

In principle all research and innovation activities in Denmark are up for regular evaluation, but evaluations of the innovation system as a whole is a new issue and have not yet been fully developed. Evaluations are currently carried out, but they are on an ad hoc basis on the requests of specific departments. More systematic policy review is however under consideration. In particular in relation to public research the evaluation efforts will be strengthened in the future. The Government stated in the Globalisation strategy that Denmark lacks a tradition of systematic evaluations of research quality. As a consequence, the Government wish to create a quality barometer, to be able to monitor and evaluate development trends. Furthermore, the Government demands a more systematic evaluation of all research programs, to make sure that allocation of funds is strictly related to quality. Finally, the research funding organisations must in the future ensure that evaluation methods are centrally developed in a systematic way, and that results and experiences are gathered and used.

Accordingly, there is currently no evidence for interactions among the policy instruments in place. Discussions of interactions have presumably taken place during the meetings in the Globalisation Council but no concrete evidence has been presented afterwards. But it can be expected that the issue of interaction will be given high priority in the future and that evidence will be pursued.

However, the issue of interaction has been discussed in a broader context. It is argued by many observers that the, perhaps, most important strength of the Danish innovation system is rooted in the social cohesion and the interaction of the elements of the organisation of the Danish society. It has often been described as a paradox that a small high-income country with high wages, high taxes, a large public sector, a relatively low level of R&D activity, and a relatively low proportion of people with a higher education in science and technology has been able to adjust to changing international market pressures and stay competitive and rich. One explaining factor has been a high degree of social cohesion including a relatively equal income

distribution based on comprehensive redistribution mechanisms. A central institution in the formulation and implementation of economic policies has been the corporatist system of interactions between the state, the trade unions, and the employers. This has created a labour market with a high degree of 'flexicurity' combining high flexibility for employers to hire and fire with high degree of income security for the employees. A related aspect of the social cohesion model is the high labour market participation rate for women in combination with an extended public supported childcare scheme. However, in recent years the Danish social cohesion model has been put under political pressure from more neoliberal tendencies common to most of the Western world.

Another explanatory factor has to do with a 'mode of innovation' dominated by small and medium sized low-tech firms mainly making local incremental innovations based on learning by doing, learning by using and a high degree of learning by interacting especially with customers and suppliers combined with 'efficient commercial ability' (Lundvall, 2005).

Along the same lines the Danish Innovation Council argue that Danish prosperity is based on a culturally rooted ability to collaborate, adapt to new requirements, and find new solutions. Accordingly it is argued, that Denmark's top ranking in international competition surveys today largely is due to process strengths. Danes are good at cooperating both with one other and with customers, creating a Danish user-driven power of innovation.

As mentioned above Danish competitiveness has in a number of different ratings recently been ranked very high. The different international indexes have different emphasises, and therefore the ratings varies. However, a common trait is that frame-conditions for innovation and private enterprises are rated high. In general, Denmark's position is explained as a combination of a wellfunctioning society with a quite efficient public sector, limited bureaucracy, a fair and transparent legal system and a low level of corruption and crime (Sekretariatet for ministerudvalget, 2006).

This tendency is also illustrated in the Economist Intelligence Unit ranking in *Global Outlook (May 2006)*, where Denmark is ranked as having the best business environment in the world in 2006-10, just as last year. According to the EIU-study Denmark stands out for the successful balance that it has struck between the state and market. Product markets operate efficiently and labour markets are flexible (with low non-wage labour costs and few restrictions on hiring and firing). Denmark compensates for its high tax burden with the quality of its public goods. Denmark's highly developed infrastructure and institutions, skilled labour force, political and economic stability and sophisticated financial sector are features shared by other developed EU states. However, Denmark stands out in that its business-friendly governments have strongly encouraged private enterprise and competition.

This illustrates that the question of interacting effects needs to be viewed in a very broad context if nation specific differences are to be explained. A too narrow view on a limited number of instruments and their interacting effects may show a false picture of strengths and weaknesses of a nations policy mix.

11. Case study proposal

With the Globalisation strategy the Danish government has attempted to view policy formulation as a coherent process where not only the interactions between different R&D instruments are taken into account, but also where coordination and interactions between different policy fields are given high priority. This process is closer to the policy construct line of thinking than what has been the tradition in Denmark. Furthermore, the process has been characterised by a widespread inclusion of stakeholders. We believe that this process would be a good case study.

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