Stockholm School of Entrepreneurship
Science-based companies
Term paper

Biotech incentives

A four-country-comparison of incentives for biotech growth in Europe

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Abstract

The aim of this study is to deepen the understanding of how four European countries including Denmark, Finland, France and Ireland support their biotech industry. We described and detailed the individual instruments these countries are using in stimulating their biotech industries. The types of measures in focus were tax incentives for research and development, R&D, and governmental leadership. By comparing the incentives in each respective country, we found that all the four countries showed many common denominators regarding governmental leadership, such as creation of incubators, allocating funds, supportive instruments for collaboration between research institutions and the industry. The tax incentives for R&D expenditure varied from virtually non-existing (Finland) to rather drastic measures (Ireland and France). The outcome will provide information to inspire leading decision makers in Sweden.

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1 Introduction

The world-wide pharmaceutical industry is a major economic sector. Medication and vaccine sales alone are worth 300 billion Euro. More than half of new medications being approved originate from biotechnology companies – most of them based in the US (1).

The number of biotechnology companies in Europe has increased significantly from 400 in 1997 to 1500 in 2001(2). Despite the numerical advantage against the 1,200 companies in the US, the US industry has better financing, has more companies on the stock exchange, better capitalization, and more employees (Figure 1). Now, many European countries are implementing measures to help the biotech sector grow and turn the tables on the US competitors.

SwedenBio, the Swedish biotechnology industry organization, published the report "A National Biotech Agenda for Growth" in February 2004, including an analysis of the environment of the biotechnology industry in Europe and North America. This reports further details a number of outstanding measures and some preliminary results in Denmark, Finland, France, and Ireland. The impact of these measures shows the possibility to seriously improve the environment for the Swedish biotechnology companies.

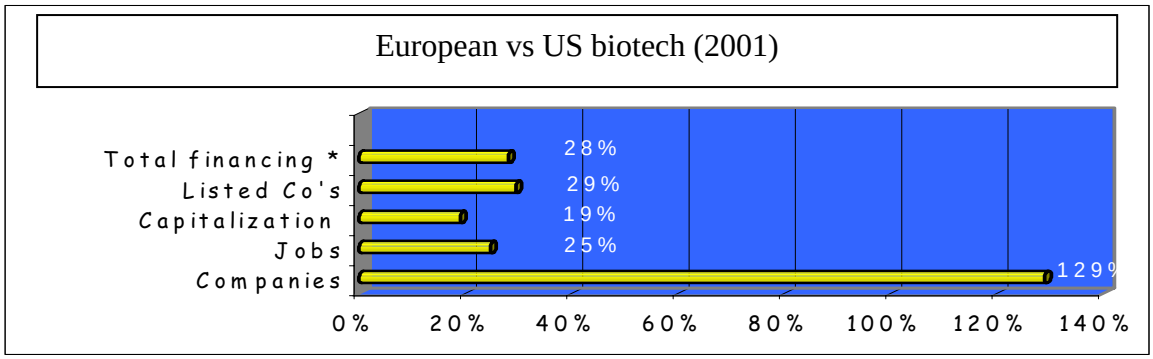

Figure 1. The European biotechnology industry compared to the US counterpart in 2001. Europe has more biotechnology companies, but the biotechnology companies in the US are more often listed on the stock exchange, have a better capitalization, and more employees. Source: Ernst & Young, France Biotech & Objectif 2010.

2 Material and Method

The four countries discussed here were selected because of their outstanding supportive instruments. The choice of Denmark and Finland was based on the fact that these Scandinavian neighbours received high scores in international comparisons on policy settings and country performance. Ireland and France were selected for having introduced strong tax measures the last couple of years.

The support for the biotech industry has been compared between the four countries, and the comparison is mainly focused on two areas:

Tax incentives for R&D expenditures: Does the country have tax incentives to stimulate R&D? Which are these instruments and how do they work? How much money? Where from? Which type of company is targeted?

Governmental leadership: How does the government co-ordinate and lead the initiatives in biotech? Are there examples of national “Vision and Mission” statements on how the country should develop its biotech industry? Are there committees, councils etc in place? Which players are represented in these bodies?

Summaries of the support in the two selected areas are presented for the four countries and overall ratings of their support will be produced.

3 Results

Each country is presented with the sections Background, Tax incentives for R&D and Governmental leadership.

3.1 Denmark

3.1.1 Background

Denmark has for a long time been a successful country within the pharmaceutical business, which also has lead to growth in related areas, e.g. biotechnology and services within health care. The expression ”Bio-sunnhet” is now often used and includes areas like pharmaceutical industry, medical technology, biotechnology and health care services(3).

On a per capita basis, Denmark is number two in Europe for R&D spending within life science(4). In 1999, 40 000 Danish people were working within the Bio-sunnhet-area, which corresponds to about 3.5% of all people employed in the private sector in Denmark(3, 5). Biomedical industry can often be found in geographical clusters, and in Denmark the industry is mainly located in the Copenhagen-region. This region, together with the southern part of Sweden, is often referred to as Medicon Valley and the biotechnology industry has steadily grown in this area during the last years(6). Sixty percent of the pharmaceutical/biotechnology industry in Scandinavia is, for example, located in the Medicon Valley-area(7). Figure 2 shows the number of biotech start-ups in Medicon Valley 1995-2002.

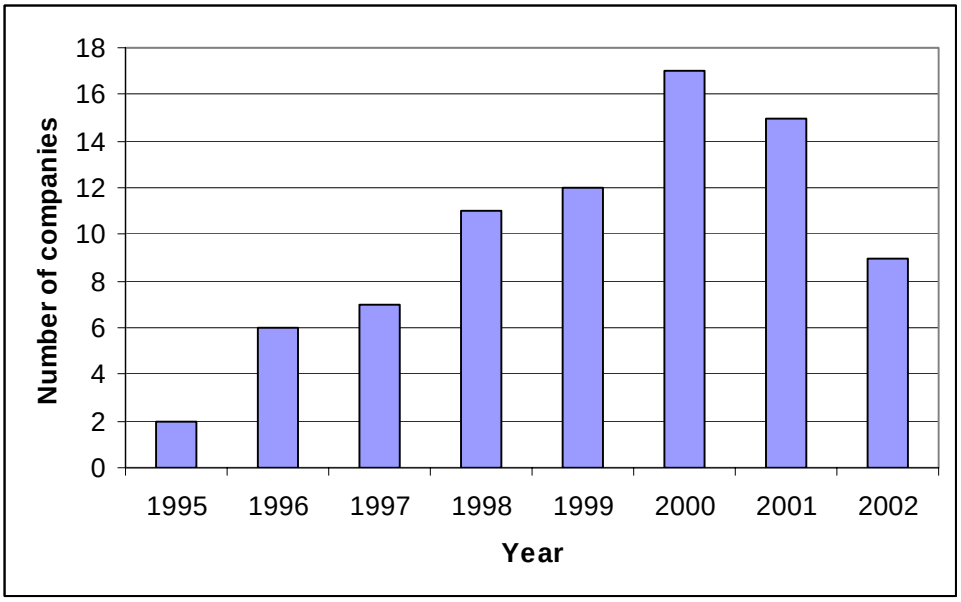

Figure 2. The number of biotech start-ups in Medicon Valley 1995-2002, Source: (8)

Research and development in Denmark is mainly organised in four sectors:

- Universities and other higher education (including hospitals)
- Sector research institutions
- Approved technological service institutes
- The private sector

The private sector stands for about 63% of the total research and development.

3.1.2 Tax Incentives for R&D and Expenditure

The corporate tax in Denmark is currently a flat 30%, but there are some different tax rules aimed at stimulating business and R&D. Expenses for researching new markets incurred by an existing business with the view to expand the business are, for example, deductible in the year they are incurred or may be depreciated over a 5 year period. There is currently a 150% tax deduction of money spent on sponsorships to research and researcher schools at the universities and government research institutions. The government has also recently introduced regulations that give private companies a special deduction for research projects that are co-financed with a public research institution. The idea is that small and medium-sized enterprises also can have a 150% deduction on their own research expenses when collaborating with a public research institution(9).

The ministry of science, technology and innovations (VTU) also provides subsidies to companies to employ industrial PhD students. The students must work on a full-time basis for three years, whereby 50% of the student's time is spent at the enterprise and 50% at the university.

Since 2002, there is also a regulation that gives researchers and key employees from other countries a special tax rate (25%) during the first three years in Denmark (5).

There have been attempts in Denmark to change business taxation in order to increase investments in small companies. One such tax change is the business scheme (Virksomhetsskatteordning), which enables interest expenses to be offset against profits and allows entrepreneurs to be taxed at the lower corporate tax. Another tax change is the new taxation on partnerships (Dansk partnerskabs model), which means that partners in a company can deduct losses incurred from other incomes(10). These tax incentives do, however, not seem to have had a large impact on the investments made in Denmark so far.

3.1.3 Governmental leadership

3.1.3.1 Public expenditures in biotech R&D

The public expenditures per capita on R&D in Denmark are similar to other countries for R&D within the whole technology-sector, but are lower for R&D within the "Bio-sunnhet"-sector(11). Denmark has one of the lowest levels of venture capital investments as a share of GDP among

OECD countries, but there does not seem to be a lack of available financing for companies. One reason for this is that Denmark is good at attracting capital from other countries(10).

A general objective of the Danish government is, however, to increase the investments in research and development. In 2002, the public and private expenditures on research and development constituted about 2% of the GNP, and the aim is to increase this to 3% of GNP in year 2010. Another aim is that 2/3 of the total investments should be financed by the private sector(4). The universities (including hospitals) and the governmental research institutions account for about 96% of the expenses for public research in Denmark.

The long-term goal for the Danish research policy is to have competitive research at the international level. Public investment is an important factor to achieve this goal. In 2002, the government allocated 100 million Danish kronor (DKK) for research and development within the Bio-sunnhet-area.

3.1.3.2 Cooperation between research institutions and the business sector

The government in Denmark is working for improving the quality of research in the biotechnology sector and to facilitate cooperation between research institutions and the business sector, in order to stimulate commercialisation of the research(12).

The government has an action plan to facilitate interaction between the business and industry sector and knowledge institutions. Today, Denmark is among the middle of the OECD countries in this aspect, but the government aims at improving the Danish position.

The government has set aside a total of 275 million DKK over the next four years to facilitate cooperation. The work will focus on six areas (Table 1)(9).

Table 1. List of initiatives to strengthen the interaction (from (9))

1. Collaboration on research and development
A. Restructuring the public appropriation scheme
B. Extension and expansion of the tax deduction system for research expenses
C. Good practices in relation to collaborative research
2. Access to the right competences
A. Better leave-of-absence schemes for researchers
B. Increased use of the Industrial PhD Programme
C. Setting up internships for students
D. International mobility
E. Networks on research-based continuing education
F. E-learning as a tool in continuing education
3. From research to business
A. Improved collaboration on technology transfer
B. Next generation innovation environments
4. The culture of interaction in a university setting
A. Interactive objectives and strategies
B. Flexible employment structure at the universities
C. Researcher hotels
D. Portal to the knowledge system
5. Better prioritisation of research and innovation
A. Criteria for realisation of strategic research
B. Schedule prioritising the future strategic research focus
6. A new course for technological service
A. Improved framework for technological service
B. A stronger position in the knowledge system

A new organisation called Biotech Research and Innovation Center (BRIC) is currently being established (13). The purpose of BRIC is to facilitate biotechnology research and business, by establishing research collaborations between public research institutions and the industry and promoting the exchange of ideas within the Danish biotech research community. Another way of stimulating research in Denmark has been the establishment of research parks, which were mainly set up between the mid 1980's and 1992. The research parks are typically a joint venture between public and private actors and are organised as independent private institutions. Today there are 6 research parks in Denmark (although one new is now being set up).

3.1.3.3 Capital for new companies in Denmark

Figure 3 shows the source of capital in Denmark for different development phases of new companies.

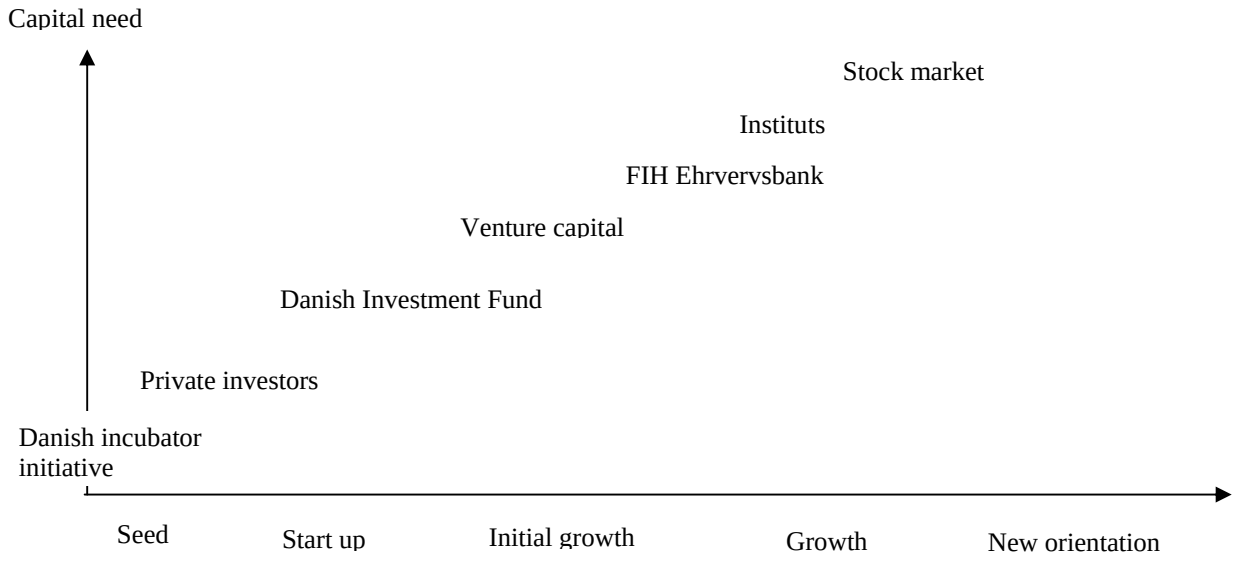

Figure 3. Sources of capital. Source: Adapted from (14)

One action to stimulate new business in Denmark is the establishment of the Danish Investment Fund (DIF), a state owned financial company, which focus on seed, start-up and high-risk loans(15). The objective of DFI is to stimulate development through investments in small and medium size business. During 2001, DFI invested in 22 biotechnology companies(4).

Another initiative to facilitate research and innovation is the so-called Danish incubator initiative (innovationsmiljøer), which was established in 1998(16). The purpose is to facilitate commercialisation of new ideas, inventions and research by working for closer contacts between innovators, research and capital. During 1998 and 1999, the Danish incubator initiatives have invested a total of 125 million DKK in pre-seed capital projects, which has lead to the establishment of 172 innovative companies. About 100 of the ideas, which the companies are based on, are today patented. The incubators are the most risk-taking sources of finance in the Danish financial system, and thereby work as a first source of funding for new companies. Almost 10% of the initiated pre-seed capital projects have been continued with other funding. Besides funding, the incubators also offer advisory services to the companies.

3.1.3.4 New patent law

A new law for research patents was introduced in Denmark in year 2000. The purpose was to increase the possibility for commercialisation of research within the public sector. The new law regulates the rights and income from public research. The law means that the researcher is obligated to inform the institution of his/her results and the institution then has two months to value the commercial potential of the research findings. If the institution chooses to commercialise the research, the researcher has the right to 1/3 of the profit. If the institution chooses not to commercialise the research, then the researcher him/herself has the possibility to commercialise it. The law also means that the institutions are obligated to contribute with

competence in order to defend patents etc. Since the institutions rarely have the competence to do this on their own, 5 patent-syndicates has been established to help the institutions with these issues.

3.2 Finland

3.2.1 Background

With the development of genetic research, more and more biotech industries have been started during past two decades. Finland is famous in Internet and telecommunication. Now, it is also pinning its hopes on biotechnology. There are over 120 biotechnology companies in Finland, and half of them were founded after 1995 (Figure 4)(17). Most of these companies are small and young, and even they are some years away from bringing a product to the market (18). However, with a knack for tapping into both the power of the free markets and the resources of the public sector, as well as its pro-business economy and support of R&D, Finland is becoming the leading country in the field of biotechnology. The country's biotech industry ranks sixth in Europe.

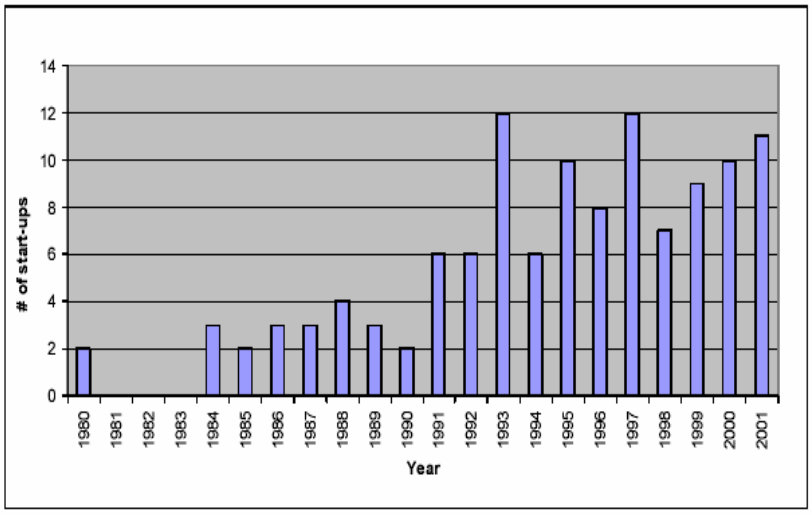

Figure 4. Finnish biotech companies by year of establishment

3.2.2 Tax incentives for R&D

Although the biotech companies grow very rapidly, no tax incentives are currently used, and no such incentives are planned in Finland (19). However, in order to reinforce the international competitive position of the Finnish tax system and to promote companies' investment, growth and their capacity to generate employment, the government's taxation reform has been proposed.

According to the proposal, the corporate income tax rate will be reduced by 3-26%; the capital tax rate will be reduced by 1-28%. The imputation system of corporation tax will be repealed and partial double taxation of dividends will be introduced. Dividends received by private individuals and deceased persons' estates will be taxed differently depending on whether the dividends have been distributed by listed companies, including companies listed on the so-called ancillary lists, or by non-listed companies. The taxation of profits distributed by co-operative societies will be subject to separate examination based on the principle that profits distributed by ordinary co-operatives shall remain subject to single taxation. Taxation of facultative pension insurance, transfer of enterprises to descendants and taxation of capital and sales profits as well as the financial situation of municipalities are also motioned.

In addition, the fiscal situation of general and limited partnerships and of private entrepreneurs in relation to limited companies will be secured by adjusting the part of distributed profits, which is taxed as capital income. A separate examination will be made of the impact of the corporation and capital tax reform on the municipalities' financial situation. That impact will be fully compensated, bearing in mind the extensive reform in 2005 of the system of contributions paid by the State to the municipalities.

3.2.3 Governmental leadership

Although there are no tax incentives, Finland has taken many effective measures in stimulating the growth of biotech entrepreneurship or providing environments by launching the Finnish enterprise policy. This policy aims to create competitive business environments and atmospheres in favour of entrepreneurship for enterprises, regardless of their size, field of action and location (20). Based on the policy, these measures include fund allocation and foreign investment, existence of the science parks and biotech alleys, and well-developed education and training system for entrepreneurship. In addition, some other measures involving the start-up and growth of SMEs are also carried out in Finland.

3.2.3.1 Fund allocation and foreign investment

Since the 1980s, the investments in R&D in Finland have risen steadily. The publicly funded organizations together with industry support have started to invest heavily in R&D projects. In the 1990s, the total public spending alone on biotechnology reached €340 million. Both private and public sector investments in the biotech sector are above the international average. In 1996, the Finnish government made its very important decision to allocate funds from the privatization of state-owned companies to support science and technology. The goal was to increase the national R&D input to 2.9% of GDP by 1999. Due to rapidly increasing investment by the private sector, this level was achieved a year ahead of schedule. In Europe, only Germany and Sweden boast a higher number of patent applications per capita, helped along by the fact that universities can retain their intellectual property rights (21). Today, the public funding and the input from industry have risen to 3.6%. This places Finland second in the world for R&D spending per capita. 29% of the total R&D investment is funded by the Government and 71% by the private sector.

The R&D of technology in Finland is supported by two major public organizations, Sitra and Tekes. Sitra (http://www.sitra.fi), which is also named Finnish National Fund for R&D, is an independent public venture capital fund that provides early-stage financing. Currently, more than 30 active venture capital organizations exist in Finland, and Sitra has developed a funding line aimed specifically at biotech companies. The investments of Sitra into biotechnology have grown to an annual level of €34 million. Sitra has more than 50 companies in its investment portfolio.

Established in 1983, Tekes, or the National Technology Agency (www.tekes.fi), also plays an important role in supporting Finnish biotech companies. Tekes provides grants and risk loans to R&D with the aim of cultivating internationally competitive products, processes, or functions under the supervision of Ministry of Trade and Industry from funds awarded from the state budget. In 2000, Tekes supported 2,297 R&D projects worth €370 million altogether, 30% of which alone went to the biotechnology sector. Along with IT, the biotech sector is the main targets of Tekes funding; especially biotech start-ups are given extra support. In 2001, TEKES invested €400 million in 2,400 R&D projects. The investment in chemistry and biotechnology sectors amounted to €106 million.

The Academy of Finland is another body of financing. The national organization for science administration finances high-level research via individual projects and programs, centres of excellence, researcher training and providing expert services to science policy issuers operating under the supervision of Ministry of Education. In the year 2000, the Academy provided funds worth €157 million, representing 12% of total public R&D expenditure in Finland.

As mentioned above, the governmental institutions Tekes and Sitra are the two largest capital loan suppliers to Finnish SMEs biotechnology enterprises. However, George A (2004) claimed that the scientific standards and the level of government support are high, but a vital ingredient, venture capital, is missing. Finland does not have a well-developed investment community, so the country's biotech needs to attract investors from abroad (18).

3.2.3.2 Science Park and Biotech Alleys: Centres of Excellence

Another reason for the biotechnology sector success in Finland lies in the existence of science parks and close co-operation between industry, universities and research institutes. In order to bring together commercial enterprises and biotech-focused university research with a view to commercial exploitation of academic research discoveries, a nationwide network of biotech centers in Finland has been formed. Founded in 1988, TEKEL, the Finnish Science Park Association, is one important organization assisting the rapid growth of science parks. This organization initiates and develops collaboration between its member parks and with national and international contacts. Up to now, TEKEL has 20 member science parks and technology-intensive companies. Approximately 1,700 companies and 15,000 experts or service providers from a variety of fields operate in TEKEL science parks. The TEKEL science parks have a combined area that totals approximately 900,000 m^2. The main activities of TEKEL include business development, national programmes such as the Centre of Expertise Programme, the TULI Scheme (New Business Originating from Research) and the IRC (Innovation Relay Centre) interaction between science parks and collaboration, between companies in science parks and universities.

Several biotechnology centers have been set up in association with universities with strong biotechnology expertise. The main centres are located in Turku, Oulu, Kuopio, Tampere, and Helsinki. Helsinki Science Park (Helsingin Tiedepuisto) (http://www.sciencepark. helsinki. Fi), which has a multidisciplinary approach that aims to bridge the gap between industrial and academic research, is one of the successful science parks. Although it has only about 10 years history, this science park has grown from a university campus to a full-fledged science park. More than 1,500 research scientists and technicians work in top research groups and individual companies in the fields of biotechnology, pharmacy, biomedicine, diagnostics, food and environmental technology. Helsinki Science Park Ltd is a joint venture of the Finnish government, the University of Helsinki, the City of Helsinki, SITRA (a major VC fund) and a number of industrial federations. The core facilities of Helsinki BioCenter include protein chemistry research group and core facility DNA laboratory, nuclear magnetic resonance (NMR) unit, peptide synthesis, oligosynthesis/division of biochemistry, laboratory animal facility and transgenic mice unit, technical services (Department of Biosciences) etc.

The Turku Science Park and Kuopio Technology Centre are also excellent centres for biotech companies. These science parks throughout Finland provide high-quality beneficial circumstances for new business activity development - particularly those that are technology-oriented. In these science parks, companies can cultivate joint ventures, establish business units for outsourcing, or simply set up their own R&D projects in addition to the availability of personnel experienced in science and business as well as the easy access to laboratories, pilot facilities, and large hospitals.

“Biotech alleys”, clustered around major university centers, are another form of a nation-wide network of biotech centers. These alleys have grown with a concentration of companies to design, manufacture, and distribute the tools necessary for research work. This kind of research center in Turku, which is a sort of a mixture of academic research, business entities, and services units, houses over 50 groups and 500 scientists.

3.2.3.3 Education and training for entrepreneurship

In Finland, entrepreneurship education is taken into consideration throughout the schooling system, from primary schools to universities in Finland (20). Entrepreneurial education is included in school-specific curricula and aims to develop an attitude of ‘intrapreneurship’, involving flexibility, initiative, creativeness, risk-taking capabilities, and knowledge of business as well as of the preconditions for entrepreneurship from the point of view of postgraduate studies. In upper secondary schools, the theme of entrepreneurship may be approached by means of either a school-specific theme- ‘entrepreneurial education’-or by integrating courses in entrepreneurship into applied studies either in connection with different subjects or as separate school-specific courses. According to the Vocational Education Act, one of the objectives of vocational education is to make students acquainted with entrepreneurial spirit and entrepreneurship. A national programme on business know-how at university level aims to promote entrepreneurial spirit and entrepreneurship.

The Business Departments at the 15 regional Employment and Economic Development Centres (T&E Centres) provide various programmes that are targeted at company management, key personnel and people who intend to become entrepreneurs. The programmes include training in establishing a company, task- and problem-related training, company analysis and development and management training. The Ministry of Trade and Industry has launched, in co-operation with

the regional T&E Centres, the ProStart programme for assessing and developing a business idea to evaluate the viability of business ideas, the preconditions for becoming an entrepreneur and to assist in working on the idea. The high standard of education at all levels in Finland produces graduates who are not only knowledgeable in the latest scientific developments, but also technology-savvy and well equipped for the needs of the industry.

3.2.3.4 Measures to promote the start-up and growth of SMEs

Incubators are one of the effective measures for start-up biotech companies. Turku Bio Valley Ltd (http://www.bioturku.fi/) is a special bio-incubator providing services and facilities for start-up biotechnology companies. It also gives advice to new companies, based on its knowledge on the special requirements of the field. In addition to providing incubator support, the services of bio-incubator include specialist services, training and advice on strategies, marketing, financing, quality systems, internationalization, immaterial rights; private and general laboratories; contacts to universities, financiers, co-operating companies and authorities etc.

Finland has developed Business Service Points located in the 15 regional T&E Centres. These service points have become important sources of information for prospective entrepreneurs as well as entrepreneurs, for instance, various procedures involved in applying for licences, permits and authorisations. In addition, Patents Officers, Female Entrepreneur Advisers and Technology Advisers are also available at some service points. The new corporate information system called Business Information System was introduced in the year 2001. Entrepreneurs only need to fill in one single registration application when establishing a company. Other measures include strengthening the technological capacity of small enterprises, successful e-business models and top-class small business support (20).

3.3 France

The biotechnology sector in France is characterized by diversity and a relatively high number of new start-ups (22). The first French biotech companies appeared in the 1980s, but none is considered successful yet. The second-generation biotech companies emerged after the 1st Innovation Law was enacted in 1999, and the sector grew 30% the next three years with 30-40 start-ups launched every year supported by a dozen bioincubators. In 2003, there were 260 biotech companies with around 4500 employees, placing France in third place in Europe after the UK and Germany in terms of companies and employees.

The largest biotechnology companies in France, including companies listed on the stock market, have on average 100 employees and between 5 and 100 million euros in sales. Unfortunately, most of the companies do not have revenues and a third of the companies have a negative revenues growth rate, whereas 4% of the companies account for 80% of the turnover in the industry.

3.3.1 Tax Incentives for R&D and Expenditure

France has two major tax incentive measures; the Research Tax Credit and the Young Innovative Company Status.

3.3.1.1 The French Research Tax Credit

Research Tax Credit, or Crédit d´Impôt Recherche (CIR), was passed in 1983 and supports companies to increase their research effort (23). Between 1992 and 2000, almost 4.3 billion euros were injected into the French economy through this measure.

In 2004, the CIR was improved and introduced a more favourable calculation of tax credits:

- 45% of the increased amount of research expenditures of the current year, and 5% volume-based calculation of research expenditure of the current year, compared to 50% of the incremental amount of research expenditures before the improvement.
- The tax credit is applicable up to eight million euro per company and year compared to 6.1 million euro in the previous system.
- Tax credits higher than the tax liability can be carried forward for offset in the three following years. If still not used after three years, it is refunded in cash by the tax authorities.

This incentive is effective for both SMEs and large companies. However, the SMEs are particularly favoured by CIR, since the measure is restricted to a turnover of eight million euro.

The effect of the 2004 improvement is that a company will still be eligible for tax credits even if research spending has decreased compared to the prior two years. The old system presumed an increase in R&D spending on a year-to-year basis, which is often not reality for most companies.

With this new framework, the negative credits corresponding to the decrease in R&D expenditure, is offset against incremental amounts only for the following five years. If the expenditures are not increased during the next five years, the negative tax credit is annulled. This was not the case in the old model.

3.3.1.2 Young Innovative Company Status

The most aggressive form of stimulant for science-based companies in France – and probably the EU - is the Young Innovative Company Status (YIC), which was introduced January 1, 2004 (24). The aim is to stimulate growth of the private sector through lowered tax and operational costs and by stimulating investments in R & D. Projections show that the initiative would yield public revenues after just three years as a result of the increased number of employees.

The YIC apply to SMEs that are less than eight years old and spend at least 15 % of their expenditures on R&D for eight years after their inception. If these conditions are met, the company is granted:

- full social cost (social security, unemployment and pensions) exemption for all employees involved in R & D projects for eight years
- full income tax exemption for the first three profitable years, 50% relief for the next two years up to 100,000 euros (the average income tax is otherwise 33.33%)

- full local business tax[1] exemption for eight years.

Investors are also included in the initiative through capital gain tax exemption on shares or stock options held for a minimum of three years. With only an estimated 4,000 business angels, France falls well behind the UK (an estimated 50,000) and the U.S. (300,000 to 400,000). To increase the strength of this small group of investor, it will now be possible to create a one-man venture capital firm, exempt from corporate income tax and income tax on dividends and capital gains. The company must meet two conditions: Firstly, at least 80 percent of its assets must be invested in innovative businesses that are less than five years old. Secondly, no single investment may exceed 25 percent of the total invested sum.

The impact of the YIC on French competitiveness is dramatic (Figure 5) (25). In a comparison of wage costs of a typical biotech SME in Europe, the US or Canada, France moved from the last to the first position due to the introduction of the YIC. Another study demonstrated the same dramatic effect on overall operational costs and net income, where French SMEs again went from last to one of the first positions. In April, 2004, most of French Biotech's members had started applying the Status. The savings per employee and year was estimated to 10,000 euro.

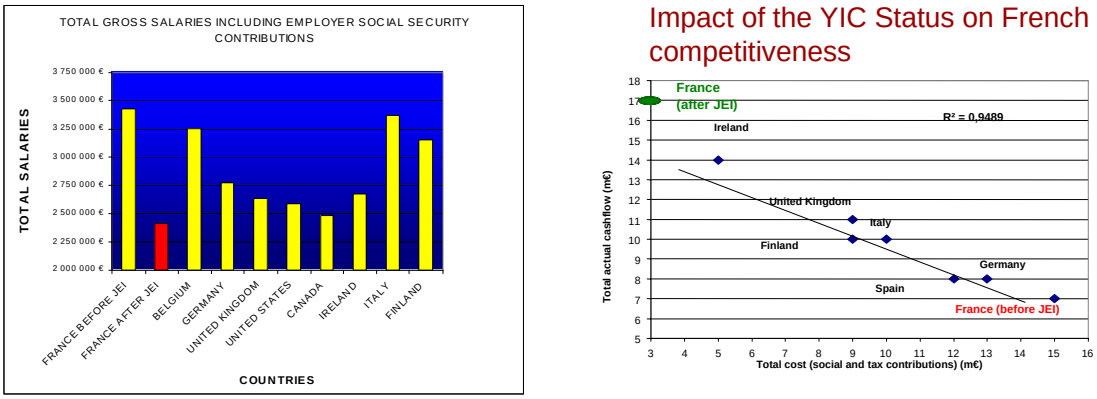

Figure 5. Comparison on French competitiveness before and after the introduction of YIC Status on salary costs (left), and cash flow and total cost (right).

3.3.1.3 Industrial views on the tax incentives in France

A few company contacts were approached for comments on the tax incentives for their respective company. The answers were contradictory. Philippe Poncet, Chief Financial Officer, Transgene, were quite optimistic:

> The research tax credit is certainly a good incentive for us. The tax credit is paid to the company in cash in the 4th year after it was generated, if it could not offset payable income taxes. In the case of Transgene (a loss making company) which therefore cannot utilize the tax credit against payable income taxes, we have receive € 4.8 million in cash in the last 3 years corresponding to tax credits generated in the years 1997 to 1999.

[1] Business tax in France is otherwise levied by local communities. The tax sum is determined annually in the district where the premises and the establishments are located. The tax base is made of the sum of the rental value of the premises plus 16 % of the value of fixed assets.

> The new computation rules effective 1.1.2004 are an improvement to the previous scheme. New computation rules intended to yield higher tax credits provide for a calculation based on both the actual research and development expenses in the given year and the increase in research and development expenses over the average of two previous years. The previous rules were based only on the increase of R&D expenses. I have calculated that the tax credits of the last 3 years (2003, 2002 and 2001) would have been higher by around 700 k€ each year, would the new rules having been applied in those years.
>
> The administrative work involved is significant but can be managed by a company the size of Transgene (165 people).

Another view, not putting much emphasis on the incentives for the growth of the company, was presented by Eric Cohen, Finance Director at Hybrigenics SA:

> First & main benefit: reduction of social security costs. In France, the social security costs paid by the employer are about 43% on top of the gross salary. The Y.I.C.S leads to a decrease from 43% to 20% of these costs. In value, it's a reduction of nearly 500 K€/year. Unfortunately also, this status is available for young companies, i.e. companies UNDER 8 years old: Hybrigenics has been created in 1998 and will benefit from this reduction ONLY in year 2004: consequently we are not going to hire some new staff or modify our investment plan.
>
> Second main benefit: modification of the calculation of the Research Tax Credit. For Hybrigenics the law will generate around 200K€ of credit. Unfortunately, the credit is returned in cash by the administration 5 years after it has been booked if not taxes had come in deduction from it: again this will not changed our recruitment and investment plans for the current & coming years.

3.3.2 Governmental Leadership

The governmental leadership promoting French biotechnology has been strong. The minister of Finances has designated biotechnology as a strategic priority for France. The French R&D expenditure is thereby 2.2 % of GDP, positioning France as the fourth largest spender of OECD-countries (after Japan (2.98%), the US (2.7%), Germany (2.48%), and Great Britain (1.86%). Furthermore, the French government plans to boost the proportion of GDP spent on research and development from 2.2 percent now to 3 percent by 2010(26).

The governmental support of R&D companies has taken form in a number of different measures, such as The Innovation Law, support to the creation of innovative companies, support to the collaboration between public research and the industry, and the Plan Biotech 2002.

3.3.2.1 The Innovation Law

The upsurge of second-generation biotech companies in France was at least partly due to the Innovation Law which was effective starting July 1999 (23). The law facilitates the implementation of public research results in the industry and the creation of innovative companies. The law covers four areas:

1. The mobility of researchers towards industry. Academic researchers are allowed to participate as associates or managers in a new company, in the activity of a company or to provide scientific assistance and even participate in a board of directors or a board of supervision.
2. Co-operation between public sector research establishments and companies.
3. The fiscal framework for innovative companies, essentially easing tax burden on innovative companies.
4. The legal framework for innovative companies.

3.3.2.2 Creation of innovative companies

To encourage the creation of new innovative companies, three additional incentive measures have been implemented since 1999:

- **A national competition for innovative technology companies.** Since its start in 1999, the competition has had 6,664 applicants, given rise to the start-up of 466 companies, and created a total of 2,300 jobs or on average five jobs per company.
- **Incubators** supporting entrepreneurs with market analysis, business plan drafting, hiring process, and finances have been created. In most cases they do not allocate office or laboratory space to the projects. Thirty-one incubators were selected for government support over a three-year-period. At the end of 2002, 30 incubators were operational and had resulted in 344 companies and around 1 300 jobs. 40 % of the incubated projects were from winners of the national competition. The fourth year of the competition, biotechnology projects were third in number.
- **Three national pre-venture funds** (91.61 million euros) have been started, each with a focus on a specific area (biotechnologies, information, and communication technologies) and seven regional pre-venture funds (43.74 million euros) were selected.

3.3.2.3 Support to public research – business partnership

- **Research networks and Technological Innovation (RRIT):** 16 networks have been set up in fields such as life sciences. Their main vocation is to improve the partnership between public research and the socio-economic sector, to accelerate the use of new technologies and to structure research policy. Between 1998 and 2000, 299 million euros were invested in 707 projects, and yet another 80 million euros in 131 projects in 2002.
- **15 National Technological Research Centres (CNRT):** CNRT encourage cooperation between government research laboratories and industrial research centres.
- **Technological Research Teams (ERT):** Technological Research Teams were set up in 1999 to assist the development of technological research within universities and the development of research partnerships between the social and economic world and public research.

3.3.2.4 Plan Biotech 2002

Addressing the issue of the poorly developed biotechnology industry, the French government adopted the Plan Biotech 2002. This scheme aims at facilitating the creation of biotechnology start-ups and supporting the growth of existing companies by creating an increasingly favourable climate for investment and assisting the transition into profitable pharmaceutical companies (24). The government proposal means about euro 500 millions of direct investments and long term loans mainly allocated to the French biotech industry. The two key actions defined in Plan Biotech 2002 are as follows:

- 90 million euro is to be spent on bank loan guarantees to finance acquisitions of foreign biotech companies and R & D investments. The aim is to encourage private investment and IPOs and the cooperation between public and private research. The expectation is to generate some 450 million euro in long term guaranteed bank loans in 2002. In addition, Plan Biotech 2002 is expected to attract private investments amounting to several hundred million euros.
- The other Euro 60 million will be channelled into a new seed financing venture fund to promote more start ups in which venture capital funds can invest, once "proof of concept" has been established by new companies.

3.4 Ireland

Ireland is trying to advance among the bio-company friendly nations along with a number of other EU countries. Ireland has worked with other challenges than most of the other EU countries in order to create an environment which attracts bio-investments. This is due to the development o Ireland during the last decade. It is of vital importance to understand this in order to understand the current situation and the future plans for Ireland.

Ireland was the poorest member when joining the EU in1973. During that time Ireland had low wages and was a quite undeveloped country compared with the rest of the European Union. In 1981 a scheme of low income tax for manufacturing companies was launched to replace the Sharon relief and the export sales relief. This scheme lowered the tax to 10% from 32% and is more commonly known as “manufacturing relief” or the “10 per cent rate of corporation tax”. This combination with other factors, such as the low wages, has attracted a number of foreign companies to Ireland.

During the last ten years Ireland has faced a boom in growth. The good part of this is that the average income has increased a lot and hence the government income. The bad part is that Ireland no longer is a low-wage country. The obvious strategy is to move up the value chain. One step in that direction was taken in 1999 when Ireland started the unification of the corporate taxes for trading income from 32% to 12,5% for all companies. This was done by lowering the company taxes by 4% units each year until 2002 and to 12.5 % in 2003 (for all companies which were not already embraced by the 10% “manufacturing relief”)

3.4.1 Tax Incentives for R&D and Expenditure

Ireland has several taxation schemes that are applicable for R&D companies.

3.4.1.1 Seed capital

Ireland has since 1984 a seed capital scheme, SCS, which has now been extended to 2006. This scheme allows individuals to have a refund of up to 31.750€ form income tax from the six previous years. There are a number of conditions that needs to bee met in order to prevent abuse, among those are the conditions that the investor needs to bee an employee of the company, and that the investor will have at least 15% of the issued shares. Furthermore, the company must operate in an approved area, such as commercial research and development (25).

3.4.1.2 Public expenditures in biotech R&D

Parallel to SCS, a scheme for private investments in the similar companies was launched, Business Expansion Scheme, BES. This scheme has now been prolonged to 2006. In short; BES supports the same type of companies as SCS and gives the investor a tax relief of his/her investment immediately after the investment. The investment must be in newly issued non-preferential shares in a post of at least 250€ and may not exceed 31,750€ for the investor and the total sum may not exceed 1,000,000€ for the company (27).

3.4.1.3 Business Angels

Business angels or "informal private investors" are individuals that can provide financial support in the early stage for companies. These individuals will usually also support and want an active role in the company by adding their knowledge from prior engagements. The BCS scheme is encouraging these investors. The investors' capital is estimated at 10 million euro and the investments are usually in the range of 25,000 euro to 125,000 euro (28).

3.4.1.4 Tax credits for R&D expenditure

During the spring of 2004, Ireland has changed the ability for companies to use expenditure on R&D for tax credits. This was formally only possible for buildings, as in many other countries. In short 20% of the R&D cost can be used to lower the company tax. If not used, the credit can be carried on indefinitely. The new law is subject to clearance by the European Commission (29).

3.4.2 Governmental leadership

Forfás is the national board responsible to give policy advice on enterprise, trade, science, technology and innovation in Ireland. It is also responsible to coordinate several development agencies under the Department of Enterprise, Trade and Employment. The most important agencies are:

- **Enterprise Ireland,** responsible for the development of Irish sales, export and employment.
- **IDA Ireland**, responsible for secure foreign investments and encourages foreign companies to expand in Ireland.
- **Science foundation Ireland (SFI)** Finance by grants and other types on financing research in the Information and Communication Technologies (ICT) and Biotech (BioT) sector. Both researchers and projects dealing with leading edge technology and/or will increase enterprise competitiveness has a higher chance of getting grants.

Furthermore, there are other agencies as well that work with issues like accreditation and regional development.

3.4.2.1 Enterprise Ireland

The main function of Enterprise Ireland is to support existing, create new and internationalize Irish companies. They will help companies in finding financing such as venture capital, business angels and finding EU grants. They also issue own grants. For R&D a special funding called "the Research Technology and Innovation (RTI)" is issued by Enterprise Ireland with the goal to increase the amount of high quality in Irish businesses, for initial public offerings they have special grants and they give PhD and postgraduate scholarships to encourage further studies. This leadership is much centralised but it is reported to work well(30).

Enterprise Ireland also provides a network with 33 offices in countries outside of Ireland, this to help Irish companies with deals outside the republic. Knowledge networks are also provided for companies.

3.4.2.2 IDA Ireland

The main focus of IDA is to attract and support foreign investments to Ireland. 2002 IDA supported 1094 companies with 116 million € in return. The companies paid about 2 billion € in corporate tax. Of the new employments generated in those companies about 13 % were in the pharmacy and health sector(31).

3.4.2.3 Development of Irish foundlings

The statements made by Forfás and its agencies are strong in their choice of words when arguing why investments are needed. Biotech is viewed as the main area of growth. When one is looking at the figures the picture becomes a bit confusing; the grants given by Forfás in 2003 to the ICT and BioT sectors was lowered by over 10,000k€ or - 40%.

Enterprise Ireland, EI, has a portfolio of shares in small companies. Looking at the BioT shares in this portfolio in 1999, then 4,590 k€ was distributed in 17 companies. In 2002, 3,485$ was distributed on four companies (figures from EIs Annual Reports(31)). There could be several causes to these facts but most of those are not good for the BioT companies. Either EI has lowered their investments in BioT companies or the development in the BioT sector is very poor -24% in contrast to +63% for the all the shares in the fund, a combination of the two explanations is also possible.

4 Analysis and Discussion

The retrieved data presented a number of similarities and differences in strategy, which will be discussed in a cross-country comparison as well as a country-specific analysis.

4.1 Cross-country comparison: Similarities and differences

A number of common denominators were found among the European countries to strengthen identified weaknesses:

- The development of company size is stimulated through the support of investments in R&D expenditure, including employment of R&D staff, which eventually can help the companies gain a larger market cap.
- There are also a number of measures to increase the access to capital covering the major part of the business life cycle, e.g. pre-venture funds, capital venture funds, and incentives to private investors.
- To help build a critical mass in biotechnology, the governments have initiated support for the new and existing networks.
- The poor exploitation of public research results is encouraged through the support of cooperation between academia and the industry, the creation of incubators.

These measures can be categorized into three areas; economical environment, start-up of new enterprises and knowledge (R&D, education). Further, three different implementation strategies have been utilised; Tax incentives, direct financial support and support organisations (advice and facilities) (Table 2).

Table 2. Areas and implementation strategies

Denmark	economical environment	Start-up of enterprises	R&D + education
Tax incentives			I
Financial support		I	I
Support organisations		I	I

France	economical environment	Start-up of enterprises	R&D + education
Tax incentives		I	I
Financial support		I	
Support organisations		I	I

Finland	economical environment	Start-up of enterprises	R&D + education
Tax incentives			
Financial support		I	I
Support organisations		II	I

Ireland	economical environment	Start-up of enterprises	R&D + education
Tax incentives	I	I	
Financial support			I
Support organisations	I	I	

Note: this table shows a suggestion on the distribution of efforts for the different countries. Each country is assigned five credits distributed to the most important target areas and to the means of getting there.

According to our findings, all of the countries have build up support organisations for start-up companies and they are promoting entrepreneurs. France is most aggressive having both tax schemes and founds. Ireland supports early companies with targeted tax schemes, while Denmark and Finland supports via founds and grants. Finland governmental support with labs that are available for companies, this is very good support for biotech start-ups.

The promotion of R&D is also very strong in all countries. Denmark is working this area most of the countries followed by Finland. They work both with educational and research issues, with a focus on closing the gap and integrating academia and company research.

France and Ireland has R&D schemas as well but have worked more with the commercial environment. Ireland alone is working with the general economical environment. Apart from the tax incentives Ireland has a large support organisation for promoting Ireland and help Irish companies to develop.

4.2 Country-specific analysis

In addition to some similarities, each country has its own specific strategies to promote the growth of their biotech companies. The comparison of these incentives for biotech companies of the four-country is summarized in Table 3. These measures taken by each country have generated many positive effects.

Denmark has some tax incentives aimed at stimulating research and attraction of human capital. The effect of the incentives is not known at the moment, but these types of measures may be particularly important in Denmark, since it is a small country where lack of well-educated people may be a problem. Commercialisation of research is an important issue for the Danish government. The collaboration and contact between research institutions and business is important for creation of new science based companies, and the Danish government are in several ways trying to stimulate this. Establishing research parks, the Biotech Research and Innovation Centre, the Danish incubator initiative and the Danish Investment Fund are some examples of important measures taken by the government. The biotech industry in Denmark is geographically very small and concentrated around the Medicon Valley area. The small distance between research institutions and biotech companies may be an advantage for Denmark since it probably stimulates the contacts between them.

Finland has no tax incentives, and no such incentives are planned, but the tax reforms have been proposed. More important, the incentive measures taken by Finland government promote the long-lasting growth in a healthy state, partially result from the advanced infrastructure and positive public attitude towards biotechnology, high-level research and know-how in the life sciences, as well as a comprehensive and sophisticated national health system that offers various facilities for clinical trials and population-based studies. Factors such as the advanced technical skills, entrepreneurial ethics, and cosmopolitan people are big incentives for foreign investment in Finland. The powerful and effective governmental leadership result in the fast growth of Finnish biotech companies and its leading position in Europe in the field of biotechnology. International and domestic venture capital enhance the possibility that further fuel the environment of creativity that promotes the rapid development of the biotechnology sector in Finland, and with a robust, well-funded university system training good scientists, the industry's continued development is ensured. These measures taken by the Finnish government help to provide a favorable social and economic environment for the industry to prosper. As a result of government's efforts to boost biotechnology, the biotechnology industry is becoming one of the most important and promising high-tech growth sectors in Finland. There are now about 180 research groups, 14 biotech graduate schools and several science parks and biocentres dedicated to biotechnology in Finland(32).

France clearly demonstrates strong initiatives both regarding governmental leadership and tax incentives, particularly the Young Innovative Company Status, a strategic initiative which moves France to a very competitive position regarding salary and total costs, previously a weakness for the French industry. The main target of both measures is the creation of new biotechnology companies as well as the support of the newly created companies. However, the older generation companies also receive some support through the business-academia partnership measures. Still, there seems to be room for more support aimed at the old companies, especially considering the fact that only 4% of the biotechnology companies account for 80% of the turnover in the sector. One cannot enough stress the importance of the background and the path of the Irish economy, from poor through production to now. This struggle has been short and intense. Although the Irish economy is still growing very fast there is a regression in GNP growth, from 10% in 2000 to 1.8% in 2002. During the same time the governmental expenses has continued to grow in percentage of GNP(33), in total numbers with 40%. If these trends continue and the Irish government does not adjust to the new situation in time this can start a down-going spiral that would be very hard to exit. Things might even get worse as EU expand to the east where new

countries are where Ireland used to be. In the long run, Ireland cannot get the same amount of EU funding as now, i.e. a net gain of 1’445 €m in 2003(33).

The Irish strategy to meet this threat is to move up the value chain. Science foundation Ireland, SFI, tries to put their main force on the integration of education into enterprise. The main areas are information technology and biotechnology. That biotech is one of the focus areas is natural since there are a number of big pharmaceutical production plants and more are planned. The establishment of production plants and the good company environment makes the Irish strategy logical and well fitting to the current situation.

Governmental leadership is large and firm. Enterprise Ireland, EI, is involved in numerous of activities from building networks to granting applications the tax reduction scheme (Seed Capital Scheme, Business Expansion Scheme). We believe that if the same organization has controlling and a helping function it will lead to insecurity and distrust among the receiving party. For entrepreneurs witch are striving to be independent, the fact that EI is the only choice will also have a negative influence.

The Irish workforce has the right mindset of wanting to fight and feeling threatened. We believe that this mindset is due to the fact that most of the Irish workforce remembers the “bad old days” and hence the risk of being fat and happy is reduced considerably.

Ireland has an advantage that most other countries never will acquire; 99% of the Irish people speak English fluently. Thus, it is easier for large companies to move production to a country with low language barriers.

Table 3 Comparison of the incentives for Biotech

Items		Denmark	Finland	France	Ireland
Improvement goals	#1	Commercialization and generation of research.	Good governmental service by laboratory facilities and networks.	Create competitiveness for young R&D companies.	Keep company competitiveness through a good business climate.
	#2	Attract and generate a well-educated workforce.	Promoting entrepreneurs.	Utilisation of research.	Improving the education level.
Tax incentives	Corporate tax	30%	29%	~33.3%	12.5%
	Primary tax target	Integration of academia and enterprise	Tax Reform has been proposed	Young R&D companies	SME companies
Government leadership	Actions	Establishment of incubators.	Fund allocation **and attracting foreign investments**	Innovation Law regulating and encouraging researchers in enterprise	Grants and guidance for start up.
		Stimulate private-public cooperation creating PhD-initiative	Science research parks and "biotech alleys"	A national competition for innovative technology companies.	Agency to attract foreign investors and companies
		Creation of law regarding clinical research and the finding in these.	Promotion of education and training system for entrepreneurs	Creation of incubators	Agency to increase foreign trade for local companies.
		Centralisation of governmental administration regarding R&D.	Various measures to promote SMEs, such as incubators, simplify administrative process.	Creation of research networks and research centres.	Network with international contacts and Knowledge networks.

5 Conclusion

The conclusion from the comparison of the governmental leadership is that most similarities could be found in France, Ireland, and Denmark. The most common measures to stimulate research and creation of new business was creation of incubators to facilitate commercialisation, allocation of funds directed towards life science or biotechnology companies, increase of the mobility between academia and the private sector and offer grants to PhD-students. In addition to found allocation and establishment of science research parks, Finland has also developed a good education and training system for entrepreneurship, which will benefit this country in a long run. Many measures in favour of the start-up and growth of SMEs are carried out. The tax incentives for research and development expenditure varied from virtually non-existing (Finland) to rather drastic measures (Ireland and France).

These findings present a number of strong measures to be seriously considered by the Government. Forecasts for some of these instruments, such as the Young Innovative Company Status, show strong benefits not only for the biotechnology industry, but also for the public revenues. If these strong measures are not acted upon, the Swedish biotechnology industry may not only lose even more in competitiveness against the US, but to other European countries as well.

References:

1. http://www.time.com/time/europe/digital2002/biotech.html. 2002.
2. *Ernst & Young, France Biotech & Objectif 2010.*
3. Albert C, Laegreid O. *Rapport om rammebetingelser for kommersialisering av bioteknologisk forskning i Danmark*. Report. Den Kgl Norske Ambassade, Copenhagen 2003.
4. *Invest in Denmark, www.investindk.com*. 2004.
5. *Bio-/sundhed Et nyt partnerskab for vækst. Erhvervs- og Boligstyrelsen. September 2002*. 2002.
6. *Commercial attractiveness of biomedical R&D in medicon valley*. Report The Boston Consulting Group 2002.
7. *Medicon Valley - facts & figures www.mediconvalley.com*. 2004.
8. *Medicon Valley Academy, www.mva.org*. 2004.
9. *New Ways of interaction between research and industry 7. november 2003 Ministeriet for videnskab, teknologi og udvikling*. 2003.
10. *Venture capital country note: Denmark. Directorate for scienace, technology and industry. Committee on industry and business environment. April 2003*. 2003.
11. *International Benchmarking af Bio-sundhedsområdet i Danmark, September 2002. Erhvervs- og boligstyrelsen.* 2002.
12. *Bio-sundhdsindustrien i Danmark. En strategi og 10 anbefalinger fra Visionsgruppen for Fremtidens Bioteknologi, Sundhet og Erhverv. Ehrvervr- og Boligstyrelsen.* 2002.
13. *Biotech Research and Innovation Center (BRIC). www.bric.dk*. 2004.
14. Lindgaard-Christensen J. *Private Investorers bidrag til innovation, DISKOrapport nr. 5, Erhvervsudviklingsrådet*. 1998.
15. SwedenBio. *Biotechnology in Sweden - A National Biotech Agenda for Growth*. 2004.
16. *Evaluering af innovationsmiljøer - Hovedrapport 1. maj 2000. Ministeriet for videnskab, teknologi og udvikling*. 2000.
17. *Hermans, raine - tahvanainen, antti-jussi, ownership and financial structure of biotechnology smes: evidence from finland. Helsinki: etla, elinkeinoelämän tutkimuslaitos, the research institute of the finnish economy, 41 p. (keskusteluaiheita, discussion papers, issn, 0781-6847; no. 835). World wide web: http://www.etla.fi/.* 2002.
18. George A. *The Finnish line, the insider: Focus on Nordic Research, NewScientist,March 27, p50. Homepage: http://www.newscientistjobs.com.* 2004.
19. Oivukkamak M. *Personal communication with Matti.Oivukkamak, Chief Councellor, Ministry for Foreign.* 2004.
20. *Directory of measures in favour of entrepreneurship and competitiveness in Finland, http://europa.eu.int/comm/enterprise/enterprise_policy/enlargement/ cc-best_directory/.* 2002.
21. Mc Carthy R. *First past the Finnish post: How Nordic know-how is helping to win the technology race. http://www.iscpubs.com/*. 2001.
22. *French Biotechnology Industry: Diverse, Young and Promising. Invest in France Agency.*
23. *http://www.france-science.org/innovation/innovationlaw.asp*.
24. *http://www.technotimes.org/011019A.htm*.
25. *The Seed Capital Scheme: Tax Refunds for New enterprises http://www.revenue.ie/doc/it15b.doc*.
26. *France introducing measures to foster innovative companies. France-Biotech. www.france-biotech.gov*.
27. *Business Expansion Scheme Relief for Investment in Corporate Trades http://www.revenue.ie/pdf/it_55.pdf*.
28. *Business Angels. http://www.enterprise-ireland.com/GrowFinance/businessangels.htm*. 2004.
29. *TAX Briefing. Issue 55 - April 2004. http://www.revenue.ie/publications/txbrefng/tb55.pdf*.
30. *Epohite , June - Cross country comparison of the relation between country performance and policy settingshttp://www.epohite.fhg.de/Documents/wp3_final_report/wp3_report_v2.pdf*. 2003.
31. *Enterprise Ireland Annual Report 2002; Financial Statements. http://www.enterprise-ireland.com/Publications/pdf/EI%20annual%20report%20accounts%202002.pdf*.
32. Aura A. *Overview of the Finnish Biotechnology Industry,http://www.samedanltd.com/members/archives/EBR/Winter2002/ SirkkaAura.htm*. 2002.
33. *Budgetary & Economic Statistics, Department of Finance-Ireland.(http://www.finance.gov.ie/documents/publications/other/bes03.pdf)*. 2003.