

# BIOTECHNOLOGY IN SWEDEN

A NATIONAL BIOTECH AGENDA FOR GROWTH

sweden**BIO**

THE SWEDISH BIOTECHNOLOGY INDUSTRY ORGANIZATION

## Message from the SwedenBIO board

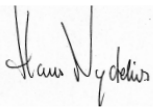
Few topics are more intensely debated and create higher expectations as well as contrasting emotions than biotechnology. The potential contribution to economic growth and improvements for mankind is very high. However, as in all scientific fields, there is a need for a robust set of facts on which to base assessments and decisions.

To provide this insight, SwedenBIO launched an in-depth survey in Q4-2003 to leading Swedish biotechnology companies on how the Swedish government can facilitate the growth of research and development in the industry. The result is this report "A National Biotech Agenda for Growth" that challenges the Swedish government to act on the opportunity to become the leading biotech country in the world and capture the full growth potential.

On behalf of the Swedish biotechnology industry, SwedenBIO is pleased to present the industry's view on the competitive situation of Sweden as a region for conducting biotechnology R&D. We strongly urge the Swedish government to consider what a thriving biotechnology industry would mean to the future Swedish economy and to implement the suggested recommendations within the coming one-two years. SwedenBIO sees a good collaboration with leading ministers, government, industry, investors and academic leaders as crucial for the national biotech success. A National Biotech Committee should be implemented early in 2004 to create a strong commitment among all stakeholders.

We would like to thank all companies and investors that have been involved and contributed to the results and the recommendations in the National Biotech Agenda.

Sincerely,



Hans Nyctelius  
President, SwedenBIO



Björn Nilsson  
CEO, KaroBio, Chairman SwedenBIO



Mats Pettersson  
CEO, Biovitrum



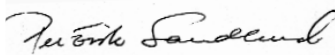
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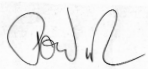
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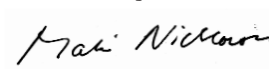
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Per Olof Wallström  
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# 1. Executive Summary

The global biotechnology industry is the fastest growing industry in the world. Over the last five years, the industry has yearly grown with more than 15 percent and annual increase in R&D spending has been 34 percent, while the number of new drugs from biotech companies has soared from 5 to more than 30 per year over the last ten years. Although huge human benefits derived from biotechnology already, the better part of its potential remains to be developed. The product development pipeline is filled with more high potential products than ever before. Products that, over the next five to ten years will create an enormous growth of high quality job opportunities in research, development, manufacturing and sales.

Biotechnology, in its wide definition, has the potential to become Sweden's next cornerstone for industrial development. Biotechnology, along with pharmaceutical development and medical technology are areas where Sweden on a per capita basis is the number one nation in the world together with Switzerland. The current Swedish position is promising but success is not guaranteed without coordination of efforts from the industry, government, academia and the public. Biotechnology is an important growth engine and has the potential to become a vital part of the Swedish economy together with advanced medical technology and pharmaceuticals.

However, even though biotechnology has the potential to represent a major driver for economic growth, it is far from certain that Sweden will reap the full benefits of this opportunity. The lack of a coherent governmental strategy and leadership is an obstacle. The following National Biotech Agenda is a suggestion on how the Swedish government in an efficient way can support the growth of the Swedish biotechnology industry.

Over the recent years, competition for job opportunities and investments within the biotech sector has led other countries to implement aggressive growth strategies in order to attract biotechnology companies and investments to their countries. Sweden has implemented few changes, while the governments of for example Canada, Singapore, France and the UK have recognized that there is fierce international competition to attract biotechnology investments. As a result, the leading position of Sweden within the biotech sector is being challenged, along with the risk to lose job and tax opportunities.

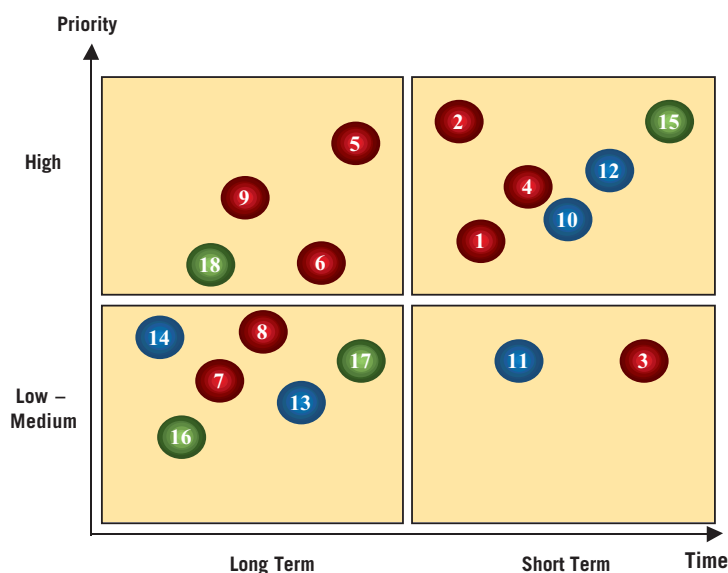
The SwedenBIO National Biotech Agenda analysis has shown that the USA has the by far best environment for the research-intensive biotechnology industry. Recent changes in France and Canada have also elevated these countries to second place overall, slightly before the U.K. The relative competitiveness, by location, for biotech R&D, was found to be worst in Germany and Sweden of the top nations covered. Countries outside the benchmark with an increasingly good environment for biotechnology R&D are Denmark, Israel and Singapore.

The main reasons for the relatively weak position in Sweden are:

- Lack of governmental leadership in the sector.
- Low public expenditure in biotech R&D.
- Decrease of education quality and difficulties in attracting human capital.
- Lack of tax incentives to conduct R&D.

Several biotech executives have confirmed these findings. In reply to the National SwedenBIO survey question, “In comparison with other countries, how would you rate the general R&D environment in Sweden?”, 85 percent of the participants answered that they rated the environment either worse or much worse in comparison to the USA. Indeed, the best indicator confirming these findings are true is the fact that the Swedish biotech industry is losing ground to other nations. For example, both the number of biotech employees and the number of biotech companies in Canada have grown twice as fast as in Sweden over the last five years.

This disparate development within the biotech industry can be explained partly by the insufficient of support from the Swedish government. If Sweden is to build and retain a prospering biotech industry, the government needs to realise that it plays a major role in facilitating this growth. To improve Sweden’s position as a world-class region to conduct biotechnology R&D and to facilitate the growth of job opportunities, the biotechnology industry has, through SwedenBIO, come up with ca 100 improvement suggestions on how to facilitate the growth of the industry (Appendix I). Of these, 18 have been prioritised regarding their impact and likelihood to be successfully implemented under a National Biotech Agenda.



#### Strengthen the Science and Knowledge Base

1. Increase funding for competitive biomedical R&D projects
2. Stimulate R&D investments through directed tax incentives
3. Enable work permits for foreign scientists and management
4. Extend tax brake for foreign specialists and management from 3 to 5 years and speed up handling process
5. Re-focus university education by funding more post-docs and professor chairs and fewer Ph.D. graduates
6. Co-fund a two year Post-Doc Program for the life science industry
7. Stimulate interest for biotechnology at elementary schools
8. Focus R&D funding to 3-4 geographic centres-of-excellences
9. Focus R&D funding to key scientific areas

#### Strengthen the Capital Supply

10. Create a pre-seed fund to enable innovators to validate the technical and commercial concept
11. Encourage Business Angels to invest in early-stage, biotech ventures
12. Create a seed and bridge fund to co-invest with private investors
13. Create an outsourcing fund for companies to collaborate with universities
14. Encourage Pension Funds to invest in biotechnology

#### Strengthen the Governmental Leadership

15. Establish a National Biotech Committee at the Department of Industry employment and communications
16. Establish centre of excellence network program
17. Secure the leading position in clinical trials
18. Educate the public in the benefits of biotechnology

Exhibit 1.1: National Biotech Agenda, SwedenBIO

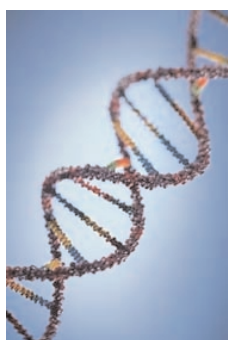
The following five actions are prioritised in the short term by the Swedish biotech industry:

#### ESTABLISH A NATIONAL BIOTECH COMMITTEE AT THE MINISTRY OF INDUSTRY, EMPLOYMENT AND COMMUNICATIONS

Active government leadership is a key factor in establishing Sweden as a global leader in biotechnology. Industrial development is currently hampered by limited co-ordination and a lack of common vision within government, industry, and academia. The government should establish a National Biotech Committee, with the objectives of increasing co-ordination and facilitating biotech growth. The focus should be to set a common agenda for Swedish biotech, and introduce measures designed to make Sweden one of the global leaders. The committee should include 3-4 full time employees at the Ministry of Industry & Trade, with executive powers (including budget responsibility); as well as an expert advisory committee consisting of top-representatives and experts from government, industry, academia and the financial community. The Department of Industry & Trade and the Department of Education are the two most obvious governmental sponsors, but a wide representation is essential.

*Estimated cost: 5 million SEK annually*

#### CREATE A PRE-SEED FUND TO ENABLE INNOVATORS TO VALIDATE THE TECHNICAL AND COMMERCIAL CONCEPT



After the investigational phase of a research project, there is a need to validate both the scientific/technical proof of concept and the business potential. Although such validation cost little in financial terms (normally between 0.5-2 million SEK), the money available for such studies is currently very scarce in the university setting. As a result, researchers are forced to form a company in order to raise the necessary capital, resulting in a new business that has been established without a fully validated concept. To remedy this, the government should provide researchers with funding to examine the soundness of their technical innovations before forming a company. Such a fund could be administered through e.g. university holding companies to avoid extra administrative costs. The

companies emerging from such processes should have to return money to the fund, if they are successful. If not, no money should be returned.

*Estimated cost: 200 million SEK annually*

#### CREATE A SEED AND BRIDGE FUND TO CO-INVEST WITH PRIVATE INVESTORS

Most Swedish biotech companies are financially vulnerable and will need additional capital to survive. This SwedenBIO report indicates that the problem of capital supply is two-fold; firstly, the capital available in the system is scarce, especially at earlier stages, and secondly, the amount of raised capital is too little to effectively leverage and market new innovations. To remedy this, the government should provide a co-investment fund. The focus of such a fund would be to offer private venture capitalists joint investments at an early stage. The fund should be managed independently and professionally, and make investments only if a private investor matches the venture capital investment. Based on SwedenBIO's financial analysis and benchmark, at least 300-400 million SEK is required annually for the Life Science sector to match international levels.

*Estimated cost: 300-400 million SEK annually*

**STIMULATE R&D INVESTMENTS THROUGH DIRECTED TAX INCENTIVES**

The National Biotech Agenda report shows clearly that many nations stimulate investment in life science R&D by making such investments tax deductible. This kind of encouragement does not currently exist in Sweden, limiting the level of investment in R&D and consequently hindering the growth of existing and new companies. The government should introduce tax incentives for investment in R&D, similar to those introduced in France and Canada. Tax deductions would be based either on an absolute amount or on the increase in R&D investment from one year to the next, with small investor companies benefiting from extra tax deductions.

Swedish tax legislation for R&D investments should be as good as in the best EU countries.

*Estimated cost: 0*

**EXTEND TAX BREAK FOR FOREIGN SPECIALISTS AND MANAGEMENT FROM 3 TO 5 YEARS**

Individual scientists and specialists are often responsible for pushing the frontiers of science ever forward. Key individuals with specialist skills are therefore extremely important to the continued success of the biotechnology industry. For Swedish companies, it is difficult to recruit leading specialists and management, due to high personal income taxes and as the tax breaks are shorter and complex to get, and the scope of eligible positions is narrower. The existing tax break should therefore be extended from three to five years, and encompass not just foreign scientists but also key personnel in e.g. management, IP, finance. Canada recently expanded its tax break from three to five years in order to facilitate the development of Canadian biotech companies, through the encouragement of foreign specialists.

*Estimated cost: 0*

# 2. Introduction and Objectives of the report

Biotechnology has the potential to represent a major driver for growth of the Swedish economy: even though it is far from certain that Sweden will reap the benefits of this opportunity. The success factors can be summarized in three areas; 1. Strengthening the science base and knowledge supply, 2. Strengthen the capital supply and, finally, 3. Improve environment for biotechnology. All these three areas need to be optimised to leverage the full potential.



To assist the creation of a prospering biotech community and give high-quality industry advice, SwedenBIO has gathered the opinion from more than sixty senior biotech executives, asking the question “How can the Swedish government create an environment to facilitate the growth of biotechnology in Sweden?” SwedenBIO has conducted the following analyses in Q4-2003 to picture the situation for biotechnology companies in Sweden:

- **WORKSHOPS:** Senior executives and investors in the biotech area have been invited to give their views on the environment for biotechnology in Sweden. The objectives have been to define key industry challenges and generate proposals how to improve the environment for biotech companies in an optimal way.
- **BENCHMARK:** A benchmark study on governmental actions in leading biotech countries has been conducted. The objectives were to learn what successful actions other governments are implementing to facilitate biotech industry growth.
- **SURVEY:** A survey has been done with 70 senior executives and investors in the biotechnology field. The objectives were to understand issues and to test the initial hypothesis on identified problems.
- **FINANCIAL ANALYSIS:** A financial model has been developed to estimate the expected demand and supply for venture capital within the biotech industry.
- **INTERVIEWS:** In-depth interviews with senior executives have been conducted to discuss actions and verify recommendations on the required governmental actions.

Based on these analyses, SwedenBIO has assessed the current competitiveness of Sweden as a location for conducting biotechnology R&D, and identified major areas where improvements are required to capture the full industrial potential. A comprehensive action list of 18 main growth levers has been developed. It is the firm belief of SwedenBIO that these can be the common agenda for the government, biotechnology industry, investors and academia in the coming years. We need to act now to secure the excellent potential of Swedish biotech!

### 3. Biotechnology – A high growth sector!

Modern biotechnology as a commercial industry began when recombinant human insulin was first marketed in the United States in 1982. The effort leading up to this landmark event began in the early 1970's when recombinant DNA technologies were invented and Genentech, by many seen as the first biotechnology company, was established in 1976. KabiGen with the growth hormone development was a pioneer. Even though the history of modern biotechnology is short, the benefits already achieved for society have been manifold:

- Millions of patients in the world can live normal lives thanks to more than 100 drugs developed using biotechnological methods
- Several diagnostic tests have been developed to enable patients to be prescribed the optimum treatments for diseases, including cancer, obesity and Alzheimer's
- More than five million employees benefit from high-level work opportunities created in the most research-intensive industry in the world

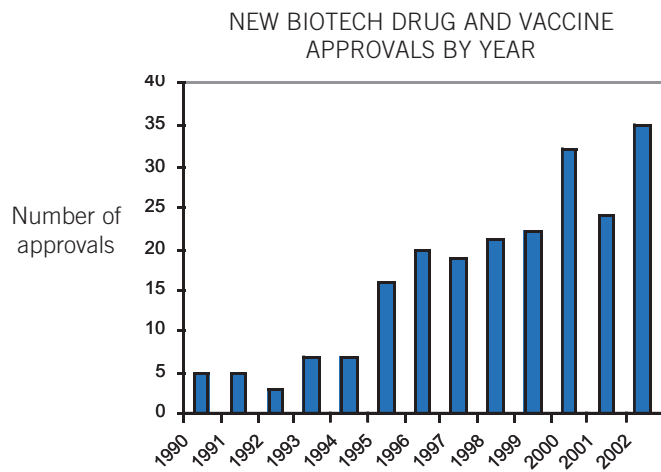
Despite the benefits derived from biotechnology to date, the better part of its potential still remains to be developed. More than 50 percent of all diseases have no curative treatment today. For example:

- More than 300 biotech drugs are currently under development and several of these will reach the market in the coming 5-10 years
- In 2001, 82 percent of all drug candidates in late clinical development (phase III) were derived from biotech companies
- Emerging technologies, such as the understanding of the genomic and proteomic interplay, offer the potential to revolutionize several industries, including agriculture, food and pharmaceuticals
- The more than 100 000 patients dying each year from organ failure could potentially be saved by developments in transplantation, stem cells and regenerative medicine.

Based on such developments, the world's fastest growing industry has been built. Global biotech revenues from public companies reached 41.3 billion USD in 2002, a yearly growth rate of 15 percent over the last five years. The increase in R&D investments was 34 percent, and 2002 also saw the number of biotech companies increase by 3 percent, even though the year was shadowed by general economic downturn. The biotech pipeline is filled with more promising products than ever before. Products that, over the next five to ten years, will create an enormous new range of job opportunities in research, development and production. Several multinational companies such as IBM, Motorola and Toyota have identified Life Science as their next growth area.

*“Several biotech companies have reached a phase where they need to expand and locate their production and research facilities. This will create an enormous growth of job opportunities over the next years”*

*Hans Nyctelius,  
CEO SwedenBIO*



*Exhibit 3.1: New biotech drug and vaccine approvals by year.*

*Source: "Rewriting the rules", 2003, Mercer Management Consulting*

## 4. Biotechnology – a future cornerstone of the Swedish economy

Today, biotechnology is one of the fastest growing industries in Sweden (See exhibit 4.1), with many companies, such as Amersham Biosciences, Q-Med and Biacore being global leaders in their fields. As of 2003, the Swedish biotech industry had created more than 6000 jobs, in addition to the more than 20 000 employees of the pharmaceutical industry, and thousands of researchers at the universities, which are closely involved in biotech development. This number is not including several thousands of indirect job opportunities in legal, consulting and other support functions. It is estimated that for every biotech industry job another two indirect jobs are created.

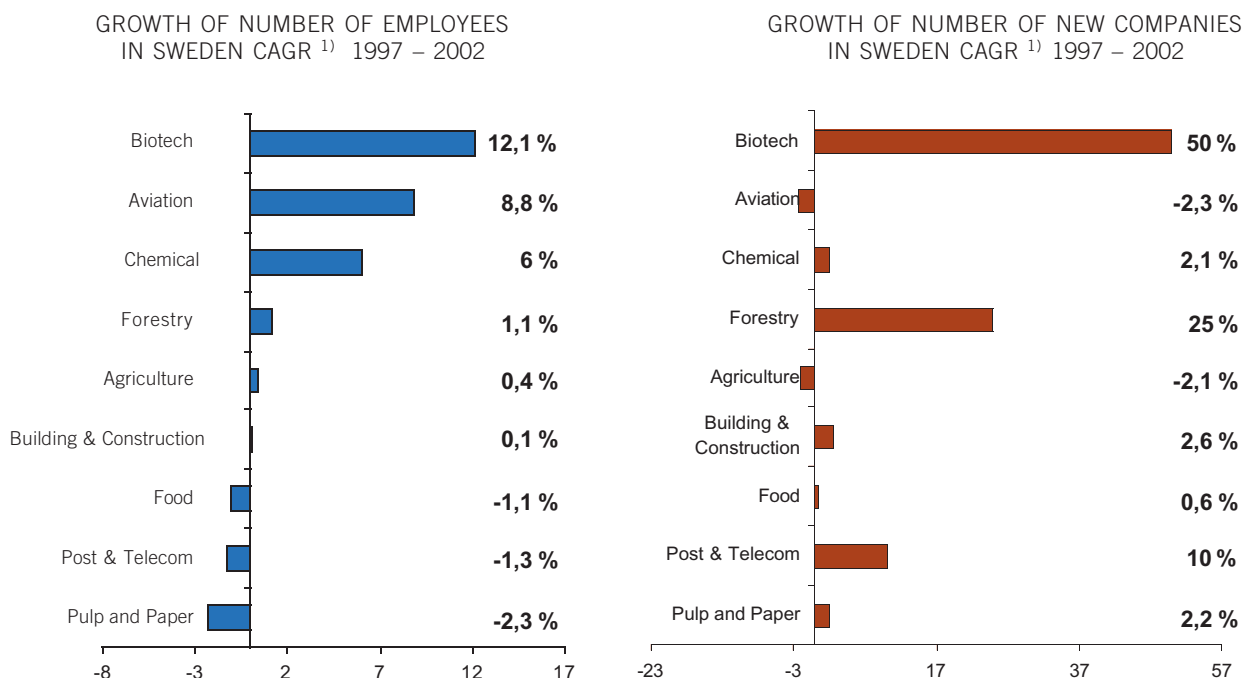


Exhibit 4.1: Growth rate of employees and companies in Sweden. Source: Statistiska Centralbyrån, SwedenBIO analysis,<sup>1)</sup> CAGR=Compounded Annual Growth Rate

The Swedish biotech industry is highly focused on healthcare. About 100 out of an approximate 200 Swedish biotech companies work within pharmaceutical development employing more than 2500 people directly, accounting for more than 50 percent of the revenues in the sector. Active Biotech, Biovitrum, Karo Bio and Medivir are some leading firms. Biotech tool companies that develop instruments and technologies for more rational and high-throughput drug research account for another 60 companies, of which Amersham Biosciences, Biotage (former Pyrosequencing), Global Genomics and Gyros are some examples. The agro biotechnology sector involves a relatively less number of companies, although Svalöf-Weibull and Hilleberg are of considerable size. The Swedish biotech industry is mainly located around three large clusters: Stockholm-Uppsala, Medicon Valley (Lund-Malmö and Copenhagen) and MedCoast Scandinavia (Gothenburg and Oslo). The first two each comprise close to 100 biotech companies and are among the top 5-6 Life Science clusters in Europe.

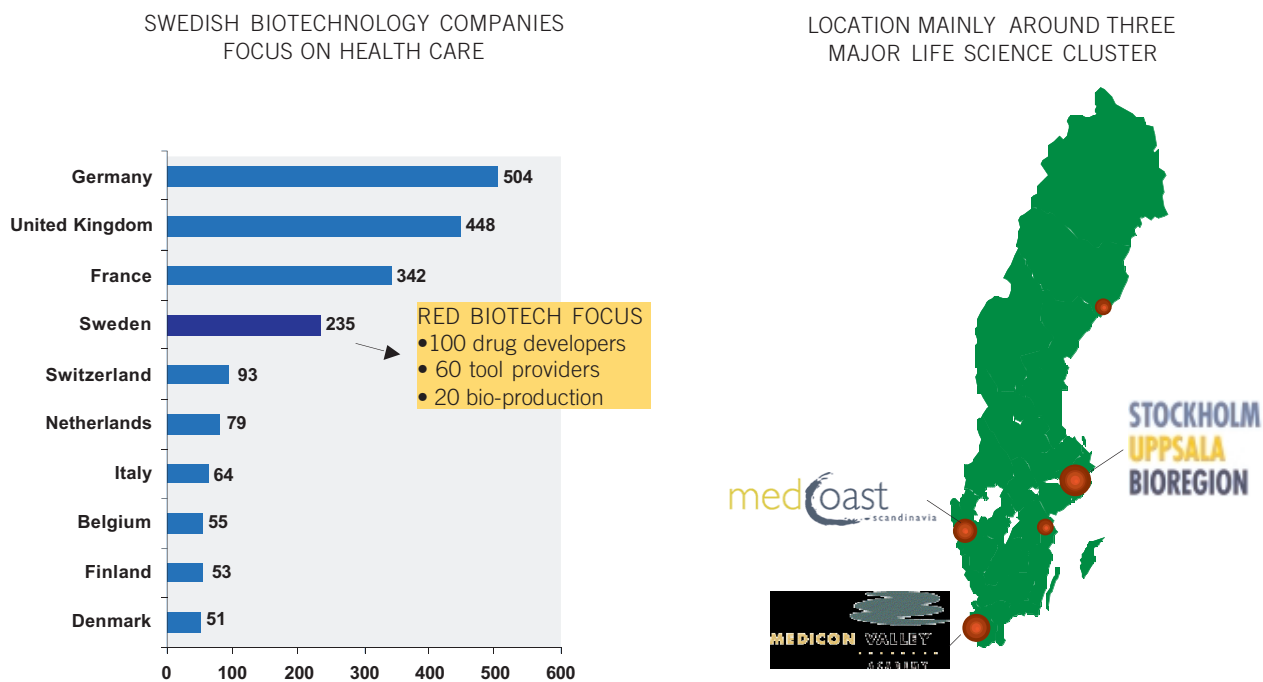


Exhibit 4.2: The focus of Swedish biotechnology. Source: SwedenBIO and IVA analysis 2003

The Swedish biotech industry compares well on an international level. In terms of absolute number of companies globally, Sweden ranks in 9th place. In terms of companies per inhabitant, however, Sweden ranks first. Sweden is also home to some world-renowned universities, including e.g. Karolinska Institutet, The Royal Institute of Technology (KTH) and Chalmers. These universities have a world-class academic excellence. The number of publications in well-respected biotech research journals is often used as an indicator of the level of academic excellence. Sweden usually scores as one of the leading nations in publications per capita as well as number of citation levels (See exhibit 4.3). Furthermore, the number of patents in biotechnology has been surging with a growth rate of nine percent each year since 1997. Although this is promising, there are reports indicating a decrease of Sweden’s academic output and relative quality mainly due to decreasing public research funding in the last decade.

*“Sweden is still a high technology country but clearly on a slope downhill due to decreased funds for basic research for over ten years”*

*Björn Nilsson, CEO, KaroBio*

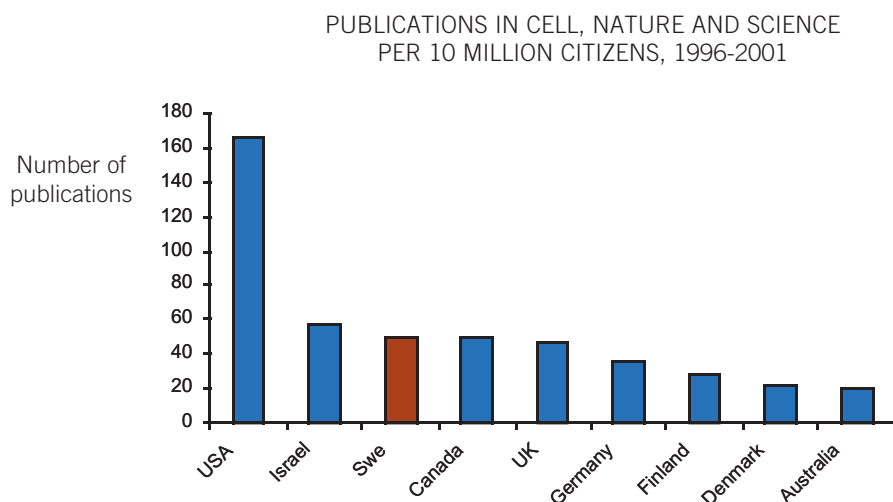


Exhibit 4.3: Publications in Cell, Nature and Science per 10 Million citizens, 1996-2001. Source: “Wettbewerbsfähigkeit Deutschlands als Standort für Arzneimittelforschung”, Boston Consulting Group, 2001

Sweden appears to have all the ingredients for success, including about 100 years-worth of experience in the biological sciences and pharmaceutical industry. However, the relative position of the Swedish biotech industry compared with other countries has been in gradual decline over the last four years. For example, biotech investment and venture capital activity in Canada is twice as high as in Sweden, even though Canada has only been seriously active in the biopharmaceutical field for little more than a decade. In an increasingly fierce competition, it is far from certain that Sweden will benefit fully from its strong tradition and experience.



## 5. The international competition for the biotechnology industry

The biotech industry, still in its infancy, has over the last few years been the fastest growing industry in the world. The bulk of its potential has still to be realised, and the range of applications is potentially revolutionary. Over the next ten years, biotech companies will decide where to expand and localize their research and production facilities, and from this expansion, a large number of job opportunities will arise.

In the last five years, a number of countries have recognized biotechnology as an important growth industry and are building successful biotech clusters by making their regions attractive for biotech companies and investors. Aggressive national strategies to attract biotech companies have been implemented. For example, the Danish authorities have introduced a five-year tax holiday for foreign researchers with a very rapid decision process, and France is implementing a special tax status for Young Innovative Companies reducing employment and capital gains taxes. The indication is that several other countries, e.g. USA, Canada are following in their footsteps.

Because a number of nations are relative newcomers to the commercial pharmaceutical industry, they still lag on several key industry indices, such as the number of Ph.D.s and scientists in the workforce. However, even for these countries, executing a clearly defined strategy to attract biotechnology companies has created a strong base for future growth. Looking forward, this enables them to capture an increasing share of the biotechnology market.



The benefits of such strategies are already evident. In 2002, only 3 per cent of international investments in health care were made in Sweden, compared with 7 per cent in Canada, and 5 per cent in both Singapore and Switzerland. All three of these countries currently have a similar standing as Sweden in the biotech field, despite the much weaker tradition in Canada and Singapore within the life sciences industry. From the perspective of Swedish economic development, this is a worrying trend, which cannot be turned around without governmental coordination and support. The key question for the Swedish government is how many of the emerging biotechnology job opportunities could, and will, be located in Sweden.

The Swedish government needs to recognize its fundamental role to provide the biotech community with a prosperous growth environment. The US, Canada, France and Denmark are good role models. The Swedish government must implement a coherent national biotech strategy soon not to avoid value destruction and loss of competitiveness. To assist the government and give the industry's view on what needs to be done, an analysis has been conducted. The SwedenBIO analysis reveals that other governments use six growth levers, that successfully implemented can help the industry in short to medium term.

This is done currently by most leading biotech nations. The levers are:

STRENGTHEN THE SCIENCE AND KNOWLEDGE BASE

- Implement tax incentives directed towards the research-intensive biotech sector.
- Attract and develop a world-class workforce

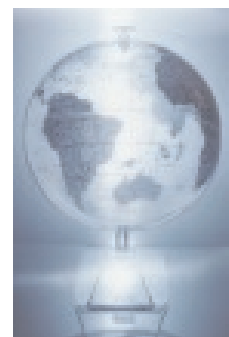
STRENGTHEN THE CAPITAL SUPPLY

- Assist in industrial financing
- Provide biotech funding to facilitate company expansion

IMPROVE THE ENVIRONMENT FOR BIOTECHNOLOGY

- Provide a progressive regulatory environment
- Provide visionary and coordinated leadership

For this report, leading biotech countries have been analysed with respect to each of these growth levers, and thereby describe which national strategies have been most successful.



## Canada's strategy to attract biotechnology companies

Canada is now widely recognized as a leader in biotechnology despite a relatively short industrial tradition in the biotech and pharmaceutical area. Twenty years ago, these industries were close to non-existing. Canada has over the last ten years made a commitment to strongly support and build up its biotech industry. The major building blocks of this strategy have been:

### A STRONG GOVERNMENTAL VISION

- Biotechnology is strongly anchored as an engine for economic growth in the Canadian government
- Canada has a fully implemented leadership organisation - Canadian Biotech Advisory Committee - that is led by the Department of Industry, Employment and Communications

### MAJOR GOVERNMENTAL INVESTMENTS IN BIOTECHNOLOGY RESEARCH

- National Research Council invested ca 481 million SEK in 2001/2002 in biotechnology research projects, which is four times as much as public Swedish investments based on a per capita comparison
- Genome Canada has received 2.2 billion SEK in governmental financing
- The Natural Sciences and Engineering Research Council, NSERC, invested 232 million SEK and the Canadian Institute of Health Research, CIHR, 771 million SEK in biotechnology in 2002

### AGGRESSIVE TAX INCENTIVES TO PROMOTE INVESTMENTS IN RESEARCH AND DEVELOPMENT

- Young innovative companies program where small, technology based companies pay no taxes
- Small companies investing in R&D may deduct 140 percent of what they invest from profits

### ATTRACTING LEADING PERSONNEL AND SCIENTISTS

- A 5-year tax holiday for researchers and management experts have been implemented

The results have in a short period of time paid off. Despite its short history within the biotech area, Canada has successfully managed to build a strong biotech sector within its borders. By executing a strong strategy to attract biotechnology companies the situation in Canada today is:

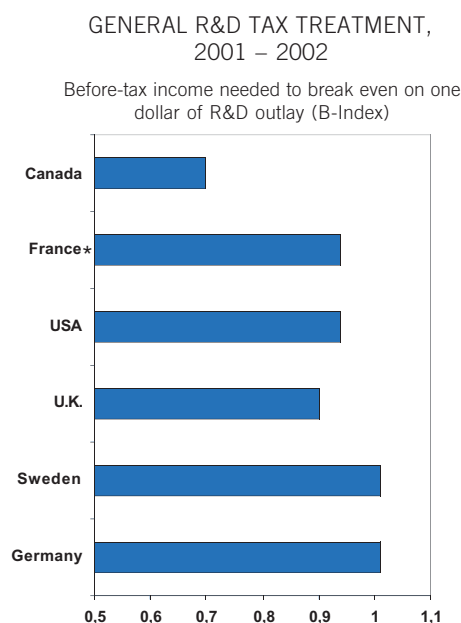
- The number of biotech and med-tech companies has annually increased with 29,6 percent in the state of Quebec in comparison to 8,3 percent in Sweden between 1997 and 2001
- The number of biotech and med tech employees has annually increased with 30,4 percent in the state of Quebec in comparison to 13,8 percent in Sweden between 1997 and 2001
- The global ratio of international R&D investments in life sciences was 7 percent in Canada, in comparison to 3 percent in Sweden
- The biotech invested venture capital in Canada was more than double the invested biotech venture capital in Sweden between 1997 and 2001

## 5.1 Sweden provides few tax incentives to invest in biotech R&D

Internationally, the tax environment for conducting R&D has changed radically over the last five years. To help capitalise on the biotechnology potential, several governments have implemented new tax relief and credit schemes for research-intensive companies. Due to these changes, tax incentives for investing in R&D, and consequently investments in R&D-intensive biotech companies, are the lowest in Sweden, compared to other leading biotech nations.



Exhibit 5.1.1 shows how much money a company needs to invest in R&D to break even, when making one dollar income. For example, a company making one dollar in income in Sweden needs to invest one dollar in R&D, according to Swedish tax laws you may only deduct one dollar from the income. In Canada, you only need to invest 0.7 dollars. In the benchmark study conducted by SwedenBIO, France and Canada provided the most beneficial tax environment for companies and investors to put money into biotech R&D. In these countries, the net cost of increasing R&D budgets from one year to the next was close to zero.



*Exhibit 5.1.1: General taxation treatment of research and development. Source: OECD, based on data from the European Commission (Inventory of public biotechnology R&D programs in Europe, 2000), Eurostat, Statistics Canada, and national sources, May 2001*

*\*) Not including the Young Innovative Company Program introduced 2004 in France.*

Beneficial tax measures implemented by other countries generally fall into one of the following categories:

- RESEARCH TAX CREDIT FOR R&D INVESTMENTS ON ALL SPENDING ABOVE AN AVERAGE OF THE PREVIOUS YEAR EXPENDITURES. For biotechnology companies in France, this means that the actual cost of an increase in R&D spending is only 50 percent of the increase. This is a low cost measure, which gives a strong incentive for increasing the investment in R&D. Over the last three years, similar incentive schemes have been implemented in Canada, and several states in the USA (e.g. Massachusetts and California). Sweden has no such incentives.
- SMALL BIOTECHNOLOGY COMPANIES ARE GIVEN EXTRA TAX INCENTIVES RELATED DIRECTLY TO THE AMOUNT OF MONEY THEY PUT INTO R&D. In the UK, for example, one dollar spent on R&D allows 1.5 dollars in profit to be exempt from taxation. For larger biotech companies in the U.K., the ratio is lower, at 1.25, effectively allowing 1.25 dollars profit to be exempt from tax per dollar spent on R&D. For small or young companies making relatively little profit, such tax allowances represent a significant incentive to continue investing in research. Indeed, over the last five years, similar tax benefits have been introduced in the following countries: Canada (ratio 1.4 for small biotech and 1.2 for large biotech companies), France, and the USA, where tax allowances are state dependent. For example, Massachusetts has a 1.1 ratio, and California a 1.15 ratio. Sweden has no such incentives.
- AN EXTRA TAX CREDITS BASED ON R&D SPENDING WITH REFUNDABLE INVESTMENTS. An issue for young, research-intensive biotech firms has been that they often have no profits from which to deduct R&D investments. Consequently, the tax credits have no effect. To help circumvent this problem, France introduced a refundable tax credit scheme last year, meaning that if companies do not have any profits, they get money back from the government. This effort has been introduced in Norway (with a 20 percent R&D tax credit), as well as in France. Another effort is being discussed in the US where loss-making companies may sell their tax deductions to other companies. Sweden has no such incentives.
- YOUNG INNOVATIVE COMPANY PROGRAM. Starting January 1st, 2004, France has implemented a tax relief program that will dramatically reduce the tax costs for small biotechnology companies. In the program, young biotech companies will benefit from full social cost exemption for all employees involved in R&D projects for eight years, full local business tax exemption for eight years, and full income tax exemption for the first three profitable years and 50 percent relief for the following two years up to 100 000 Euros.

*“The current tax environment in Sweden encourages companies to locate their R&D facilities abroad as soon as they reach profits”*

*Bengt Ågerup,  
CEO, Q-Med*

One key point to be learned from schemes introduced in other countries is that tax incentives are not expensive to introduce. On the contrary, the governments claim such initiatives are expected to pay back, not only in the long term, but also in the short term, through knock-on benefits on unemployment and indirect effects, such as knowledge increase and the establishment of new companies. Assuming, for example, that Sweden has approximately 100 biotech companies, each spending approximately 5 million SEK on research, incentives such as a 25 percent tax credit, effective on year-on-year increases in R&D spending, would cost the government in total a little more than ten million SEK, assuming the companies would spend 10 percent more on R&D.

## 5.2 Sweden invests too little public money into biotechnology research

Investments by the Swedish government into small and medium sized companies have historically been effected through a number of channels:

- STIFTELSEN INDUSTRIFONDEN, which has assets of just over 4 billion SEK for this purpose. Since 2002, Industrifonden has collaborated on seed funding decisions with NUTEK, although Industrifonden carries out the actual financing.
- STIFTELSEN INNOVATIONSCENTRUM (SIC) is being funded over the period 1994- 2004, with starting capital of 500 million SEK from employee investment funds. This has given the foundation about 90 million SEK per year.
- THE SEVEN INDEPENDENT TEKNIKBRÖSTIFTELSENA, which are located in different university towns in Sweden, have a total of about 1 billion SEK in capital at their disposal to support spin-offs, until the dissolution of the funds in 2007.
- DIRECTED INITIATIVES, such as Vinnova, Vetenskapsrådet (which invests approx. 34 million SEK into biotech annually) and Stiftelsen för Strategisk Forskning.

Only a limited proportion of this money is invested into biotechnology. Due to differences and the complexity of countries governmental structures, it is difficult to measure the total amount being invested into biotechnology. A useful indication is the amount of money that research councils invest in competitive R&D funding per capita (See exhibit 5.2.1). This reflects the funding situation for leading edge research of a country. Sweden is clearly much below its main competitors and the public research funding in Sweden is decreasing in relative terms.

*“The funding strategy needs to change in Sweden to provide fewer research projects with larger funding to be able to keep up with the international competition in selected areas”*

*Staffan Josephsson,  
Managing director,  
Investor Growth  
Capital*

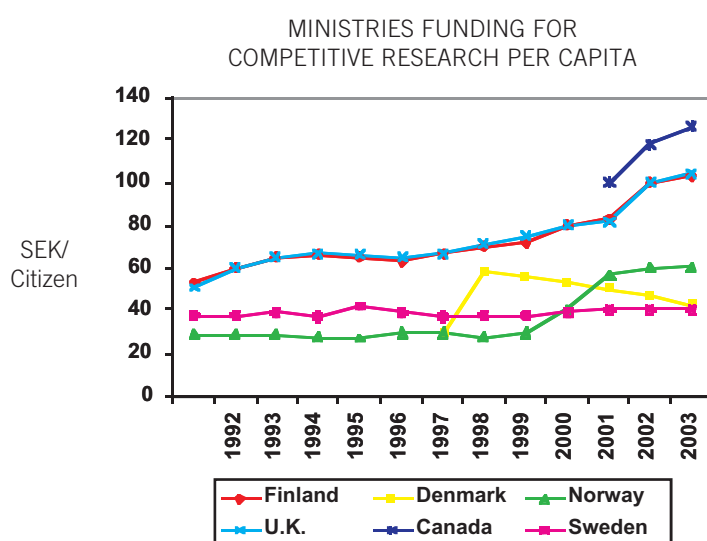
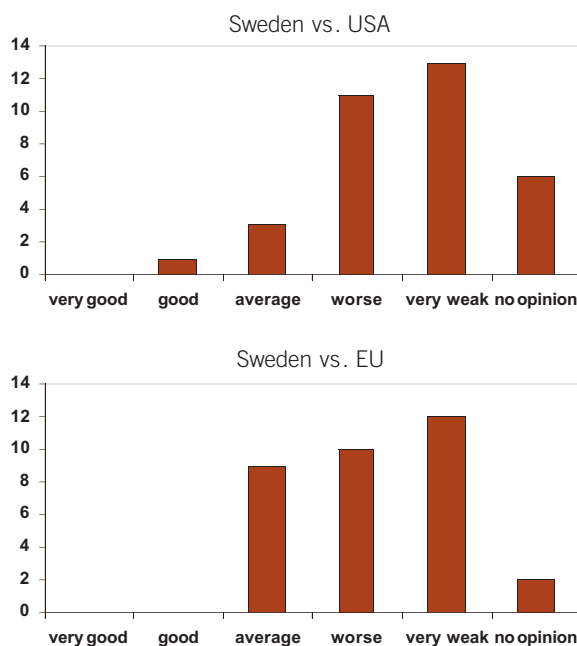


Exhibit 5.2.1: Ministries funding for competitive R&D per capita in medicinal research. Source: Vetenskapsrådet, Bo Öhngren, Linstenrapporten, 2003, SwedenBIO analysis

When considering leading biotech countries, it is evident there is a large investment and funding gap for Sweden to fill. This divide will become even larger in the future, as all biotech-intensive countries except Sweden are planning to increase their yearly public research investments into medicine and biotechnology significantly over the next five years.

These findings were also confirmed through the SwedenBIO National Agenda survey December 2003. In response to the question “In comparison to other countries, how would you rate the access to government financial support in Sweden?” 90 percent of participating CEOs and senior investors answered either “worse” or “very weak”. None indicated above average.

IN COMPARISON TO OTHER COUNTRIES, HOW WOULD YOU RATE THE ACCESS TO GOVERNMENT FINANCIAL SUPPORT ?



*Exhibit 5.2.2 Rating of relative attractiveness of governmental financial support. Source: SwedenBIO National Agenda Survey, Dec, 2003*

The National Institute of Health (NIH) in the US is outstanding in this category. NIH has doubled its research funding in the last five years and the NIH budget was 28 billion USD in 2003. The total public research funding into biotechnology and medicine reached 49 billion USD in 2003. This is more than 8 times the per capita R&D funding in Sweden. A significant proportion of these funds are available for SME companies in e.g. small business grants. In contrast, the EU frame programs are very difficult for SMEs to apply for effectively, due to bureaucracy, unclear ownership of IP and multi-partner requirements.

To reach the average level of governmental investments seen in leading European countries (Germany, France and the U.K.), in relation to investments per GDP, Sweden would have to invest an additional 300 million SEK annually into biotechnology. Such investments need to be distributed through an existing organisation, such as Vetenskapsrådet or Industrifonden, to avoid high administrative cost. In addition, it should be distributed on a competitive basis, where research groups should compete for the money to increase effectiveness.

## Seed financing initiatives in leading biotech countries

Germany has more early stage biotech companies than any other European country. Many of these were founded in the late 90's, favored by a new government policy to promote biotech companies. One of the initiatives was to raise public funds for early-stage investment in biotech, by which also private funds were mobilized. There is today, however, a fear of what will happen to the large number of companies that sprung from such initiatives. To ease the situation a new fund of 500 million Euro, focusing on German high tech companies, was announced in Oct 2003. The European Investment Fund (EIF) and the German state raise the money by providing 50 percent each, and the fund will offer private venture capitalists joint investments in early stages as well as follow-on investments. The fund will be managed by the EIF and will only invest in a specific company if a private professional investor matches the investment. In this way, the German government believes each Euro it raises can be leveraged more than six times.

Denmark's government has taken an active role in promoting the growth of Danish venture backed companies. One action has been to set up The Danish Investment Fund (DIF). DIF is a state owned financial company with a capital base of 2400 million DKK and a focus on seed, start-up financing and high-risk loans to a broad range of sectors. It was an important factor behind the growth in seed stage investments in Denmark between 2001 and 2002 - a time when Sweden and most other European countries saw a sharp decrease in early stage funding. DIF operates independently and does not require a private investor to join in order to invest.

Canada has initiated a number of biotech investment programs. The National Research Council invested 481 million SEK in 2001/2002 in biotechnology research projects. Genome Canada have received 2.2 billion SEK in governmental financing and co-invested with private firms 3.4 billion SEK (1.7 billion SEK from government side) in 60 technology platforms. In 2001, approx 820 million SEK of these funds were invested. NSERC invested 232 million SEK and CIHR 771 million SEK in biotechnology. Further technology funds, with a substantial biotech focus are: Technology Partnership Canada invests yearly 300 million SEK and Canada Foundation for Innovation have received 18 billion SEK to be invested in research.

France has announced a plan as part of its 2004 budget to provide 20-40 million Euros for biotechnology.

The U.K. plans to invest 100 million GBP per year in 2005 – 2006 through the office of Science and Technology. It is not decided how much of this money will be invested in biotechnology. The U.K. is also following up on the Science and Research Investment Fund (SRIF) with SRIF2 by investing 1 billion GBP into science infrastructure over two years, 2004-5. The U.K. will also invest 500 million GBP through regional venture capital funds to SME's. The funds, managed by experienced venture capital professionals, will be commercially focussed, making commercial returns. A specialized bio incubator fund was established, BMI Challenge, funded with 4.9 million GBP to support start-up companies.

## 5.3 Swedish biotechnology companies suffer from a lack of capital in early stages

Over the last decade, the Swedish biotech industry has profited from an impressive increase in levels of venture capital investment. This has contributed to the rapid increase in number of biotechnology start-ups and today, many biotechnology companies are developing their ideas thanks to funding from venture capitalists (VCs).

However, the downturn in the stock markets in recent years has changed the climate for investments dramatically, especially early stage investments. Early investors generally look to exit their portfolio companies within 3-7 years, and rely on an Initial Public Offering (IPO) or more often an industrial buyer through a trade sale. In 2002 and 2003, the IPO volume has been very low worldwide, as investors have been dissatisfied with market pricing of their portfolio assets and criteria to go public has been more demanding. Without a viable exit possibility, investment managers focus on their existing portfolio doing follow-on investments, and avoid new investments. This has placed an enormous strain on the biotechnology companies as they often have a high cash-burn during their early years. However, the IPO window for biotechnology companies in the US has opened in Q4-2003.

*“There is clearly a financial gap at early stages of Swedish biotechnology”*

*Lars Ingelmark,  
Head of Life  
Sciences, 6th  
AP fund*



The question is whether the supply of venture capital is enough to ensure sustained growth in the many promising biotechnology companies in Sweden. Many players today are experiencing an obvious divide between the industry's demand for capital, and investors' supply. Another question is whether there are sufficient venture capitalists willing to invest in the seed- and start-up phases to enable the commercialisation of novel research.

In the National Biotech Agenda financial analysis conducted by SwedenBIO, 45 senior biotech executives expressed their views on venture financing in Sweden. The biotechnology companies and venture capitalists surveyed correspond to 40 percent of the total number of employees in Swedish biotech sector, and investment managers controlling an estimated 60 percent of total venture capital funds in the country.

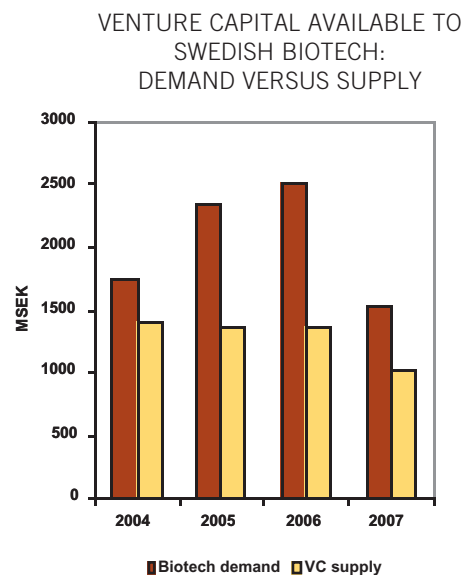
The company executives were asked to estimate their biotech firms' cash reserves, along with time to break-even, and average cash-burn until break-even. From the resulting figures, the future demand for venture capital was calculated, on the assumption that the demand is zero once firms start to generate positive cash flows. To estimate the biotech industry's total demand for VC investment, figures obtained from the responding firms were multiplied by a factor corresponding to the total number of biotech companies in Sweden.

The supply of venture capital was calculated by asking investors how much they plan to invest in biotechnology firms over the coming years. The following assumptions were made:

- The Swedish biotech industry is comprised of approximately 200 companies.
- The responding VCs' funds correspond to 60 percent of total venture capital available.
- Firms are reliant on venture capital until they generate positive cash flows.
- The total market demand for venture capital is assumed to be an aggregate of each of the individual companies financial needs.

The main conclusion of the analysis is that the level of venture capital financing needed to sustain biotech industry growth far exceeds the capital available. The general perception among both company executives and investment managers is that there is a major lack of capital for early stage financing. The model reflects the existing research portfolio situation in companies. New company start-ups are assumed to be equal to companies disappearing from the market.

Exhibit 5.3.1 clearly demonstrates the shortcomings of the available venture capital. In the coming years, an increasing number of companies will run out of cash and need new money. This need is not matched by current VCs' investment plans. As more and more companies reach break-even the demand will turn more moderate. All in all, over the next four years, an estimated extra 3000 million SEK would be needed to keep today's biotech companies going.



*“Research discoveries in Sweden are often world leading. However, scarcity of funding opportunities weakens the innovative height before a product reaches the market”*

*Mats Pettersson,  
CEO, Biovitrum*

*Exhibit 5.3.1: Supply vs. demand of venture capital available in the Swedish biotechnology industry. Source: SwedenBIO National Biotech Agenda analysis, Dec 2003*

Both investors and biotechnology firms were asked of the difficulty to raise capital at different stages of a company's development. The consensus view was that there is a severe lack of capital in the early stages especially for seed money (Exhibit 5.3.2). Several professional investors indicated that they will not do seed and first round

investments. This can be a severe shortcoming limiting the generation of new high-quality companies in especially biotechnology where the investment cycles are longer due to complex and lengthy R&D.

PLEASE RATE THE GENERAL LACK OF CAPITAL AS YOU PERCEIVE IT IN THE FOLLOWING STAGES OF FINANCING (5=EXTREM LACK, 1=NO LACK)

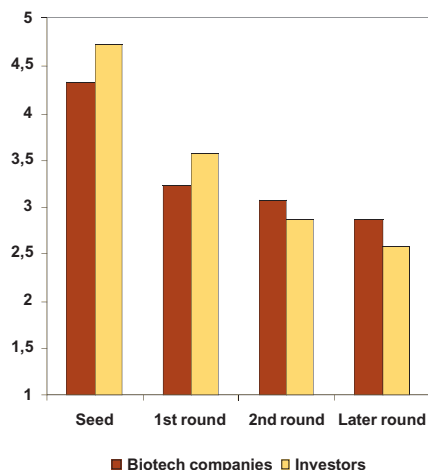


Exhibit 5.3.2: Perceived lack of capital per investment stage in the Swedish biotechnology industry. Source: SwedenBIO National Biotech Agenda analysis, Dec 2003

So what could the Swedish government do to improve the situation? In general, three criteria need to be fulfilled in order to create companies out of academic research. Firstly, top-quality science is a must in order to generate a strong flow of ideas. Secondly, a wide range of competencies is needed to support and guide the scientists. According to the results of interviews, both these criteria are already fulfilled in Sweden, although in a long-term perspective, they must be nurtured with substantially better research funding. Thirdly, however, money is also needed, and this is the major bottleneck. The initial investment is often small but vital, ranging from 0.5 – 2 million SEK, but private investors are reluctant to participate in early stage financing to develop a prototype or proof-of-concept and solid patent portfolio. A small increase in public resources e.g. through a pre-seed fund can bring a sizeable increase in commercialised projects.

Other countries have recognized these issues and created public venture funds specialising in early stage financing. Such initiatives have also been initiated in Sweden, e.g. the Vinnova incubator program, but with far too little money available. There is a strong biotech industry support for such pre-seed funds in Sweden. One concern raised, however, is the possibility that public funds would end up financing non-viable ventures rejected by private investors. To reduce this risk, public initiatives abroad often let venture capital professionals manage the funds, and only allow investments where other private venture capitalists are willing to invest jointly. It is also important not to spread out management to achieve critical mass and efficiency.

In the United States, U.K and Switzerland, the financial gap has been bridged partly by business angels (wealthy private investors) who tend to invest more willingly in the early stages of development. Several reports call for a greater awareness within Europe of the benefits of business angels. A key factor is the tax environment and in particular, taxes on private capital gains since an unfavourable taxation framework might deter investments and thus act as a drag on wealth and job creation. This has often been highlighted as particularly relevant in Sweden, where taxation on capital gains is relatively high.

*“Our fund, like most other biotech venture capital funds, will rarely invest in early stage seed financing”*

*Lars Gatenbeck,  
Partner, H&B  
Capital/Life  
Equity Sweden*

## How other leading biotech countries assist seed companies

Sweden has implemented several measures to support and facilitate growth of small biotechnology companies. Additional programs not implemented in Sweden but found in other countries, are outlined below.

### INVESTIGATING AN INNOVATIVE IDEA – U.K.

Companies that have an idea for an innovative product, process or service, but which are not sure if they are ready to take it forward successfully, may be able to receive help under a Grant for Investigating an Innovative Idea. The grant reimburses some of the costs of consultants chosen to provide expert advice on identified 'barriers' to the successful implementation of the new concept, service or product. The project outcome is an action plan.

### PROVIDING A NETWORK OF EXPERTISE – U.K.

U.K. has introduced a government-funded scheme that enables businesses to access the skills and resources of the UK knowledge base by enabling high quality graduates to work in companies on knowledge transfer projects. Small companies can participate in TCS, and benefit from the expertise of academics and researchers from a higher education institution or research-based organisation, or the knowledge of a graduate.

### SMALL FIRMS LOAN GUARANTEE SCHEME (TCS) – U.K.

The Small Firms Loan Guarantee Scheme guarantees loans from banks and other financial institutions for small firms with viable business proposals that have nevertheless failed to get a conventional loan because of a lack of security. The scheme is available to UK companies with an annual turnover no more than 1.5 million GBP.

### THE NETWORK CENTRE OF EXCELLENCE PROGRAM – CANADA

Canada has implemented seven Network Centers of Excellence (NCEs) in the life science fields. An NCE is a virtual network of experts focused on technical issues. Each NCE, financed by the government, engages about 50 professors, 20 – 50 companies and 100 – 150 research students, and manages 15 – 25 different projects. Every NCE is annually funded with 17 – 35 million SEK. The objective is knowledge-sharing and to define and implement research projects.

### PROVIDING INFORMATION ABOUT AVAILABLE PUBLIC FUNDING - IRELAND

Ireland has implemented an institution to provide start-ups with information on EU-level funding options and requirements for entitlement.

### PROVIDING FUNDING FOR RESEARCH INVESTIGATIONS - FRANCE

Pre-seed investments are made available before forming a company, for example in the field of molecule screening of compound libraries.

### FUNDING MANAGEMENT EXPERTISE AND PROJECT LEADERS FOR START UPS – FRANCE

To help enable the researchers to focus on the research, a project leader dedicated to assisting with technical and development issues is provided for start-ups. The objectives are to cut overhead costs during the vulnerable early phase.

### BUSINESS ANGELS NETWORK – GERMANY AND FRANCE

Germany and France have created a network of business angels to invest in seed companies. In addition, charitable contributions to the pharmaceutical and biotechnology fields have also increased over the last five years. The role of the government has been to provide beneficial legislation for private individuals to contribute financially.

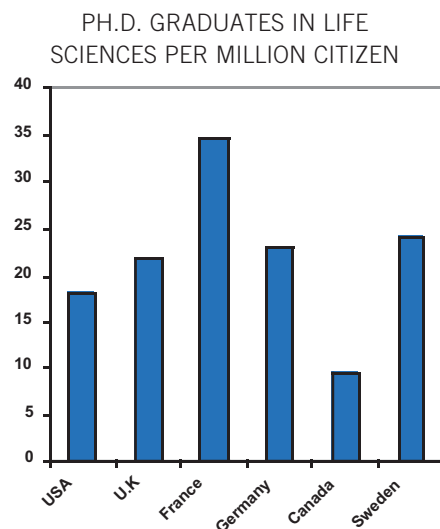
## 5.4 Sweden has a good access to life science researchers, but provides too few career paths in mid/high- level positions.

Access to thought leaders at key academic centres and an educated workforce is the most frequently mentioned reason for biotech companies to relocate their research activities. Providing measures to assist in the development of such a workforce is one of the key levers governments must consider if they are to positively influence their biotechnology industries.

In terms of a biotech workforce, Sweden is currently on a par with other leading biotech countries, except the USA, which has attracted a greater number of thought leaders. Sweden has also a good supply of Ph.D. graduates on a per capita basis in biotechnology and life sciences (see exhibit 5.4.1). In response to the SwedenBIO survey question, “In comparison with other countries, how do you consider the access to competent employees in Sweden?”, only 10 percent of the CEOs answered “worse”, while more than 50 percent answered either “good” or “very good”.

*“The current specialist taxation might work for large companies, but smaller companies need an easier and faster decision process to be able to take advantage of it”*

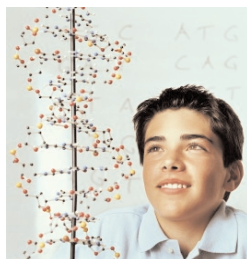
*Mattias Kalén,  
CEO,  
AngioGenetics*



*Exhibit 5.4.1: Ph.D. graduates in six leading biotechnology countries. Source: OECD, European Commission (Inventory of public biotechnology R&D programs in Europe, 2000), Eurostat, Statistics Canada, and national sources, May 2001*

However, a number of issues still remain within the biotech related education system in Sweden. The most critical are:

- It is still too difficult to attract foreign experts to Sweden.
- Basic research is not focused and prioritised on the most relevant research fields.
- Research is not focused at leading universities and centres-of-excellence
- Universities still harbour a technology-focused, rather than business-focused culture
- There is a lack of cross-scientific collaboration and education



Most importantly, the Swedish system does not provide an adequate career path for Ph.D graduates. A large number of Ph.D.s are currently being produced through the Swedish system, but there are too few higher- and mid-level positions (e.g. post-docs, professorships) available. This result is that more Ph.D.s end up working outside their area of expertise or get unemployed. Sweden needs to be able to provide a clear and attractive career path for researchers dedicated to life science. Less focus should be placed on increasing the number of Ph.D.s. It should rather be shifted towards putting more resources on post-doc programs as well as in providing better funding for leading young professors to develop their career paths (e.g. fast-track programs).

Other countries have also recognized the importance of enticing thought leaders into their biotech communities and keeping them there. Key actions include:

- EXPAND NATIONAL ACTIVITIES TO HELP GENERATE MORE THOUGHT LEADERS

In 2001, Canada initiated a program to establish 2000 research chairs and professorships at Canadian universities. In 2003, 900 were inaugurated. Two types of grant levels are recognized: a). Experienced researchers with leading-edge research receive approx. 1.2 million SEK, b). Researchers with the potential ability to generate world-class research get 0.6 million SEK. The program is open for non-nationals as well as Canadian citizens attracting talent. Of the 80 research chairs appointed in June 2003, 14 were international researchers and another 16 Canadians citizens returning home.

- ATTRACT FOREIGN PERSONNEL AND THOUGHT LEADERS

Some countries have introduced tax relief programs and tax holidays for foreign citizens entering their borders. Canada has implemented a five-year tax holiday from provincial taxes for foreign researchers. A researcher moving to Denmark gets a five-year period with no taxes. Discussions are also ongoing in France to introduce 30 percent tax-relief for foreign experts. Sweden has introduced 25 percent tax relief for foreign researchers, but in contrast to Canada and Denmark, where both researchers and other management personnel fall in this category, Sweden only accepts researchers for the tax-relief program. 1000 out of 2000 applications for research posts in Sweden were accepted for this program in 2002, but several biotech CEOs see the program as too slow and bureaucratic. No similar measures are yet implemented in Germany, the U.K. or the US. Several countries have complex and time-consuming visa application processes. Such processes have had a tremendous negative effect on the likelihood of attracting foreign talent. Canada represents the only country in the study to have introduced a "fast track" lane for immigrants with special expertise.

- STIMULATE THE INTEREST FOR BIOTECHNOLOGY RESEARCH

A recent issue emerging in most benchmarked countries relates to the ability to attract young talent to technology programs. The most gifted students seem to prefer business or social studies to technical fields. Several states in the USA have therefore started to introduce biotechnology at the elementary school level. Further efforts have also been made to educate the general public in the potential benefits of biotechnology, as well as the issues surrounding the field. The objectives of these programs are to create an awareness of and interest in biotechnology as a subject.

## 5.5 Sweden has a good regulatory and clinical trials environment

Biotech research is highly dependent on a number of environmental factors. Key fundamentals include clinical trial activities and good legislation for regulatory issues.

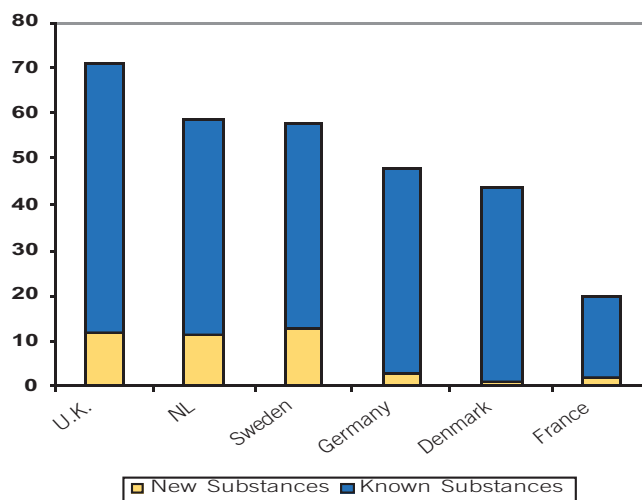
### A. SWEDEN HAS A STRONG TRADITION IN CLINICAL TRIALS

The strong presence of AstraZeneca and Pharmacia (now part of Pfizer) in combination with the highly respected Swedish Medicinal Products Agency has contributed to the establishment of high clinical trial activities. Sweden is a leading reporter country within the EU for mutual recognition of new pharmaceutical drugs (exhibit 5.5.1). However, reports indicate that Swedish clinical trial activities are declining, both in terms of money invested and the number of clinical trials conducted. In 1999, 10 billion SEK was invested into clinical and pre-clinical trials. In 2002 this figure had decreased to 8.2 billion SEK. A decrease of 20 percent, while the Medical Research Council in the U.K. increased their funding with 26 percent over the same time period. Clinical trials are, nevertheless, vital to the successful development of a biotech industry and to capture a larger share of the value generation in pharmaceutical development. For companies providing tools and instruments to the pharmaceutical industry, being close to the customers is a key factor for success. For the biotech companies active in biopharmaceutical production, access to competencies in clinical trials is also crucial.

*“We have invested heavily into research and development in Sweden, but Sweden’s strong position is threatened due to lack of political will to strengthen clinical research”*

*Martin Nicklasson,  
Executive Vice  
President,  
AstraZeneca*

NUMBER OF RMS APPROVALS IN 2000



*Exhibit 5.5.1: Number of drug approvals in clinical trials in six countries.*

*Source: “Wettbewerbs-fähigkeit Deutschlands als Standort für Arzneimittelforschung und Entwicklung”, 2001, Boston Consulting Group. (RMS= Reference member state projects)*

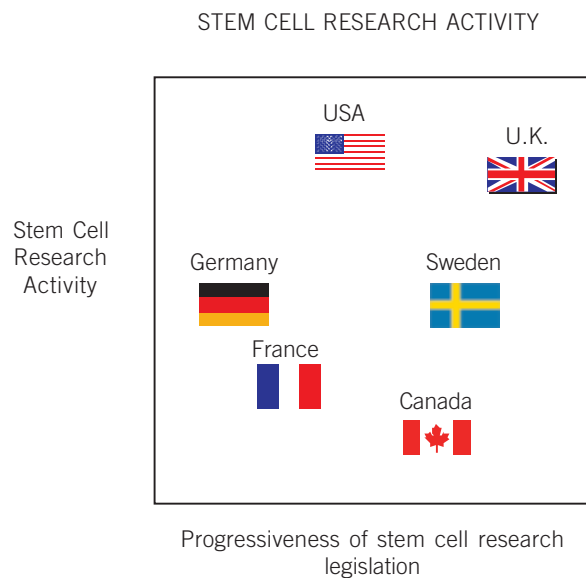
Challenges with respect to clinical trials in Sweden include the lack of coordination on a national level, hospitals do not prioritise clinical trials enough, medical doctors are not rewarded or given enough time to conduct clinical trials, and the new bio-banking legalisation has created a major administrative obstacle to the ability to

conduct effective trials. Sweden is still a leader in clinical trials but competition from the new EU member states is increasing. Such issues have been targeted in several other countries. The Department of Research in Germany has invested 280 million Euros into the establishment of centres for clinical studies during the last four years

#### B. SWEDEN IS GENERATING INTEREST IN ITS PROGRESSIVE STANCE ON THE REGULATORY ENVIRONMENT

Biotech is the subject of vigorous public debate in a number of different fields. These include e.g. genetically modified crops, manipulation of human cells from embryos for pharmaceutical research, use of biobanks and animal cloning. These are all areas of key importance to the future of biotechnology R&D. Indeed, both the rate and direction of research and innovation in these fields are likely to be shaped by public attitudes. It has been shown that progressive legislation often goes hand in hand with the level of public education and acceptance of biotechnology.

With this in mind, Sweden and the U.K. have assumed the most progressive regulatory positions in Europe, actively funding and allowing adult and embryonic stem cell research. The UK has also allowed somatic nucleus transfer (often referred to as “therapeutic cloning”), which is an important tool for e.g. studying new disease mechanisms as well as developing efficient and safe therapies. Canada has banned therapeutic cloning but is actively funding adult and embryonic stem cell research. France and Germany have banned therapeutic cloning and allow only limited embryonic stem cell research. In exhibit 5.5.2, stem cell research legislation has been used as an indicator of how progressive the regulatory environment is.



*Exhibit 5.5.2: The legalisation and activity within stem cell research for six leading biotech countries. Source: “Global perspective on biosciences 2002”, Swedish Trade council, SwedenBIO analysis 2003*

## 5.6 Sweden suffers from a lack of government leadership in biotechnology

Sweden currently has a number of governmental organizations that promote growth in start-ups and in the biotech industry. On a national level, government agencies such as Vinnova, Invest in Sweden Agency, NUTEK and Department of Foreign Affairs have activities in the biotech and life science field. The level of coordination is remarkably low and a clear strategic intent is not obvious. On a regional level, several biotech organizations have been created around the university regions with Medicon Valley as the most established one followed by UppsalaBio, Stockholm Bio and MedCoast in Gothenburg. The cooperation in e.g. marketing at international fairs is far from optimal, although some competition should be fostered.

However, there remains a lack of coordinated effort on focusing and organizing the biotech industry at a national level. A strong executive council, anchored in industry and academia and capable of understanding and acting on key issues and trends in the industry, is totally absent in Sweden today. The participating biotech CEOs and investors indicate that decision makers within the government lack a detailed understanding of the biotech industry's needs. In Sweden, the Ministry of Industry, Employment and Communications (Näringsdepartementet) has a good expertise pool in IT and telecom with 6 full time officials with expert competence. A similar reinforcement is needed in biotechnology and life sciences to rapidly increase the understanding and interest among leading Ministers in key positions of e.g. Finance, Education, Industry and Social departments.

*“Sweden has several ministries and agencies to promote biotechnological growth. However, there is a lack of coordination on the top national level”*

*Hans Sievertsson,  
Former head of  
R&D Pharmacia*

The lack of a National Biotech Agenda has given rise to the following challenges:

- Weak governmental competencies relating to the identification of, and reaction to, trends and issues important to the biotech and life science industry.
- Limited prioritisation and no coordination of biotech industry initiatives.
- Difficulties in providing the industry with academics, Ph.D.s and engineers with the right skills.
- The biotech industry is not yet on the national agenda for economic growth in Sweden, and effective measurements to capture the growth potential are lacking.

Sweden is not the only country suffering from a lack of a national strategy and organisation regarding its biotechnology industry, but over the last few years a number of other governments have begun to develop biotech-focused strategies and organisations. The key elements of activities in other countries are:

- CREATE A STRATEGY BUILT ON AN AMBITION TO BECOME A LEADING FORCE IN BIOTECH: Such a vision is often accompanied with a common agenda within the industry, academia and governmental bodies. The governments of the USA, U.K., Singapore, Canada, France, Germany and Israel, for example, have already stated their clear vision of becoming the leading national force in biotechnology development. Finland has recently made most efforts in the Nordic region.

– CREATE A LEADERSHIP ORGANISATION TO IMPLEMENT SUCH AMBITIONS:

For example, the state of Massachusetts, with several world-leading academic institutions and biotech companies, is implementing state governor positions such as: a senior biotech advisor reporting directly to the governor; a dedicated full time position for the industry within the office of business development; an industry advisory board to coordinate the biotech agenda; and a secretary of economic affairs with resources to invest in life science opportunities. Canada is the only country with a fully implemented leadership team, consisting of the CBAC – Canadian Biotech Advisory Committee – which operates under the remit of the Ministry of Industry. Canada has also implemented an education committee to lead the science education agenda, and the U.K., France and Singapore are discussing similar structures.

– CREATE PUBLICLY SPONSORED BIOTECHNOLOGY CLUSTERS:

For example, the French organisation, Genopole outside Paris, was founded in 1998 through collaboration between the Ministry of Research and the Evry city and the university of Evry as a biotech cluster with the objectives of accelerating biotech research and improving academic excellence. Genopole receives its funding by the French Government and offers incubator services such as rebated lab space and shared research equipment. The UppsalaBio program funded by Vinnova with 100 million SEK over ten years that should be matched by industry or regional funding is the largest Swedish program so far, but is small on an international comparison.

– INCREASE PUBLIC AND INTERNATIONAL AWARENESS OF THE ROLE OF BIOTECHNOLOGY IN SOCIETY: Governmental bodies in the USA, Canada and the U.K. are already investing heavily in educating the public on biotech issues as well as potential benefits. The rationale behind such programs is that a country cannot become a biotech leader without wide public support and acceptance. The European Union is clearly behind the US regarding the public acceptance for biotechnology research. All benchmarked countries studied also invest in positioning themselves as the leading biotech nation, in order to attract foreign companies.

## Genopole – the biotech growth incubator of France

In 1998, the French ministry of research, the city of Evry and the University of Evry founded Genopole outside Paris, with the mission to:

- Create and foster a research biopark dedicated to genomics and related sciences
- Reinforce a complete set of advanced training in life sciences
- Make citizens aware of science

Genopole has established a company creation process, through which researchers from all universities can apply for their projects to be accepted by the Genopole incubator. A development fund then finances early research on projects before a committee of experts made up of 13 scientists and industrial executives validates them. If accepted, the project is hosted within the shared research facilities and gets funded by the pre-seed fund for the pre-start-up process. In this phase, Genopole offers shared facilities for the project, including:

- A bioinformatics database
- A transcriptome platform
- A Flow Cytometer/Cell Sorter (FACS)
- Autoclaves, ultracentrifuges
- A high-speed computer network
- An international conference centre
- An electronic library
- General logistics such as secretarial, office and conference rooms

In the company-forming phase, the company founder is assisted by a project leader who, whilst leaving project responsibility in the hands of the creator, provides assistance in many other areas, such as carrying out a strategic positioning study, technical and economic feasibility study, market pre-study, management training and search for financing. To assist in financing of the projects, Genopole has created and manages a "seed" investment fund called Genopole Day One, to invest in the new company from its inception.

In addition to the company creation process, Genopole offers:

- Advisory Bodies
- Continuing Education Programs
- Clubs, for knowledge sharing
- In-house Seminars

In 1997, Genopole had 511 people on site, today there are 1 673 people. It is one of leading EU centers.

The key learning points for Sweden are:

- Genopole offers pre-seed funding to validate ideas or innovations before a company is created.
- Leading academics have stressed a similar need exists in Sweden.
- Genopole offers funded management and technical expertise during the start-up phase. Again, leading academics maintain such assistance is also vital in Sweden
- Genopole offers research equipment and facilities to be shared among companies in the incubator

## 6. A summary of the conditions for the Swedish biotech industry

Sweden's long-standing favourable position within the global biotech industry has been spurred by a number of success factors, including major investments by e.g. AstraZeneca and Pharmacia in pharmaceutical R&D, a high level of academic excellence, good collaboration between academia and industry, and a growing venture capital industry.

However, SwedenBIO's National Biotech Agenda analysis shows that this position is now challenged. Pharmacia are no longer supporting the growth of intellectual capital to the same extent, and several countries have implemented aggressive measures designed to generate attractive job opportunities in their countries. In the last five years, such changes have rendered the Swedish biotech environment relatively unfavourable, as summarised in exhibit 6.1.

In general, the USA has an outstanding environment for the research-intensive biotechnology industry. Recent changes in France and Canada have also elevated these countries to second place overall. The relative competitiveness, by location, for biotech R&D, was found to be worst in Germany and Sweden. Countries outside the benchmark with an increasingly good environment for biotechnology R&D are Denmark, Israel and Singapore.

OVERVIEW OF ENVIRONMENT FOR BIOTECH INDUSTRY

	Tax incentives for R&D expenditure	Public Expenditure in Biotech R&D	Access to industrial financing	Education and Attraction of Human Capital	Regulatory and clinical trials environment	Governmental leadership
USA						
U.K.						
France						
Canada						
Germany						
Sweden						

Excellent   
 Very Good   
 Good   
 Average   
 Bad

Exhibit 6.1: Overview of the competitive environment for conducting biotechnology research. Source: SwedenBIO National Biotech Agenda analysis, Dec 2003.

As can be seen, the weak areas for Swedish biotech are:

- A LACK OF TAX INCENTIVES TO CONDUCT R&D. The recent implementation of new tax incentives in several countries, including Canada and France, has effectively attracted a large portion of international biotech investment to these countries, and Sweden now scores last in this category compared to key biotech countries.
- LOW PUBLIC EXPENDITURE IN BIOTECH R&D. The Swedish public investments in the biomedical area are low. To keep up with the leading countries, the Swedish government would need to double its research funding to be on an average for leading EU countries. A further issue is that existing investments lack focus. Considering the importance of cluster organisations to biotechnological development, there is a need to focus investments on leading biotech regions and universities as well key areas.
- DECREASE OF QUALITY IN EDUCATION AND DIFFICULTIES in attracting human capital. Even though Sweden does not suffer from a significant lack of Ph.D.s in the biotech field, the trend in quality is downwards. This has been pointed out by several senior biotech executives, and confirmed when measuring the number of Swedish publications over time. The trend can be explained partly by the lack of prioritising top students and the lack of incentives to attract leading foreign researchers and innovators.
- A LACK OF GOVERNMENTAL LEADERSHIP in life sciences and biotech. Key biotech countries have implemented teams to help governmental understanding of key issues within the biotech sector. These organisational bodies consist of executive committees as well as expert panels and advisors. Such industrial structures are absent in Sweden.

These findings were confirmed by interviews with senior biotech executives. In reply to the Survey question, “In comparison with other countries in general, how would you rate the general R&D environment in Sweden?” 85 percent of the participants answered that they rated the environment either worse or much worse in comparison to the USA. Indeed, the best indicator confirming these findings are true is the fact that the Swedish biotech industry is losing ground to other nations. For example, both the number of biotech employees and the number of biotech companies in Canada have grown twice as fast as in Sweden in 1998 - 2002.

This disparate development within the biotech industry can be explained partly by the lack of support from the Swedish government. If Sweden is to build and retain a prospering biotech industry, the government needs to realise that it holds the key to the future and they need to act swiftly and decisively.

## 7. Governmental actions to secure growth and value capturing

Sweden hosts one of the world's leading biotech industries, thanks to a strong history of research excellence and unsurpassed track record of industrial breakthroughs not only in pharmaceuticals but also in developing new drug discovery tools and medical technologies. As pointed out, the Swedish competitive position has in recent years been threatened mainly due to lack of governmental support and interest, while other nations are launching ambitious initiatives to stimulate their own national biotech industries. Despite this, all the components required to create a new economic pillar for biotech growth in Sweden remain. Based on the results presented in this study, a number of actions are recommended, which rapidly could bolster Sweden's position as one of the best regions in the world for biotechnology innovation, industrial development and employment.

Most of the recommendations can be realised immediately, with limited costs for the Swedish government and taxpayers. The dynamic effects with increased private investments, employment and tax revenues will also repay investments within a few years.

SwedenBIO believes that major efforts is necessary to achieve the following:

- Strengthen the science and knowledge base
- Strengthen the capital supply
- Strengthen governmental leadership in the biotech industry

*“The Swedish government can jointly with regional political heads of the strong biotech regions provide effective support for growth“*

*Magnus Lundberg, CEO Pharmacia Diagnostics*

### Strengthen the Science and Knowledge Base

1. Increase funding for competitive biomedical R&D projects
2. Stimulate R&D investments through directed tax incentives
3. Enable work permits for foreign scientists and management
4. Extend tax brake for foreign specialists and management from 3 to 5 years and speed up handling process
5. Re-focus university education by funding more post-docs and professor chairs and fewer Ph.D. graduates
6. Co-fund a two year Post-Doc Program for the life science industry
7. Stimulate interest for biotechnology at elementary schools
8. Focus R&D funding to 3-4 geographic centres-of-excellences
9. Focus R&D funding to key scientific areas

### Strengthen the Capital Supply

10. Create a pre-seed fund to enable innovators to validate the technical and commercial concept
11. Encourage Business Angels to invest in early-stage, biotech ventures
12. Create a seed and bridge fund to co-invest with private investors
13. Create an outsourcing fund for companies to collaborate with universities
14. Encourage Pension Funds to invest in biotechnology

### Strengthen the Governmental Leadership

15. Establish a National Biotech Committee at the Department of Industry employment and communications
16. Establish centre of excellence network program
17. Secure the leading position in clinical trials
18. Educate the public in the benefits of biotechnology

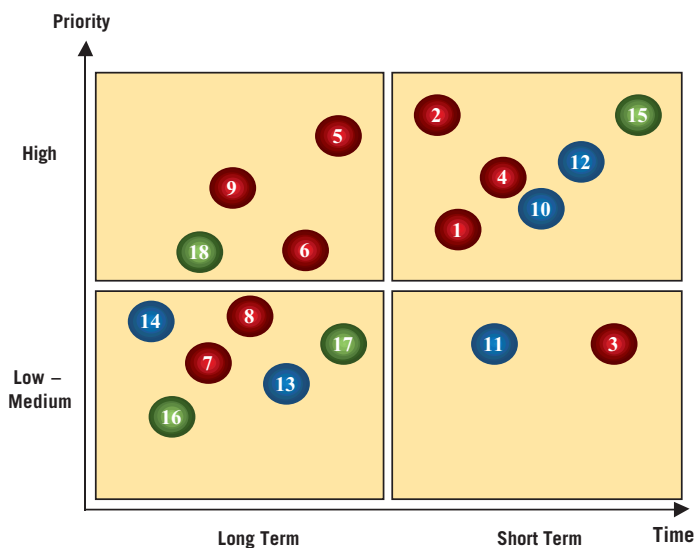


Exhibit 7.1: Summary of prioritized actions needed to get Sweden on par with leading biotechnology countries. Source: SwedenBIO National Biotech Agenda, Dec 2003.

## 7.1 Strengthen the science and knowledge base

The long term success of the Swedish biotechnology industry is extremely dependent on the government's ability to support and retain a world class environment for biotech and medical R&D. SwedenBIO believes that to create such an environment the government should stimulate investments in R&D through directed tax incentives.

### – INCREASE THE FUNDING FOR COMPETITIVE BIOMEDICAL R&D PROJECTS

To support the science community effectively, funding should be based on competition to ensure quality and effectiveness. However, the analysis has revealed that this type of funding has decreased over the last ten years, while competitive funding in other countries is rapidly increasing. As a result, Sweden is now investing least into biotech R&D among the leading biotech nations (less than 50 percent per capita). To reach competitive levels significant efforts must be made. SwedenBIO estimates that an additional annual 300 million SEK is needed initially although in the long term perspective more money must be invested. These funds should be administered through an existing organ, such as Vetenskapsrådet or Industrifonden, to avoid more administrative costs and should be distributed on a competitive basis.

*Estimated cost: 300 million SEK annually*

### – STIMULATE R&D INVESTMENTS THROUGH DIRECTED TAX INCENTIVES

The report shows clearly that many nations stimulate investment in life science R&D by making such investments tax deductible. This kind of encouragement does not currently exist in Sweden, limiting the level of investment in R&D and consequently hindering the growth of existing and new companies. The government should introduce tax incentives for investment in R&D, similar to those introduced in France and Canada. Tax deductions would be based either on an absolute amount or on the increase in R&D investment from one year to the next, with small investor companies benefiting from extra tax deductions. Swedish tax legislation for R&D investments should be as good as in the best EU countries.

*Estimated cost: 0, depending on program*

### – ENABLE WORK PERMITS FOR FOREIGN SCIENTISTS AND MANAGEMENT

The ability to recruit the best company personnel and students into the biotech community, whatever their country of origin, is an essential factor in building a successful biotech industry. However, Swedish legislation does not automatically provide foreign research students with a work permit. A system that more easily grants leading researchers with work permits should be established immediately, to help capitalise on the knowledge offered by foreign specialists and management. Examples of similar initiatives are the Green Card systems in the USA and Germany.

*Estimated cost: 0*

– EXTEND TAX BREAK FOR FOREIGN SPECIALISTS AND MANAGEMENT FROM 3 TO 5 YEARS

Individual scientists and specialists are often responsible for pushing the frontiers of science forward. Key individuals with specialist skills are therefore extremely important to the continued success of the biotechnology industry. For Swedish companies, it is difficult to recruit leading specialists and management, due to high personal income taxes and as the tax breaks are shorter and complex to get, and the scope of eligible positions is narrower. The existing tax break should therefore be extended from three to five years, and encompass not just foreign scientists but also key personnel in e.g. management, IP and finance. Canada recently expanded its tax break from three to five years in order to facilitate the development of Canadian biotech companies, through the encouragement of foreign specialists.

*Estimated cost: 0*

– RE-FOCUS UNIVERSITY EDUCATION BY FUNDING MORE POST-DOCS AND PROFESSOR CHAIRS AND FEWER PH.D. GRADUATES AND LIFE SCIENCE STUDENTS

The number of Ph.D. and life science students in Sweden has been increasing rapidly over the last ten years and is larger than the current demand for Ph.D. graduates. Conversely, the number of funded professorships and lectureships has not been increasing at the same rate. The upshot is that biotechnology Ph.D. graduates are increasingly being forced either to work in non-biotech fields, move abroad or become unemployed, which represents a major waste of skills and governmental resources. The government should provide adequate career possibilities for talented researchers, by providing fewer Ph.D. places, and finance more mid- and high-level positions in academia (e.g. post-docs, professorships).

*Estimated cost: 0, refocus of existing funding*

– CO-FUND A TWO YEARS POST-DOC PROGRAM FOR THE LIFE SCIENCE INDUSTRY

The education of Ph.D. graduates does not match the needs of the Swedish biotechnology industry, and additional training and education are needed in a company environment. To remedy this, the government should help make the transition of Ph.D. from academia to industry easier by co-funding a program for post-doc researchers moving into an industrial environment. This would both stimulate the transfer of talent to the industry, and help bolster industry–university collaboration and knowledge transfer. Similar programs could also be developed for newly graduated university students getting scholarships to do explorative research with co-funding by the industry.

*Estimated cost: Low, depending on program*

– STIMULATE INTEREST IN BIOTECHNOLOGY AT ELEMENTARY SCHOOL

Interest and basic knowledge-building within the sciences, including biotechnology, should start at the level of elementary school education. Unfortunately, the Swedish elementary school environment does not include appropriate equipment or adequately educated teachers for biotechnology. The government should introduce the subject as mandatory within elementary school education, provide both teachers already in the schools and students who are training to become teachers with basic training in biotechnology, as well as providing schools with equipment for biotech experimentation.

*Estimated cost: Low, depending on program*

- FOCUS R&D FUNDING TO 3-4 GEOGRAPHIC CENTRES-OF-EXCELLENCE

Swedish research funding is often characterised by being evenly distributed geographically, which can mean that whilst many research organisations receive some resources, few receive enough to compete on an international level. Sweden needs to focus the limited resources on fewer, but better financed research groups. Because limited resources make specialisation a necessary research strategy for a small nation like Sweden, the ability to compete will be boosted by focusing available R&D funding on research institutions situated in the established biotech clusters of Mälardalen (Stockholm-Uppsala), Medicon Valley (Lund-Malmö) and Gothenburg and the more recently established universities of Umeå and Linköping.

*Estimated cost: 0*

- FOCUS R&D FUNDING TO KEY SCIENTIFIC AREAS

By the same token, Swedish research funding is too evenly distributed across different scientific disciplines, resulting in too little funding in those areas, which can feasibly compete at an international level. To improve this, key scientific areas should be selected as funding priorities. Sweden has a strong tradition in e.g. metabolic and cardiovascular diseases, CNS and immunology/inflammation research. Drug development in both proteins and small molecules and drug discovery tool provision are areas of Swedish strength. Environmental biotechnology and functional foods can be of interest but hosts relatively few companies.

*Estimated cost: 0*

## 7.2 Strengthen the capital supply

Increasing numbers of patent applications and published papers in leading science magazines and journals indicate that Sweden is not suffering from a lack of ideas. The limiting factor at the moment appears to be the process of effectively developing these ideas further and selecting those that have a true business potential. SwedenBIO believes that to facilitate this process the government should:

– CREATE A PRE-SEED FUND TO ENABLE INNOVATORS TO VALIDATE THE TECHNICAL AND COMMERCIAL CONCEPT

After the investigational phase of a research project, there is often a need to validate both the scientific/technical proof of concept, and the business potential. Although such validation cost little in financial terms (normally between 0.5-2 million SEK), the money available for such studies is currently scarce in the university setting. As a result, researchers are forced to form a company in order to raise the necessary capital, resulting in new business that has been established without a fully validated concept. To remedy this, the government should provide researchers with funding to examine the soundness of their technical innovations before forming a company. Such a fund would, in the initial phase, require approximately 200 million SEK p.a., and could be administered through university holding companies, to avoid extra administrative cost. The companies emerging from such processes should have to return money to the fund, if they are successful. If not, no money should be returned.

*Estimated cost: 200 million SEK annually*

– ENCOURAGE BUSINESS ANGELS TO INVEST IN EARLY STAGE, BIOTECH VENTURES

In leading biotechnology countries, such as the USA, Germany and the U.K., networks of business angels (individuals who invest in start-up companies), are behind several of the most successful biotech companies. Despite the fact that there is also a great need for this kind of capital in Sweden to support many of the start-up biotechnology companies, business angel networks are absent, primarily due to tax legislations. The government could play a major role in stimulating the foundation and success of new biotech companies by making investment in them tax-deductible for private individuals, e.g. like in Canada and the US.

*Estimated cost: 0*

- CREATE A SEED AND BRIDGE FUND TO CO-INVEST WITH PRIVATE INVESTORS

Most Swedish biotech companies are financially vulnerable and will need additional capital in the future to survive. This SwedenBIO report indicates that the problem of capital supply is two-fold: firstly, the capital available in the system is scarce, and, secondly, the amount of raised capital is too little to effectively leverage and market new innovations. To remedy this, the government should provide a co-investment fund. The focus of such a fund would be to offer private venture capitalists joint investments at an early stage. The fund should be managed independently and professionally, and make investments only if a private investor matches the venture capital investment. In this way, fund capital can be most effectively utilised and leveraged. Based on financial analysis and international benchmark, at least 300-400 million SEK is required annually for Life Sciences to match international levels. Part of this funding should be possible to get from EIB, similar to the German high tech growth fund launched in 2003.

*Estimated cost: 300-400 million SEK annually*

- CREATE AN OUTSOURCING FUND FOR COMPANIES TO COLLABORATE WITH UNIVERSITIES

In comparison with the USA, the level of collaboration that combines basic research conducted at the universities, with applied research conducted in companies, is close to non-existent in Sweden. This is often cited as a limiting factor to the advancement of biotech development in Sweden. To increase the level of university-company collaboration, the government should establish a fund to help promote co-investment in academic research. A company willing to outsource research activities to an academic department would thus receive financial support from such a fund. Analyses suggest this fund should, initially, have available approximately 50 million SEK, and could be administered by an existing governmental organization, such as Vinnova, to help reduce administrative cost. The current activities from Vinnova are on a much too small scale.

*Estimated cost: 50 million SEK*

- ENCOURAGE PENSION FUNDS TO INVEST IN BIOTECHNOLOGY

Adapting the investment criteria of public pension funds would make it possible for such funds to invest minor amounts of their total capital in growth industries such as biotechnology, and could thereby represent an important source of capital for research and development. A similar strategy has been launched in California, where the largest pension fund, CalPERS, has invested 285 million USD in five companies. Similar programs are also in place in Canada.

*Estimated cost: 0*

## 7.3 Strengthen the governmental leadership

The creation of a clear biotech leadership will be crucial for Sweden both to be able to react to trends and issues within the industry, and to implement change.

SwedenBIO believes that to create such a leadership the government should:

- ESTABLISH A NATIONAL BIOTECH COMMITTEE AT THE MINISTRY OF INDUSTRY, EMPLOYMENT AND COMMUNICATIONS  
Active government leadership is a key factor in establishing Sweden as a global leader in biotechnology. Industrial development is currently hampered by limited co-ordination and a lack of common vision within government, industry, and academia. The government should establish a National Biotech Committee, with the objectives of increasing co-ordination and facilitating biotech growth. The focus should be to set a common agenda for Swedish biotech, and introducing measures designed to help make Sweden one of the global leaders. The committee should include 3-4 full-time employees at the Ministry of Industry & Trade, with executive powers including budget responsibility: and an expert advisory committee consisting of top-representatives and experts from government, industry, academia and financial community. The Department of Industry & Trade and Department of Education are the two most obvious sponsors, but a wide representation is essential.

*Estimated cost: 5 million SEK annually*

- ESTABLISH CENTRE OF EXCELLENCE NETWORK PROGRAM  
In 1989, Canada introduced the centre of excellence network program (NCE) to drive projects in defined high tech areas. The NCE's have succeeded above all expectations in terms of company creation and knowledge sharing. In the Canadian model, each network receives 17-35 million SEK on an annual basis. Sweden should assess the possibility to establish a similar centre of excellence network with leading Swedish professors, the biotech companies operating in the field of interest and students and post-docs conducting relevant research. The objectives of such a network should be to define and drive projects, act as an expert panel and deal with issues in the field. The role of the government would be to provide funds for project management, infrastructure and activities, as well as measuring results. Sweden's initial NCE program could include 2-3 networks with a focus on "next generation" technology areas (e.g. stem cells, nanotechnologies).

*Estimated cost: Low, depending on program*

- SECURE THE LEADING POSITION IN CLINICAL TRIALS  
Clinical trials are vital to the successful development of a national biotechnology industry. In recent years, however, Swedish hospitals and Landsting (the counties) have been forced to focus on providing more care and carry out less research. It is strongly recommended that the government should more actively encourage the counties and hospitals to conduct more clinical trials and participate in clinical research. Governmental activities should include:

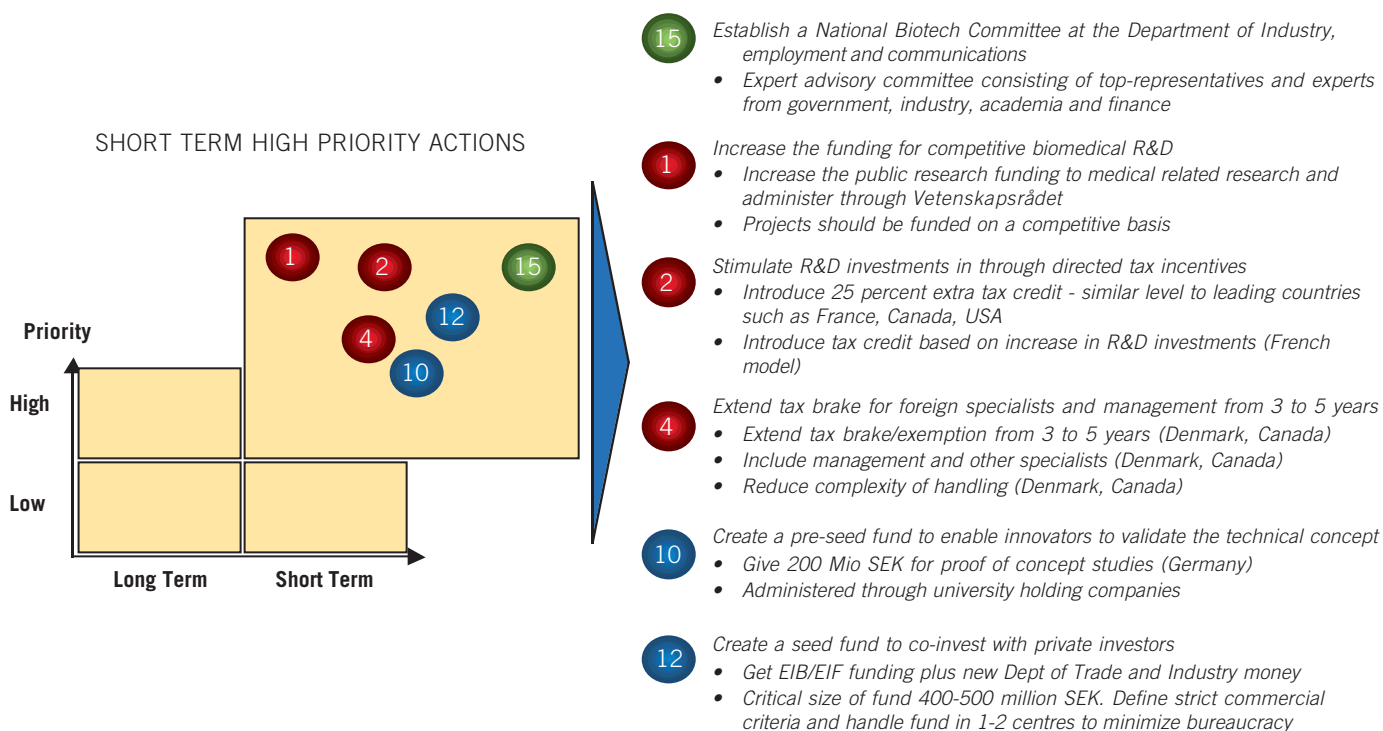
providing a merit system for medical doctors conducting clinical trials; change the legislation on bio-banking to reduce the administrative burden; and develop centres of excellence for clinical trials. Furthermore, hospitals should be encouraged to provide pre-screened patients, and an academic merit system for doctors and nurses conducting clinical research.

*Estimated cost: depending on program*

– EDUCATE THE PUBLIC IN THE BENEFITS OF BIOTECHNOLOGY

The biotech industry faces a number of ethical and legal issues, particularly in areas such as cloning, DNA-registration and stem cell research. Moreover, the level of acceptance of such technologies and the legislation surrounding them closely correlates with the level of understanding by the general public. If Sweden wants to build a leading biotechnology cluster, it must have the support and informed consent of its own population. The government should therefore launch a program to increase knowledge and awareness of the general public on the benefits and challenges of biotechnology. This could be effected through the elementary school system as well as through the provision of funding for seminars and literature for adults.

*Estimated cost: Low, depending on program*



*Exhibit 7.2 Summary of the short term, high priority actions.*

In conclusion, SwedenBIO will with this National Biotech Agenda initiate a close dialogue and interaction with the Government and other key players to secure the future success of Swedish biotechnology industry. The potential is undisputable and Sweden has a good upside potential if decisive actions as described above are implemented effectively in the coming year. The short-term high priority actions outlined below are from a national perspective not very costly, and dynamic effects on the economy should allow Sweden to rapidly capitalize on the outcome.