

The Swedish Research System at a Glance – Key characteristics of a success story

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This report is the result of an intergovernmental exchange to Stockholm, which allowed me to explore the Swedish research system between the 31.5.2005 – 10.7.2005. The information should answer most of the questions¹, which I collected from Austrian research actors before my departure. In addition, the form of this report should give the reader a more comprehensive view on the Swedish research landscape. Special focus was given on those characteristics, which could be of interest for the ongoing development of the Austrian research system.

This report could only be written because of the valuable input of 21 actors² within the Swedish research system, who allowed me to share some of their insights during my stay in Stockholm. I want to thank all my interview partners for their enthusiasm and time!

1. Agency system

The Swedish research model relies more on **bigger agencies and smaller ministries**. Although many aspects of the Swedish research system have changed during the last fifteen years it should be underlined that the structural relations between governmental and business R&D remained stable.

The high concentration of business R&D in few large multi-national companies (e.g. ABB, AstraZeneca, Volvo, Saab, SKF) lays the basis for research policy. With large companies and a SME-sector highly dependent on these large companies there is little need for collective research. Consequently, the institute sector is relatively small in Sweden. Most basic research in Sweden takes place at the universities, university colleges and a handful of private universities which make up the Swedish higher education system. Basic resources are allocated to these institutions from the State, but there are also many other sources.

In the **1970s and 1980s**, the Swedish public system of financing research developed into a pluralistic system with numerous financiers independent of each other. The basic research councils were one part of the system, the many sectoral public agencies with R&D resources another. In addition, the early **1990s** saw the establishment of a number of research foundations aimed at financing research in specific areas. Because of this, a need for the state was seen to guarantee especially the support for basic science. Furthermore, the fiscal crisis during the 1990s made it necessary to reorganise the governmental organisation for research.

In 2000, the Swedish Research Council and other funding agencies were founded. The Swedish Research Council

¹ The questions can be found in the appendix

² The names can be found in the appendix

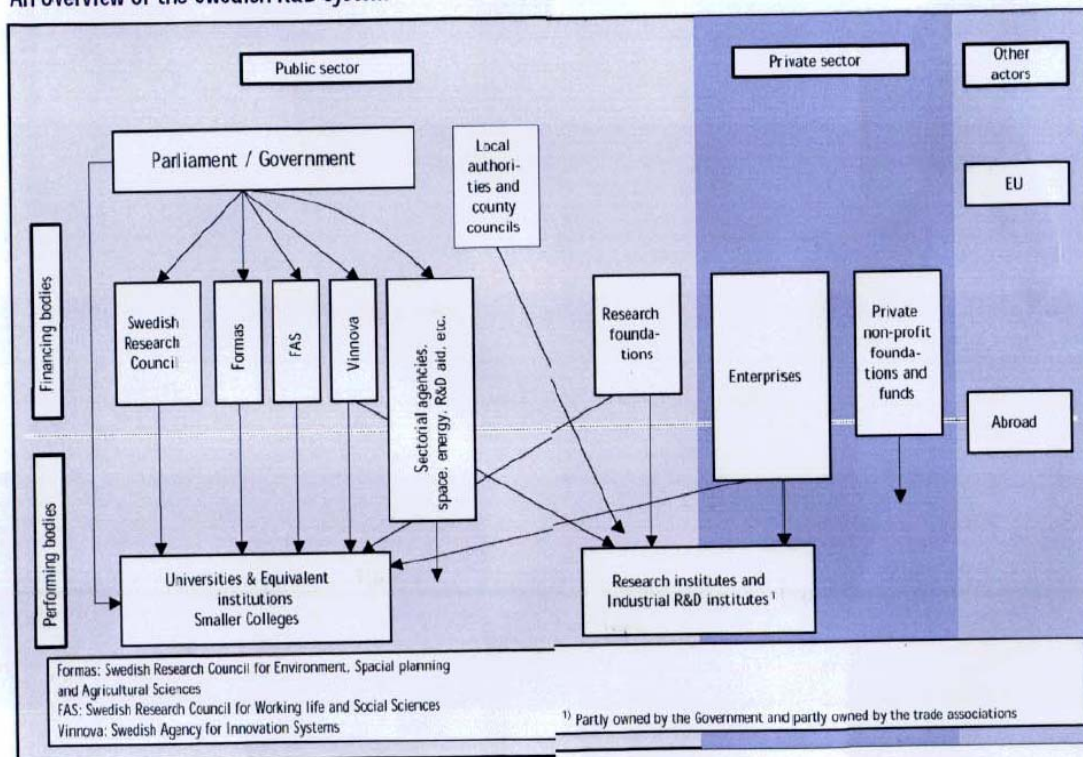
integrates several different research councils (covering different research sectors). Researcher representatives elected by the research community hold a majority of seats in the councils. This researcher-controlled system is of fundamental significance to the quality assurance in the councils. The rationale behind is, that only researchers have the expertise to determine whether research maintains good scientific/scholarly quality.

In 2000, the parliament's decision to reorganise laid an emphasis on this unique mechanism of **researcher's self-**

committees, but have very few possibilities of taking initiatives for new research programmes.

The **Swedish Research Council** is an independent agency of the Swedish Ministry of Education and Science. Caused by the agency system in Sweden, ministries generally have to use their agencies heavily because they employ comparatively little staff (e.g. in the Ministry of Education and Science only 14 people work in the research policy section). To achieve perfect cooperation, the ministries specify yearly targets and methods for the agencies, which can be

An overview of the Swedish R&D system



governance and marked a policy shift. The self-governance policy differentiates the Swedish model from almost all other countries. It also shows how much the public funding sector trusts the national researchers. One obvious aspect of this is that programme officers at the Research Councils work as a secretariat for

both general and quite specific. Efficient target setting contains the simultaneous definition of measurable indicators. A yearly auditing then proves, if the targets were met. The Director General of the Swedish Research Council, which is elected by the Ministry of Education and

Science, is responsible for reaching the targets.

The **Ministry of Education and Science** has overall responsibility for the coordination of research policy in the government offices. It initiates and oversees the preparation of the **research policy bills** submitted during each parliamentary term of office. Because research resources exist within the scope of all ministries, the Ministry of Education and Science drafts its research policy bills in active collaboration with other ministries. The Minister of Education and Science chairs a Research Advisory Board. Other members are researchers and representatives of the business sector. The government has also appointed a scientific advisor, who is entrusted with promoting the interests of research and its role in society.

One important element of Swedish research policy is the “**sectoral research principle**”, by which each sector assesses its own needs for R&D programs and weighs them against other needs for promoting the advancement of that sector. Among the public agencies that allocate sizable resources for research and development work are the National Road Administration, the National Rail Administration and the National Space Board.

Among the public bodies that fund research are a number of **research foundations**: the Swedish Foundation for Strategic Research, the Knowledge Foundation, the Foundation for Strategic Environmental Research, the Swedish Foundation for Health Care Sciences and Allergy Research and the Swedish Foundation for International Cooperation in Research and Higher Education.

These research foundations were established by the Swedish government in 1994. The foundations finance research to a sum of about SEK 1,5 billion annually.

In my interviews, following **drawbacks** of the system were mentioned:

- Sometimes centralization would reduce the overhead costs.
- The European Union tended to see the system as problematic because people from the agencies were not seen on an equal footing with people from the ministries.
- Some of the goals set were politically driven, especially in areas of political hypes.

My interview partners stressed following **advantages** of the system:

- Applications for research money are selected according to excellence criteria.
- The different research councils are competing about public money, which raises their effectiveness.

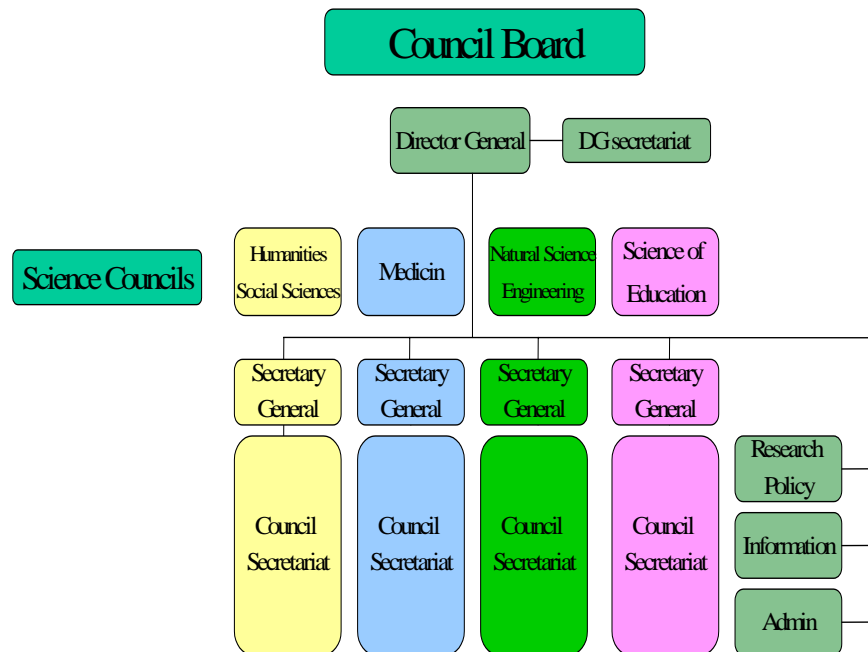
2. The Swedish and the European Research Council

The Swedish Research Council

The Swedish Research Council is a government agency under the aegis of the Ministry of Education and Science which is responsible – at a national level – for the development of basic research and information about research in Sweden. Scientists at Swedish universities and university colleges compete on a national basis for research grants (SEK 2,000 million /~214 million €) from the Research Council. **The Council ranks and finances basic research of the highest quality** in all scientific disciplines. The aim is to ensure that Sweden maintains its leading position as a nation engaged in research.

Since 2001, one way of doing this, is to give special support to the country's most **prominent researchers**. For this reason, extra funds were allocated to 26 excellent researchers from the whole scientific spectrum in 2004. The Swedish Research Council participates in a wide range of international research organisations, to enable Swedish scientists the access to leading-edge scientific equipment. The Council also promotes the government with analyses of research policy and advice on research issues.

The **board** has 13 members - 5 appointed by the government and 8 by the scientific community in elections



organised by university faculties. Each Science Council has 21 members including substitutes (Chair +10 members) - 7 are appointed by the government and 14 by the scientific community. The election at universities takes part every 3rd year. In total, 130 people work in the Council office, about 90 in boards, 100 experts are asked and about 700 people work in evaluation or committees.

Every year, the applications for projects, equipment, research positions etc. are received in May, and then evaluation is done during summer and early autumn before the decisions are made in November and December. Contracts are typically granted for 3 years.

Besides the national research council, my questions addressed the **European Research Council**. The European Research Council is generally seen as

very positive; some interview partners also claim it a Swedish initiative. It should be seen as a big benchmark for researchers and already now the research community is very much interested in the European funds. The worries are, that maybe the focus will be too much on applied science and that new trust problems and conflicts between the research agencies will arise.

The success will depend on the amount of money granted, the degree of bureaucracy, the number of applications received and on technical forecasts. There was no fear that the national research councils would become obsolete because rather a small amount of researchers will receive grants by the European Research Council and there will still be specific national needs, which can only be served by national Councils.

3. Research strategy

The state has the overall responsibility for ensuring that Sweden develops and makes use of new knowledge. Because financial research resources exist within the scope of all ministries, the **Ministry of Education and Science** has the overall responsibility for coordination.

It initiates and oversees the preparation of the **research policy bills**, which are published usually in the mid of each governmental period. The process of formulating the research bill usually starts 2 years earlier by asking for input from all affected groups. Following this, there is a common discussion with the ministries on how the report should be written in order to ease an agreement later on. The discussion at governmental level results in final changes of the bill.

The bills contain **general directions** on where the public research money will be spent in the next governmental period and by whom. They include a number of statistics to undermine the statements made. The fundamental theme of the last research bill Research for a Better Life (Government bill 2004/05:80), which was published on the 22nd March 2004, is investment in research and development to promote high scientific quality, together with a concentration of efforts in areas that can lead to social development and business growth. Special initiatives are proposed in research in medicine, technology and sustainable development. At the same time, priority will be given to internationally competitive research environments, i.e. centers of excellence.

Main opinions expressed by my interviews were:

- The research system stresses a lot the bottom up approach for research funding. Nevertheless, some directions are formulated top down. Some criticized that this approach is a short term approach. Sometimes highly praised modern directions are not even understood by the ones who want to foster them.
- If the focus today is on actual society needs, the solution will only be there within 20 years, when the problem might have gone.
- There is little effort on innovation and the research system is looked at separately from the innovation system.

- There are only limited new opportunities because most of the money is already earmarked.
- The universities were involved and had to create their research strategy, which was then not considered in the discussion process.

It was unclear to what extent concentration on areas is good. It might only be good where a lot of expensive equipment is needed, whereas collaboration was always regarded as positive. It was stated that the visibility of the research strategy is low outside the funding channels, but it was not clear if that was necessary.

In my interviews there was plaudit that the industry was involved very early in working groups to participate in the creation of the bill creation, that the objectives are very good, that larger money is spend to stronger research groups, that the research bills are well written and that the process is a very transparent one.

4. Society

The Swedish research system is top ranked in international statistics and internationally well known for its quality.

The society is very much **pro science oriented** and the trust in science is extraordinary high. According to a study by Vetenskap & Allmänhet conducted in 2004, 85% of Swedes consider that scientific and technological development makes life better for ordinary people. This has gone up from a figure of 65% 25 years ago. In general, Americans and Europeans are less positive about

science. In Sweden too, the attitude towards science is strongly positively connected to levels of education. Swedes are **well-educated**, still 75% find that science and technology is difficult to understand for ordinary people. Young people are more skeptical about research, which raises some worries in current discussions.

My interview partners stressed some **methods used in promoting science in society**:

- The university system involves 350.000 students and 100.000 new students every year, which channel knowledge about the universities to most families in Sweden.
- Science competition and especially the Nobel Prize awards have a great publicity.
- Academies are promoting science, but can only do this on a low scale because they do not receive a lot of public money.
- The press, although not having many science journalists, mostly publish positive articles on science and its importance on the economy. Until now, there were not many reports on scandals.
- There is regular science news on TV.
- At the science theatre Klara Söppeteater in Stockholm professors act. Other actors ask naïve questions, which the audience would not dare to ask. This way, the scientists are confronted with concerns of ordinary people to provoke discussions. For school classes lunchtime performances are organized. The Science Theatre

- is now part of the European Theatre of Science (ETS).
- Centers of excellence must have an information strategy to promote their science results.
 - The Swedish research council is offering an expert answer system (www.expertanswer.se) for journalists, whose questions are transferred to the universities for reply. In addition, press releases from the universities are collected and published.
 - The Swedish Research Council offers a website (www.forskning.se) to explain science results for a broader audience.

5. Relationship between the public funding sector and the scientists

In R&D related to the GDP, business sector investments are 2,97%, whereas the public sector invests 0,9%. By looking at this fact one might raise the questions what role public money plays in the system and how scientists sense their relationship with the public funding system. By looking closer at those figures, some might see that the government focuses more on the research issues (the R of R&D), whereas companies focus on development issues (the D of R&D).

The public research system is supporting R&D by **direct funding**. Special tax reductions for research do not apply. Those subsidies, which are mainly addressing the university system, fall in two parts: all universities and university colleges receive permanent grants (on average 45% in 2003) by the government; the remaining research is externally financed. The money granted

by the research councils is supposed to be competition based; this means that the councils decide which proposals are financed. The goal behind public support is to only use research money in cases the private financing would fail, which sometimes is hard to judge.

During my interviews, the relationship to the public funding sector and the level of funding was found to be good, although some **criticism** was put forward:

- The providers of research money want to influence certain directions and discuss those directions with representative groups. The group members themselves might never be asked.
- Most research money never reaches SMEs.
- Because Sweden is highly regulated there is a fairly high amount of bureaucracy.
- Some money and energy is lost by researchers on sales and marketing only because of competitive application processes.

6. Diffusion of knowledge

The discussion was mostly dominated by the overall **struggle between basic research**, which was also negatively named blue-sky research, and **applied science**, often called need-driven research. Those in favor of the balanced approach were quite happy when both sides complained, which was interpreted as balanced. One meaningful argument for applied science was that research could focus on variables, where the industry believes they could be most useful for usage instead of random testing of variables. One significant argument for basic science was that

more inspiration will come from basic researchers because they do not have to focus on the same types of problems. This results in other points of view considering that the numbers of basic researchers in some fields in comparison to applied researchers in industry is rather small (in some cases 5:500). Another reason to focus on basic science is that companies will hardly conduct basic science.

Beside those quarrels some facts on the Swedish system came up. The public system so far concentrated its money on the university system whereas the companies spent their money within their barriers, which left the **research institutes³ underfinanced** in the middle between those worlds. Larger companies also tend to see the institutes as knowledge leakages, which might be one reason why those institutes are sometimes regarded unattractive from the business side. Policy makers wish that the universities act as collaborators to save additional research institutions. Overall, there is already increasingly more contact between the academic world and the industry proven by the number of academic spin offs.

On the enterprise part there seems to be the problem, that industry research stays within companies borders, that there are red tape problems for founding and running an enterprise, that the tax level is high even for SMEs, that running a business is not a big status symbol in Sweden and more seen as a means to live than a vision of growth, and that entrepreneurial education is failing. The barriers for SMEs to contact universities

are manifold (different language used, mental barriers, long-term focus of research institutions whereas SMEs would need a quick fix, and daily business preventing the workers from long-term thinking and activities...)

On the academic side there seems to be the problem, that the owner of the patent (the researcher himself/herself) does not use it extensively. Therefore, need is for a suitable organization and pre-seed money. Recently, more and more universities - supported by extraordinary governmental money - created innovation centers to help patent owners. A more fundamental problem is that often those people, who are good in inventing things, are not the best entrepreneurs. In former years, more professors came from industry, which was often quite useful in fostering collaboration, but nowadays the attitude of many scientists is against applied science and patenting activities because they are rewarded mainly for research activities leading to publications.

Between the academic and the enterprise job market the transparency could be improved. More intellectual matchmaking between the different actors with the help of agencies could strengthen the collaboration between those worlds. Until now, it is mostly up to the researcher to start collaboration.

7. Research infrastructure

In general, the feeling about the national research infrastructure was good. To share resources there is a strong need to know who is doing what. As **human resources group around research infrastructure**, it can be an important community building instrument.

³ defined as common research institutes between companies and organized as a public private partnership model

The **research equipment is paid by** universities from the regular budget, by special research infrastructure projects including strong research environments by the committee of research infrastructure within the Swedish Research Council, by project money (indirect costs are usually around 50%), and by research foundations like the Wallenberg foundation. The Wallenberg foundation is a private organization, which grants are made primarily to fund very expensive research equipment.

The Swedish **universities have to rent the public buildings** from the government, which burdens their yearly budget for research infrastructure. One of my interview partners claimed, that it is also quite possible to become the

“slave of equipment”, because of the ongoing maintenance costs and human resources one has to employ for usage. Companies can get access to public research infrastructure by employing PHD students, who use the university infrastructure.

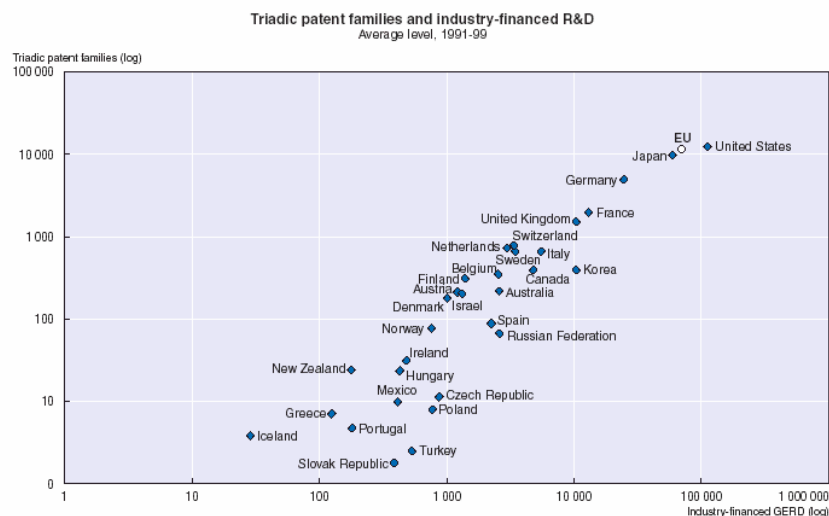
At the moment Sweden analyses possibilities that the European Spallation Source⁴ (ESS) project is constructed in Sweden.

⁴ a next generation facility for research with neutrons

8. Patent Market

Patent intensity is quite high. As can be seen in the graphic below, countries with a high level of R&D industry-financed R&D expenditure (such as the United States, Japan, and Sweden) also have large numbers of triadic patent families⁵.

Reasons for high patent activities might be the industry structure and the business culture. Research intensive companies have to have patents for



Source: OECD, Patent and R&D databases, November 2003.

competition and structural reasons. Furthermore, there is a tradition of innovations supported by a committed business culture. For example, years ago, it was quite common in many companies to distribute money to employees for fresh ideas. The society considers having a patent a status.

At university the **patent owners are the researchers**, although there is some discussion at the ministries that the ownership should be transferred to the

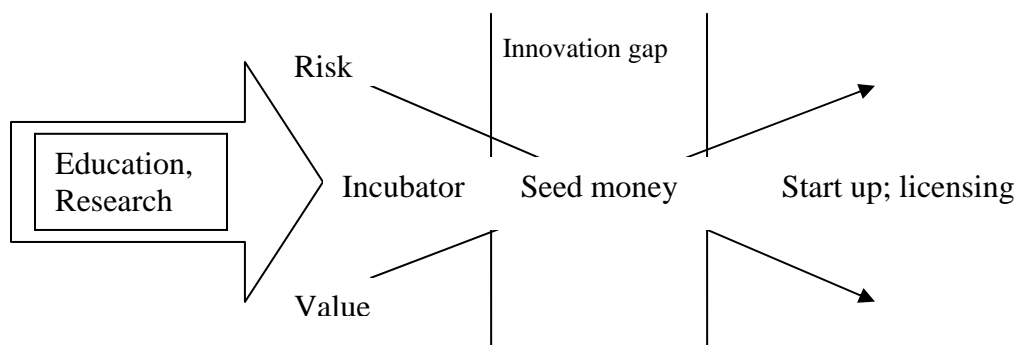
⁵ Inventions protected at the European Patent Office, the Japanese Patent Office and the US Patent and Trademark Office.

universities. For researchers it is better to publish than to patent due to the patenting costs and the fact, that patenting is not much rewarded in the academic world. Strong research groups usually have both – high publications and patent activities. Recently, incubators were founded within universities to help research finding people for implementation and carrying the patent forward.

9. Venture Capital Market

Sweden's venture capital market is above EU average, but lower than OECD average according to OECD data. The share of the high tech sector of venture capital is both lower than EU average and OECD average.

In the interviews, the venture capital market was regarded as good, but the **seed capital market as bad**. The venture capital market varies strongly from sector to sector. The graphic below



from the Swedish Federation of Enterprises shows that for businesses financing the low risk and high value part is lucrative, whereas the really early stage investments are often avoided because of the risks involved. These risks are mainly stemming from long

innovation cycles (sometimes decades) and risky predictions.

The early stage money is derived from business angels, especially in the Stockholm area, and credit organizations like Innovationsbron.

10. Globalisation

The biggest concern was to keep the high level of business research in Sweden. Because of competitive research environments abroad, competition is expected to increase in research activities. Depending on a few large companies, the Swedish system is **vulnerable**. Its strength is the quality basic research system with its links and contacts to industry. If companies move, they might also loose some of their knowledge chains. Until now, Sweden is still competitive proven by the high part of foreign direct investment related to R&D.

Nevertheless, there is some risk that research activities might move because R&D is often conducted close to manufacturing sites, close to skilled and cheap workforce and close to research money flows. Some research groups

already claim that they will move away because their area of interest is prioritised higher in other countries.

Quite naturally, the question arises, which methods can be deployed to stop this movement. In a short answer, **Sweden must try to be the best.** Research activities will not move if Sweden has the best research activities, people, infrastructure and education.

If research is done somewhere else, the **best strategy might be cooperating** to create spillover effects to Sweden. This is naturally easier if the research is done within one company. An interesting example to show how difficult cooperation can be on public level is a cooperation project between Finland and Sweden, which was only possible because the Finnish government supported their researchers and the Swedish government supported their scientists. On the EU level too, all national administrations look on how much money flows back from Brussels.

11. Attractiveness of Sweden as a research location

Companies still choose to invest in R&D in Sweden. Research often flows where the production is placed, where the market is and/or where basic knowledge is available. The Swedish industry structure is heavily dependent on research. There are a handful of **large companies, which are successful** and tend to grow, although Sweden lacks medium sized companies. One reason for that might be that the unions focused on big companies for a long time. Some innovative and small companies built around those large companies.

The most frequent answer to my question, why Sweden is such an attractive research location, was simply **history**. Beginning from the 19th century, there has been a good climate for industrial development and public was aware that R&D is important for the well-being of the nation. Cooperation and trust have been high between politicians/the public sector, the business community and researchers in academia – the so-called Triple Helix. It was stated very often, that it is good to build on something if there is already something there.

In a broader perspective, there has been a **stable environment** characterized by good infrastructure- and labor standards in which people and companies could develop. Thus, strong research environments were created and now being fostered further by public programs. Sweden was also active in promoting these research environments.

Human resources are the most crucial success factor for the prosperous Swedish research system. Sweden has an innovative engineering society with a positive stance to innovative processes. It is particularly a mental question how easy things can be changed. Famous scientists have played a role model for young scientists for centuries and especially the Nobel prize award regularly creates new ones on a yearly basis. The Swedish university system educates many Swedes to work in the field of science and the importance of internationality was understood very early. Moreover, the traditional Nordic leadership style with a fair share of democracy leads to a big arena for employee- responsibility. This is an excellent model to spur creativity.

Appendix: List of questions

1. What is the Swedish research strategy? Who creates it and how? Is **the sectoral research principle** a good system? How visible are the research bills?
2. How does the cooperation between **science and economy** look like (incl. SMEs and industry)? Which role plays basic research? Through which channels do the results **diffuse** to applied research? How can this cooperation be improved?
3. How does the cooperation between **science and society** look like? Which role is taken by the press? Are the **academies** of use?
4. How does the cooperation between **science and the public funding system** look like? Which role plays the government, if most of the research money comes from companies? Which **framework conditions** lead to higher research incentives from companies? Which direct and indirect subsidies exist? Which consequences do those instruments have?
5. Which **research infrastructure** is offered by whom (scientific equipment, start up centers, universities of excellence, technology parks, centers of excellence...)? What are the infrastructural problems? Is there infrastructure sharing?
6. Why do so many firms participate in the **patent market**?
7. What characterizes the **venture capital market**?
8. Do companies research **abroad**? In which countries? Is research output imported from abroad?
9. Why is Sweden such an **attractive research location**?
10. Austria is on the **transition to a system relying more and more on agencies** like the Scandinavian countries. How do national administrations and the national agencies **cooperate**? Are there **any advises** for this transition period especially how division of work is done?
11. What is your experience with the number of **funding channels**?
12. How is the **Swedish Research Council** organized?
13. What is the position to the **European Research Council**? Will the role of the Swedish Council have to change in the light of this European initiative?

Appendix: Interview partners

Organisation	Website	Name	Email
Ministries			
Ministry of Industry, Employment and Communications	www.regeringen.se	Ann- Katrin Berglund	ann-katrin.berglund@industry.ministry.se
Ministry of Education & Science	www.regeringen.se	Mariann Samuelson	mariann.samuelson@educult.ministry.se
Research councils			
FORMAS	www.formas.se	Hans - Örjan Nohrstedt	hans-orjan.nohrstedt@formas.se
Swedish Research Council	www.vr.se	Lars M Nilsson Ulf Sandström	lars.nilsson@vr.se us@vr.se
VINNOVA	www.vinnova.se	Thomas Liljemark	thomas.liljemark@vinnova.se
Analysis			
Institute for Growth Policy Studies	www.itps.se	Göran Hallin	goran.hallin@itps.se
Support			
EU/FoU-rådet	http://www.eufou.se http://www.almi.se/almi_in_english.html	Hans Bergman	hans@eufou.se
ALMI Företagspartner AB	http://www.almi.se/almi_in_english.html	Marie Selberg	marie.selberg@almi.se
Universities			
Royal Institute of Sweden in Stockholm	http://www.kth.se/eng	Olle Grinder	
Industry			
Hynell Patentavvälte	www.hynell.se	Peter Kylin	peter.kylin@hynell.se
Böhler Uddeholm	www.uddeholm.com	Lennart Jönson Henrik Jespersen	lennart.jonson@uddeholm.se henrik.jespersen@uddeholm.se
Inova	www.inova.nu	Victor Isaksen	victor.isaksen@inova.nu
Interest groups			
Confederation of Swedish Enterprise	http://www.svensktnaringsliv.se/index_english.asp	Peter Johansson	peter.johansson@svensktnaringsliv.se
Association of Swedish Higher Education	www.suhf.se	Bengt Karlsson	bengt.karlsson@suhf.ki.se
Academies			
Royal Swedish Academy of Engineering Science	www.iva.se	Thomas Malmer	tm@iva.se
Others			
Patent office	www.prv.se		
Research press		Kajsa Eriksson Lena Wollin Maria Koblanck Gustav Löfgren	kajsa.eriksson@vr.se lena.wollin@vr.se maria.koblanck@vr.se gustav.lofgren@vr.se