

A scientific tradition with strong historical foundations

Sweden is for its size one of the world's leading research nations. Today some 80 000 researchers are working here. Many of them belong to international leaders in their respective fields. Total investment in research and development on a per capita basis is the highest in the world after Israel. An analysis from New Zealand recently showed that no country has as many top-ranked universities in the world in relation to population as Sweden.

Sweden also has a proud history in the scientific area. Carl von Linné is one of the most prominent botanists in the history of science. Svante Arrhenius more than 100 years ago was able to forecast the impact of carbon dioxide on producing the greenhouse effect. Anders Celsius invented the temperature scale used throughout the world. Jöns Jacob Berzelius is one of the great names in the history of chemistry. He is one of a group which has helped Sweden to establish a world record when it comes to the discovery of elements. Of the 92 elements in nature, 23 were discovered by Swedish chemists over the period 1735-1879. In 1938 Lise Meitner came to Sweden as a refugee from Nazi Europe, and during Christmas of the same year, she and her nephew Otto Frisch solved the enigma of fission processes at a small hotel in Kungälv. Meitner later became a Swedish citizen.

The work of these researchers reminds us of a feature of fundamental importance to the very nature of research - namely its time dimension. The diversity of species and global warming are issues that are at the very top of the political agenda. When issues such as these are being discussed, scientific findings from long ago are often cited. In the 1890s Arrhenius, using just paper and pencil, calculated temperature changes in the atmosphere and he could hardly have suspected that his achievements would still be celebrated at the beginning of the 2000s.

Not all knowledge can have direct applications. But experience shows that a solid base of knowledge, even knowledge that initially does not appear to be useful,

increases the opportunities for developing society and making a better life possible.

The Nobel prize plays an important role in the international perception of Sweden as a prominent scientific nation. Alfred Nobel was both a skilled inventor and a successful businessman. The Nobel prize would not have existed had he not been able to commercialise his technical breakthroughs. The history of Swedish science is also the history of successful exploitation. It also records the work of inventors and innovators, who found solutions to concrete problems and created products enabling people all over the world to lead a better daily life, with inventions such as safety matches, ball-bearings, separators, gas accumulators, dynamite, the refrigerator and much else. They provide the basis for the birth of world-class industry in Sweden.

In more recent decades Swedish researchers have developed many important pharmaceutical products and medical equipment. Some examples are the growth hormone, Genotropin, Losec, the medicine for stomach ulcers, as well as the gamma knife and pacemaker.

Eli F Heckscher and Bertil Ohlin's trade theory is still fundamental to research on international trade throughout the world, and their work just as that of Arrhenius, has experienced a renaissance in our time as the effects of globalisation are being analysed. Swedish research into peace and conflict is respected throughout the world. The term "Stockholm syndrome" was coined by the psychiatrist and researcher, Nils Bejerot, and has become established in international psychiatric research. Many such examples can be given.



Goals of research policy

The overall policy of the Swedish Government is to strengthen Sweden's position as a research nation and thereby increase its scientific competitiveness in a globalised world. This is primarily to be achieved in three ways.

Strengthening independent research

Independent research in science is crucial for identifying areas of great importance for the development of society, both in our immediate surroundings and on a global level. Investments in applied research and product development require a strong foundation in basic research.

The Government's policies are intended to promote and further strengthen independent research. The financial frame will be expanded through a substantial increase in funding. Diversity in the funding system is being strengthened and the autonomy of higher education institutions increased.

The Government has also taken the initiative in launching a number of strategic research initiatives. This means substantial resources are allocated to research in certain areas after a rigorous evaluation process. This initiative also underlines independent research, but within broad research areas that have been identified as particularly important.

Promoting research of the highest quality

The Swedish research landscape has a number of world class "peaks". Often this involves areas where Swedish industry is investing heavily in research and development. It is not possible for Sweden to belong to the best in the world in all areas. Nevertheless more peaks are needed, average levels need to be raised and the number of weak research areas reduced.

Sweden still has one of the highest number of science publications on a per capita basis. Despite this, quality as measured by the number of citations has declined in the last 25 years. Although the number of articles from

Sweden has increased, the attention they have received has decreased relative to that of other countries. One reason for this is that many more countries than hitherto are investing in research, and competition for attention is increasing. Another factor may be that the quality of Swedish research in certain areas has declined in relation to that of other countries.

A number of countries comparable to Sweden over the last 20-25 years have made substantial investments in research, and as a consequence have increased their share of attention in international publications. At the same time as research has increased in volume, in a number of cases it has had a greater international impact as measured by number of citations. Strategic changes in the organisation of research funding carried out in e.g. Denmark and the UK also appear to have had positive effects on the recognition the research of these countries has received internationally.

The quality of Swedish research must be strengthened. Besides increased funding, the system for research funding must be changed in order to give more explicit priority to quality.

Ensuring that research is increasingly leveraged

The increasing importance of knowledge in society means that higher education institutions should to a greater extent work in an ongoing dialogue with other actors to formulate new knowledge needs, jointly search for answers, and where appropriate, contribute to developing solutions to societal problems.

It is important that research increasingly contributes to economic growth and competitiveness. Larger investments are needed in the best research in areas of relevance for society and industry.

The new research policy

Resources for research and innovation are now being substantially increased in Sweden. The starting point has been based on two fundamental insights:

- Without new knowledge, the greatest challenges to mankind - such as climate change and the greenhouse effect, the energy crisis, water shortages, widespread poverty in parts of the world, the impact of current demographic changes, prolonged international conflicts and the risks of pandemics - cannot be dealt with successfully.
- In an era of globalisation Swedish competitiveness must focus on building high knowledge content into our export products. This is the reason that research, development and innovation are central components of growth policy.

Major increases in resources

Public investment in research and research based innovation is being increased by an additional SEK 5 billion 2012 compared with 2008. This investment represents an increase of 20 % in government funding of research.

The EU Lisbon Agenda sets the goal that the total R&D funding of member states should amount to at least 3 per cent of gross domestic product, of which two percentage points is to come from industry.

As regards total R&D spending, Sweden has already surpassed this goal, primarily as a result of the substantial investments of Swedish companies in research and development. With the additional resources now being allocated the Government anticipates that public sector research funding will reach 1 per cent of GDP by 2009.

Resources distributed based on quality indicators

Traditionally, funding of research in universities and university colleges is done either through direct appropriations allocated on the basis of historically established levels, or through support from external funding agents for specific projects.

Direct appropriations to institutions of higher education is increased with some 15 % with all of the increase and a further 10 % of hitherto direct grants being distributed yearly based on research quality. This gives clear signals to research institutions of higher education to increase research quality and the development of outstanding research environments.

Quality is measured in terms of institutions' capacity to attract external funding and the number of publications combined with a citations analysis. Using quality based criteria for allocating funding should stimulate institutions of higher education into identifying research profiles where they have a relative competitive advantage. A more explicit differentiation of roles between institutions of higher education and greater specialisation can thus be attained.

Research investment in nationally strategic areas

There is a growing appreciation in Sweden and many other countries that there is a need to mobilise research resources in certain areas.

For this reason Sweden makes an investment in strategic research areas amounting to SEK 1.8 billion on a yearly basis.

This is a new element of Swedish research funding.



The Government has used three criteria to determine the strategic areas to be given priority:

- Research that can contribute to finding solutions to important global problems and issues.
- Areas in which Sweden already carries out world-class research.
- Areas where companies in Sweden are carrying out their own research and development, and where state investments reinforce the development and competitiveness of the business sector in Sweden.

The strategic investments aim at building up a number of new world class research environments in research areas that have been specifically selected because of

their strong strategic importance for society. A number of the strategic research areas are also appropriate for partnership programs with industry, where institutions of higher education, authorities, companies and research institutes make joint investments.

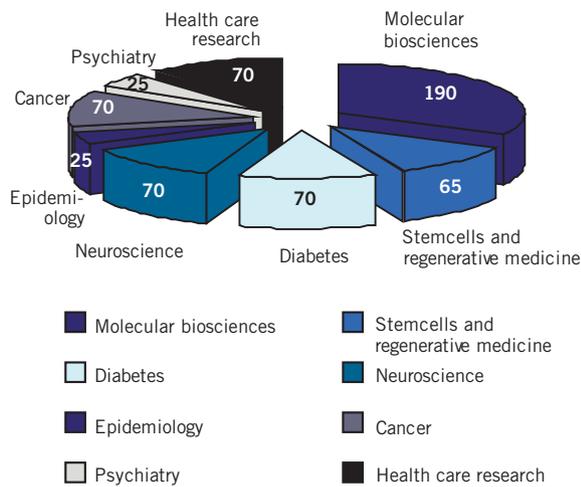
The system will contribute to raising research quality, improving conditions for commercialisation, encouraging cross-disciplinary scientific approaches and increasing opportunities for the system to make use of EU funding.

The areas have been chosen on the basis of strategies that have been drawn up by research funding agents, universities, other research actors, as well as companies and organisations representing industry. The Swedish Research Council has also carried out an assessment of the areas of strength in Swedish research.

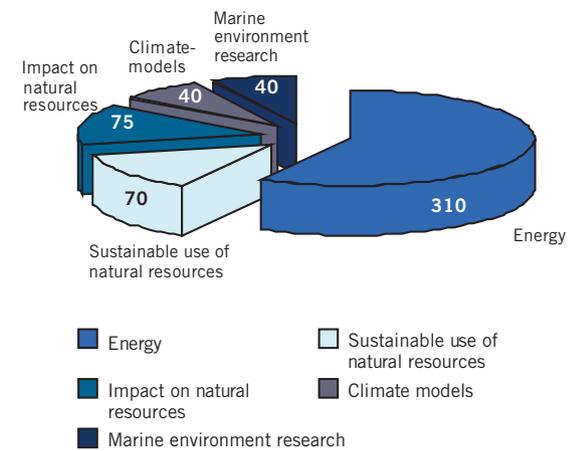


Strategic investments are now being made in the following areas:

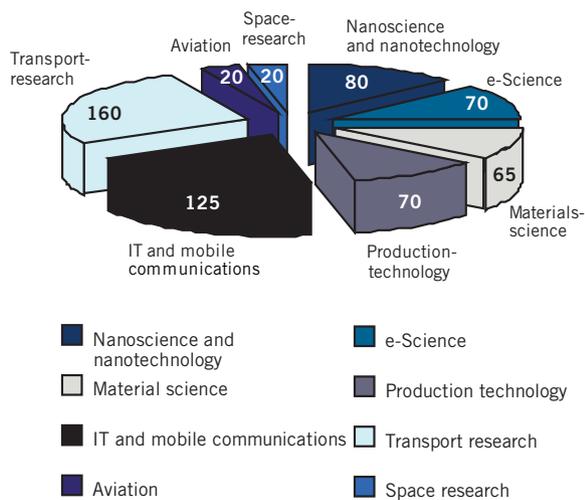
Medicine, SEK millions



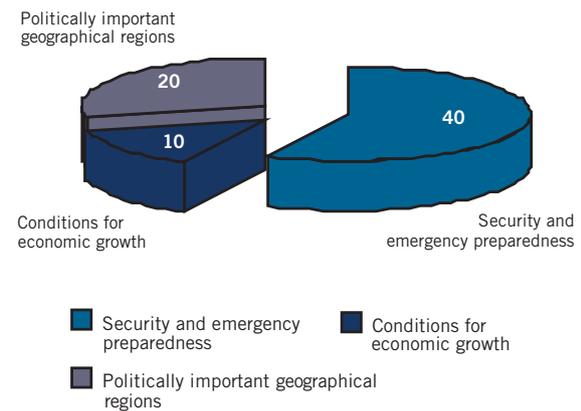
Climate, SEK millions



Technology, SEK millions



Other themes or areas, SEK millions



Increased appropriations to Research Councils and Vinnova

External financing has often been too limited for researchers to run projects without support from a number of funding agencies. It has also not been possible to grant quite a number of applications considered to be of high international quality. This has led to a fragmentation of research where excessive time has been spent on finding funders for personnel, equipment and running projects.

The role for Research Councils and Vinnova shall therefore be reformed in order to put more emphasis on long-term support based on research profiles of institutions and developing new research areas. These funders will also be provided with an addition of SEK 670 million per year for strategic investments.

Improvements to the innovation system

A well-functioning system and the transfer of knowledge between the academic world and the business sector is one of the foundations for the development of large Swedish high-tech companies. Sweden is now improving the research-based innovation system. In total SEK 75 million will be allocated to universities, SEK 75 million to Innovationsbron (Innovation Bridge) and SEK 200 million to industrial research institutes. The model can be summarised as follows:

- Universities with a research profile in Technology and Medicine will receive funding to build up special service functions – innovation offices – for researchers whose research is considered to be capable of commercialisation. The innovation offices will also aim at supporting commercialisation at universities and university colleges which do not

have corresponding resources for achieving this. At all institutions of research, there should be access to appropriate competence for working with innovation.

- Increased funding for Universities Holding companies at.
- Experience from partnerships, applied research and development in companies, innovation work, management, international involvement and other appropriate experiences from surrounding society shall be considered as important factors when appointing academic staff.
- Innovationsbron AB has been strengthened in its role as a national player for seed financing and business development based on research related ideas with market potential.
- Partnership programs with industry should be developed within the the designated strategic research areas.
- Industrial research institutes play an important role as a bridge between academic research and needs-based research, company related research and development. They will receive greater opportunities to fulfil their mission.
- A requirement is being introduced whereby researchers will be obliged to notify patentable research findings to their own institutions.
- The Higher Education Act has been amended so that external partnerships is to be an important part of the other tasks of the institutions of higher education, and also that such partnerships should actively exploit research outcomes.



International cooperation to be boosted

International cooperation is necessary to carry out high quality research, as well as recruiting students, doctoral candidates and researchers from other countries.

As a result of the European framework programmes, cooperation with European researchers has increased, and is now at a level with the cooperation that exists with researchers in the USA. This is a development that should be supported. Swedish institutions of higher education should play a leading role in international cooperation by actively cooperating with researchers from other countries and by increased student and teacher exchange.

The EU's decision to invest in the European Institute of Innovation and Technology (EIT) will lead to the creation of networks between European universities in different areas of technology. This proposal fits in well with the Swedish research landscape with its high levels of competence in information and communications technologies, and environmental and energy technologies. Sweden's strategic investments can facilitate the participation of higher education institutions in playing a leading role in some of these EU initiatives.

Within the framework of fund appropriations, funding should be provided for international research cooperation also with countries outside the EU.

Greater autonomy

Strong and independent universities and university colleges are a prerequisite for freedom of research. The Government has increased the influence that institutions of higher education exercise when appointing board members. The new arrangement means that universities themselves propose representatives, which the Government then appoints. No persons will be appointed on a political mandate.

The Government intends to further increase the freedom of institutions of higher education. The Commission on University Autonomy, which has investigated the future organisation of the higher education sector in Sweden, has submitted proposals which the Government will consider when finalising its plans.

Dishonesty in research

It is important that the public's confidence in handling suspected cases of fraud and dishonesty in research at universities and university colleges is maintained and strengthened. The responsibility of universities and university colleges themselves for investigating allegations concerning fraud in research should remain. In certain cases, however, an investigation carried out by experts from outside the institution of higher education where the fraud is alleged to have taken place, can contribute to confidence in the findings of the investigation. State universities and university colleges as a rule shall be obliged to obtain a statement from an independent national commission of experts in an investigation.

Infrastructure

Publicly financed research also covers investments in infrastructure that make possible research in more disciplines, for example, larger research facilities and databases.

The building of the European Spallation Source (ESS) in Lund, will provide a boost for both Swedish as well as European leading-edge research. Both production and funding of ESS will be done in cooperation with European countries. When the facility has been completed, up to 5000 researchers annually could be working there.

Donations to research

The Government wishes to strengthen the opportunities for Swedish research to receive private financing. This can be achieved through gifts to research from private persons and companies, as a complement to other forms of support. One way of encouraging this could be by allowing tax relief on such gifts. A Government Commission is currently examining the possibilities of introducing such a system in Sweden.

