



# **Swiss Science and Technology Policies**

Recent developments (late 1999 to 2001)

by Patrick Vock

## Center for Science and Technology Studies

The CEST develops, monitors and assesses the fundamentals for policy decisions in the fields of research, tertiary education and innovation in Switzerland. Through this it contributes to the development of the country's scientific, economic and cultural potential. To this end it carries out analyses, evaluations and prospective activities.

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The conclusions made in this report engage the author alone.  
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## **Foreword**

Every two years, the OECD publishes the “Science, Technology and Industry Outlook” which includes the latest information concerning the science, technology and innovation policy developments of its members. The brochure you are now reading is the Swiss contribution that serves as the basis for this year's OECD issue. The choice of themes (cf. table of contents) is in keeping with OECD presentation style.

## **Vorwort**

Alle zwei Jahre publiziert die OECD den “Science, Technology and Industry Outlook”, welcher u.a. die jüngsten Entwicklungen im Bereich der Wissenschafts-, Technologie- und Innovationspolitik ihrer Mitgliedsländer zusammenfasst. Die vorliegende Publikation stellt den schweizerischen Beitrag für die Erarbeitung der diesjährigen Ausgabe dar. Die Themenauswahl (vgl. Inhaltsverzeichnis) folgt dem von der OECD vorgegebenem Format.

## **Préface**

Tout les deux ans, l'OCDE publie les “Perspectives de la science, de la technologie et de l'industrie” qui donnent un résumé des développements les plus récents de la politique de la science, de la politique de la technologie et de la politique d'innovation dans les pays membres. Cette publication présente la contribution de la Suisse pour l'édition de cette année. Le choix des thèmes (voir table des matières) suit le format préétabli par l'OCDE.





# 1. General framework and trends in science, technology, and industry policy<sup>1</sup>

## 1.1. Overview and assessment of policies for science, technology, and industry

### ERT-message 2000-2003 as the framework

The goals and proposed measures (legal changes, credit requests, etc.) of the Swiss government concerning education, research and technology in 2000-2003 are described in its ERT-message<sup>2</sup> to Parliament. For the first time, these policy areas were treated in one single document in an attempt to foster coherent policies in education, research and technology.

The message sets five strategic goals:

- creating tertiary education networks<sup>3</sup>
- linking tertiary education networks to international cooperation
- promoting of excellence in education and research<sup>4</sup>
- valorising knowledge<sup>5</sup>
- developing the above-mentioned networks qualitatively and quantitatively<sup>6</sup>

In addition, the following fields were selected as thematic priorities of national policies:

- life sciences
- humanities and social sciences
- sustainable development and environment
- information and communication technologies.

### Preparation of the ERT-message 2004-2007

Preparation for the next message to Parliament is already under way. The Federal Council is scheduled to issue the message in November 2002. Parliament is expected to decide by September 2003.

### Reform of the tertiary education system

For several years now, the Swiss tertiary education system has been going through far-reaching changes to cope better with its changing environment and traditional fragmentation (federal institutes of technology, cantonal universities, cantonal universities of applied sciences (Fachhochschulen)).

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<sup>1</sup> This paper deals only with science and technology policy.

<sup>2</sup> The "Message concerning the promotion of education, research and technology for the years 2000-2003" was issued by the Federal Council on November 28<sup>th</sup>, 1998. Discussion in Parliament took place in autumn 1999.

<sup>3</sup> e.g. through the integration of the universities of applied sciences or the establishment of a new Swiss University Conference.

<sup>4</sup> e.g. through more performance-oriented awarding of grants to universities and universities of applied sciences, the establishment of an Institute of Accreditation and Quality Assurance, or the setting up of national competence centres/networks for universities and the universities of applied sciences.

<sup>5</sup> e.g. through the establishment of the Swiss Network for Innovation, or the promotion of dialogue between science and society (through the foundation "Science et Cité").

<sup>6</sup> e.g. through a new incentive scheme for cooperation between universities, the promotion of young scientists, additional financial resources for the further setting up of the universities of applied sciences, or the increased flexibility of the federal institutes of technology.

Issues are: the establishment of universities of applied sciences, a new constitutional article serving as a base for a comprehensive and nationally-coordinated tertiary education policy, more performance-oriented financing mechanisms, improved and harmonised quality control, steering mechanisms which are more integrated, etc.

### **Institutional changes**

To better steer the science and technology system, the following institutions were created or re-organised:

- **Swiss University Conference (SUC)**

The SUC was set up<sup>7</sup> by federal and cantonal authorities to coordinate nationwide the activities of the cantonal universities and the federal institutes of technology (see 2.2).

- **Swiss Science and Technology Council (SSTC)**

The SSTC is the advisory body of the Federal Council for matters relating to education, research and technology policy. The SSTC is a successor to the former Science Council and its establishment involved (1) the inclusion<sup>8</sup> of technology in view of a more integrated perspective on science and technology policy, (2) the replacement of practically all members of the Council, and (3) a reorganisation of its structure. The Centre for Technology Assessment (TA), which is affiliated with the SSTC, targets its efforts on fields of technology considered to be controversial, particularly concerning life sciences, the information society and energy and mobility.

- **Centre for Science and Technology Studies (CEST)**

The CEST, emerging from the scientific staff of the former Science Council and now affiliated to the science and technology administration,<sup>9</sup> is responsible for gathering and assessing information for the national research, higher education, technology and innovation policy (analyses, case studies, etc.) as well as for evaluations.

- **Rectors' Conference of the Swiss Universities (CRUS)**

Looking back on a long tradition,<sup>10</sup> the CRUS serves as a consultative body of university rectors. It provides a platform for Swiss universities to discuss common interests and concerns. It supports the co-ordination of and co-operation in teaching, research and service, the exchange of information and co-operation between all universities and other organisations.

- **Institute for Accreditation and Quality Assurance**

On behalf of the SUC, this institution<sup>11</sup> will improve quality control and nationwide accreditation procedures (see 1.2).

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<sup>7</sup> Based on different federal and cantonal laws and agreements the rules of procedure came into effect on January 1<sup>st</sup>, 2001.

<sup>8</sup> The change in name and task is related to a change in the research law which was discussed and decided by Parliament in autumn 1999 and came into effect on August 1<sup>st</sup>, 2000.

<sup>9</sup> The CEST was established through the rules of procedure of the SSTC on June 6th, 2000. The CEST received its mandate on June 20th, 2001, signed by the two federal offices in charge of science and technology policies.

<sup>10</sup> The new statute of the CRUS, a registered society, came into effect on January 1<sup>st</sup>, 2001.

<sup>11</sup> Based on an agreement between the Confederation and the university cantons the rules of procedures came into effect on February 22<sup>nd</sup>, 2001.

- Foundation “Science et Cité”

“Science et Cité” was founded<sup>12</sup> in late 1998 and is dedicated to the promotion of dialogue between science and society. Its several activities include the first nationwide science festival in 2001.

## **1.2. Nature and process of policy evaluation**

### **Constitutional article on evaluation**

The evaluation of the effectiveness and the efficiency of public measures and policies is becoming more important and is gaining wider acceptance. The complete revision of the Swiss Constitution (which came into effect in 2000) takes this into account and incorporates a new article (Art. 170) on evaluation. This in general provided momentum and revived the broad discussion about evaluation, which is carried out in different fields and by various organisations. Obviously, this also applies to the field of education, research and technology.

### **Institute for Accreditation and Quality Assurance**

The cooperation agreement between the federal government and cantons hosting a university (so-called “university cantons”), which came into effect on January 1st, 2001, lays the foundation for establishing the Institute for Accreditation and Quality Assurance. It is affiliated with the new Swiss University Conference (see below) and fulfils the following tasks relating to the cantonal universities: It proposes a nationwide procedure for accreditation; it prepares decisions for accreditation; it defines the requirements for quality assurance; it issues recommendations on evaluations that are carried out by the universities themselves; and it can carry out discipline-wide evaluations.

### **Evaluation of the two research-funding organisations**

In April 2001, the Swiss government initiated an evaluation of the two major research-funding bodies, the Swiss National Science Foundation (SNF) and the Commission for Technology and Innovation (CTI). The primary goal of the evaluation is to come up with recommendations as to how to optimise support schemes to enhance the performance of the national science and innovation systems. The evaluation has been entrusted to the Swiss Science and Technology Council (SSTC) and is being carried out in three phases: (1) a self-evaluation by the institutions involved, (2) a peer evaluation, and (3) recommendations by the SSTC. The results are intended to guide the formulation of the funding policies in the ERT-message 2004-2007.

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<sup>12</sup> The foundation charter was signed on October 20<sup>th</sup>, 1998.

## **2. Public sector research and public research organisations**

### **2.1. Policy changes and background/rationale related to public sector R&D**

#### **Funding volume and priorities**

The ERT-message 2000-2003 gives the frame for overall funding and priorities. In general, there are no drastic changes and overall there is only a minor increase in funding.

#### **National Research Programmes (NRP)**

Through the National Research Programmes (NRP), administered by the Swiss National Science Foundation, the government supports research projects which relate to contemporary issues of national importance and whose results are deemed to be a scientifically-sound contribution to the solution of pressing societal or economic problems. The individual programmes last up to five years and each receive between CHF 5 million and 20 million. Since the 1970s, some 50 programmes have been launched. In 2001, the selection procedure was slightly modified. Today, the federal government decides every year (previously every four years) on the launching of one to three new NRPs. To prepare for this decision, programme proposals, collected from interested parties through a bottom-up process, are reviewed for scientific quality and assessed in view of their relevance for science policy. With these changes, it is now possible to react faster to perceived political and societal needs. Furthermore, the NRPs are better linked to the users of the results.

#### **National Centres of Competence in Research (NCCR)**

In late 1999, the decision was made to introduce a new instrument for research promotion, namely the National Centres of Competence in Research (NCCR). They replace the former Swiss Priority Programmes (SPP).

With this research instrument, also administered by the Swiss National Science Foundation, the government intends to achieve the following goals: to strengthen the Swiss position in strategically-important research areas through the promotion of research of the highest quality; to renew and optimise the division of labour and coordination between the different Swiss research institutes as well as their international networking; and to foster exchanges between basic research and technology transfer and the education of young scientists, through a coherent promotion strategy.

A NCCR is devoted to an institutionally-backed research area of national importance and is made up of a leading house (typically a university department or research institute) and a network of (academic) partners. Due to the stated objective of knowledge and technology transfer, the NCCRs develop links with potential users of their results (including firms), and involve them in project planning from the outset. The leading house – which has to be supported by the home institution – is responsible for the coordination of the network, for the scientific orientation and for the management and control of finances. The lifetime of a NCCR is a maximum of 12 years, while financing is provided over a four-year period, with continuation subject to an evaluation. Financing comes from three sources: federal grants channeled through the Swiss National Science Foundation; the resources the home institutions devote to the leading houses and their partners; and external funding.

Even though the government eventually decides which NCCRs – of which around 20 are planned – should be supported, they also include elements of a bottom-up approach as thematic orientation, structures and management are left to the researchers themselves. At least 80% of the funds for all NCCRs should be devoted to the four priority themes of the Swiss science policy mentioned above (see 1.1).

In January 1999, the first call for NCCRs went out. After a rigorous evaluation, the Swiss National Science Foundation proposed 18 projects for the final selection procedure. In December 2000, the Federal Council decided to fund 10 out of the 18 NCCRs. Four proposals were rejected, and four others were postponed. After securing additional financing (through Parliament), the Federal Council decided in June 2001 to fund the four NCCRs which had been postponed.

For the first four years these fourteen NCCRs will have CHF 529 million at their disposal, of which CHF 224 million are contributed by the SNF. The thematic distribution of the NCCRs is as follows: five in the life sciences, three dealing with ICT, two interdisciplinary projects with a strong social science orientation, one concerning the environment, one in materials science, one in nanoscience and one in optics.

### **National Competence Networks of the universities of applied sciences**

In the process of creating the Swiss universities of applied sciences (see 2.2), one important element is the building up of a capacity in applied research and development, including cooperation between the different schools and other universities, as well as with the economy, especially with SMEs. The National Competence Networks gather together scattered resources for the benefit of teaching and research at the partner institutions as well as for the easier access of firms to new technologies and practical problem solutions. In 2001, six National Competence Networks were selected, based on evaluations. These networks profit from consulting services and financing provided by the Commission for Technology and Innovation (CTI). The National Competence Networks, awarded for three years with the possibility of renewal, deal with ICT, microelectronics, wood, production and logistics, biotechnology, e-commerce and e-government.

### **New advanced synchrotron light source at PSI**

In October 2001, the Paul Scherrer Institute (PSI), a federal research institute, opened its new advanced synchrotron light source, the Swiss Light Source SLS. At present, the demand for high quality synchrotron radiation is increasing all over the world. A broad range of scientists from the fields of physics, chemistry, biology, medicine, etc. can use this innovative tool. Although planned as a national facility, the SLS is a part of the international network of research facilities and is open to international research groups on the basis of scientific merit. PSI has experience in accelerator technology and is a well-established user laboratory. It also has the additional advantage that it hosts a new neutron spallation source (SINQ) and has a large user community at the proton cyclotron using muon spin resonance (muSR) techniques. This permits combined investigations with neutron, muon, and photon probes.

### **Swiss Institute of Bioinformatics**

Aware of the mounting importance of information technology for biology, arising from the challenges of the post-genomic era, the federal government has supported the creation of the Swiss Institute of Bioinformatics and is co-funding its operations. Located in Lausanne and in Geneva (with an extension planned in Basle), the institute brings together under the same heading previously independent research units active in database production and maintenance (most notably SWISS-PROT), sequence analysis, biological computer modelling, etc. It is also heavily involved in postgraduate teaching of bioinformatics.

## **2.2. Initiatives to reform the organisation and governance of universities and public research organisations**

### **Federal law on university support and cooperation**

On April 1<sup>st</sup>, 2000, a new federal law concerning the (financial) support of universities and cooperation within the tertiary education sector came into effect. Even though it is a step towards a more integrated tertiary education policy, it applies only to cantonal universities. Due to the lack of a constitutional base, it was not possible to create a law applying to the whole higher education sector (universities as well as the universities of applied sciences). For this reason, the applicability of the new law will extend only until 2008. In the meantime, the necessary constitutional article should be approved and brought into effect.

The law introduces a new funding scheme with a performance-oriented grant mechanism. The federal contributions to universities are channeled through three mechanisms:

- **Basic grants:** With around CHF 400 million yearly, they constitute the bulk of federal financial support. They are intended to contribute to the operating costs of universities (on average some 20% of total operating costs). Some 70% of the yearly amount earmarked for basic grants is distributed among the universities according to the number of students and the related education costs (weighted by disciplines), and 30% is distributed according to the research performance measured by the volume and the number of research projects. Previously, basic grants were allocated mostly according to the expenditures of the universities (e.g. total wage sum).
- **Investment grants:** Around CHF 60 million yearly are reserved to help finance major investment projects such as construction, equipment, etc.
- **Project grants:** Around CHF 45 million can be used for projects which are favoured by several universities and which are of national importance. The federal contribution has to be matched up with the same amount given by the university cantons. The grants are used to establish a network for innovation to foster technology transfer, for setting up a virtual university campus as well as for cooperation projects between universities. An example of the latter is the cooperation of the Universities of Lausanne and Geneva and the Federal Institute of Technology in Lausanne, which includes the fusion of their basic science departments, the transfer of certain disciplines, the establishment of two thematic priorities and the development of a complementary education system. To ensure the setting of national priorities as well as efficient coordination, the grants are decided by the newly- established Swiss University Conference (SUC).

In addition, the law – backed by an agreement between the federal government and the university cantons – lays the groundwork for the SUC, which was established on January 1<sup>st</sup>, 2001. By bringing together cantonal and federal decision makers, it serves as a platform to achieve efficient cooperation among universities. The conference can take binding decisions on

- guidelines for the duration of curricula and the recognition of curricula and diplomas
- assignment of project bound grants (mentioned above)
- accreditation of organisations and curricula
- guidelines for the assessment of teaching and research
- guidelines for the valorisation of university knowledge

### **The reform of the universities of applied sciences (Fachhochschulen)**

Switzerland is in the process of setting up Swiss universities of applied sciences. It started in 1996 and will continue to 2003. The goals are to create application-oriented universities out of several dozen former technical colleges, to integrate them as equal partners into the Swiss tertiary education system (with its cantonal universities and the federal institutes of technology), and to support a better division of labour including concentration and thematic priority setting for National Competence Networks (see 2.1). In 1998, the government issued the authorization to run seven universities of applied sciences until 2003. Since then, every effort has been made to achieve the assigned tasks, including education and applied research and development. In 2001, a comprehensive evaluation of all schools and curricula was carried out to get a sound assessment as a base for improvement and decision-making at the end of the reform process.

### **Lump sum grants and performance targets for the FIT domain**

In 1999, an agreement between the federal government and the Board of the Federal Institutes of Technology (FIT)<sup>13</sup> was reached on the goals and resources for the years 2000-2003. Aiming at a greater autonomy for the FIT domain, the government grants an annual lump sum of around CHF 1,500 million but in turn specifies a list of tasks to be executed. In the next four years, starting from the current activities in education and research, priority is to be given to the scientific fields of engineering sciences related to microsystems, environment, and micro-/nanotechnology, while the fields of construction, engineering sciences related to macrosystems, pharmaceuticals and system-oriented natural sciences are to be reduced. Applied research and transdisciplinary fields are to be given further emphasis. An example of a newly-launched technology-oriented programme is the ‘Top Nano 21’, which investigates the role of the nanometre in the world of science, technology and industry. To control the fulfilment of the performance agreement, an indicator system will be developed and an interim assessment will be made after 2002. A final evaluation (peer review) will be carried out in 2004.

### **Institute for Accreditation and Quality Assurance**

See 1.2.

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<sup>13</sup> The Board of the Federal Institutes of Technology (FIT) is the steering committee for the FIT domain, which includes two federal institutes of technology (universities) and four federal research institutes.

### **3. Government support for private-sector R&D and innovation**

#### **3.1. Policy changes intended to enhance the effectiveness of instruments used to provide public support for private sector R&D and innovation**

Switzerland does not directly support commercial R&D or innovation, neither through tax credits for R&D nor through direct funding of R&D. Nevertheless, several measures have been taken to lower costs for firms, as for example in the case of start-ups.

##### **Promotion of start-ups**

To promote the creation of new firms, the government has undertaken several initiatives to improve the environment for start-ups. These include tax reductions for risk capital organisations and business angels, permitting more and more investment in start-ups by pension funds, a reduction in taxation of stock options for start-ups, a reduction of nominal value for stocks to one cent, and several improvements to lower the administrative burden. In addition, the Commission for Technology and Innovation provides comprehensive support to start-ups.

#### **3.2. Changes in the balance and/or priority of public support of business R&D and innovation**

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#### **3.3. Assessments of the relative effectiveness of different policy measures to support private sector R&D and innovation**

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## **4. Enhancing collaboration and networking among innovating organisations**

### **4.1. Initiatives to promote collaboration and networking among private and public-sector organisations**

#### **Strengthening of the Commission for Technology and Innovation**

A highly-efficient initiative to foster collaboration between firms and universities or research organisations is the funding mechanism of the Commission for Technology and Innovation (CTI) which requires the private partner to invest in the project at least as much as the publicly-funded partner. It is considered successful because projects result in a direct collaboration between firms and non-profit research organisations, treat bottom-up selected themes, are carried out within a short- to medium- term time frame and receive considerable co-financing from the for-profit partner. The CTI's mission was strengthened and enlarged. The commission now supports, among other things, projects to enhance the building up of competence for applied research at the universities of applied sciences, to help researchers to start their own business, to improve vocational training research geared towards practical solutions and to nurture cluster formation in software, medical technologies and nanoscience.

The funding mechanism of the CTI projects not only fosters collaboration, it also has a positive influence on training and research. Because the funds are given to the researchers of the non-profit partner, they directly stimulate research activity in the public research sector. On the other hand, the compulsory collaboration with industry enables knowledge exchange and learning.

### **4.2. Policy initiatives to promote stronger industry/science relations**

#### **Swiss Network for Innovation**

In late 1999, the Swiss Network for Innovation (SNI) was established.<sup>14</sup> Its goal is to support tertiary education institutions in their technology transfer activities. All cantonal universities, the federal institutes of technology, the universities of applied sciences, other research institutes as well as private companies are members of the network.

#### **Intellectual property rights arising from federal research funding**

To better promote the use of intellectual property rights, the federal government revised its research law in which the general ownership rules for intellectual property arising from activities sponsored by the federal research promotion system are laid down. The new rules came into effect in August 2000 and stipulate that federal research grants can be tied to the condition that ownership rights are transferred to the institution a researcher works at.

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<sup>14</sup> The SNI is a foundation as defined by the Swiss Civil Code and goes back to an initiative of the State Secretary for Science and Research.

## **5. S&T human resources**

### **5.1. Real or perceived shortages of scientists and engineers**

Between 1999 and mid-2001, in a period of economic growth, there was considerable public debate about the general shortage of highly-qualified personnel, especially the lack of computer scientists. Different measures were discussed, and some were realised, notably several reforms in vocational training as well as an increase in funding for teaching staff.

### **5.2. Changes in training and education programmes for scientists and engineers**

Due to the anticipated shortage of professors at the tertiary education level in the near future, the government decided to introduce a new scheme to promote young scientists as of January 1<sup>st</sup>, 2000. These career development awards, which are administered by the Swiss National Science Foundation, are intended to enable young academics, while fully integrated into their home universities, to carry out truly independent research. Funds are awarded over four- to six-year periods, with a maximum of CHF 400,000 CHF a year. This amount has to cover salaries, research expenditures and overhead. This instrument not only promotes young academics but also efficiently works against brain drain.

### **5.3. Policy changes related to international migration and mobility of scientific and highly-skilled personnel (inward or outward mobility)**

Various measures are in place to attract highly-trained people (foreign or Swiss) to move or return to Switzerland for work or education. A recent initiative, named Swiss Talents, is a web platform for Swiss scientists abroad and foreign scientists with strong ties to Switzerland as well as for those that have moved or returned to Switzerland. It provides different services such as personal and professional information about the members of the network, job offers, etc.

First experiences with the career development awards for young scientists (see 5.2) show that a high percentage of the funds awarded go to young scientists returning from abroad, and thus counteract to a brain drain.

## **6. International cooperation and globalisation**

### **6.1. Policy initiatives to reduce obstacles to and otherwise promote international co-operation in science, technology and innovation**

In 2001, a strategic report dealing for the first time with Swiss scientific foreign policy was issued to articulate a future international policy in the areas of education, research, and technology.

### **6.2. Policies and government-sponsored programmes to foster international collaboration in research and development**

Switzerland is deepening its relationship with the European Union through bilateral agreements. In 1999, both parties signed a package of seven sector-specific agreements including research. The agreements were expected to go into force in the first half of 2002, after having been adopted by referendum in Switzerland in 2000 and after completion of the ratification procedures in the EU member states during 2000/2001.

At present, the participation of Swiss researchers in the EU Framework Programmes is on a 'project by project' basis, with a number of restrictions. The research agreement provides for the full participation of Swiss research institutes, universities and private-sector companies in all programmes and activities of the fifth EU Framework Programme. This will make it possible for Swiss researcher to set up and direct projects themselves, no longer subject to the limitation of being merely partners as at present. The agreement regulates all matters relating to the possession, utilisation and distribution of information, as well as intellectual property rights, in relation to all research carried out in this context. The agreement expires at the end of the fifth FRP (December 31, 2002) but can be renewed on the basis of mutual consent.

In addition, to foster the participation of Swiss scientists to the research activities carried out at major European research organisations (CERN, ESA, EMBL, ESRF), of which Switzerland is a full member, the ERT-message 2000-2003 includes for the first time a budget line called CH-Intex. It is used, under management of the Swiss National Science Foundation, to fund experiments and/or instrument development in projects involving Swiss laboratories and one or the other of the above-mentioned European institutions.

Switzerland places a high priority on bottom-up Eureka projects. It has introduced several measures to stimulate further the participation of SMEs.

In 2001, a federal research institute opened its new advanced synchrotron light source, which is open to the international scientific community (see 2.1).

### **6.3. Policy initiatives to attract foreign investment**

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## CEST - Publikationen

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