AUSTRIAN RESEARCH CENTERS

07.

Intellectual Capital Report

2007

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Foreword

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Foreword by the General Management
Wolfgang Knoll
Anton Plimon

Investments in research and development as well as the cultivation of the next generation of scientific pioneers are decisive factors in determining the growth and prosperity of our country. Austrian Research Centers (ARC) is Austria's largest knowledge center and the top performer in the field of extra-university applied research. In its role as an innovation driver, ARC works together closely with industry and within a dense network of other national and international knowledge centers to develop novel approaches for innovative solutions to tomorrow's problems and challenges. Innovations are absolutely indispensible and offer industry and the economy extensive value-added. Companies that are innovation-oriented and active on an increasingly global scale have a lasting influence on Austria as a center of knowledge and a place to do business. However, Austrian Research Centers also profits from the dynamism of the Austrian and European innovation system.

Global economic systems and scientific networks developed extremely dynamically during the course of 2007. The challenges faced by research, technology and education policies should, for example, be met through strategic energy and climate initiatives on the part of the European Union, through the planning and founding of elite universities and regional centers of excellence combining commerce and science, and through steps to satisfy the rising demand for highly qualified scientists.

The Intellectual Capital Report 2007 is intended to present an overview of the research-specific networks of educational, commercial and scientific systems. The interaction of Austrian Research Centers with the commercial sector in the area of technological development is highlighted in two key areas: Energy and ICT (Information and Communication Technologies). This report contains a structural overview for 2007 of the data relating to the human resources and intangible assets of Austrian Research Centers, such as structural and relational capital. These data have been presented in the same format as that used in the intellectual capital reports of ARC since 2003.

The year 2007 marked a clear turning point for Austrian Research Centers. In the course of the 2008 financial year, ARC is undergoing the most fundamental change processes in its corporate history. The core scientific focus of Austrian Research Centers in the years ahead will be on its position as an Austrian research institute with a European format which is strategically aligned to the central infrastructural issues of the future. We look forward to being able to report on our progress in this direction in the coming years and trust you will also find this year's Intellectual Capital Report both inspiring and informative.

Anton Plimon
General Management Austrian Research Centers – ARC

Wolfgang Knoll

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Executive Summary

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Executive Summary

The corporate performance of Austrian Research Centers in 2007 was marked by more intensive cooperation with Austrian universities in our strategic research areas. **Compared with 2006, the number of scientific publications in peer-reviewed journals increased by more than 10 %.**

Publications in the Science Citation Index (SCI) per se are, however, primarily a performance indicator for universities; the relevance of this scientific indicator for Austrian Research Centers lies in international referencing and citations.[1] A first-time analysis of international references and source references to the research results of Austrian Research Centers revealed a significant increase over the past three years and this figure is forecast to rise again in 2008.

In addition to the increased performance in the scientific system, 2007 also saw a consolidation of ARC's technological knowledge base as a result of applied research and technological development work: **The number of patents granted to Austrian Research Centers increased by more than 100 % compared to 2006.** This represents a major contribution to the technological edge enjoyed by our customers who operate within the context of commercially-oriented global technology systems.

Related patent clusters are focused knowledge-based assets in the respective national and international innovation systems. A value-based analysis will reinforce the commercial core competences and allow optimization potentials in secondary technological areas to be exploited. The commercial value of patents per se in the US university sector represents an average of one to five percent of total university expenditures. Analyses carried out in European contract research organizations reveal a relative value of less than three percent of total organization-specific expenditure.[2]

For Austrian Research Centers, the most relevant performance indicator is the integration of scientific expertise and patented technological knowledge into contract research activities on behalf of our customers. The spectrum ranges from the licensing of intellectual property rights to prototypical system integration in which multiple patents may at times be integrated simultaneously.

In 2007, our customers commissioned ARC to carry out more than 600 new contract research projects. This figure represents one commercially specific indicator for Austrian Research Centers. During the first year of the 7th EU Framework Programme, ARC, together with its scientific and commercial partners, competed at the European level to secure no fewer than 23 new research and technology projects with a clear focus of the Group's main research areas.

Despite **the Austrian Patent Office recording the third highest level of patent registrations in the EU in 2007**, considerable potential to optimize and rationalize remains in the years ahead given that European and global competition to secure the best personnel is only just getting off the ground. The scarcity of raw materials, technological components and new socio-political and economic challenges will intensify the selective demand for new technologies and have a sustained impact on the development of nations' knowledge-based resources.

Qualitatively high levels of technological infrastructure also form a necessary prerequisite for successful contract research organizations in addition to highly qualified and motivated scientists and managers. Austrian Research Centers has a long way to go in terms of emerging and converging technologies. The economic and political focus on areas such as transnational research in the USA, where the National Institutes of Health (NIH) has invested several hundred million euros, demonstrates the scale of the potential innovation that is currently being tapped.

1 Citations are particularly important in the context of scientific publications since professional scientific procedures require that reference is made to the sources of information used and to other relevant scientific work.
2 The MP3 patent is a European exception.

The EU Framework Programmes for Research and Technology Development highlight a significant reduction in participation on the part of large industrial players, one of the clear customer target groups of Austrian Research Centers.

For this specific industrial sector, joint technology initiatives and joint ventures, such as **ARTEMIS (Advanced Research and Technology for Embedded Intelligence and Systems) and IMI (Innovative Medicines Initiative)**, will in future increasingly represent the technology policy tools for technological innovations at the European level. A strategic, technological and commercial positioning of Austrian Research Centers will also have to take account of the new policy efforts of several of the EU27 member states to develop joint technology and technology programs.

Summary of Intellectual Capital Indicators

1. 1. 2007 to 31. 12. 2007

Bezeichung	2003	2004	2005	2006	2007
Human capital					
Number of employees (headcount)	764	885	995	992	976
Number of researchers (headcount)	397	484	522	524	527
Proportion of women (%)	24	26.4	25.7	24.8	24.6
Proportion of women in senior positions (%)	14.7	19.2	19.8	20.3	18.0
Training days per employee (total)	1.21	0.8	0.8	1.5	2.1
Structural capital					
Hit rate for EU research programs (%)	35	40	43	72	50
Relational capital					
Number of new EU projects	16	27	25	31	23
Number of inter-disciplinary contract research projects	16	44	44	59	64
Number of international researchers	44	77	97	92	103
Number of PhD students	118	144	152	156	142
Number of diploma students	92	122	125	119	91
Core processes					
Number of newly acquired contract research projects	314	511	499	592	652
Project revenues from CR activities inc. small-scale projects (EUR Mio.)	32.781	33.058	35.951	39.024	37.722
Revenues/project (excl. small-scale projects) (EUR)	50,027	41,353	53,633	56,228	55,118
Results					
Total of all operational revenues (TEUR)[3]	96,320	98,680	114,651	118,233	126,329
Market success (%)	50	49	50	54	55
Proportion of new research projects secured from industry (%)	52	62	74	77	72
Coordination of EU projects and networks	8	8	12	17	17
Number of customer training sessions	1,033	1,740	1,628	2,015	1,526
Publications in peer-reviewed scientific journals		105	135	137	151
Publications in peer-reviewed scientific journals per researcher	0.23	0.24	0.26	0.26	0.29
Publications in peer-reviewed conference proceedings, journals and books published per researcher	0.72	0.78	0.97	1.00	1.03
Proportion of publications in future technology fields (%)	43	39	41	43	54
Patents granted	6	8	21	18	40
National patent applications	36	23	45	41	36

3 Based on the figure for 2007 contained in the Annual Report

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Knowledge networks

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Knowledge networks in innovation systems

In its capacity as an extra-university research institute, Austrian Research Centers works closely with participants in national innovation systems. The significance and intensity of these particular knowledge networks involving businesses, public authorities and the international research committee will be illustrated below.

Interaction with the Austrian economic system

The economic system of universities
Austrian universities are facing new challenges. On the one hand, the way in which they are financed is changing and, on the other, they are having to become more specialized owing to the European and international systems.
Contributions from national and international third parties have become increasingly important for universities. As such, the two main functions concerning the education of highly qualified human resources and generating new scientific knowledge are becoming increasingly reliant on competitive financial contributions.

Current data[4] show that a significant proportion of third party contributions to Austrian universities come from the Austrian Science Fund (FWF). In 2004, contributions amounted to around EUR 90 m. Similarly, European finance for research activities has become ever more important – in 2004, such funding amounted to 4.65 % of higher education spending on research and development.

The transfer of knowledge to companies is particularly important when universities work together with other participators in the national innovation system. According to figures from Statistik Austria, the quantitative value of extramural business spending in Austria directed at domestic universities equated to less than 1 % of all company research and development spending in 2004 (EUR 28.5 m, or 0.7 % of EUR 509.9 m extramural spending). The way in which these data are interpreted – that companies are not consistently integrating Austrian universities into their research agendas – still needs to be analyzed.

With regard to Austria's position on the European Innovation Scoreboard[5] (25 individual indicators divided into five groups), there are two identifiable weaknesses despite a number of encouraging developments. In terms of the input groups for innovation engines, the number of graduates (aged between 20 and 29) in the fields of natural and engineering sciences, and the number of persons with a degree in Austria, is considerably below the EU average.

This fact is documented in publications from the Federation of Austrian Industry, which views the field of Human Resources as being the greatest barrier to the growth of innovation networks in Austria, and points to a serious shortage of skilled personnel in the innovation field. In the "Employment Market Forecast 2010", it is predicted that there will be a shortage of 1,000 graduates (out of a total of 4,300) in the 15 most sought-after fields of study (technical and natural sciences).[6]

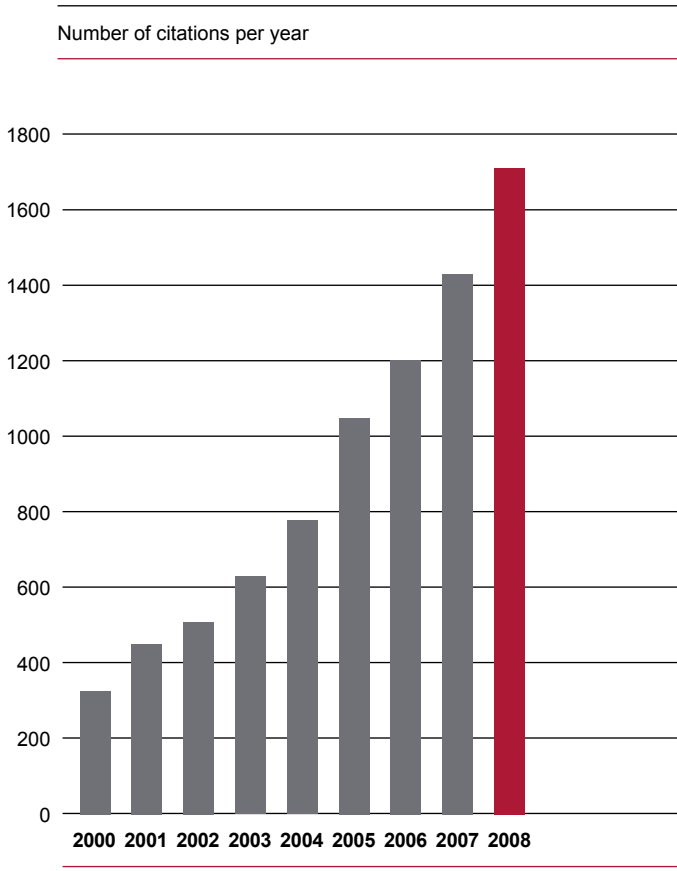
4 Statistik Austria
5 http://www.proinno-europe.eu/index.cfm?fuseaction=page.display&topicID=275&parentID=51
6 "Die besten Köpfe für Innovation", Human Resources in Research and Development as the key to growth and affluence in Austria, Federation of Austrian Industry, February 2007

Austrian Research Centers and the university knowledge system

Austrian Research Centers works together with both Austrian and European universities in a number of ways. On the one hand, joint research projects are carried out as part of national and European research and technology programs; on the other, acquiring knowledge from exploratory university research is important for Austrian Research Centers' business activities. The way in which these knowledge networks with universities are quantified can be regarded as an output factor thanks to joint scientific publications in peer-reviewed journals.

When analyzing international references (citations) to Austrian Research Centers' scientific publications (Science Citation Index), a clear increase in the amount of referencing can be seen (whereby the following data refer exclusively to referenced sources in the ISI/Thompson Web of Science)[7], including the forecast for 2008:

Average citations per item: 7.40.
The h-index[8] is 37.



The top 10 scientific cooperation partners of ARC in the higher education sector

An analysis of joint SCI publications by Austrian universities and ARC reveals that, taking an overall thematic view, there were the following levels of interaction between 2004 and 2007 (list in descending order):

1.	Vienna University	6.	Austrian Academy of Sciences
2.	Vienna University of Technology	7.	Slovak Academy of Sciences
3.	University of Natural Resources and Applied Life Sciences Vienna	8.	INRA/CNRS (F)
4.	Medical University of Vienna	9.	Polish Academy of Sciences
5.	Graz University of Technology	10.	University of Munich

The top 10 countries which cooperate scientifically with ARC around the world

If the scientific institutes are ordered according to their respective country, irrespective of whether they are commercial or academic institutes that publish joint SCI publications, the following knowledge networks can be observed (listed by country in descending order, based on data from 2004 to 2007, excluding Austria):

7 No specific discipline norms were considered.
8 The h-index was developed by J.E. Hirsch and published in Proceedings of the National Academy of Sciences of the United States of America 102 (46): 16569-16572, November 15, 2005.

1.	Germany	6.	UK
2.	France	7.	Spain
3.	USA	8.	Switzerland
4.	Italy	9.	Poland
5.	The Netherlands	10.	Sweden

This naturally leads to the question of how the technology profiles of these national economies stand in relation to current cooperative research projects, and how Austria can expand or modify its specialization in technology sectors in the long-term with European/global benchmarking through research and technology cooperation on a national and international level, and in line with the objectives of Austria's technology policy.

Technological developments for the economy and IPR

Technology policies of individual European states are increasingly focusing on intensive research in high-tech commercial sectors in the hope of generating new sources of long-term employment, of stimulating a new phase of growth for the respective commercial sectors, and of successfully positioning the respective countries strategically to compete globally in the area of manufacturing (keyword: China).

Patents are an output-relevant factor for assessing the degree of technological specialization in national and international commercial sectors. Data from the European Patent Office and Austrian research and technological reports[9] points to a low degree of specialization in the Austrian economy. This is thematically important for the dynamic development of knowledge networks between businesses, universities and other extra-university research facilities, because developing and supporting "emerging technologies" form part of the objectives of Austria's technology policy.

The most significant field of technology in Austria, measured in terms of the number of patents, is mining, followed by consumer goods and electrical engineering. The Austrian economy is also strong in the technology field of materials science, in metallurgy, as well as in machine tools. In the areas of **information technology, telecommunications and audiovisual technologies,** Austria has been able to optimize its technological profile, measured in patents, but is still well below the European average.[10]

Patent statistics in the Austrian higher education sector
Concerning the importance of the higher education sector when analyzing patents granted, 21 were issued to Austrian universities in 2006. The University of Veterinary Medicine Vienna was the leading institute, awarded 5 patents.

Austrian Research Centers and Austria's technology profile
Austrian Research Centers was granted 18 patents in 2006, and a total of 40 in 2007. Its strategic focus with regards to patents centers on selected technology fields in which patent clusters relevant to further technological development are created. However, European legislation has still not been able to reduce the cost of patents in Europe as compared with the USA, for example. Patent retention and selective validity are criteria that are being increasingly considered in relation to optimizing costs. Specific high-tech portfolios belonging to Austrian Research Centers are introduced into the presentations of business and technology-based knowledge networks.

9 Commissioned by the Federal Ministry of Science and Research (BMWF)
10 Austrian Research and Technology Report, data OECD 2001 – 2003

ARC patent portfolio performance 2007
A publication by the Austrian Patent Office documents the performance of Austrian Research Centers' strategic patent portfolio in 2007. 2007 statistics on patent applications in Austria reveal that the company AVL is the Austrian "patent master" in the business world. Fronius International moved up a place in 2007, now occupying second position. ARC Seibersdorf Research secured the third position for the first time[11], followed by Siemens AG Austria.

Indicators of the internationalization of Austrian Research

Technological developments in and the globalization of both the economy and society are leading to an intensification of global knowledge networks.

Commercial sector
45 % of R&D spending in the Austrian commercial sector can be credited to companies in foreign or European hands. Moreover, the thematic focus is heavily skewed in favor of just a few sectors in Austria, such as electronics and pharmaceuticals. In 2004, the amount spent by the Austrian commercial sector[12] on research contracts for non-Austrian organizations totaled around EUR 248 m (compared to EUR 28 m spent by countries on external R&D in Austrian universities).

International research and technological cooperation
Results for investment in and the successful procurement of research projects in the 7th EU Framework Programme for Research and Technological Development translate into a quantitative book value of investment of 8 % for large companies in Austria in relation to every authorized European R&D cooperation agreement in 2007 with Austrian participation.[13] In 2007, the proportion of small and medium-sized companies in Austria in the 7th EU Framework Programme stood at around 20 %.

When comparing this with all the data collected from the 6th EU Framework Programme (2002 – 2006), it becomes clear that the 2007 data constitute a representative sample. When considering the financial return flows to Austria (R&D projects), it is evident that projects undertaken by large companies account for 9 % of return flows, with this amount increasing to 13 % for small and medium-sized companies. In total, the amount of value of EU subsidies granted in the 6th EU Framework Programme to Austrian participants was around EUR 425 m.

Large Austrian companies as EU coordinators
Only 3 % of all Austrian participants are large companies which act as coordinators of European research projects (2007) – compared to 18 % for SMEs.

11 In 2006, ARC Seibersdorf Research GmbH was a wholly-owned subsidiary of ARC when the patent was applied for, and does not fully represent the entire Austrian Research Centers GmbH – ARC in the 2007 report.
12 Austrian Research and Technology Report
13 M. Ehardt-Schmiederer, B. Wimmer, M. Ramadori, V. Postl, C. Kobel, T. Coja, J. Brücker: 7th EU Framework Programme for Research, Technological Development and Demonstration (2007 – 2013), provisional overview report – 2007 results

Interaction with the Austrian commercial sector

How important is extra-university research in Austria with regards to international and national research activities and technological developments? This question can be answered both thematically and financially.

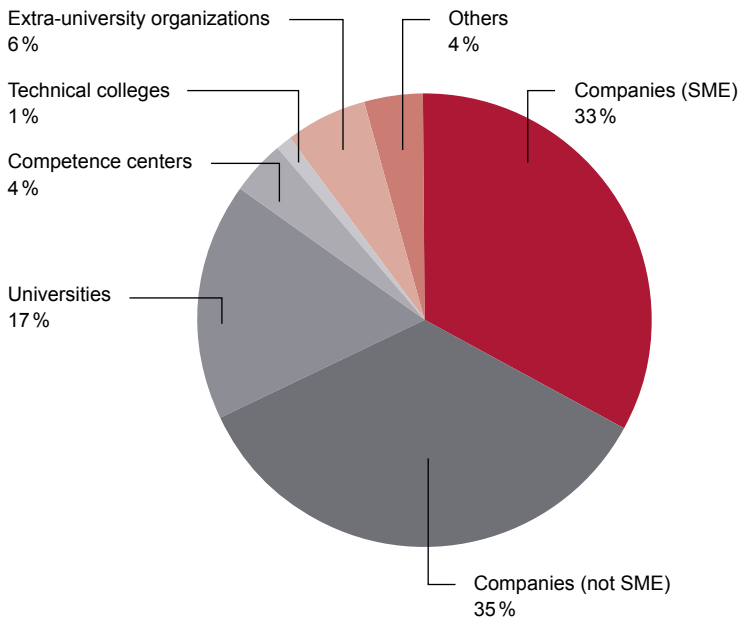
A financial analysis reveals that, in the 6th EU Framework Programme (2002 – 2006), extra-university research organizations were responsible for 25 % of financial capital return flows to Austria. In 2007, these extra-university research organizations were responsible for 22 % of financial capital return flows to Austria. 28 % of all Austrian investors are extra-university research organizations that act as European project coordinators.

When analyzing national funding programs, it can be seen how transparent knowledge networks are implemented between university and commercial partners: Successful research cooperation agreements between Austrian Research Centers and participating partner organizations were evaluated for the 2000 – 2007 period.

Over the past eight years (2000 – 2007), Austrian Research Centers has been carried out nationally funded research and technological projects with companies (an average of 68 % of projects), universities (17 %), other extra-university organizations (6 %) and competence centers in Austria (4 %).

This cooperation analysis underlines the importance of Austrian Research Centers in national funding programs for research and technological development with regards to the network with Austrian companies, in particular SMEs. Funded technological cooperations are a successful way of intensifying the interaction between contract research organizations and businesses. This leads to another important role for the Austrian Research Centers in the innovation system: contract research for our customers.

ARC cooperation partners in national funding programs by The Austrian Research Promotion Agency (FFG)



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Organizational Chart
As at 31.12.2007

Organizational Chart

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Organizational Chart

As at 31.12.2007

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Strategic Knowledge and Patent Portfolio

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Strategic Knowledge and Patent Portfolio

Strategic Knowledge and Patent Portfolio

The main core processes of Austrian Research Centers focus both on engaging in thematic research and technological programs with scientific and commercial partners, and on performing contract research activities.

Along with highly qualified human resources, international relationship networks and dedicated infrastructure facilities (laboratories, experimental equipment, etc.) are essential preconditions for the performance of these core processes. Austrian Research Centers also trains scientists who then, after several years, join companies and strengthen the potential of the relational capital in the long-term.

Austrian Research Centers' scientists are involved with companies in national funding programs in specific focal areas. They independently conduct research activities to develop technologies, are prominently represented in European research cooperation activities, and increase the amount of knowledge transferred to Austria.

Information Technologies

Information Technologies regards itself as an international provider of advanced technology for intelligent system solutions, focusing on the areas of:

- Computer Vision
- Safety & Security
- Ambient Intelligence

Intelligent systems are designed to support people in many different areas of life, to provide them with comfort and security, to deliver accurate information, to make universal communication possible and to increase productivity.

ICT systems of the future

Most people are not aware that the most common way of using computers is by far that of so-called embedded computers. 98 % of modern computer systems are embedded in every kind of electrical equipment. Computers can be found in common devices and appliances such as credit cards, mobile phones, cars and airplanes, as well as in places such as flats, offices and factories. Embedded computer systems consist of hardware (nanoelectronic components) and software.

More than four billion embedded processors were sold last year, with the global market recording sales of EUR 60 billion and growing at an annual rate of 14 %. International market growth forecasts predict that more than 16 billion embedded devices will be sold in 2010, and more than 40 billion by 2020. It is expected that, within the next five years, the share of embedded systems will increase significantly in advanced markets such as automobiles (36 %), industrial automation (22 %), telecommunications (37 %), consumer electronics (41 %) and health/medical equipment (33 %).

Embedded computers and electronics have a considerable strategic product value. The value added for embedded software end-products is significantly higher than the actual cost of the embedded device. In 2010, a modern car will be worth 35 % more, owing to the amount of integrated electronics. Up to 90 % of these new innovations are related to the areas of:

- Motor management (improving efficiency and reducing emissions)
- Safety features (such as stability, antilock brake and airbag systems)
- Convenience (navigation and entertainment features)

Embedded computer systems are becoming ever more complex, being both difficult to design and to build.

Research and technological development in DECOS (2004 – 2007)
At the beginning of 2004, Austrian Research Centers started an international research project in the 6th EU Framework Research Programme: “DECOS – Dependable Embedded Components and Systems.”
The aim of DECOS was to create a generic technological platform for integrated, distributed systems in the area of critical, embedded real-time applications requiring a high level of security and reliability.

Together with European industrial partners such as Airbus, Audi Electronics Venture, Centro Ricerche FIAT, Hella, Infineon, Thales Avionics and TTTech Computertechnik, research tasks were carried out on several key system functions: Improved diagnosis and maintenance, supplying basic universal technology to integrate applications with varying reliability requirements, as well as reducing the number of hardware components, thus cutting costs. The project's volume exceeded EUR 14 m, which then triggered further development of this technological know-how, helping to ensure a sustained innovative edge over international competitors. Commercial areas of use include the automobile industry, aviation and space travel, medical engineering and autonomous systems.

A strong national technology program: FIT IT
Aside from European components, the Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT) founded a national information technology program "Embedded Systems" in 2001 – to improve the technological know-how of every Austrian researcher involved.[14]

Success in the 7th EU Framework Programme (2007 – 2013)
Based on these national research activities, Austrian Research Centers started a continuative European technology cooperation project in 2007. In the 7th EU Framework Programme for Research, Technological Development and Demonstration (Sector ICT for intelligent vehicles and mobility services), it will be examined how further embedded sensor components can be integrated into systems (such as in the cars of the future): ADOSE – Reliable application specific detection of road users with vehicle on-board sensors.[15]

Between 2008 and 2010, a EUR 10 m research project will be implemented under the leadership of Centro Ricerche FIAT with the aim of improving road traffic safety and reducing accidents by using advanced sensor technology and sensor networks. European partners include ST Microelectronics, Robert Bosch GmbH, Magneti Marelli Sistemi Elettronici etc, whereby the particular challenge for Austrian Research Centers is to optimally integrate a newly researched sensor technology (Vision System on Chip) based on bio-inspired "silicon retina stereo sensors", into time and safety-critical on-board sensor systems. Technological award: In 2007, this technological development won the ICECS 2007 BEST PAPER AWARD[16] at the 14th IEEE International Conference.

ARTEMIS illustrates the long-term, strategic, and mainly industrial importance of research with regards to ICT systems.

Joint technological initiative "embedded ICT systems": ARTEMIS (2008 – 2017)
The joint venture ARTEMIS[17] is a new public-private partnership between the European Commission, member states and European industrial companies in the field of embedded systems (Artemisia, a non-profit industrial association).

It was here that, for the first time, European businesses took the lead in providing funding for research. Based on a program of work spanning several years and agreed on by the European Commission and member states, invitations to tender for cooperative research projects are being prepared.

14 http://www.fit-it.at/
15 http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&QUERY=011a4889aa36:3fa2:1af3a453&RCN=85243
16 C. Posch, D. Matolin, R. Wohlgenannt, Electronics, Circuits and Systems, 2007. ICECS, 07. 14th IEEE International Conference, pp. 1071-1074, Dec. 11 – 14, 2007, ICECS 2007 BEST PAPER AWARD
17 Council Directive (EC) No 74/2008 of 20 December 2007

With regards to content, three technological focal points for the future of embedded ICT systems were defined by European industry in a multinational process:

- Reference Design and Architecture
- Seamless Connectivity and Middleware
- Design Methods and Tools

New processes ranging from safety-critical embedded ICT systems, individual health management and the secure transfer of information to technologies for life in large cities are being researched in eight thematic programs.[18]

Together with Austrian companies, Austrian Research Centers is engaged in intensive preparations in order to input its technological knowledge and expertise into these long-term and key research areas defined by European industry. The first international invitation to tender for ARTEMIS will be begin in the middle of 2008.

Award for the best scientific publication at the 14th IEEE conference.

18 https://www.artemis-ju.eu/call_2008

Materials Technologies

The strategic goals of Materials Technologies are to become the national technological leader and to achieve European recognition in the following thematic focal areas:

- Composite materials, processes and (sub)systems
- Multifunctional materials and process development
- Technological application of light metals for transport systems with reduced emissions

Materials to optimize energy in power plants

The Austrian report on climate protection[19] presents current emission trends for greenhouse gases in Austria and describes the current situation concerning how climate strategies are being implemented with regards to the Kyoto Protocol.

The sectoral analysis of Austrian greenhouse gas emissions in 2006 details the following causes: Industry and manufacturers are responsible for 27.8 % of emissions, traffic 25.5 %, using energy 17 %, room heating 15.6 % and agriculture 8.7 %. Aside from measures such as trading emissions, research can lead to new technologies which can, for example, increase the efficiency of power plants and reduce emissions through the use of new materials. A European initiative is presented below which has exactly these points as objectives, and in which Austrian Research Centers is bringing its expertise to bear. Details are also provided of a successful, international, industrial centre of competence in which industrial companies and research organizations have come together to achieve specific objectives.

Research umbrella COST 536 (2004 – 2009)
COST 536 represents an international research cooperation agreement with the goal of improving the efficiency of power plants by developing new steels. 47 institutes and 15 European countries are jointly researching ways to reduce the amount of fuel needed for power plants and to reduce emissions through the use of new materials.

The Austrian project consortium is made up of four industry partners: BÖHLER Edelstahl, Kapfenberg, voestalpine Gießerei Linz, Böhler Schweißtechnik Austria and MCE Maschinen- und Apparatebau GmbH; and two research partners: Austrian Research Centers GmbH – ARC/Alloy Development Group and TU-Graz/IWS. The team has already developed very innovative solutions in the subject area. These include heat-resistant 9 % Cr steel coated with a boron alloy, tested and developed by BÖHLER Edelstahl and Austrian Research Centers as part of the COST action 522.

Research agenda
Highly efficient steam power plants with low emissions are undergoing three stages of development: at a nano level, at a mesoscale and at a macro level. This covers everything from innovative alloy developments to validating the integrity of specific components. The COST action develops, qualifies and generates improved materials with a Cr class of 9 % to 12 %, and with an optimized degree of high temperature resistance in order to create vital components which are needed to build and operate advanced steam power plants. In particular, the aim is to develop materials for heavy forging (such as for turbine rotors) and casting (such as casings for turbines and valves).

19 Publisher: Umweltbundesamt GmbH, ISBN 3-85457-947-0

Nanoscale aspects when developing metallic materials
For specific applications, suitable materials (e.g. steel and nickel alloys) may be designed for use under difficult industrial conditions, at a sub-microscopic or even atomic level, with a particular combination of physical, chemical and mechanical properties. These properties are created by choosing suitable alloy elements and generating an appropriate microstructure with heat treatment and production techniques such as casting, forging and milling. As a rule, a composite material is created in which a ductile metallic matrix is strengthened by means of small, hard phase II particles that are only 20 to 50 nanometers in size.

Mesoscale aspects when checking materials
The next step in testing materials verifies the usability of the new materials. The test cycle involves measuring changes in weight caused by oxidation and spalling, as well as examining microstructures. The results are collectively recorded and analyzed using modern neuronal network techniques, with which any correlations between the mechanical properties, chemical composition and heat treatments become evident. This accelerates the development of new steels with optimal properties for industrial use.

Macroscale aspects when validating material components
In order to completely validate the components which have been made out of the new steels, including their welded joints, the materials have to be inspected without being destroyed and have to undergo specific mechanical and oxidation test procedures.

International partners
The international project team includes interdisciplinary research partners such as MPS Stuttgart, Cambridge University, various Fraunhofer institutes, Jülich and TU Denmark, alongside such European business partners as Alstom (UK), Siemens (D) and Salzgitter Mannesmann (D).

Austrian awards
The Austrian project was nominated for the Dr. Wolfgang Houska Award 2007 (B&C Private Trust), with the award going to the Graz University of Technology, ad personam Horst Cerjak.

Competence networks for aviation technology – Austrian Aeronautics Research Network

Materials for aviation must be lightweight, have a high degree of specific stability and heat resistance, and generally satisfy the highest standards of quality. In order to become more successful as suppliers of materials and airplane parts, nine industrial companies and three research organizations, with their eyes on the European aviation industry, came together under the guidance of Austrian Research Centers and founded a competence network for aviation technology – the **Austrian Aeronautics Research (AAR)** network – in 2001.

AAR was the first Austrian initiative to create a cluster in the area of aviation and it is the basis from which the Austrian aviation supply industry is positioning itself as a technology partner with international aviation industry giants such as Airbus, EADS and Boeing.

AAR is funded by Austria's Federal Ministry of Economics and Labor within the framework of its model program to promote competence networks, and it is also supported by the City of Vienna's technology agency, the Tiroler Zukunftsstiftung, the Province of Upper Austria, technet capital and the Styrian Business Promotion Agency. With this network, the first medium-term research program for the domestic aviation sector in Austria was set up with a budget until 2008.

Objectives of the aviation network

- AAR consolidates scientific and industrial competencies in Austria in the areas of **light weight alloys and intermetallics, polymer composite materials, and engineering** in aviation. This is done in order to set common research and development focal areas that improve the competitiveness of the Austrian aviation industry.
- The design of the research program, and thus AAR, is derived from the efforts of the company partners involved to evolve from **component suppliers to sub system suppliers** and to establish themselves as **partners to the aviation industry**.

Focal areas of the research program

- New materials for the aviation industry
- Mathematical and experimental methods for describing, measuring and evaluating material and component damage under operating conditions
- To create methods for online monitoring (structural health monitoring) and thus to predict the the remaining life time of components

Industrial research is concentrating on light weight and composite materials and processes, the design of components and the certification of methods and procedures for aviation.

From zero to 1,600°C in just a few minutes. In the ARC “space chamber”, materials are tested under extreme conditions

Nano-System Technologies

The area of Nano-System Technologies generates innovative ideas for products and creates prototypes that nanoscience and nanotechnologies specifically use to their benefit. Its vision is to implement and utilize

- nanotechnology in nanosensors, and
- nanochips for the purpose of making diagnoses

together with business partners (SMEs and large companies) and other ARC divisions. These promising fields of research are making a long-term contribution to the areas of safety, energy, communications, transport and health, thereby supporting the strategic aims of Austrian Research Centers in key areas.

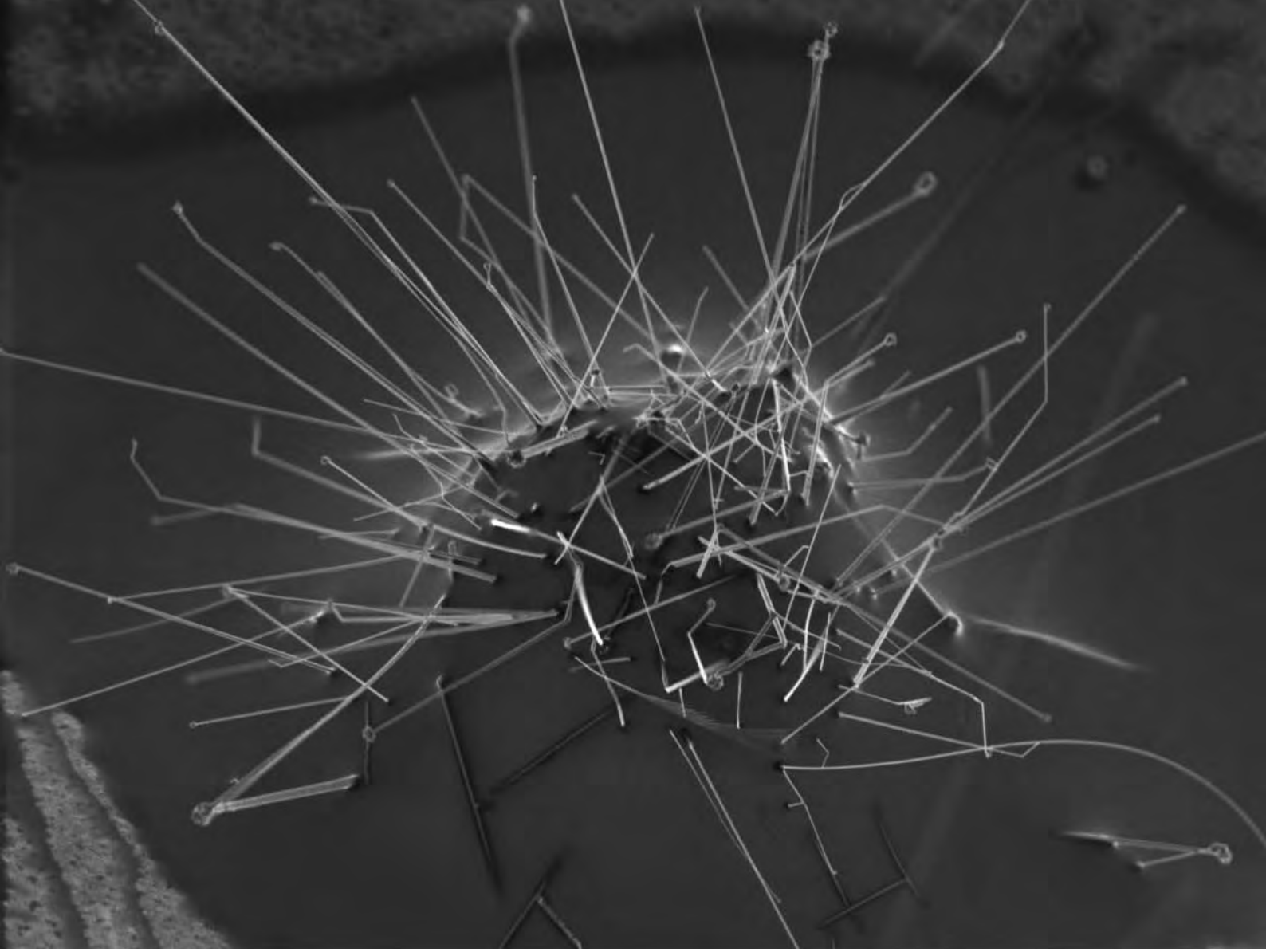
New sensors for technological innovations

Sensors, in particular gas sensors, are an integral part of our technological environment. Everything from fire protection systems in building and air-conditioning techniques to industrial process controls and the analysis of exhaust emissions, as well the medical diagnosis of breathable air requires highly sensitive gas sensors.

Metallic oxide sensors are the most commonly used type of gas sensors. They use special metallic oxides which react with surrounding gas molecules, thereby absorbing or discharging electrons. In this way, the reaction with the gas can be directly converted into an electrical signal. Although the use of metallic oxide sensors has been spurred on in recent years though its introduction into CMOS technology, there are still some problems concerning the selective recognition of individual gas components and reduced sensitivity.

It is here that nanotechnology offers a range of new approaches to significantly develop current gas sensors: Nanostructures, such as ultrathin, nanocrystalline layers and nanowires, possess a much larger surface-to-volume ratio than conventional sensors and allow more accurate measurements to be taken and response times to be accelerated. At ARC Nano-System-Technologies, innovative gas sensors and electronic noses have been developed, based on the latest nanotechnology and production procedures.

Monocrystalline SnO_2 nanowires are used as sensor elements on silicon and can detect carbon monoxide, methane, hydrogen and humidity. These nanosensors are extremely sensitive: At operating temperatures between 200°C and 400°C, the sensors are able to measure the concentration of carbon monoxide and methane at concentrations of just a few parts per million.



Self organized growth of SnO_2 nanowires

Mobility & Energy

In strategic research, arsenal research focuses on methods and technologies that demonstrate considerable potential for the future in order to support current and future partners in realizing radical innovations. In accordance with the various innovation mechanisms, arsenal research addresses the areas of:

- Intelligent Transport Infrastructure
- Energy Generation & Distribution
- Energy in Buildings
- Advanced Vehicle & Propulsion Systems

Tomorrow's development tools for future-oriented solutions
Gradual climate change, the scarcity of energy resources and increasing mobility needs in the context of over-stretched infrastructure are currently leading to a dramatic and global paradigm shift. In light of these current challenges, the European Union has assigned the areas of transport, climate and energy top priority in the research agenda for the coming years.

In the promising areas of mobility and energy, arsenal research has already established itself as a recognized key player in the national and international research scene. The mission of arsenal research is to purposefully use this advance in know-how in order to move Austrian industry to the forefront of the key topics of tomorrow. Enabling technologies, such as the broad field of numeric simulation, make it possible for us to deal with highly complex problems swiftly and flexibly in a multidisciplinary environment. arsenal research is using these new possibilities to develop innovative methods, procedures and tools to solve problems that arise from the current paradigm shift.

The value added for Austrian industry extends over two time horizons: In the area of classic contract research, our experts make use of state-of-the-art methods, as well as modern laboratory infrastructures, to solve concrete developmental problems, thus giving national companies a competitive advantage in the global market. Looking even further into the future, arsenal research is working more closely with selected strategic partners to create new development tools for solutions of the future. In this way, our company will be able to position itself in a larger environment and guarantee its knowledge-based advantage in the long term.

Strategy for success

arsenal research's dominant position in the future-oriented areas of mobility and energy has been achieved thanks to joint efforts by customers and organizations. Most of all, though, our employees ensure the key future role that arsenal research will play as a front runner in the key issues of tomorrow thanks to their flair for innovation and dedication. Nevertheless, technological excellence alone does not account for the success of arsenal research. As shown in the categories of ARC's intellectual capital model, arsenal research has also been extremely successful in tapping the value added potential of human capital, structure capital and relational capital. This is shown in the examples below.

Human capital
Our employees are our most important assets. The research teams at arsenal research are a blend of highly qualified, young and international individuals. As such, the share of academics has increased from 34 % (when a new structure was introduced in 2000) to approximately 65 % in 2007. At the same time, the average age has reduced to around 36.

Aside from the high percentage of academics and the young teams, our research company stands out for its internationality and comparatively high number of women. Consequently, people from ten different nations are currently working at arsenal research, and two divisions out of six are headed by women.

Relational capital
In 2007, cooperation work and networks were extremely successful for arsenal research.

In a European context, we have been able to establish ourselves as key partners in EU projects and networks that are strategically important to us (EU projects INTRO, EUROSYSLIB, MODELISAR, Smart Grid, DER-Lab, ENARD (IEA) and SARA).
arsenal research is also taking the lead in strategically important issues in Austria. For example, arsenal research initiated the development of a national technology platform in the area of "smart grids" including all important stakeholders: VEÖ, Energie AG Netz OÖ, Salzburg Netz, Linz Strom Netz, Wienstrom Netz, TU Graz, TU Wien, Siemens AG Österreich, IRM and Fronius.

Smart grids will also play an important role in the upcoming ENERGYbase. Several years ago, arsenal research developed trendsetting building and energy concepts together with pos architekten in the Sunny Research project. This concept is now becoming a reality at the Vienna TECHbase facility in Floridsdorf. From summer 2008, this energy-efficient solar office block will be available to rent, offering 7,500 m^2 of floor space. Companies, research and academic institutes which are involved in the area of renewable energy are particular targets for ENERGYbase. arsenal research's involvement was decisive in developing a degree course in renewable urban energy systems at the University of Applied Sciences Technikum Wien. Its modules are closely linked to the focal areas of arsenal research, particularly in the area of smart grids. Over the next few years, employees at arsenal research will teach at the college, engage in projects with students, supervise dissertations or undertake joint research projects reflecting the increased cooperation between the college and arsenal research.

In the field of alternative drive technology, which is seen as being key to energy-efficient mobility, arsenal research has assumed the role of Austrian representative for the areas of hybrid cars, electrochemical energy storage and electrical two-wheelers within the framework of the "Implementing Agreement on Hybrid and Electric Vehicles" by the IEA (International Energy Agency).

It is not just networks that stand out in 2007. This year also signaled the beginning of demonstrating innovate technologies in this field. As part of the A3 lead project "Bio-SOFC-Drive", arsenal research is focusing on developing and demonstrating an SOFC Battery-Hybrid-Drive powered by biogenic fuels. The engine is being developed and integrated into several cars, as well as test fleets, through a series of steps. Here, arsenal research is mainly responsible for managing the energy needs of the entire system. Development partners are alp^2s, as the SOFC developer, and Blaguss, ÖAMTC, FH Wieselberg, the Werfenwenden municipality, CLIMT and MLU, who are the users.

In order to master the interdisciplinary challenges during development, arsenal research also relies successfully on internal networks and knowledge transfer. Know-how transfer and the close cooperation between different fields of research are part of daily business. As such, even significant advances and successes in the fields of modeling and simulation occur in part due to systematic joint learning processes. arsenal research has even created its own "Communities of Practice" as a framework for scientifically and methodically linking different disciplines and divisions – a concept that works, as the company's excellent position demonstrates.

The condition of the road is often decisive when calculating the accident risk. Hotspots on Austria's roads are easily identifiable with the road safety software, MARVin.

In order to be able to develop scientific-based solutions to problems, arsenal research is of course firmly established in its fields of research within the scientific community. This can be inferred from the number of dissertations, theses and scientific publications last year. Moreover, two of our employees completed their postdoctoral theses in 2007, further increasing the standing of arsenal research.

Health Technologies

The selected objectives of the Health Technologies division are:

- Undertaking outstanding research and technological development work at an international level for the health and environment market. This means assuming the lead in these areas of science in Austria, and being among the top five in specific subject areas in Europe.
- Achieving excellence in the field of molecular analysis platforms and establishing bioinformatic systems for drug and chemical safety
- Achieving excellence in the field of molecular monitoring systems for health, safety and the environment.

eHealth

One of the biggest **challenges facing healthcare is societal demographic change** in Europe, North America and Japan, and the resulting increase in age-related diseases, as well as the costs for hospitalization, rehabilitation and care. A large proportion of these age-related diseases are made up of chronic diseases such as high blood pressure, diabetes, cardiac insufficiency and Alzheimer's disease. Inadequate or a lack of treatment leads to further severe and cost-intensive complications such as heart attacks, strokes and kidney failure, to name but a few. German statistics on strokes show that around one-third of all stroke patients need rehabilitation and long-term care, as they often suffer some degree of paralysis as a result of the stroke. These factors, as well as an increased health awareness of the healthy population, translate into a rising demand for health products and services. Consequently, research in biomedicine technology, along with biotechnology has become increasingly important.

For an optimal therapy in the case of chronic diseases such as high blood pressure, cardiac insufficiency, diabetes mellitus, obesity and psoriasis, it is particularly important to be compliance with the prescribed treatment, in addition to receiving appropriate and individually dosed medication. By using mobile, electronic devices for patients, the doctor can also review how treatment is progressing between visits to the practice. Information is automatically provided when values exceed or fall below individual thresholds, or when undesirable side effects occur. This makes it possible to take action and help the patient as swiftly as possible. Finally, severe complications for the patient can also be avoided, thus reducing the costs of healthcare.

Together with another company, the Austria-wide web platform "OsteoMinder" went online, with the particular aim to provide sustainable treatment and secondary prevention for chronic diseases such as osteoporosis. OsteoMinder reminds patients to take their medication, using a communication medium selected by the patient (e.g. mobile phone), and thus offering the best possible service for patients and doctors alike.

The technological innovation NFC (near field communication) makes it possible to link electronic and non-electronic data for the first time. Thanks to the interdisciplinary ARC development of an NFC module for medical instruments, it is now possible to quickly, conveniently and safely measure patients' blood pressure and to send the data to a central monitoring station simply by touching an NFC-compatible blood pressure measuring instrument with an NFC mobile telephone.

Awards
Industry analysts at Frost & Sullivan recognized the potential of this development and, as a result, presented the 2007 European Near Field Communication for Healthcare Excellence in Research Award to Austrian Research Centers for this excellent R&D work.

By making use of these technologies, pharmaceutical companies are able to obtain detailed information on how effective and safe their drugs are in practice, e.g. at the patient's home on a regular basis over an extended period of time, and without concerns about patients not following the prescribed course of treatment. An above-average growth rate of 8 % is predicted for the coming year. Telemedicine goes beyond medical technology, as classic medical technology (e.g. measuring the pulse), information and communications technology (mobile phones, PC, software) and medical services are combined.

Developing Austrian networks
An inaugural eHealth science conference in 2007 on the subject of "Medical Informatics meets eHealth" was a resounding success with 140 participants, meaning that another eHealth conference is planned for 2008 under the leadership of the biomedical engineering field.

A way into the brain

The European research project EURIPIDES (European Research initiative to develop Imaging Probes for early In-vivo Diagnosis and Evaluation of response to therapeutic Substances) is a four-year project of the 7th European Framework Programme (HEALTH F5 2007), receiving funding of around EUR 7 m. Together with Austrian Research Centers, twelve European partner organizations are using modern imaging techniques to explore why neurological patients respond poorly to drug-based treatment.

The groups Radiopharmaka and microPET Imaging have assumed a key role in the consortium by developing new PET tracers to see how drug transporter work at the site of the blood-brain barrier. In addition to this, preclinical data is obtained from microPET cameras available at Austrian Research Centers.

The most studied protein transporter at the site of the blood-brain barrier is called P-glycoprotein (P-gp). P-gp transports a number of different drugs from the brain back into the bloodstream, stopping potent drug levels from reaching the brain. A promising strategy to overcome this mechanism, and thus to improve the brain penetration of drugs, is to inhibit P-gp with newly developed P-gp inhibitors. However, a lack of analytical tests that can measure the degree of P-gp inhibition, and thus to calculate the necessary dose of new P-gp inhibitors, is proving to be an obstacle to the clinical development of new P-gp inhibitors. A procedure has been successfully developed that is based on measuring the brain penetration of the tracked transporter substrate 11C-Verapamil in a non-invasive way using positron emission tomography.

This new procedure was accepted for publication in the renowned Journal of Nuclear Medicine (impact factor 2006: 4,986) and the procedure is due to be introduced to clinics during 2008.

The Frost & Sullivan European Excellence in Research Award 2007 went to Austrian Research Centers

systems research

The objectives of the systems research division for 2008 – 2011 are:

- The continued development of existing core competencies; developing additional competencies in the area of governance to take on the role of a think-tank for RTI policies
- To maintain its market position in RTI policies; to expand its market position to "large international / internationally active corporations"
- To develop new market segments as part of long-term regional development
- To establish itself in the role of a scientific think-tank for Austrian RTI policies

Complex Learning Systems – knowledge management from the perspective of expert organizations

Interdisciplinary cooperative research encompasses the fields of Austrian Research Centers, in particular their continued development and strategic course of action.

As part of the research project Complex Learning Systems (CLS), knowledge management in expert organizations is being examined, where these expert organizations have only limited access to standardized products and processes. They stand out as skills-intensive organizations with flexible project teams that can adapt quickly to new situations and which are embedded in a complicated network of interactions inside and outside of the organization's blurred boundaries. These relationship networks provide the basis on which knowledge can be exchanged, used and developed in complex systems.

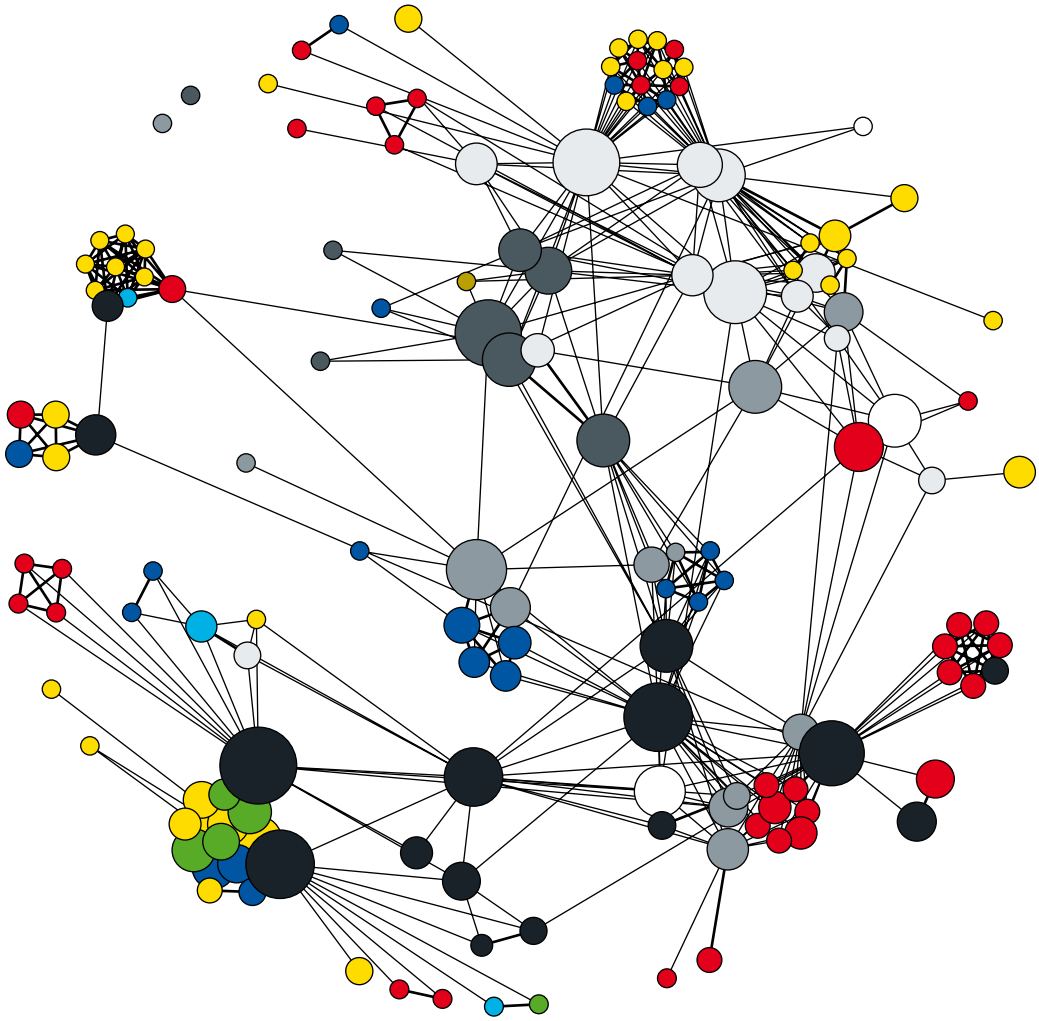
The goals of this supra-divisional project are:

- to identify and describe the most important aspects and features of knowledge management from a theoretical standpoint in expert organizations and
- to develop varying courses of action by means of case studies when implementing knowledge management in expert organizations.

A knowledge management model has been developed by incorporating theoretical system, recognition and organizational concepts, and using bibliometric and social network analysis methods. The model helps to describe and analyze knowledge processes in research-intensive expert organizations and to discern courses of action for implementing knowledge management in expert organizations.

From a practical point of view, expert organizations have raised their expectations of knowledge management. This is also the case with the Austrian Research Centers, which is implementing a needs-based knowledge management system. This involves developing a knowledge management concept and devising suitable methods and instruments, as well as implementing them, controlling them and adjusting them as necessary.

In order to establish a closer link between the size and results of individual modules, practical experience in reformulating theoretical concepts has been incorporated. This link between theoretical and practical analyses and conclusions is established in a joint learning process that makes is possible to check, validate and build on the respective results through feedback channels in theory and in practice. In this way, the model can be adapted in an iterative way due to experiences from case studies, and the steps taken to implement the model can also be reviewed in a theoretical and practical way.



Models for knowledge networks support the description and analysis of knowledge processes.

Another objective of this project is to support this joint learning process within the entire project team. With this in mind, a so-called learning platform is planned where case study experiences and theoretical developments can be shared.

Knowledge as a key competitive factor is a cornerstone of strategic planning. Along with the workforce, financial capital and real estate, knowledge is one of the most important factors in production. Its development potential – in the form of technological know-how, product design, market presence, customer understanding, creativity and innovation – determines the value of most products and services. In particular, the intellectual capital accrued by way of these factors in expert organizations such as universities, research institutes, ministries etc, considerably exceed the material assets.. The focus of knowledge management activities is on how knowledge resources should be handled to make better use of them, to safeguard them, and to develop them further.

Complex Learning Systems is based on the fundamental principles of creating order: Emergence, the irreversibility of the system's history and the unpredictability of the system's future, therefore underlining the importance of skill-intensive interactions based on self-organization.

AUSTRIAN RESEARCH CENTERS

06

Intellectual Capital Report 2007 – The ARC Model

Intellectual Capital Report

2007

Intellectual Capital Report 2007 – The ARC Model

Core process: independent research
The independent research conducted by Austrian Research Centers is integrated into a dense network based on scientific exchange and knowledge generation between the participants of the European and national innovation system. Independent research and technology projects serve as means of acquiring knowledge and expertise, and form the basis for technological innovations by the various ARC companies.
In the course of its innovative work, Austrian Research Centers cooperates with Austrian and international universities in selected strategic areas under a series of bilateral or multilateral agreements with research institutes and industrial companies within the scope of national or European research programs (7th EU Framework Programme).

Core process: contract research for customers
The exploitation of knowledge and expertise for commercial and social benefits takes place in the course of contract research activities to develop specific technological innovations working in conjunction with and on behalf of customers.

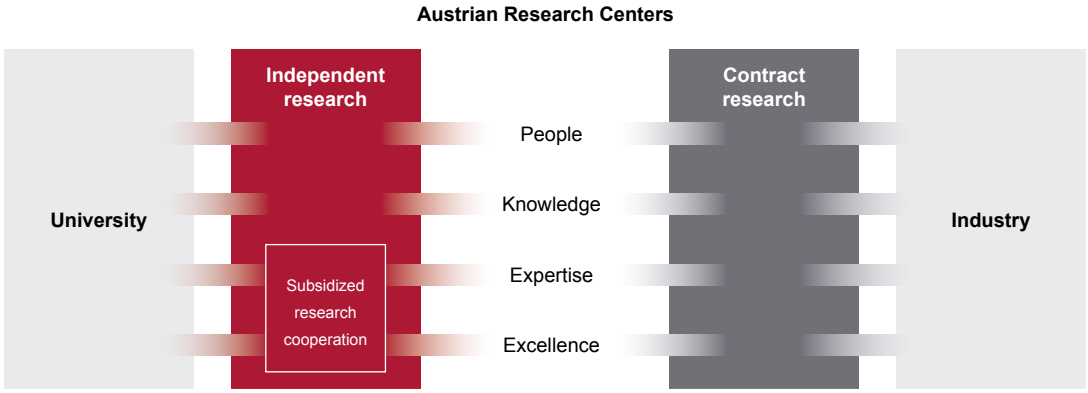
The innovation-specific levels of intellectual capital
This intellectual capital report defines several levels of knowledge and expertise flows involving Austrian Research Centers:

- The **density of scientific cooperation** with universities in the course of Austrian Research Centers' independent research activities provides a natural habitat for the first level of intellectual capital with output parameters such as joint scientific publications in peer-reviewed journals.
- The **density of technological cooperation** with companies, research institutes and public-sector organizations in the course of national and European grants is reflected in the second level of intellectual capital. The output parameters on this level are, for example, the number and relevance of new patents in the strategic patent portfolios of ARC's divisions.
- The **density of commercial cooperations** with industry players and public-sector organizations is performance benchmarked at the third level of intellectual capital. The experienced gathered by ARC in its role as a contract research organization (CRO) also provides inputs for the strategic direction of the Group's scientific research and technology programs when setting technology policy objectives.

Overall, this creates a commercial system with considerably higher degrees of freedom to undertake research activities and engage in network interaction depending on the implementation of open system components (refer also to: Open Innovation).
The intensification of the commercial activities of a research and technology-based group of companies is not incompatible with its intensified involvement in a knowledge-based society and the generation of new knowledge and expertise.

The simplest way of highlighting the complex network interactions between numerous partners from commercial and university institutes provides an overview of the players and the flows of information. The cooperation partners, such as universities and industry players, form the inherent elements of the dynamic system integration and analysis.

The ARC Model



Knowledge and expertise flows between the players determine the dynamic interaction within complex innovation systems.

AUSTRIAN RESEARCH CENTERS

07

International Assessment of ARC Research and Technological Development in 2007

Intellectual Capital Report

2007

International Assessment of ARC Research and Technological Development in 2007

Austrian Research Centers has established an international scientific advisory board to aid in defining its research strategy and technology policy direction.

The Group Advisory Board is made up of the following experts from the fields of science, research and commerce:

Chairman of the Group Advisory Board
Prof. Hermann KOPETZ

Mitglieder des Beirates
Walter AMMANN, PhD.
Prof. Haim HARARI
Prof. Günter HERTEL
Ingeborg HOCHMAIR-DESOYER, PhD.
Prof. Heinrich ROHRER (Nobelpreisträger)
Prof. Bert SAKMANN (Nobelpreisträger)
Prof. Horst SCHMIDT-BISCHOFFSHAUSEN
Prof. Siegfried SELBERHERR

The Group Advisory Board advises the Management of Austrian Research Centers GmbH – ARC in terms of the Group's research strategy and the focuses of its technology policy, in particular with regard to topic-based research programs which are reflected in both the annual and the long-term research programs. Furthermore, the Group Advisory Board also makes recommendation to the Management on reaching objectives set out by the research strategies and topic-specific research programs.

The third sitting of the Group Advisory Board of Austrian Research Centers took place in Vienna on 23 November 2007. The main issues discussed at this board meeting were the current positioning of the ARC teams in the market and in terms of research, as well as the strategic research and technology objectives of Austrian Research Centers in the period up to 2010.

Progress in 2007

The progress report dated 23 November 2007 documents the key results of the internal discussions of the Group Advisory Board.

"The Group Advisory Board is pleased to note that the recommended focus on a limited number of scientific fields has continued unabated. Since the first sitting of the Group Advisory Board in November 2004, considerable progress has been made in strategically re-orientating the Group in the direction of ground-breaking research in carefully selected areas with significant future potential.

The results presented to the Group Advisory Board (GAB) from the selected central research areas were notable for their outstanding quality. The GAB recommends continuing the focus on defined strategic areas combined with long-term and stable management structures and secure financing well into the future. The GAB also acknowledges the close links between the applied research conducted by Austrian Research Centers and discovery research (e.g. the close ties between the Biogenetics Division and the Tulln Research Center).

Statement on the presentations from ARC's divisions:

Vision Systems
The tangible results achieved by this division were convincingly presented. The GAB recommends paying particular attention to the long-term strategic safeguarding of the knowledge accrued to date. The existing conflict between a commercial perspective and broad-based economic use needs to be resolved by identifying particularly successful projects.

Nano-System Technologies
This small division is engaged in investigating extremely innovative and promising areas the economic value of which is only expected to become clear in the course of time. A focus on the area of nano-sensors is favored.

Smart Drives 4 Smart Cars
The level of knowledge established so far in the area of hardware-in-the-loop real-time simulations helps many companies in the development and assessment of their products, particularly in relation to energy efficiency. It is recommended that preliminary research activities are consolidated given the major focus on engineering. The conflict between commercial and economic benefits also needs to be resolved by selecting particularly successful projects.

Light-weight construction
The GAB holds the opinion that, in light of the growing importance of lithium-based technology for light metals and the fact that the Koralpe region has Europe's largest deposits of lithium, special attention should be paid to the further development of this technology. It is also recommended that the systematic perspective in the light-weight construction area in particular is taken into account and that ties to the relevant university institutes are maintained.

Health Technologies
The GAB favors a continuing focus of the Strategic Division Health Technologies on the divisions Life Sciences and Radiation Safety and Applications in Seibersdorf. A relocation of the Biogenetics Division to Tulln is also recommended as a means of achieving structural improvements."

(Extract from the Progress Report dated 23.11.2007)

Profiles of Group Advisory Board members

Hermann Kopetz, Chairman of the Advisory Board
Hermann Kopetz, born in Vienna in 1943, studied physics and mathematics at the University of Vienna, obtaining his doctorate in 1968 sub auspiciis praesidentis. After a spell as assistant professor at the University of Georgia, he worked for VOEST ALPINE in Linz for eight years. In 1982 Hermann Kopetz was appointed professor at Vienna University of Technology's faculty of software engineering and real-time systems, and currently heads the Institute of Computer Engineering. Hermann Kopetz is the German-speaking world's foremost expert in the field of embedded systems.

Ingeborg Hochmair-Desoyer
Born in Vienna in 1953, Ingeborg Hochmair-Desoyer studied electrical engineering at Vienna University of Technology and in Karlsruhe. After working as an assistant lecturer at the Institute of Electrical Engineering and Electronics at Vienna University of Technology, in 1986 she moved to the Institute of Applied Physics in Innsbruck. In 1995, as managing director of the Innsbruck company Med-El GmbH, she was elected V.C. Business Woman of the Year.

Haim Harari
Born in Jerusalem in 1940, Haim Harari, studied physics at the Hebrew University in his home town. He has been employed at the Weizmann Institute since 1966, where he was appointed professor of high energy physics in 1970. He was president of the Weizmann Institute of Science from 1988 through 2001. Today, Haim Harari is chairman of the board of the Davidson Institute for Science Education.

Heinrich Rohrer
Born in St. Gallen in 1933, Heinrich Rohrer studied physics at the Swiss Federal Institute of Technology in Zurich, obtaining his doctorate in 1960. From 1963 through 1997 he worked at the IBM research laboratory in Rüschlikon in Switzerland. In 1974/75 he spent a sabbatical at the University of California in Santa Barbara. Together with Gerd Binnig, in 1986 Heinrich Rohrer was awarded the Nobel Prize in Physics for the development of the scanning tunneling microscope.

Bert Sakmann
Born in Stuttgart in 1942, Bert Sakmann studied medicine, obtaining his doctorate from the University of Göttingen in 1974. He habilitated at the University of Göttingen and carried out research in biophysical chemistry at the Max Planck Institute. Bert Sakmann has been Director of the Department of Cellular Physiology at the Max Planck Institute for Medical Research in Heidelberg since 1989. In 1991, the cellular physiologist was awarded the Nobel Prize in Medicine together with Erwin Neher.

Siegfried Selberherr
Born in Klosterneuburg in 1955, Siegfried Selberherr studied electrical engineering at Vienna University of Technology, obtaining his doctorate in 1981. In 1988, he was appointed professor of software engineering for microelectronic systems at Vienna University of Technology. From 1998 through 2003, Siegfried Selberherr was Dean of the Faculty of Electrical Engineering, and, from 2004 through April 2005, Dean of the Faculty of Electrical Engineering and Information Technology at Vienna University of Technology.

Horst Schmidt-Bischoffshausen
Born in Vienna in 1940, Horst Schmidt-Bischoffshausen studied physics at Vienna University. In 1971, he moved from Research Centre Jülich into industry, where he subsequently worked in research and technology development for DaimlerChrysler AG. In the year 2000, he was appointed Head of Strategic Development, Patent Applications and External Relations at the Corporate Research Center in Germany.

Walter J. Ammann
Born in 1949, Walter J. Ammann studied construction engineering at the Swiss Federal Institute of Technology in Zurich and obtained a doctorate in structural dynamics. He has headed up the Swiss Federal Institute for Snow and Avalanche Research in Davos since 1992, became head of natural dangers research at the Swiss Federal Institute for Forest, Snow and Landscape Research in Birmendorf in 1994, and was appointed to the establishment‘s board of directors in 1999. Walter Ammann also teaches at the Swiss Federal Institute of Technology in Zurich.

Günter Hertel
Günter Hertel studied transport engineering and mathematics at the “Friedrich List” University of Transportation in Dresden, obtaining his doctorate in 1974. In 1992, he was appointed professor of the transportation systems faculty at Dresden Technical University. In 1996, he was selected to head one of the four research & technology boards at the Daimler-Benz Group, and is today Vice President for Research and Technology.

AUSTRIAN RESEARCH CENTERS

08

Scientific Advisory Boards 2007

Intellectual Capital Report

2007

Scientific Advisory Boards 2007
As at 31.12.2007

smart systems
Prof. Quirino BALZANO*
Klaus BERNHARDT
Prof. Ruth BREU
Prof. Vladimir BUZEK
Prof. Zoubin GHAHRAMANI
Reinhard GOEBL MSc.
Giacomo INDIVERI, PhD.

Biogenetics
Prof. Martin GERZABEK*
Prof. Josef GLÖSSL
Hans HEITZINGER, PhD.
Karl KIENZL, PhD.
Andreas KRENN, PhD.
Prof. Marianne POPP
Andreas ROSSMANN PhD.
Prof. Helmut SCHWAB
Horst STEINMÜLLER, PhD.
Bernhard URL, PhD.

Life Sciences
Prof. Herwig BRUNNER
Prof. Ernst LEITNER
Prof. Christian NOE*
Markus PASTERK, MSc.
Prof. Manfred ROTTER
Konrad SCHÄFER, PhD.
Prof. Hans Peter SCHWARZ
Prof. Wolfhard WEGSCHEIDER
Prof. Norbert WINKER

Biomedical Engineering
Prof. Michael BINDER*
Thomas FEIGL, PhD.
Thijs SOEDE, PhD.
Prof. Bernhard TILG
Prof. Zlatko TRAJANOSKI
Prof. Karl Heinz TSCHELIESSNIGG

Radiation Safety and Applications
Prof. Karl BUCHTELA
Prof. Werner BURKART
Prof. Klaus DUFTSCHMID
General Norbert FÜRSTENHOFER
Prof. Peter KINDL*
Prof. Kurt KLETTER
Alexander KMENTT, MSc.
Alois SIEBER, PhD.
Walter TROGER
Prof. Irene VIRGOLINI

systems research
Prof. Manfred FISCHER
Prof. Armin GRUNWALD
Herbert KAUFMANN, MSc.
Rupert PICHLER, PhD.
Mr. Christian SMOLINER, PhD.
Prof. Ludwig STREIT*
Prof. Gunther TICHY

arsenal research
Josef AFFENZELLER, PhD.
Prof. Andreas BINDER
Prof. Günther BRAUNER
Prof. Marianne HAUG
Prof. Johann LITZKA
Prof. Peter LUND
Reinhard PFLIEGL, PhD.*

ARC::TAP
Prof. Christian v. MERING
Prof. Friedrich LEISCH
Friedrich LOTTSPEICH, PhD.*
Prof. Hugo KUBINYI

*) Denotes chairperson

AUSTRIAN RESEARCH CENTERS

Intellectual Capital Indicators 2007

Intellectual Capital Report

2007

Intellectual Capital Indicators

1. 1. 2007 to 31. 12. 2007

Austrian Research Centers total

	2005	2006	2007
Human Resources			
Number of employees (full-time equivalents = FTEs)	940.6	933.8	**916.2**
Number of employees (headcount)	995	992	**976**
Number of researchers (headcount)	522	524	**527**
Proportion of research staff (% headcount)	52.5	52.8	**54**
New employees hired - total (FTE)	182	97.6	**151.3**
New researchers (FTE)	116	63	**95.8**
Total employees departing (FTE)	90	133	**145**
Total researchers departing (FTE)	42	64	**84**
of whom aged 25 – 35 (%)	55	47	**59.3**
of whom within two years (%)	69	65.8	**63.9**
Total retirements (FTE)	13	22	**11.4**
Personnel expenses (%)	51.3	53.6	**58.66**
Proportion of women (%)	25.7	24.8	**24.6**
Proportion of female research staff (% headcount)	15.3	14.9	**14.8**
Women in senior positions (%)	19.8	20.3	**18**
Women on supervisory and advisory boards (%)	11.1	12.1	**20**
Staff with more than one degree (% of researchers)	6.3	4.8	**11.6**
Expenditure for personnel development (TEUR)	696.7	534.7	**601.2**
Training			
Total training days per employee	0.82	1.5	**2.1**
Structural Capital			
Processes and equipment			
Capital investments (% of operating income) Holding	Holding	6.24	**4.86**
Hit rate for EU research programs (%)	43	72	**50**
Accredited testing procedures	1,160	1,073	**866**
Relational Capital			
Project cooperation and networking			
Number of new EU projects	25	31	**23**
Number of inter-disciplinary contract research projects	44	59	**64**
Number of inter-disciplinary independent research projects	28	32	**21**
Research activities abroad (> 1 month)	6	7	**13**
Number of international researchers	97	92	**103**
Number of international researchers on freelance contracts	63	61	**48**
Business unit managers with lecturing assignments	24	25	**27**
Number of PhD. students	152	156	**142**
Number of diploma students	125	119	**91**
Presentations at scientific conferences per researcher	0.91	0.93	**0.9**

Intellectual Capital Indicators

1. 1. 2007 to 31. 12. 2007

Austrian Research Centers total

	2005	2006	2007
Core processes			
Independent and contract research			
Proportion of total expenditure accounted for by independent research (%)	Holding	54	**48**
Proportion of competitive research projects (% of independent research projects)	Holding	27	**12**
Number of newly acquired contract research projects	499	592	**652**
Project revenues from contract research activities (incl. small-scale projects, EUR Mio.)	35.951	39.024	**37.722**
Revenues/project (excl. small-scale projects, EUR)	53,633	56,228	**55,118**
Domestic customers	73	75	**65**
Results			
Commercial results			
Total operating results (TEUR)[20]	114,651	118,233	**126,329**
Market success (%)	50	54	**55**
Number of new customers	197	210	**311**
Proportion of new projects from industry (%)	74	77	**72**
of which domestic (%)	69	64	**85**
Proportion of new projects from government agencies (%)	26	23	**29**
Coordination of EU projects and networks	12	17	**17**
Ratio prime contractor : total EU projects (%)	18	18	**21**
Number of customer courses and seminars	1,628	2,015	**1,526**
Research results			
Publications in scientific peer-reviewed journals	135	137	**151**
Publications in scientific peer-reviewed journals per researcher	0.26	0.26	**0.29**
Number of publications in future technology fields (%)	41	43	**54**
Patents granted	21	18	**40**
National patent applications	45	41	**36**
International patent applications		21	**22**
Lecturing assignments per researcher	0.31	0.22	**0.17**
Theses completed	24	15	**32**
Post-doctorates	1	1	**2**

With regard to the comparability of the indicators, it should be noted that, in isolated cases, no reference data exist for 2005 due to the holding structure existing during that period.

20 Based on figure for 2007 contained in the Annual Report

Definitions of indicators

Human Capital

Human Resources

Number of employees (full-time equivalents = FTEs)

As at 31 December of the period under review
Full-time equivalent staff – not including trainees, staff on unpaid leave, completing military service, on parental leave, and those on Social Compensation Plan A

Number of employees (headcount)

Number of staff – not including trainees, staff on unpaid leave, completing military service, on parental leave and those on Social Compensation Plan A.

Number of researchers (headcount)

Number of staff with university degrees, excluding graduates with administrative responsibilities as of 31 December of the year under review

Proportion of research staff (% headcount)

Number of researchers (headcount) / number of staff (headcount)

New employees (FTE)

Number of new employees (full-time equivalents) joining the ARC Group in the period under review not including transfers within the Group.

New research staff (FTE)

Number of new researchers (full-time equivalents) joining the Group in the period under review.

Total employees departing (FTE)

Total number of staff who left the group during the period under review.

Total research staff departing (FTE)

Number of researchers leaving the employ of the Group during the period under review.

- of whom aged 25 to 35, as a percentage of FTE researchers leaving the Group during the period under review.
- of whom leaving the Group within two years, as a percentage of researchers aged 25 to 35 leaving the Group.

Total retirements (FTE)

Number of employees (full-time equivalents) who retired during the period under review.

Personnel expenses (% of total expenditure)

Personnel expenses as a percentage of total costs. Personnel expenses include wages, salaries, voluntary and compulsory social insurance contributions, severance pay, pensions and the reversal of provisions.

Proportion of women (%)

Full-time equivalent female staff/full-time equivalents of all staff

Proportion of female research staff (% research staff)

Full-time equivalent women research staff / full-time equivalents of all research staff

Women in senior positions (%)
Number of women in senior positions / total number of senior positions. Senior positions are defined as managers, authorized signatories, divisional heads, department heads and heads of business units. Only one position is counted if several positions are held simultaneously or within the same period.

Women on supervisory and advisory boards (%)
Number of women on supervisory and advisory boards / total number of supervisory and advisory board members

Staff with more than one degree (% of researchers)
Number of research staff who have a degree in more than one discipline

Expenditure for personnel development (TEUR)
Expenditure by the Personnel Development Department

Training
Total training days per employee
Number of training days according to ARC training catalogue excluding attendance at conferences and seminars per employee (full-time equivalent)

Expenditure for training per employee (EUR)
Expenditure for centrally organized seminars within the scope of the training catalogue per employee (full-time equivalent) in euro

Structural Capital

Processes and equipment
Capital investment (% of operating revenues)
Assets acquired not including buildings and technical infrastructure (incl. IT infrastructure) / total operating revenues

Hit rate for EU research programs (%)
Number of EU programs awarded/number of applications for EU programs

Accredited testing procedures
Number of test procedures excluding monitoring procedures and dual accreditation by the Austrian Institute of Construction Engineering

Relational Capital

Project cooperation and networking
Number of new EU projects
Number of EU Framework Programme projects awarded

Number of new inter-departmental contract research projects
Number of new contract research and publicly funded research projects, or competence centre projects for which cost units were established in more than one division.

Number of inter-departmental independent research projects
Number of ongoing independent research projects (inc. projects as part of the ARC Technology Offensive) for which cost units are established in more than one division.

Research activities abroad
Number of periods of at least one month spent abroad by ARC staff.

Number of international researchers
Number of ARC researchers who are foreign nationals.

Number of international researchers on freelance contracts
Number of ARC researchers on freelance contracts who are foreign nationals.

Heads of business units with teaching assignments
Number of business unit heads who held one or more lecturing assignments at universities, technical colleges or postgraduate educational institutions during the period under review. Courses include lectures, seminars, practicals, etc. listed in the university or college catalogue in an academic year, i.e. winter semester and the following summer semester.

Number of PhD. students
Number of individuals working on doctoral theses at ARC in the period under review, i.e. supervised by ARC staff – regardless of grants and including ARC staff working on theses.

Number of diploma students
Number of individuals working on diploma theses at ARC in the period under review – regardless of grants and including ARC staff working on diploma theses.

Diffusion and networking / researcher
Presentations at scientific conferences
Presentations given at international scientific conferences / congresses (per researcher)

Participation in committees: scientific, industrial, political
Number of memberships in associations, etc. per researcher

Core processes

Proportion of total expenses accounted for by independent research
Proportion of expenses for independent research projects, i.e. including publicly funded projects, as a percentage of total expenses for projects

Number of competitive research projects (% of independent research projects)
Proportion of the costs of competitive research projects as a percentage of the costs of all independent research projects (explorative, competitive and Technology Offensive projects)

Number of newly acquired contract research projects
Number of newly acquired contract research projects for national and international customers in the period under review, excluding small-scale projects.

Project revenues from contract research activities inc. small-scale projects (EUR Mio.)
Total revenues from contract projects for national and international customers, including small-scale projects.

Revenues / project (excl. small-scale projects, EUR)
Total revenues from contract research projects for national and international customers, excluding small-scale projects / number of projects.

Domestic customers (%)
Number of customers from Austria as a percentage of total customer projects.

Results

Commercial results
Total operating revenues (TEUR)
Total revenues from research contracts, nuclear financing by the Austrian Ministry of Transport, Innovation and Technology, services provided by shareholders, own work capitalized, services rendered within the ARC Group, and other operating revenues.

Market success (%)
Percentage of total costs covered by sales revenues and grants for R&D including changes in inventory.

Number of new customers
Number of customers awarding ARC research contracts for the first time.

Proportion of new projects from industry (%)
Proportion of new projects from companies as a percentage of the total volume of new projects from customers, i.e. excluding grant projects.

- of which domestic (%)

Proportion of new projects from Austrian companies as a percentage of the total volume of new projects from industry.

Proportion of new projects from government agencies (%)
Proportion of new projects secured from government authorities with effective administrative jurisdiction, which includes ministries, provincial and local government authorities.

Coordination of EU projects and networks
Number of EU projects with ARC as the prime contractor and number of networks with ARC as coordinator.

Ratio prime contractor : total EU projects (%)
Proportion of projects with ARC as prime contractor as a percentage of all ARC EU projects.

Number of customer courses and seminars
Number of external individuals who took part in ARC courses and seminars.

Research results
Publications in peer-reviewed journals
Articles published in journals quoted by ISI in the Science Citation Index (SCI).

Publications in peer-reviewed journals per researcher

Articles published in journals quoted by ISI in the Science Citation Index (SCI) per researcher.

Publications in conference proceedings, trade journals and books per researcher

Total number of conference papers published as complete articles in conference proceedings, articles in trade journals and contributions to books or published books per researcher.

Proportion of publications in future technology fields (%)

Proportion of ARC publications in scientific journals which, according to the Institute for Scientific Information (Thompson / ISI), are among the 25 % of scientific fields that demonstrate the highest international growth rates in terms of publications over a period of three years.

Patents granted

Number of inventions for which a patent has been granted and published in the Austrian Official Gazette (Patentblatt) (only one patent per invention).

National patent applications

Number of inventions for which a patent application has been submitted to the Austrian Patent Office (Patentamt).

International patent applications

Number of inventions for which a patent application has been submitted either to the EU or worldwide (only one application per invention).

Lecturing assignments per researcher

Number of courses held during the year at universities, technical colleges and postgraduate establishments. Courses are lectures, seminars, practicals, etc. listed in the university or college catalogue in an academic year, i.e. winter semester and the following summer semester.

Dissertations completed

Number of doctoral theses approved that were supervised by ARC staff, including theses submitted by ARC staff.

Post-doctorates

Number of post-doctorates approved

AUSTRIAN RESEARCH CENTERS

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Imprint and Contact Details

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2007

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Note

Great care has been taken during the preparation of this annual report to present the data accurately. Nonetheless, the possibilities of rounding, typesetting and printing errors cannot be entirely excluded. The use of software in the preparation of rounded figures and percentages may have resulted in minor inaccuracies.

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