

The project

The province of Styria invests funding in a wide range of research and development projects. These investments are based on long-term goals which must be coordinated with the research strategy of the province as a whole. To improve the effectiveness of public funding and to help implement large-scale strategic projects with greater efficiency, the Styrian Government approved the "Pilot project for regional research networks" in an Intellectual Capital Report on the example of **NANONET Styria** on the initiative of Deputy Governor Leopold Schöggl.

Participants

The project was implemented by Manfred Bornemann and Martin Sammer. In addition to the experts at **NANONET Styria**, the following people (listed in alphabetical order) participated in the control committee: *Fritz Andrae/piCHEM – Hubert Biedermann/University of Leoben*, *Stephan Hochfellner/Styrian Government, Department 14B – Jürgen Holzinger/MAGNA STEYR – Bruno Hribernik/BÖHLER UDDEHOLM AG – Günther Leising/AT&S, JR – Emil List/Graz University of Technology – Christoph Ludwig/Styrian Government – Alexandra Nagl/Styrian Government, Department A3/Science and Research – Bernhard Pelzl/JR – Gunther Peterzell/Styrian Government – Peter Piffli-Percevic/Styrian Government, Department A3/Science and Research – Werner Rom/JR, NANONET Styria – Ursula Schneider/University of Graz – Helmut Wiedenhofer/JR, NANONET Styria – Josef W. Wohinz/Graz University of Technology.*

Objective

The pilot project of the Intellectual Capital Report for **NANONET Styria** developed and implemented the prototype of a control mechanism for regional research networks. This mechanism supports the strategic development of the network's knowledge base. The aim of the Intellectual Capital Report is to provide a transparent, verifiable overview of the effects of the research funds invested in nanotechnology research.

NANONET Styria

Nanotechnology is internationally regarded as one of the key technologies of the 21st century and is expected to have significant effects on science, industrial development and the economy during the coming decades.

Definition of Nanotechnology

"Nanotechnology is devoted to the creation, analysis, and practical use of structures, molecular materials, internal interfaces, and surfaces with critical dimensions or manufacturing tolerances ranging in size from a few to approximately 100 nanometers."

Recommended measures

Based on the Intellectual Capital Report on **NANONET Styria**, the following measures are recommended:

1. Establishing a graduate college and ensuring the flow of young researchers into the field;
2. Creating a sound planning basis by establishing a "nanotechnology master plan" in close cooperation between sponsors and industry;
3. Setting up a one-stop administrative office to process project proposals efficiently;
4. Systematically continuing the development of the **NANONET Styria** network together with its sub-networks.

The most important conclusion and the most significant intervention option is the sustainable development of human capital by guaranteeing employee career paths, which will allow experts to plan ahead in the medium term. This could be implemented very pragmatically by jointly financing a pool of experts with funding from the public and industrial sectors. This pool system would enable experts to move freely between university research and applied research and would allow research results to be translated into industrial applications. Failing that, there is a danger that the already incipient tendency of a brain drain – favouring southern Germany in particular – will continue and perhaps increase in intensity. If this is the case, the region of Styria would find itself paying for the cost of development without being able to profit from its results.

The most important branches of industry are increasingly becoming aware that the key to technological progress and new markets lies in the ability to control the structural and functional properties of new materials on the nanometer scale.

NANONET Styria therefore develops measures to achieve the following purposes:

- strengthening existing competences in the long term;
- acquiring new skills;
- generating added economic and scientific value;
- transferring research findings into technologies, devices, etc.;
- supporting supra-regional, national, and international activities.

Founded in 2001, **NANONET Styria** rests on three foundations – the economy, science and research, and the Province of Styria – and serves as a focus for the interests of the nanotechnology sector with the aim of firmly embedding these technologies within Styria.

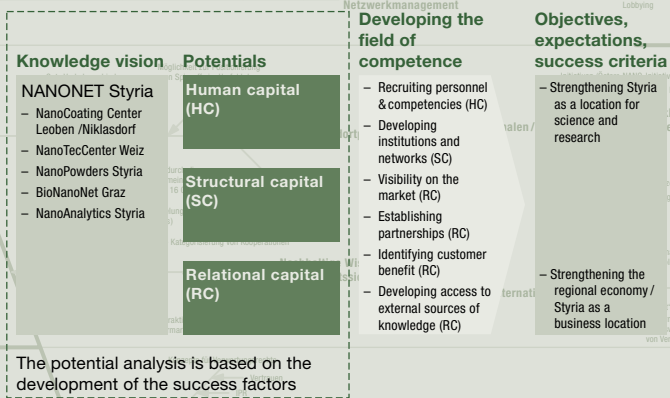
The result of this nanotechnology focus are five lighthouse projects, which are also examined in the Intellectual Capital Report:

- NanoCoating Center Leoben/Niklasdorf
- NanoTecCenter Weiz
- NanoPowders Styria
- BioNanoNet Graz
- NanoAnalytics Styria

The model

The Intellectual Capital Report presents the strategic objectives of **NANONET Styria** in their relationship to the available intangible assets and current activities for network development. By using the standard practice of distinguishing between human capital, structural capital, and relational capital, the report clearly highlights the available potentials for increasing knowledge. For each of these elements, the report identifies system specific influencing factors and examines the relationship between these factors. The success factors are linked according to their cause and effect relationships and subsequently assessed in order to provide a basis for deciding how best to use the available funds. Studying these interrelationships in a cooperative effort gives rise to shared mental models within the network, which improve the internal and external acceptance of the measures which are taken as a result of the study.

Developing the Intellectual Capital Report, which is shown as a model in the illustration below, allowed the participants to develop a joint terminology and thus improves their ability to coordinate their work efficiently with other network partners.



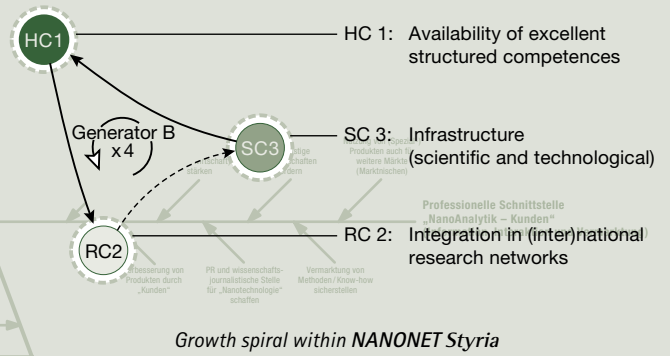
NANONET Styria intellectual capital reporting model (modelled on ARCS 1999)

The Intellectual Capital Report provides a modern communication and control instrument for knowledge-intensive issues.

There are many forces within **NANONET Styria** which tend to accelerate or slow down developments. The slowing forces come into play when, for example, researchers are burdened with routine processes or problems of business coordination and therefore have less time to devote to their research proper. However, of greater significance for attaining the network's objectives are the accelerating forces which were identified by 80 experts from the entire network.

One of these growth spirals touches on all three dimensions of the network's intellectual capital. It consists of three factors which, together, support the strategic objectives of **NANONET Styria**. The "integration of scientists into international research networks" (an influencing factor from the field of relational capital) depends substantially on the "availability of excellent competences" of key researchers, i.e. on human capital. Good relational capital opens up access to new methods and to "scientific and technological infrastructure". Thus the network's virtual resources are considerably greater than its existing structural capital. These resources support the researchers' work and simultaneously attract other top researchers. In this way, the spiral continues to turn steadily upwards.

Beziehungskapital



Influencing factors

In order to coordinate the research processes more efficiently, about 80 experts at **NANONET Styria** identified 450 elements which were ultimately grouped into 13 types of influencing factors within the categories of intellectual capital, i.e. human capital (HC), structural capital (SC), and relational capital (RC). Having defined these factors in clear terms, **NANONET Styria** now has a common terminology and, thanks to the development of impact models, a joint understanding of interrelationships and implications, which will support effective and efficient cooperation in the future.

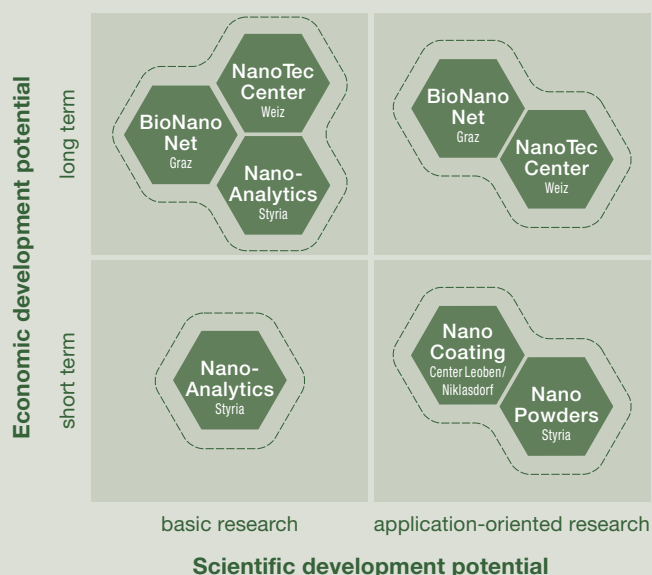
Factors influencing intellectual assets in NANONET Styria

HC 1	Availability of excellent, structured competence
HC 2	Career paths for staff
HC 3	Development of knowledge base
HC 4	Promotion of young researchers
SC 1	Identification of common goals
SC 2	Focal areas of critical mass
SC 3	(Scientific & technological) infrastructure
SC 4	Professional (network) management
SC 5	Sustainable knowledge exploitation
RC 1	(Inter)national positioning
RC 2	Integration in (inter)national research networks
RC 3	Comprehensive public relations
RC 4	Professional marketing

Selected influencing factors

Availability of excellent, structured competence	The stable scientific and technological basis and management competence describes the long-term availability of the specialist knowledge required for attaining the network's visions/objectives. This includes in particular the structural characteristics (age distribution, experience, willingness to disseminate knowledge and act as mentors, etc.) of the body of researchers as well as special competence profiles (e.g. interdisciplinary training) and social profiles (management employees, role models, communicators).
Infrastructure (scientific and technological)	The network has a state-of-the-art infrastructure, which includes the required personnel (operators), in a form and composition that is adequate for the project's objectives. The infrastructure should also include elements such as professional IPR support. The term "(scientific) infrastructure" describes the general background conditions which can make the region attractive to third parties outside the network. Clear information is available about the most important infrastructural elements and the activities that are possible within this framework.
Integration into (inter-) national research networks	The term "international research networks" encompasses the membership in such networks both of the institution in general and of individual experts. This is inherent in the personal character of relationships which, because of the required level of personal trust, is difficult to transfer to other parties.

From the perspective of the strategic development of Styria as a business location, a balanced portfolio containing both short-term and long-term projects should be developed. The five lighthouse projects of **NANONET Styria** are perfectly suited to this requirement. In the interests of long-term stability, therefore, funding should not be limited to a single project but should, wherever possible, go towards those influencing factors which benefit all five projects in equal measure.



The five lighthouse projects in the **NANONET Styria** research portfolio

The strengths of the **NANONET Styria** knowledge base lie in its human and relational capital, both of which rest to a significant degree on the reputation and the activities of the network's individual experts. There is a need for investments in the network's structural capital in the form of improvements to internal coordinating processes and the exploitation of research results. One important constraint is the continuity in research policy priorities, which is necessary for creating a stable basis for planning.

Did you know ...

- that nanotechnology is a horizontal topic, touching on almost all branches of science and thus constituting the most important basis for further technological innovation and economic sustainability?
- that almost 2000 nanotechnology patents were registered worldwide in the year 2001 (compared to only about 500 in 1995)?
- that the Provincial Government of Styria has passed a policy resolution on the long-term implementation of nanotechnology?
- that **NANONET Styria** is a major element of Austria's nanotechnology drive?
- that 20 businesses and 24 university and non-university research centres in Styria are working in the field of nanotechnology?
- that Austria's first cross-institutional two-year university course in nanotechnology and nanosciences was launched in Styria in 2003?
- that the Styrian research award for nanotechnology was advertised for the second time in 2004?
- that Styria has invested 5 million euros of public funding in nanotechnology to date?
- that world-renowned experts are working in Styria on five major project blocks?
- that scientists in Styria work on 37 of Austria's 38 research projects on subtopics of nanotechnology and nanosciences?
- that every nanotechnology dissertation announced by a Styrian research centre attracts an average of 20 applicants from all over the world?
- that Styrian researchers in individual subtopics are ranked among the world's top ten most frequently quoted authors?
- that two highly specialised global market leaders in the field of measurement technology have their headquarters in Graz?
- that research equipment valued at 15 million euros is being used in nanotechnology research in Styria?
- that about 450 influencing factors have been identified for the intellectual capital and the knowledge base required to support the visions of **NANONET Styria**?
- that there are self-augmenting cycles within the network, which contribute to the network's development – but which require additional support for maximum effectiveness?
- that there are currently over 35 research projects in Styria focusing on structures, processes and interrelationships on the nanometer scale?
- that **NANONET Styria** bundles individual activities in such a way as to make Styria the most active and the most thoroughly prepared Austrian province in the field of nanotechnology?

Contact

NANONET Styria

Helmut Wiedenhofer

JOANNEUM RESEARCH Forschungsgesellschaft mbH

Research Planning, Technology Consulting and Project Management
Phone +43 316 876-1160 • helmut.wiedenhofer@joanneum.at

Martha Mühlburger

Vice-Rector of the University of Leoben

Phone +43 664 357 69 53 • martha.muehlburger@notes.unileoben.at

On intellectual capital reporting

Manfred Bornemann

Intangible Assets Management Consulting

Phone +43 699 10 19 90 34 • manfred.bornemann@chello.at