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Multi-actor regional governance: regions as new players for innovation in Europe

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Multi-actor regional governance: regions as new players for innovation in Europe

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Abstract

In recent years, new regionally based strategy building processes emerged at the interface between public policy and the social coordination of collective action. Foresight as a governance process for stimulating regional innovation and for strengthening the regional economic system against global competition became a popular concept. Based on the experiences of a strategy building process in the Italian autonomous province of Trento, it is the objective of the paper to sketch recent theoretical and political developments regarding multi-actor and multi-level governance and policy concepts at the regional level.

1. Introduction

In recent years, the "region" (i.e. sub-national spatial entities) has not only gained importance in theoretical discussions, but as a result of convincing new theories, also in national technology and innovation policy. Basis of this development was the "re-discovery" of space in economic theory, above all in the new growth and new trade theory and the "new economic geography" based thereon (Krugman 1991, 1995, 1998), as well as the multi-faceted analyses of national, regional and new economy innovation systems and their political implications (Cooke 1992, 2001; Cooke *et al.* 2000; Nelson 1993). Also at the European level, the concept of a European Research Area in an enlarged Europe and the emphasis on its regional dimension (European Commission 2001) reflects the rising importance of strong regional science and technology clusters and the political will of fostering regional development for strengthening the competitiveness of whole Europe.

Against the background of promoting the scientific and technological potential of specific regions as the backbone of national and even European innovation systems, regional governments and authorities are confronted with a new situation. On the one hand those regions are privileged which are object of national or even European

policy support. On the other hand, for many regions the fight for public funds became harder and especially all those regions which heavily rely on knowledge resources for economic and social development entered a new form of global competition with similar regions. In this respect, the formulation and implementation of new policy concepts and the use of strategic intelligence is necessary for creating a supportive environment which not only attracts innovative companies, but human capital for research and development as well (Fürst 2001).

Not only did the region as governance entity for supranational, national and regional policy concepts gained more and more importance during the last few years (Koschatzky 2000; Kuhlmann 2001; Kuhlmann/Edler 2003), but also as platform for foresight exercises (Renn/Thomas 2002). It is this kind of strategic knowledge and vision building that enables regional policy makers to systematically look into the longer-term future and draw policy relevant conclusions for today. Combined with governance options at the regional level identified by the concept of regional innovation systems, regional policy makers have different tools at hand for shaping the economic and scientific-technological profile of their region.

Based on the experiences of a strategy building process in the Italian autonomous province of Trento, it is the objective of the paper to sketch recent theoretical and political developments regarding multi-actor and multi-level governance and policy concepts at the regional level. Success factors and strategies for regional innovation promotion at the interface between different hierarchical (supranational, national, regional) and technical policy levels (technology policy, innovation policy, regional policy) will be identified and applied to the situation in Trento. Due to its autonomous status, the province of Trento has a strong regional government with powers to formulate and implement own policy concepts and possesses the financial resources to invest in its human capital and scientific infrastructure. Knowledge building and safeguarding the regional competence basis are one of the most important policy priorities in this region. It is thus a showcase example of regional governance and policy implementation and can demonstrate the new options of regional policy making in the global context of technology and innovation.

2. Regional governance of innovation

2.1 Multi-actor regional governance

According to Mayntz (1993: 11), *governance* is the social coordination of collective action by systems of norms and order. A more detailed definition was given by the Commission on Global Governance (1995: 4), according to which "governance is the sum of the many ways individuals and institutions, public and private, manage their common affairs. It is a continuing process through which conflicting or diverse

interests may be accommodated and cooperative action may be taken. It includes formal institutions and regimes empowered to enforce compliance, as well as informal arrangements that people and institutions either have agreed to or perceive to be in their interest." Since collective action plays an important role in governance, overlaps with the concept of social capital cannot be overlooked. Governments, as one of the major institutional systems responsible for public governance, are as well as other organisations and their individuals part of a social system and are both depending and contributing to the social capital of the respective social system. The governance ability of public and private bodies is thus influenced by the available and processable knowledge and the available competences for policy-making.

In recent years, another term was introduced in the debate about (innovation) policy concepts and governance: the multi-actor innovation policy arenas (Kuhlmann 2001: 961). In democratic system, policy-making does not take place in the form of top-down decision making, but is a result of networking and bargaining between different societal actors, interest coalitions and systems. Usually, there is no dominant player, but the policy arena is composed by a variety of political, corporate, social and scientific bodies. With regard to "regions", defined as sub-national spatial entities, not only multi-actor arenas exist, but they are also object of multi-level governance structures. Due to the complexity of intervening factors at the regional level (besides the upper hierarchical policy levels, corporate and technology regimes play an important role), "...necessary adaptation and integration processes of the innovation systems can obviously not be carried out completely and exclusively by the original innovation actors in industry and science on their own...(but)...state-based mediating and regulatory capacities of political systems will remain indispensable" (Kuhlmann 2001: 966). Nevertheless, the role of a (regional) government should be confined to the setting of a favourable legal and institutional environment, and should stimulate but not govern processes. It should withdraw from innovation promotion when such processes could be organised by economic forces alone.

Since the beginning of the 1990ies, the region has gained more and more importance as implementation platform for supra-national and national science, technology and innovation policy objectives and measures. Regional governments became an additional and important actor in this policy arena. The regional dimension of innovation is even more emphasised by the policy concept of the European Research Area (Edler *et al.* 2003). According to Cooke (2003: 414), this move towards regional innovation "...brought a stronger emphasis from the sub-national, mainly regional level of intervention as animator of a public-private process of interactive and mainly incremental learning-based innovation". For regions, new disruptive technologies opened a "window of opportunity" for the self-contained configuration of their science and innovation system (Charles *et al.* 2004: 11), for the creation of interfaces with national policies and for a stronger participation at measures formerly mainly oriented towards the national level. In this context it is not only of

importance how superior policy levels can contribute to regional development by triggering regional learning processes and by supporting the learning and innovation infrastructure, but also how regions can strengthen their national and even the supra-national (European) innovation system. Three key roles are attributed to regions in this respect (Charles *et al.* 2004: 13):

- Setting regional priorities for research on the basis of small units of excellence not necessarily recognised at the national scale.
- Negotiating with central actors to shape central policies for the benefits of their regions.
- Building linkages from all elements of the regional science system into innovation, commercialisation and technology transfer.

Consequently, "governance" is a central element in the policy-oriented concept of regional innovation systems (Cooke *et al.* 2000). If political actions can steer regional development processes, which is mainly the case in public regional innovation systems and less in new economy innovation systems (Cooke 2001), then "multi-level governance (MLG) relationships" play a special role. This governance system creates the preconditions for regional openness, the docking into supra-regional, national and supra-national policy levels and the integration of regional innovation systems in globally operating technological and enterprise systems (cf. Cooke 2002: 136-137). MLG relationships however can only enhance regional innovation potentials if the learning capability and absorptive capacity of the regional policy and promotional institutions, as well as the political networks existing between them are sufficiently developed (Koschatzky 2001: 334; Marin/Mayntz 1991: 18).

Related to the interfering influences of complex supranational and national policy systems are the interfering aspects of policies with a regional focus but not with a regional balance orientation. In many strategies pursued by regional technology and innovation policy a conflict about targets becomes evident. If the view is predominantly directed towards the conflict between spatial balance and overall economic efficiency of a regionally-oriented innovation and technology policy, it has to be questioned whether a preference is to be given to the development of specialised regions (e.g. competence centres, clusters), with the consequence of a possible increase in regional disparities, or to the broad innovation promotion in a multiplicity of regions with the possible consequence of decreasing national technological competitiveness (Koschatzky 2004). This possible conflict reveals that regional innovation policy finds itself in the border area to regional structural and balance policy. This is particularly the case when measures are not implemented exogeneously (i.e. "from above"), but are formulated on the region's own responsibility (i.e. endogeneously) and own initiative and coordinated with the next higher policy level, thus placing the interests of the individual region (and not of all the regions of a country) in the centre of political action.

2.2 Regional differentiation of innovative activity

Learning and knowledge accumulation are regarded to be one of the most important thriving forces for economic renewal and growth (Lundvall/Johnson 1994; Gertler/Wolfe 2002). In theoretical concepts like clusters, innovative milieux and regional innovation systems, regional innovation differences are no longer explained by locational parameters (as have been in the traditional location theories; cf. McCann/Sheppard 2003), but by the ability of economic actors in a region to establish intra- and inter-regional information and production networks (Tödtling 1999), to participate in network integration and to profit from these networks by collective learning processes.

Despite the increasing knowledge codification (Maskell *et al.* 1998), not all forms of knowledge are spatially mobile, but are linked to personal abilities and information (know-how and know-who; cf. Foray/Lundvall 1996), to behaviours, routines and attitudes. Thus, knowledge modes with a strong tacit character are available only at certain locations and learning processes linked to this knowledge can only be realised there. According to Storper (1995), these "untraded interdependencies" are characteristic for many regions, whereby the regional production structure and specialisation, the amount of human and social capital, and the institutional framework determine not only the spatial range of the mutual exchange of informal knowledge and thus the spatial characteristics of knowledge specificities, but also the kind and quality of the regionally bound knowledge. Learning regions are regarded as spatial units in which knowledge is locally bound and in which continuous learning processes between the regional actors develop which increase the regional knowledge basis (Koschatzky 2001: 209).

Nevertheless, not all regional entities of a country fulfil the specific conditions of an innovation system. Since new and in its early stage implicit knowledge is bound to locations (localised knowledge), those locations which offer a broad range of knowledge producers are considered to be the most advantageous ones by knowledge users (Asheim/Isaksen 2002). This is particularly true for agglomerations and regions with a diversity of companies and manifold research institutions (Storper 1995; Storper 1997). The regional distribution of RIS projects supported by the European Commission clearly shows that those regions are still not capable of applying for funding for innovation-promoting measures and spending funds efficiently which would need funding most. The necessary absorptive capacity which is a pre-condition for efficient and effective political action is still missing there. Landabaso *et al.* (2001: 248) and Oughton *et al.* (2002) describe this fact as "regional innovation paradox". Before innovation-promoting measures can be successfully implemented in regions, strategic intelligence and political implementation competence must be improved in these regions.

2.3 Regional foresight as concept for multi-actor governance

Strategic competence is a necessary condition in governance and policy-making. After making first experiences with regionally oriented and implemented innovation and technology policy measures during the second half of the 1990ies (Koschatzky/Sternberg 2000), new strategic concepts emerged in recent years. One of the most important concepts related to the social capital of a region is "Regional Foresight". Foresight is a systematic attempt to look into the longer-term future and draw conclusions for today (Martin 1995). It is by now well established as a useful instrument in bringing awareness of long-term challenges and opportunities into more immediate decision-making. The current definition from the EU describes foresight as "a systematic, participatory, future intelligence gathering and medium-to-long-term vision-building process aimed at present-day decisions and mobilising joint actions. The term 'foresight' therefore represents the processes focusing on the interaction between science, technology and society" (Renn/Thomas 2002: 11). Foresight is thus not a single methodology, but different methods can be and are mixed to fulfil the purpose. There is a whole range of formal and informal methods to perform the task of looking into the future such as surveys, trend analyses, Delphi studies or different workshop types. The central point of foresight activities is to bring together actors from different sectors, thematic and societal backgrounds so that different ideas are introduced and assessed from different points of view. In foresight exercises, expectations of diverse actors about possible development paths are purposefully brought together to formulate strategic views about the future. Participatory methods are used to include the main regional actors and generate new ideas and innovative solutions. Stakeholder involvement is critical in order to ensure consent with the action plans developed in the course of foresight exercises (Cuhls *et al.* 2003: 6).

The regionalisation of governance implies an urgent demand for regionally tailored development strategies as a means to address strategic questions in a locally restricted but socially comprehensive manner (Gertler/Wolfe 2004). Foresight activities can provide robust orientations for regional decision makers in detecting and identifying opportunities for further development, and pointing out networks of actors necessary to take advantage of these opportunities as well as identifying barriers and risks that need to be addressed in advance. The advantage of the regional level is that a wide constituency of societal stakeholders can be involved and new inter-group networks can be generated. Foresight contributes to knowledge sharing, regional learning and institutional reflexivity, because individual or group-based opinions have to be mediated in a way that consensus building processes will be possible. Thus, regional foresight can help to create and develop social capital, participative policy-making approaches and institutional learning (Renn/Thomas 2002; Renn 2003).

Especially in regions with an already developed science-base, foresight can be used to find ways for a better integration of the scientific and industrial system and for fostering knowledge flows between science and industry. Since both systems, despite the need for hybrid organisations (Kaufmann/Tödtling 2001) and the inherent triple-helix structures (Etzkowitz/Leydesdorff 2000), operate according to own rules and incentives, the mediation between these systems, supported by the policy makers, can contribute to a better understanding of each other interests and can open ways for efficiently bridging both spheres by an improved transfer of knowledge and technological solutions. Being involved in this foresight exercise, regional governments come into the position to better understand the needs of each side and to implement customer tailored policy measures supporting a sustainable future orientation of the region and its different sub-systems.

With regard to the basic elements necessary for the governance of innovation drafted in this contribution, a case study illustrating a vision building process for enhancing the regional science and technology base will be presented in the next section. In January 2003, the Fraunhofer Institute for Systems and Innovation Research was commissioned by the Provincia Autonoma di Trento to carry out a regional foresight and competence study titled: "The Science and Technology Base of the Provincia Autonoma di Trento: Capacities, Trends and Opportunities" (Cuhls *et al.* 2003). Its main objective was to support the provincial government in developing a regional strategy for its research and innovation system. The case study aims at answering the following research questions:

- How can a regional strategy building process aiming at improved innovation performance be organised? What methodological steps are necessary?
- Which requisites with regard to regional self-governance favour such process?
- What are important aspects to look at under the specific regional conditions?
- Which kind of vision is possible to develop and what are the major strategies to achieve it?
- Which conclusions can be drawn for the regional governance of innovation?

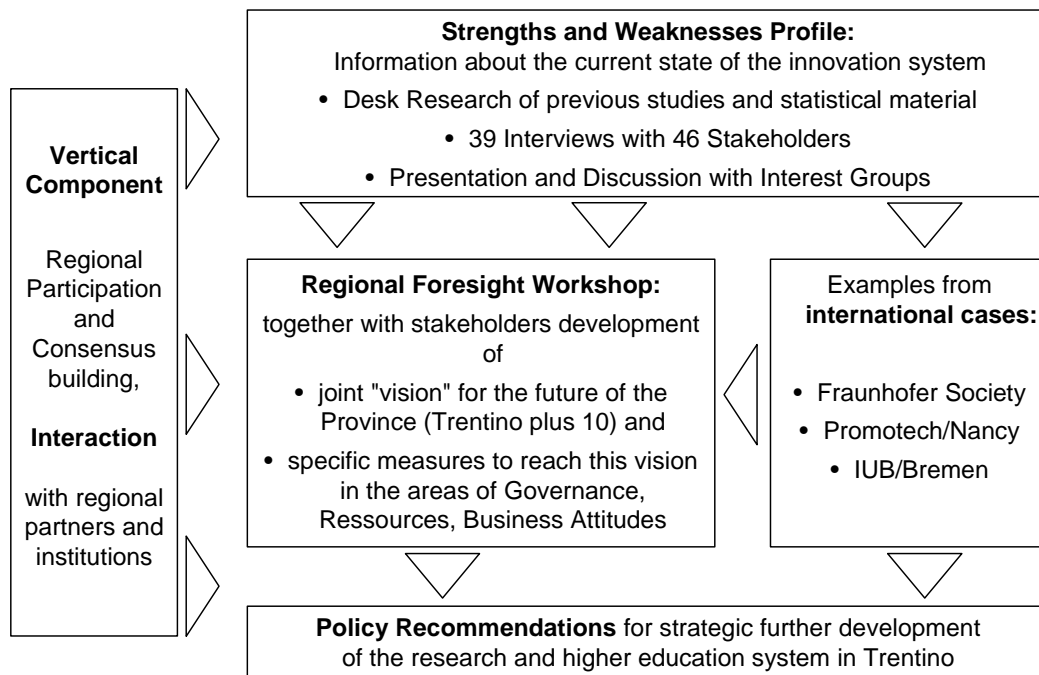
3. Strategy development and vision building in a multi-actor policy arena – the case of the Provincia Autonoma di Trento

3.1 Concept and methodology of the Trentinian foresight exercise

The foresight exercise was structured in four horizontal components and one vertical component (cf. Figure 1). As the early integration of the different interest and target groups is an important success factor in elaborating a sustainable regional

innovation strategy, particular attention was given to include representatives from the research institutes, university, industry and business association and provincial policy makers into the discussion from the first steps of the process until the conclusion of the exercise.

Figure 1: Organisation structure of the Trentinian foresight exercise



The integrative aspect was realised, firstly, in the formation of a steering committee and a task force which supported the whole process. Secondly, the different steps and results of the foresight exercise were discussed with these two groups as well as with a larger number of actors from different interest groups at several discussion tables, workshops and a final conference.

The strengths and weaknesses profile of the provincial research and innovation system was based on quantitative and qualitative data drawn from a broad range of available sources. Additionally, 39 interviews were carried out. The interviews were structured according to theses which were developed on the basis of the strengths and weaknesses analysis. The qualitative approach complementing the quantitative methodology was chosen in order to gain a deeper understanding of the provincial context, embeddedness and implicit and unwritten codes ruling the local research and innovation system.

There are different objectives of foresight which range from priority-setting in science and technology to vision-building and networking. The purpose of the Trentino exercise was twofold: firstly, the aim was to provide inputs into strategy and policy planning, and secondly, to mobilise collective strategic actions. The prepara-

tion and specific design of the foresight workshop "Trentino plus 10" was based on the strengths and weaknesses analysis of the first phase of the project. The major aim of conducting the Trentino foresight exercise was to develop a joint "vision" for the future and work out specific measures in order to make the region one of the leading innovation regions internationally. The participants were invited to bring in their specific knowledge about the situation of the region so that a vision could be outlined that most of the stakeholders can support. The participants of the workshop represented a mix of sectors and thematic backgrounds. During the foresight exercise they were given the opportunity to discuss the future of Trentino on a broad level, overcoming limited actor circles and thereby stimulating interaction, exchange and networking between the different interest groups and spheres. International regional and organisational case studies were used as further input into the vision building process.

3.2 Strengths and weaknesses profile of Trento

Located in northern Italy, the autonomous province of Trento with its 477,859 inhabitants (at the end of the year 2000; i.e. 0.8% of Italy's total population) has a strong regional government with own fiscal and juridical rights and an own budget, partially fed by own taxes and transfer payments from the national government in Rome. The government has powers to formulate and implement own policy concepts and possesses the financial resources to invest in its human capital and scientific infrastructure.

The industrial sector is characterised by small enterprises: 67.4% of all firms in Trentino have less than 20 employees. This is above the national average of 62.6%. Major sectors besides agriculture and tourism are agro-food production, wood, processing of non-metallic minerals, metal products and electric appliances (Camagni/Zaninotto 2002). 30 % of the total production of the province consists of agricultural products (of which 90 % are apple and wine). Due to the dominance of small firms, industrial R&D is only poorly developed. In 1996, Trento reached only 69.9% of the Italian average, which is, in an international comparison, already one of the lowest of the larger European countries (PAT 2002).

Compared to the industrial sector, the science sector is composed by a mixture of smaller and larger research institutes (cf. Figure 2). Under the umbrella of the Istituto Trentino di Cultura, three research centres carry out research in different fields. The ITC-IRST (Centre for Scientific and Technological Research) conducts R&D in microelectronics and advanced computer science, in voice and image recognition, in automated thinking processes, and in new materials and surfaces. The ITC-ISIG (Centre for Italian-German Historical Studies) and the ITC-ISR (Centre for Religious Sciences) are small units covering specific aspects of the historical and cultural development of the province. Another large institute is the IASMA (Istituto

Agrario) in San Michele. Major research focus is on the environment and the forest, on chemistry and biotechnology, and on agriculture in general. IASMA, ITC and other research institutes like the Centre for Alpine Ecology are funded by the provincial government. Besides these regional institutes, the largest non-regional research organisation is the University of Trento, which is partly funded by the provincial government, but predominantly by national contributions. (for a full overview on the research infrastructure see PAT 2003).

Figure 2: Major research organisations in the Trentinian innovation system



Source: PAT (2004)

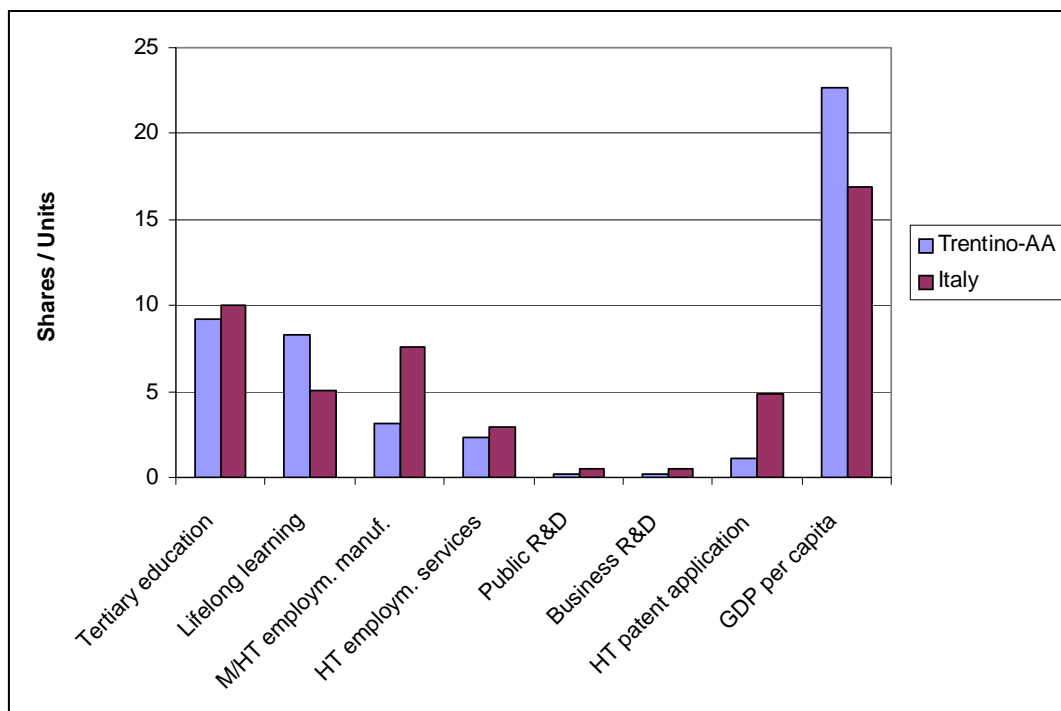
The backbone of the provincial funding system is the law no. 6. Legge 6 is the main financial instrument of the province to promote cooperation between the science and the industrial sector. It is the instrument for funding firms and measures designed to enhance the quality of the environment, the sectoral and cross sectoral integration, the sustainable development of the entire territory, the internationalisation of the economic system and the birth and success of new firms. The total research budget of the province amounted to 97.7 million Euro in 2002, an increase of 9.8 % compared to 2001 and 139 % compared to 1998 (PAT 2003: 18). This increase clearly demonstrates the political will to strengthen the science and research base of the province and to develop it as a competitive location for scientific and technological research in Europe.

Within the European Innovation Scoreboard - a data and indicator track record of DG Enterprise and a part activity of the Trend Chart on Innovation - regional comparative data has been collected and analysed for the first time in 2002 (European Commission 2002). In this database, figures are only available for the whole region Trentino-Alto Adige (Bolzano). Although there is a levelling effect when data of the two provinces are put together, the presented figures at least provide some indications for the innovative performance of the province. The indicators cover of human resources, employment in high-technology sectors, and the creation of new

knowledge through R&D and patents. Additionally, GDP per capita is used for measuring the economic potential of the regions.

Trentino-Alto Adige excels the Italian average in the share of participation in life-long learning (8.33 % of 25 - 64 years age class compared to 5.06 % in Italy) and in the GDP per capita (22,698 € compared to 16,870 € for Italy in total). Within Italy, Trentino-Alto Adige reaches the first position in the share of the population engaged in lifelong learning, followed by Friuli-Venezia Giulia with a participation rate of 7.01 %. The openness for lifelong learning seems to be a strength of the region. Compared with the Italian average (cf. Figure 3), the region lacks behind with regard to the other indicators. The share of the population with tertiary education is slightly smaller than the Italian mean (9.23 % of 25 - 64 years age class, compared to 10.03 % for Italy). Here, the regions takes the 12th position together with Abruzzo among the 20 Italian regions. A much stronger weakness regards the employment in medium- and high-tech manufacturing. Only 3.09 % of the total workforce is employed in medium- and high-tech enterprises, while in the Italian average 7.6 % are. This has certainly something to do with the industrial base of the region and the still dominating traditional sectors, i.e. agriculture, handicrafts and tourism. With this share, Trentino-Alto Adige ranks 17th in Italy, just ahead of Sicilia (2.3 %), Sardegna (2.26 %), and Calabria (1.21 %).

Figure 3: Innovation indicators for Trentino-Alto Adige and Italy



Source: own calculations according to European Commission (2002)

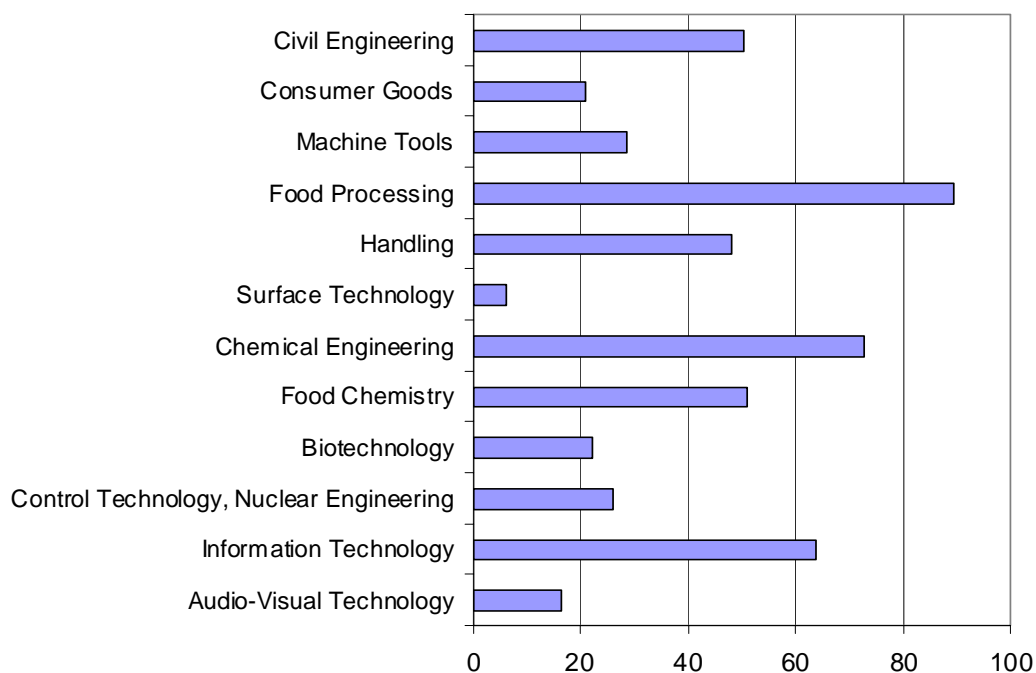
A better performance can be found with regard to the employment in high-tech services where the region is fairly close to the Italian average (2.32 % of total workforce and 2.92 % respectively). The pronounced service orientation of the regional economy is reflected in this figure. As a matter of fact, Trentino-Alto Adige reaches the 13th position among the 20 Italian regions. According to the Innovation Scoreboard data, public and business R&D do so far not play the role they should play in a modern, competitive regional economy. The region is far below the Italian average (low shares of public and business R&D expenditures). On the other hand, data from the Trentinian provincial government indicate that in Trento alone the share of public R&D amounts to 1.1 % of the regional GDP and the share of business R&D to 0.5 % of GDP (PAT 2004). With this level of R&D expenditures Trento is much above the Italian average for public R&D (0.54 %) and close to that for business R&D (0.53 %). These performance figures make clear that innovation activities in Trento are so far predominantly science-driven while industry plays only a minor role in regional R&D activities. Trento is also a good example for illustrating that income can be generated by other economic activities than R&D and innovation alone. Although in general there is a positive correlation between innovation and R&D on the one hand and per capita income on the other, the region's gross domestic product per capita was already much above the Italian average when investments in R&D were still low. Unemployment is low (close to full employment) and major parts of the labour force are absorbed by the public sector. As a consequence, for a long time there was no must for an increase in public and private R&D investments. But due to increased competition among regions and the uncertainty regarding the amount of transfer payments from Rome, the provincial government decided to increase its R&D budget for opening up additional income and employment opportunities and for broadening the economic, scientific and social base of the region, especially with regard to highly qualified labour.

Regarding technological and scientific specialisation, patents are used as a so-called throughput-indicator which provides indications for the creative and inventive ability of organisations (firms, research institutes), regions and nations. Since not all inventions are patentable and for not all inventions a patent is applied, this indicator also sheds some light on a certain aspect of the innovation process. Publications can be used as an indicator for scientific output. But as with patents, also this indicator has some limitations. Most databases have a certain bias related to the covered journals. There is either an overemphasis on journals published in English, which discriminates disciplines or countries with a high rate of publications in the own language, or on certain disciplines. For example, the most used Science Citation Index over represents medical journals and does not cover all journals which are not published in English. Nevertheless, for international or interregional comparison it still represents the best data source.

For the period 1990-2000 on average 18.6 patents per year had their origin in Trentino (inventors address). Compared with an Italian annual average of 2,755 patent

applications, the province reached a share of 0.7 % in all Italian patent applications. This corresponds to Trentino's share in total Italian population. The technological specialisation profile reveals strengths in information technology, in food chemistry and chemical engineering, in handling, food processing, civil engineering as well as in control technology and nuclear engineering, in biotechnology, machine tools and consumer goods (cf. Figure 4). These are technology fields where Trentino (although on a relative basis) excels the Italian average.

Figure 4: Technologies with positive patent specialisation in Trento 1990-2000
(index values)



Index = $100 * \tanh \ln [(P_{kj} / \sum P_{kj}) / (\sum_k P_{kj} / \sum_{kj} P_{kj})]$, while P_{kj} is the number of patents / publications in region k (Trentino) in Italian total in technology field / scientific field j.

Source: own database searches in PATDPA

In the same period 1990-2000 on average 266 publications per year with authors from Trentino were recorded in the Science Citation Index. The scientific strength of the Province is documented by a share of nearly 1 % in all Italian publications (on average 27,382 per year). According to the specialisation profile, computer science, materials science, industrial and mechanical engineering, civil engineering, physics, mathematics as well as optics, instruments, nuclear science and polymer science are the pronounced scientific strengths of the Province. Comparing both profiles, it can be concluded that computer science matches well with information technology and civil engineering on the science side with civil engineering on the

technology side. On the other hand, there seem to be fields with strength either on the science or on the technology (industrial application) side, e.g., optics (positive science specialisation, but negative in patents) or biotechnology (strongly negative in scientific output, but positive in patents).

As a result of the strengths and weaknesses analysis, the Trentinian science and innovation system can be characterised by the following positive attributes: close informal networks, institutional 'thickness' and embeddedness, rich innovation infrastructure, a well developed funding system, a sheltered area for building up national and international competitiveness, and a relatively stable and static firms population (sectors and numbers of firms). Major weaknesses concern the weakly developed co-operations between science and industry and within the business sector, the strong public sector and the high propensity for subsidies with so far little strategic priority setting, the little developed entrepreneurial culture and small industrial base, the fragmented and segmented firm structure, and the low R&D and high-tech intensity in the regional industry.

From these strengths and weaknesses it can be concluded that Trentino faces four major challenges:

- the need for a better integration of the science and business system,
- an improvement of entrepreneurial attitudes and linkages within the business system,
- adjustments and the need for priority settings in the research funding system and the research infrastructure, and
- the development of the technology base with regard to already existing strengths and the exploitation of competitive advantages with regard to other regions.

These challenges were the starting point for a further discussion of future prospects in the foresight workshop. As a general conclusion it could be argued that certain economic/technological areas in Trento have the potential to form the basis for building sustainable, internationally competitive advantages and that an obvious need exists for a more focused strategy regarding the further development of the research and higher education system. The resulting derivation of technological and economic specialisation clusters was also discussed in the foresight workshop.

3.3 Foresight and regional vision building

Policy makers who want to promote an innovation system are faced with the problem that there are a multitude of shaping factors and complexity in a regional innovation system which make it difficult to direct and steer. Different stakeholders and actor groups, market trends and technological developments have all to be taken

into account (multi-actor and multi-level governance). Complexity emerges also from the fact that innovation is based on co-operation and social and economic interaction between a whole variety of different actors and different actor groups. In order to develop adequate regional research and innovation policies, priorities have thus to be set. For this reason, the foresight process in Trentino was channelled by two focal dimensions, the sectoral and technological priorities and the decisive shaping factors for bringing about the desired changes.

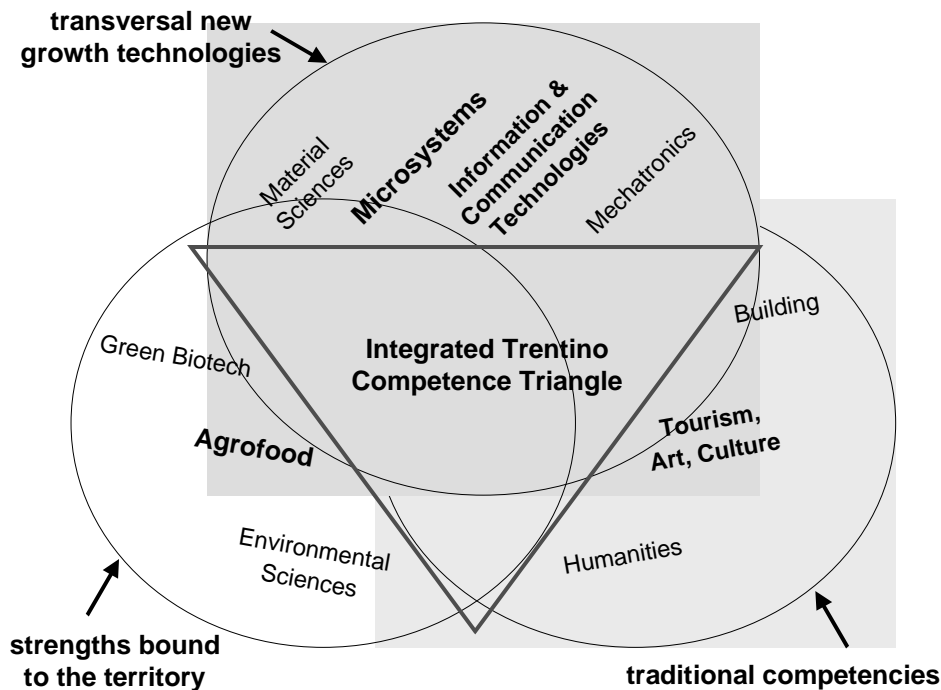
Of the six technology fields identified as critical for the future development of the Italian industry – aerospace technologies, advanced materials, energetic technologies, information and communication technologies (ICT), biotechnologies, nanotechnologies (Fondazione Rosselli/Politecnico di Milano 2003) – three are already anchored in the Province (ICT, microsystems, materials) and a fourth is in the process of being established (biotechnology). In such new growth technologies, there is a fierce competition between territories for attracting players from the business sector and academia in order to become one of the few internationally relevant competence centres. Due to the well-known mechanisms of external/network effects, critical mass and path dependence, it is generally accepted that timing is crucial for trying to establish economic clusters in new technologies.

Based on the discussion in the foresight workshop, two sectoral priorities were identified:

- "Strengths bound to the territory" which centre on the agrofood sector and include green biotech as well as the environmental sciences and
- "Traditional competencies with future prospects" with the mainstay in tourism, art and culture complemented by the building sector, health and humanities.

In combination with the mentioned transversal new growth technologies, these sectoral priorities constitute the so-called Trentino competence triangle 2014 which was formulated as a vision and general development objective in the foresight workshop (cf. Figure 5). The mentioned sectors and technologies have high potential of forming a distinct specialisation cluster for the province, thus providing Trento with a unique competitive advantage among the European regions. Of the three emerging technologies already anchored in the province, especially ICT and microsystems show a multitude of possibilities for integration with these sectoral strengths.

Figure 5: Trentino Competence triangle 2014



Source: Cuhls et al. (2003: 56)

Based on this vision, central shaping factors for the future development of the provincial research and innovation system were developed and discussed during the foresight workshop. These shaping factors take the results of the strengths and weaknesses profile of the province into consideration and address three strategic areas:

- *Governance*: institutional setting of scientific and industrial system, regulation, administration.
- *Resources*: higher education, scientific and business competences, work force, infrastructure.
- *Business attitudes*: networking, knowledge transfer, entrepreneurial attitudes, intermediary organisations.

Regarding governance, possibilities of a horizontal and systemic innovation policy design oriented towards cross-sectoral and interdisciplinary linkages in the Trentino Competence Triangle were debated on the occasion of the foresight workshop. With regard to future priority setting in the policy making of the province, the discussion made clear that it will be necessary to continuously observe developments in international science, technology and markets – e.g., through strategic intelligence, further foresight exercises, evaluation and monitoring – in order to be able to flexibly adapt to changes and keep up with international competition. Research and innovation policies in the province will have to be directed clearer to distinctive areas of

research specialisation and more targeted efforts have to be directed at integrating the knowledge flow and innovation orientation across the innovation chain.

Regarding resources, the highest priority was given to the system of resource allocation in the research system. Increases in flexibility, clarity and incentive-orientation as well as further promotion of private investment in R&D were perceived as necessary changes in this system. A second important driver of change was developing and retaining highly qualified human capital which touches on the points of Trentino's attractiveness for manpower especially excellent international students and the quality of basic education. In this context, the scarcity of management competencies and capacities in the province were also debated. Particularly in the traditional specialisation sectors, an employment push towards activities with a higher value would open new market opportunities to the province. Overall it became clear that it will be necessary to broaden the understanding of valuable resources and their implementation in the province.

The most important topic with regard to business attitudes was exchange and co-operation, the fundamental structural element of innovation systems. The discussion centred on interfirm and intersectoral networking and value chains, questions of integration into national and international networks and value chains as well as the intensity of knowledge and technology transfer between firms and science sector. A further shaping factor related to the weaknesses of the Trentinian innovation system was entrepreneurial attitude and "economic atmosphere". In order to transfer and transform the knowledge generated in the research institutions into marketable products and thus into welfare for the Trentino population, it will be necessary to promote a stronger entrepreneurial spirit among a broad share of the population. This is a special challenge, since until recently the public sector provided a sufficient number of jobs so that outside the agricultural sector the risk-taking step of funding an own business was seen to be unnecessary.

The fundamental recommendation of the foresight exercise was to create a greater flexibility within the institutional fabric of the province. This concerns the science system, in which the research infrastructure should be subject to further adjustment according to newly introduced general priorities, but also the governance system which needs a re-shaping with regard to a stronger emphasis on priority setting in research and technology funding. It concerns also the higher education system which is so far fairly independent from the provincial government's influence on its science base and which needs a stronger focus on the scientific backing of the proposed competence triangle. It even concerns the business system, in which entrepreneurship and R&D have to play a greater role in a competitive future Trentino and in which resources should be coupled and synergies be exploited by a tighter networking within the system and also between the science and the business system.

The second important message is that Trento should further engage in new, future-oriented technologies, both by own development work of the Trentinian research institutes and firms, and by application of external knowledge. Much potential is already available within the province and should be further utilised. On the other hand, one important recommendation was that Trento should take care not to lose ground in its traditional sectors which not only today but also in the future can significantly contribute to value added and wealth in the Province. Yet, this will only be possible, if Trento manages to link the traditional strengths with new knowledge and new technologies, thus upgrading them.

4. Regional foresight in the context of multi-actor and multi-level regional governance: Outlook and further research questions

The Trentinian foresight exercise provides manifold conclusions about the potentials and bottlenecks of multi-actor regional governance of innovation. With regard to the research questions formulated in section 2.3, the following answers can be given:

- Foresight can be one important instrument for deriving a regional innovation strategy. Structured and mediated by external support, individuals and interest groups can be brought together who otherwise would not automatically come into an exchange of opinions and information. On the other hand, this mediation is a difficult process and needs diplomatic and tactical skills by which the majority of the involved parties can be convinced to accept and support the achieved results (Gertler/Wolfe 2004: 59). This process is fairly time consuming and finds good starting conditions in social systems which are already experienced in the bargaining between different societal actor groups. It is with no doubt important that all innovation relevant stakeholders are involved in the foresight exercise and that it is made clear from the beginning that results will be transformed into policy action.
- An important requirement which favours regional self-governance is a certain degree of autonomy. This autonomy can have different characteristics. It could be political like in the case of Trento where the regional government has the right to issue own laws and funding programmes. It could be financial in a way that at least a certain budget is available for the execution of regional strategies and activities. It could be cultural in a way that by cultural identity and self-motivation resources are put together and synergy effects are created so that at least certain activities can be implemented. Important is also the availability of strategic intelligence in terms of an explicit system of research priorities setting and coherent research planning. In light of the increasing speed of development and change of international markets and technologies as well as the shortening of the validity of

knowledge, it is foreseeable that such a system has to be shaped so as to not only adapt flexibly to these changes but also to proactively conceive of and pursue strategies that will sow the seeds for future welfare even in uncertain technological terrains. Knowledge and information are the key factors for the functioning of such a system that will be fitting for the emerging knowledge age.

- Three major shaping factors are important to consider: governance, resources and business attitudes. Governance issues are related to the institutional setting of the scientific and industrial system, to regulation and to administration. Resources deal with higher education, scientific and business competences, human capital, and infrastructure. Business attitudes address networking, knowledge transfer, entrepreneurial attitudes, and intermediary organisations. Depending on the regional conditions and the specific strengths and weaknesses in each of these shaping factors, different recommendations with regard to the improvement of systemic interaction and the upgrading of the regional science and technology base are possible.
- The characteristics of the shaping factors are also highly correlated with the vision and objectives which are possible to develop during a foresight exercise. Therefore no general conclusions can be drawn. An open question in this respect concerns the time horizon of the vision and the related strategies. Usually, it should not be too short but also not too long. The Trento triangle 2014, developed during the year 2003, is rather at the lower end of the time scale than oriented too much into the future. The strategies formulated on the background of the vision had thus to include precise recommendations. For example, in the Trentinian case one recommendation dealt with the restructuring of the provincial research institutes. Due to the fact that a lack of strategic planning and usage of possible synergies between the institutes was identified, it was suggested to achieve a higher degree of flexibility by transforming institutes into foundations, associations or even corporations. This flexibility should be triggered by a funding model with higher autonomy from the government, for example, in a model of 60 percent public to 40 percent third party funding. It has to be pointed out in this respect that there is not one optimal model for structuring such a research system, but different conceivable options depending not only on organisational and disciplinary specificities but also on political decisions and priority setting.

According to the Trento example, regional governance of science and innovation is possible, but faces the challenge of multi-actor innovation policy arenas (Kuhlmann 2001: 961). Even in the case of the comparatively small region of Trento, a multitude of actors came together and brought in their interests in the vision building process. These actors transport own interests, but are also part of groups and systems rooted in and outside the region. Trento is a somehow ideal case because the province possesses own political powers and responsibilities to stimulate scientific developments, knowledge transfer and to establish a competitive research infrastructure. Nevertheless, also in Trento certain parts of the regional innovation sys-

tem are out of the direct reach of the provincial government, e.g. the national university. Since it is an important player for the scientific profile and development of the province, it is at least not certain whether certain changes in the provincial research institutes will have the expected effects on the whole system. In the case that barriers between the different research organisations cannot be removed, "island solutions" might not be fully effective. It is this issue of multi-level governance which makes it difficult for regional governments to fully assess the effects and success rates of own policy actions. Decisions of a regional government are the sum of non-regional party directives, lobbying, bargaining processes and own interests of policy-makers. It is thus necessary to better understand the regional and externally influenced political and governance structures in specific regional contexts for being able to come to some general conclusions about the governability of science, technology and innovation at the regional level.

Having this complexity of multi-actor and multi-level governance spaces in mind, general conclusions about strategies and institutional arrangements for efficient and effective innovation support are difficult to draw. This is especially the case because existing empirical evidence about successful development paths is rather selective (see for instance the always cited role model of the Silicon Valley; Saxanian 2000), stems from a limited number of economic contexts (mainly Europe and the United States; cf. Bryson *et al.* 1999, Clark *et al.* 2000), and is difficult to compare because of different methodological approaches. As a matter of fact, it is not only necessary to carry out in-depth research about the impact mechanisms of the regional governance of innovation, the mutual interaction in multi-actor innovation policy arenas and the impacts of multi-level governance and the side-effects of non-regional policies in specific regions. It is also necessary to enlarge the empirical basis about knowledge-based regional development strategies in order to draw on as many different case studies as possible. With regard to Cooke (2003: 414), who identified two moves in policy governance in recent years, i.e. the move towards regional innovation and the move towards knowledge-based clusters, a third move is suggested here: the move towards foresight and vision building and the necessity to understand the mechanisms of multi-actor and multi-level regional governance.

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5. References

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