

**EVALUATION OF THE IMPACT OF THE ACTIVITIES
PROMOTED BY THE KESSLER AND MACH
FOUNDATIONS ON THE PROVINCIAL SYSTEM IN
TRENTINO IN THE PERIOD 2005-2007 WITH
PARTICULAR REFERENCE TO THE PROVISIONS OF THE
2007-2008 PLANNING AND FINANCIAL AGREEMENTS
SIGNED WITH THE PROVINCE**

<u>FINAL REPORT</u>

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1.Introduction

Some characteristic features of the Province of Trento have to be shortly highlighted from the beginning in order to understand the general context.

Trentino is a very small area. It has a rather low density of population due to the importance of mountainous areas with forests (0,8% of the national population on 2,9% of the Italian territory). On the other hand, it can be considered as one of the wealthiest areas in Italy. Its GDP per capita is among the highest at EU level (a characteristic that is shared with some other Alpine regions in Europe). Unemployment is low.

From the 1970's, growth has mainly relied on tourism, construction, agriculture (apple and wine), and agro-food coupled with tourism. From the 1990's, computer and ICT-related activities started to develop and contribute to the regional economic fabric, which remains dominated by SMEs.

From a politico-institutional point of view, the Province is autonomous – Trento Autonomous Province (hereafter: TAP) – which means that it benefits from its own tax revenues which are given back to it by the Italian State. TAP manages accordingly a very important budget with respect to its size. At the same time, due to the historical and cultural context of the Region Trentino Alto Adige, TAP benefits from the transfer of regional competences to the provincial level.

A major consequence is that TAP authorities are in a position of setting up and developing their own public policies with solid financial capacities for implementing them.

Some **RTDI-related indicators** allow for positioning Trentino with respect to the EU and to Italy¹.

The percentage of R&D expenditure in the provincial GDP is much lower than the EU 15 average. With respect to Italy, this percentage is close to the national average; it is much lower than in Lazio and Piemonte (which are rather close to the EU average); it is lower than in Liguria, Emilia-Romagna, Friuli-Venezia Giulia, and slightly lower than Lombardy and Campania. However, Trentino remains far from the Barcelona objective concerning the distribution between public and private R&D expenditure: 1/3 public – 2/3 private. Public R&D expenditure (public institutions and UoT) amount to c. 82 % in 2003 and 77 % in 2005. This is confirmed by statistical data on human resources in R&D (equivalent full time): if stability or a slight growth can be observed along the period 2000-2005, there is however an imbalance between the public sector (the number of employed people has been growing) and the private sector (diminution from 2002).

Globally, Trentino has improved its position from the beginning of the 2000's at national level as far the % of R&D expenditure in the GDP is concerned.

In addition, R&D per capita is significantly higher than the Italian average and not very far from the EU average. As public expenditure is predominant, it means that TAP clearly considers research & innovation as a strategic priority.

A series of reports concerning Trentino RTDI strategies and policies has confirmed this TAP policy choice.

¹ Source: TAP.

1.1. Previous Reports on Trentino RTDI strategies and policies

A ‘Regional Innovation and Technology Transfer Strategy’ (RITTS) exercise was realised at the end of the 1990’s under the 5th Framework Programme and managed by the Istituto Trentino di Cultura (ITC). The main findings were summarised in a publication ‘Trentino Know-how’, and the RITTS paved the way for 3 pilot projects in the field of RTDI.

The participation of TAP in the RITTS programme was an early signal of the commitment of provincial authorities to have strong policies supporting research and innovation.

In 2003, was published a Technical Report ‘The Science and Technology Base of the Provincia Autonoma di Trento: Capacities, Trends and Opportunities’, realised by the Fraunhofer-Institut für Systemtechnik und Innovationsforschung, Karlsruhe (ISI). The expert team provided a number of recommendations concerning the research system, research infrastructure, cooperation between research and industry, improvement of competences and the development of an entrepreneurial culture, the efficient and effective allocation of public funds.

Later on, the TAP ‘Research Observatory’ edited its 2003 annual report ‘Scientific Research in Trentino’ (hereafter: ‘Scientific Research 2003’), which made proposals concerning future changes, following an evaluation exercise including interviews of main actors².

Finally, TAP participated in a FP6-funded project ‘TeRIS’³ which included a report on the ‘Regional Innovation System of Trentino’, delivered in September 2006.

1.2. Recent changes in TAP RTDI policies

1.2.1. Short panorama in 2003

In 2003⁴, the main research institutions funded by TAP were:

- Istituto Agrario S. Michele all’Adige (IASMA)
- Centro di Ecologia Alpina (CEA)
- Istituto Trentino di Cultura (ITC)
- University of Trento (UoT)

These institutions were funded through the provincial budget, the three first ones being part of the provincial administration, while UoT was a separate legal body as university.

Besides this source of funding, TAP had created in 2000 a provincial fund aimed at funding research projects on a competitive basis, i.e. through calls for proposals.

Calls were open to businesses as well as to research organisations, among which the four institutions above-mentioned, which could thus complement their financial resources beyond TAP ‘recurrent’ funding (*“fondi ordinari”*).

² La Ricerca scientifica in Trentino, Rapporto 2003, Osservatorio della Ricerca, Servizio Università e Ricerca Scientifica, Dipartimento Programmazione, Ricerca e Innovazione, dicembre 2004.

³ Template for Regional Innovation as a Tool for Evening out the Regional R&D Investment Disparities (www.terisproject.net). TAP was a partner of the project, together with University of Trento and Finnish and Greek partners.

⁴ La Ricerca scientifica in Trentino, Rapporto 2003.

The 2003 distribution of funding to ‘organisations belonging to the sector of training, research and innovation’ was as follows⁵:

Beneficiaries	Amount of funding (MEUR)	Distribution (%)
IASMA	25,6	22,63
CEA	2,7	2,4
ITC	29,5	26,12
UoT	27,7	24,51
Funding to public and private bodies (partially competitive research)	15,1	13,36
Industrial and crafts businesses (competitive research)	8,3	7,35
Others	4,1	3,63
Total	113	100

If we limit to funding for research activities *stricto sensu*, the distribution appears different:

Beneficiaries	Amount of funding (MEUR)	Distribution (%)
IASMA	8,54	13,4
CEA	0,81	1,3
ITC	29,5	46,4
UoT	0,52	0,8
Funding to public and private bodies (partially competitive research)	15,1	23,7
Industrial and crafts businesses (competitive research)	8,3	13,1
Others	0,8	1,3
Total	63,6	100

The main differences between the two tables concern IASMA (which had funding for educational and training activities in particular) and UoT (which had funding for operational activities and investment in facilities).

Between 1999 and 2003, the total funding to ‘organisations belonging to the sector of training, research and innovation’ had grown by 160% which again illustrates the commitment of TAP to supporting RTDI.

However, as stated in the foreword to ‘Scientific Research 2003’ written by the provincial minister in charge of research and innovation, the expected diminution of TAP financial resources in the future led to rethinking public policies with an effort toward rationalisation while maintaining the key strategic importance of supporting RTDI.

This effort was detailed through listing the following objectives⁶:

- Giving more autonomy to research centres and making them ‘leaner’
- Having a clearer definition of priorities and networking strategies
- Reducing fragmentation of research

⁵ La Ricerca scientifica in Trentino.

⁶ La Ricerca scientifica in Trentino, pp. 7-8.

- Paying more attention to innovation to address the lack of specialisation of the provincial economic fabric (better integration of research and innovation activities)
- In terms of governance, having new programming instruments

It must be noted that these objectives were globally in line with the recommendations formulated in the Fraunhofer-ISI Report.

1.2.2. The reorganisation of the TAP System of Research & Innovation (2005-2006)

The Provincial Act of 2 August 2005

This reorganisation which addressed the objectives proposed in ‘Scientific Research 2003’ was implemented by the Provincial Act of 2 August 2005 accompanied by the Multi-annual Programme for Research 2006-2008:

- Creation of a ‘cooperation framework’ for setting up a provincial system of research, interacting with the national and international levels, with all actors involved in provincial development
- Creation of favourable conditions for developing an innovation system aimed at improving the competitiveness of the provincial economic fabric
- Constitution of 2 Foundations transforming the public research centres into autonomous legal bodies:
 - o Foundation Bruno Kessler (FBK) corresponding to the former Istituto Trentino di Cultura (ITC)
 - o Foundation Edmund Mach (FEM) corresponding to the former Istituto Agrario di S. Michele all’Adige (IASMA) and to the former Centro di Ecologia Alpina (CEA)

The 2 Foundations had accordingly to prepare and adopt their own project of reorganisation. They had from their creation the capacity to apply on their own behalf to provincial, national and EU calls and to develop a commercial activity – while complying with their institutional objectives.

The 2005 Provincial Act defined three ‘instruments of action’:

- Programming agreements that had to be signed with the 2 Foundations, UoT, and other public bodies
- Calls for financing research projects (competitive research)
- Provision of financial incentives for innovation (Provincial Act 13 December 1999)

A ‘Single Fund for Research’ was created within the provincial budget for funding the different instruments.

The main novelty concerned of course the programming agreements: as the research institutes were no more part of the provincial public administration, the new legal entities had to ‘negotiate’ and sign agreements with TAP defining the conditions and the extent to which they would continue to get recurrent funding (“*fondi ordinari*”) from the Province.

The Multi-annual Programme for Research 2006-2008

The Multi-annual Programme for Research 2006-2008⁷ defined a set of objectives and priority thematic areas, evaluation criteria, and the type of projects' expenses eligible to the 'Single Fund for Research'.

There is an extensive list of 22 priority areas which can be grouped into 5 larger research areas: Materials, ICT, Agro-environment, Biology and Bio-medicine, Human and Social Sciences.

Concerning the governance of the research system and the setting up of an evaluation mechanism, it was decided to create a 'Techno-scientific Committee for Research & Innovation' and a 'Committee of Evaluation of Research'.

The Multi-annual Programme also established different 'lines of intervention' in relation to the 'instruments of action':

- Large research projects, with long-term objectives and a strategic perspective): to be implemented through calls and programming agreements;
- Development projects, contributing to the development of the provincial territory: implemented through calls and provision of incentives;
- Agreements, i.e. programming agreements with the Foundations and other public bodies;
- Exploratory projects: implemented through calls and provision of incentives.

A last point regarded intellectual property. The Development Agency 'Trentino Sviluppo', which by the way is also a Business & Innovation Centre, was entrusted with the management of patents and intellectual property rights belonging to the Province – i.e. concerning research results obtained due to TAP funding – with the objective of promoting business initiatives on the provincial territory.

The Programme of Provincial Development for the XIII Legislature

The Programme (PPD) was approved on 29 May 2006. It identifies 'Knowledge' (and the System of Research & Innovation) as one of its four strategic components, together with 'Competitiveness', 'Solidarity and Employment', 'Identity and Territory'.

It defines the following objectives for the System of Research & Innovation:

- Increasing the degree of internationalisation of the research system
- Increasing the proportion of funding for R&D deriving from public sources external to TAP and from the private sector
- Finalising and implementing an assessment system of the quality of the research system, based on quantitative indicators and peer review
- Promoting synergies between the research system and local development based on high quality innovations, and capable of attracting private enterprises

⁷ Programma pluriennale della ricerca per la XIII legislatura periodo 2006-2008 (Legge provinciale 2 agosto 2005, n. 14).

1.3. Today situation

The two Foundations, FBK and FEM, are now legally constituted. They are engaged in a process of restructuring corresponding to the new framework and concerning departments and units, personnel, definition of their own objectives, diversification of their financial resources, definition of monitoring and evaluation indicators, etc.

Each of them signed its own Programming Agreement with TAP on 1st of February 2008.

Besides the Foundations, a ‘Technological District’ (innovative cluster) named ‘Habitech’ has recently been created which focuses on sustainable construction, renewable energies and environmental technologies. This creation corresponds to the 22nd priority thematic area (technologies for sustainable construction, renewable energies) which had not been addressed so far.

TAP succeeded in attracting a Microsoft R&D Department in collaboration with UoT and FBK. This was an achievement directly related to the above-mentioned fourth objective of the PPD as well as to the idea of creating a ‘cooperative framework’ with all actors involved in provincial development.

In accordance with what was expected, strategic and policy focus on RTDI clearly remains, and to some extent has been strengthened, and the growth of TAP financial allocations has been curbed in comparison to the period 1999-2003.

Since the synergies between the research system and local development now constitute an objective of the PPD, it is interesting to have an estimation of the distribution of R&D expenditure into socio-economic objectives (the latest TAP available data concern the period 2003-06):

Socio-economic objective	% of R&D Expenditure 2006	Growth in volume 2003-2006 (%)
Industrial production and technologies	41	+ 44 %
Agricultural production and technologies	26	+ 49 %
Health	10	+ 2269 %
Environment	9	+ 12 %

It appears that priority has been given to the regional economic fabric (even if some research has probably benefited to external actors in the industrial sector). Health is clearly up on the agenda. The future of environmental RTDI relies on the dynamics of the Technological District

In conclusion, we can compare the contributions of the Provincial Budget to the different actors implementing research in 2003 and 2006 with the 2008 Provincial Budget appropriations:

Type of expenditure	Amount (MEUR)			% of Provincial Budget		
	2003	2005	2008 (as of 18.09.08)	2003	2005	2008 (as of 18.09.2008)
Total Provincial Budget	3 956	3 915	4 419	100	100	100
Contributions to research: Foundations and other bodies (except UoT)	54,7	58,8	67,5	1,38	1,50	1,53
UoT	27,7	40,3	41,7	0,70	1,03	0,94
Public contribution to industrial research (LP 6 + other funds)	8,35	17,6	39,8	0,21	0,45	0,90
Sub-total without UoT	63,05	76,4	107,3	1,59	1,95	2,43
Sub-total with UoT	90,75	116,7	149	2,29	2,98	3,37

Source: TAP

1.4. Objectives and conditions of implementation of the present evaluation

1.4.1. Key issues of the evaluation according to the terms of reference

The Techno-scientific Committee for Research & Innovation decided to provide for an evaluation procedure by independent experts following models adopted at international level. The evaluation procedure was based on the implementation of the evaluation model prepared by the Committee, “which identifies impact as the result of the resources and support provided by the provincial administration, giving rise to effects (direct or indirect) which have repercussions on specific areas such as: the progress of scientific knowledge; economic aspects and consequences; repercussions on the decision-making process and administrative management; culture, society and citizens; the environment and sustainability”.

The terms of reference of the evaluation specified that the evaluation report should support the process of defining future planning and financial agreements beyond the present programming period, concerning the two Foundations, FBK and FEM.

The starting point of the evaluation was the “measuring and comparison (positioning within the international context) of the **scientific quality** of individuals and their clustering within scientific structures in Trentino”.

On this basis, the evaluation questions had to focus on two areas:

- “Analysis of the **planning process** for activities in relation to obligations and objectives (and to the resources and opportunities available)”
- “Analysis of the relationship between the internal system and the external context (**evaluation of impact**) in the scientific and economic context, also in relation to the resources available, the objectives established and the results obtained”

In order to support the work of the panel of experts (hereafter: PoE), it was intended that the Committee and the provincial administration, in particular through the Unit ‘University and Scientific Research’, would provide information, data and documents, including material formulated in part, giving a picture of the existing situation; it was also intended that it would be the task of the Foundations to make available all the information and documentation

requested for the proper implementation of the evaluation exercise, in so far as effectively possible.

Finally, the terms of reference indicate that the recommendations of the PoE must be targeted at three categories of actors – and justified in relation to these categories: policy-makers, Foundations (and their departments and units), researchers.

1.4.2. The implementation of the evaluation exercise

The PoE mixed scientists specialists of scientific fields covered by the Foundations and experts of RTDI public policies and strategies and of their evaluation.

Two missions in Trentino were organised by Unit ‘University and Scientific Research’ for the members of the PoE. All members of the PoE were not able to take part in the second mission, but those who could not tried to have separate interviews at different dates.

The list of actors and stakeholders interviewed is given in Annex 1.

The first mission took place on 23 to 25 July. A first meeting was held with the provincial administration with a presentation of the global situation and stakes by Maurizio Fontanari; basic data, information and documentation were provided to the PoE by the Unit ‘University and Scientific Research’. There were subsequent meetings with heads of FBK and FEM and visits were paid to the Foundations. In addition, the PoE had a working lunch with Assessore Gianluca Salvatori, the provincial minister in charge of research & innovation.

The PoE had an internal meeting on 25 July for listing the people they wanted to meet during their next mission, and discussing a working document prepared by the coordinator responsible for drafting the report. The working document proposed a plan for the future report in relation to the terms of reference and distributed the tasks among the members of the PoE; the plan was validated by the PoE.

The second mission took place on 11-12 September. According to PoE requests, there were: interviews and meetings with some other research institutions, and the Vice-Rector of UoT; complementary meetings with representatives of FBK and FEM; meetings with managers of Trentino Sviluppo, the president and the administrator of the Technological District; a specific meeting with major stakeholders.

A meeting of the PoE was organised in Milano on September 29 to discuss the drafting of the final report.

The members of the PoE express their thanks to the Unit ‘University and Scientific Research’ for their help in the implementation of the evaluation exercise, concerning the provision of data, information and documentation, as well as the organisation of meetings, interviews and visits.

Finally, it must be reminded that the exercise was conducted by an international panel of 9 experts. The exercise is accordingly different from an evaluation conducted by a consultancy team. Each expert of the PoE takes its own responsibility for its share in the evaluation, especially for what regards the assessment of scientific quality within each Foundation and within each department and unit (when possible).

1.4.3. Problems encountered and limits of the evaluation exercise

It is very important to present the problems that the PoE has encountered and the resulting limits of the evaluation exercise.

The PoE identified three major problems which brought limits to the evaluation exercise:

- Access to data and information

In spite of the efforts deployed by the provincial administration, it was sometimes difficult to obtain data from the Foundations, and in particular quantitative data from FBK. When valuable data were obtained in a Foundation or some of its departments, they were not in general comparable to those that could be got in others. The lack of comparability of data caused some difficulties to the PoE.

Such a situation may be understood due to the on-going restructuring within the Foundations due to the reform resulting from the 2005 Provincial Act. However, it clearly reflects the need for having appropriate monitoring and assessment instruments, accompanied by quantitative indicators, within the Foundations, as it will be emphasised later in the present report.

- Difficulty to assess the impact on the provincial economic fabric and society

The meetings with the stakeholders held in September were extremely interesting, but they were not sufficient to allow the PoE for providing a really detailed and consistent assessment of the impact of the research conducted in the Foundations in the period 2005-2007 on the provincial economic fabric.

Addressing impact led the PoE more to raise issues for the future than to answer satisfactorily the question of present impact.

- Little time available

The short period of time that could be dedicated to the evaluation exercise reinforces the two previous problems encountered.

Referring first to what has been said above concerning access to data and information, the starting of the evaluation exercise end of July let little time to the Foundations for addressing the PoE requests and to the PoE itself for processing the available information.

Second, there was no sufficient time available for collecting and processing precise data on impact of research conducted in both Foundations on the regional economic fabric.

1.4.4. Conclusions: specificities of the exercise

The plan discussed in July for the report intends to cope with these problems.

If it basically addresses the classical items of an evaluation study, i.e. coherence, effectiveness, efficiency, and impact, its chapters adapt the contents of these items to the data and information available and to the short period of time that was given to the PoE for implementing its task, while complying as far as possible with the terms of reference:

- Coherence of the objectives and funding :
 - It was possible to address thoroughly the coherence of objectives, but the lack of sufficiently comparable data concerning the different sources of funding did

not allow for establishing an entirely satisfactory relationship between objectives and financial resources

- Scientific quality and effectiveness:
 - Scientific quality was the starting point of the PoE as stated in the terms of reference. Due to the timeframe, assessing scientific quality was considered as the simplest way (if incomplete) to approach effectiveness
- Governance and efficiency:
 - Due to some lack of data and lack of comparability, efficiency was approached through a mainly qualitative assessment of the governance system both at the level of the provincial system of research & innovation and at Foundations level
- Impact:
 - As indicated above, impact on the provincial economic fabric and society was difficult to assess in a classical way for at least two reasons : the establishment of Foundations is too recent, and little time could be dedicated to gather relevant data. However, the PoE concentrated on the impact of the 2005 reform on stakeholders of the system of research & innovation and on issues raised for the future.

2. Coherence of objectives and funding

Coherence of objectives and funding is directly related to the “analysis of the planning process in relation to obligations and objectives (and to the resources and opportunities available)” that the PoE is invited to implement according to the terms of reference.

The 2005 reform has led to the definition of objectives, which is in itself an excellent component of policy-making. However, the multiplicity of official documents produced various lists of objectives, the coherence of which has to be assessed.

2.1. Objectives as in the Programme for Provincial Development (PPD)

These objectives (see above § 1.2.2) are:

- Increasing internationalisation
- Increasing the proportion of external sources of funding
- Implementing an assessment system of quality of the research system (quantitative indicators and peer review)
- Promoting synergies between the research system and local development with a dimension of attracting businesses

Two of these objectives are strategic: internationalisation and local development. The two other ones are ‘instrumental’: diversification of funding sources and assessment of quality.

Concerning the strategic objectives, they are not necessarily contradictory; however, the constraints resulting from the limitation of human and financial resources may make them conflictual. Pursuing an objective of internationalisation means investing in order to have world-class research which may divert resources from technology transfer and innovation

support services. Taking provisions to transfer the knowledge gained in international cooperation into services to be provided to the regional innovation system would surely help to overcome the problem.

Such a potentially conflicting situation between strategic objectives is far from exceptional in regional research & innovation systems⁸. It was illustrated in Trentino by the sensitivity of farmers' organisations to the reform of FEM.

The 'instrumental' objectives are related to the strategic objectives. The assessment of scientific quality is a condition for developing world-class research and going at international level. External resources may come from participation in EU Framework Programmes, which in its turn is linked to internationalisation. They may also come from contract research with and technology transfer to businesses, provincial or not. When targeted businesses are established in the province, there is evidently contribution to local development. But there is also contribution to local development when TAP R&D organisations sell expertise and/or services to external businesses, since they export 'knowledge', establish contacts and cooperation between the region and external actors, and – last but not least – increase their turnover.

2.2. Objectives as in the Multi-annual Programme for Research 2006-2008

They can be synthesised as follows:

- Strengthening the TAP research system through increasing quality and assessing it
- Strengthening human capital and creating critical mass in fields of priority for the provincial territory, while "in harmony with" European and national policies
- Favouring the interaction between research and the provincial territory through strengthened cooperation within the research system, and with businesses, with respect to the major objectives of territorial development
- Concentrating support on priority areas (prevent fragmentation of public intervention)
- Strengthening the capacity of the research system to be competitive at national and international level (with opportunities of getting funding through national and EU calls)
- Encouraging research organisations to diversify their sources of funding

These objectives are quite coherent with those of the PPD. There is an additional objective which is related to the issue of governance of the research system, i.e. the cooperation within the research system (already mentioned in the 2005 Provincial Act: 'cooperative framework').

The objective of concentration on priority areas seems a little bit in contradiction with the list of 22 'priority thematic areas' in the same document. Is there a real critical mass in 22 areas ? Is it possible for the TAP research system to go international in 22 areas ? Can TAP afford to prioritise 22 areas ?

⁸ An interesting example is provided by the Regional Innovation Strategy of Central Norway (Trøndelag). Central Norway has less inhabitants than TAP. The capital city, Trondheim, has 130 000 inhabitants, and benefits from the presence of the National University of Technology (NTNU). NTNU objectives are focused on world-class research and belonging to international networks, while local and regional authorities expect innovation support to the benefit of the territory.

2.3. Objectives and expected results of the Foundations as in the Programming Agreements (PA)

The PA signed on 1st February 2008 list common objectives of TAP and each Foundation as well as expected results.

2.3.1. Common objectives

- **FBK:**
 - General objective: stability of the objectives (guarantee of resources for maintaining scientific and technological competences)
 - Specific objectives: making the territory beneficiary of research results in terms of innovation and dissemination of knowledge; developing high quality research, with international visibility, focused on key thematic areas agreed between FBK and TAP; contributing to the implementation of the research & innovation system through involvement of key actors
- **FEM:**
 - General objective: stability of the objectives (guarantee of resources for maintaining scientific and technological competences)
 - Specific objectives: strengthening sustainability and competitiveness of the provincial agricultural production; improving the process of transformation of foodstuffs, with particular attention to quality and traceability; deepening studies on impact of diet on human health (fruit, quality foodstuffs); deepening studies on the link between ecology, biodiversity and bio-complexity of alpine systems

2.3.2. Expected results

- **FBK:**
 - Interdisciplinarity
 - More efficient and coherent organisational model, included at administrative level
 - Internal and external mobility
 - Rationalisation of collaborations in particular with UoT
 - Experimentation of a system of internal evaluation and assessment of impact of the activities on the territory
 - Increased internationalisation (personnel and activities)
 - Increased quantity and quality of research and results within a logic of territorial system
- **FEM:**
 - Development of innovative knowledge
 - More scientific publications at int'l level
 - Development of technology transfer activities together with IPR
 - Diffusion of research results to the territory
 - Training of young researchers
 - S&T support to agro-environmental policies in the Province

2.3.3. Comments on the Programming Agreements

For FEM, specific objectives seem globally more focused on the contribution to local development than on the internationalisation of the research system.

Emphasis on internationalisation can be found more clearly in the expected results than in the objectives.

For FBK, high quality research is an objective, while curiously the assessment of quality is an expected result. FEM objectives are much more focused on specific scientific fields; a direct link seems to be established between world-class research and the impact on provincial agricultural production. This is not surprising since FBK covers a rather wide range of fields, whereas FEM covers agricultural sciences. FEM does not mention collaboration with UoT.

2.4. Objectives of the Foundations

Since the Foundations are legal entities, they are entitled to define their own objectives, which of course is directly linked to the objective of diversification of funding sources.

- **FBK (according to its constitution):**
 - Cultural activities, scientific research, technological development for both advancement of knowledge and service to local community
 - Frontier research with interdisciplinary approach and potential applications, and cooperation with UoT
 - International opening up of Trentino, through int'l collaborations and exchange, with involvement of UoT and other key actors of the territory
 - Promotion of innovation capacities, involving the local business community, transfer of research results, support to entrepreneurship
- **FEM (according to the presentation made by R. Viola):**
 - Core objectives: enhancing the Trentino land-based economy and sustaining its environmental and natural resources through the provision of education, research and innovation
 - Mission: to contribute to the development of a knowledge-based economy in the agro-food and environmental sectors, to promote a sustainable land-based economy, to improve the quality of life in a world that is rapidly changing

However, the recent and important development of the FEM 'Genetics and Molecular Biology Development' leads to consider that there seems to be to some extent a FEM 'hidden agenda' focused on supporting world-class research (and internationalisation).

2.5. Coherence of objectives and funding

As previously stated, the implementation of objectives and the diversification of funding sources are inter-related.

Globally, it is expected that in the future TAP recurrent funding (*'fondi ordinari'* guaranteed in the PA) should diminish to the benefit of other sources of funding that can be categorised as follows and related to the PPD objectives:

Funding Sources	Link to PPD Objectives
EU Framework Programmes: calls for proposals (competitive research)	Internationalisation / Assessment of quality of research
National public funding	Visibility at national level / Assessment of quality of research
Provincial calls for proposals (competitive research)	Contribution to local development
Private sources: <ul style="list-style-type: none"> Provincial businesses (contract research, technology transfer, services) Extra-provincial businesses (exporting knowledge) Revenues of IPR (an open question: for the moment, IPR are managed by Trentino Sviluppo) 	Contribution to local development Internationalisation / Assessment of quality of research / Contribution to local development Contribution to local development / Internationalisation

It was not possible to split the resources of the Foundations and their departments into these categories in a fully satisfactory and comparable way.
The data available at the moment are presented hereafter.

2.5.1. FBK

- Materials & Microsystems Centre (M&M)⁹:

Funding sources	2005		2006		2007		2008 (budget forecast)	
	MEUR	%	MEUR	%	MEUR	%	MEUR	%
TAP <i>fondi ordinari</i>	4,03	47	4,44	44,4	5,25	63	7,42	69
EU calls	0,22	2,6	0,15	1,5	0,52	6,2	0,56	5,2
National funding	1,64	19	0,45	4,5	0,48	5,8	0,62	5,8
TAP calls	1,79	21	3,44	34,4	1,02	12,3	0,29	2,7
Industry and other public bodies	0,89	10,4	1,51	15,2	1,06	12,7	1,86	17,3
Total	8,57	100	9,99	100	8,33	100	10,76	100

There has been no significant progress toward a global diversification toward external sources of funding so far. TAP recurrent funding stays as the major funding source. However, there is a tendency to growth of funding from industry and other public bodies.

⁹ Source: FBK data.

- IT Centre (IT):

Funding sources	2008 (budget forecast)	
	MEUR	%
TAP <i>fondi ordinary</i>	4,26	46,5
EU calls	2,3	23,5
National funding	0,16	1,6
TAP calls	0,68	6,9
Industry and other public bodies	2,1	21,5
Total	9,8	100

The share of EU calls is important as well as the share of industry and other public bodies. TAP recurrent funding is less than half of the financial resources.

- Human and Social Sciences (Centre for Religious Studies and Centre for Italo-German Historical Studies)¹⁰:

TAP recurrent funding represented about 92 % of total funding in 2007 and 93,9% in the 2008 budget.

- Research centres with an agreement with FBK (*Centri in convenzione*)¹¹:

These research centres are not part of FBK but are linked to it through a specific agreement. They benefit from PA through FBK.

Funding sources	2007		2008	
	MEUR	%	MEUR	%
TAP <i>fondi ordinari</i>	4,5	65,2	5,5	73,3
Other sources	2,4	34,8	2	26,7
Total	6,9	100	7,5	100

The distribution of the sources of funding is highly variable. However, globally, TAP recurrent funding is the major source of funding.

¹⁰ Source: FBK, Piano dell'attività di ricerca (biennio 2007-2008).

¹¹ Idem.

2.5.2. FEM

Funding sources 2008	Agrifood		Genetics and Molecular Biology		Agricultural Resources		Plant Protection		Natural Resources		CEA	
	MEUR	%	MEUR	%	MEUR	%	MEUR	%	MEUR	%	MEUR	%
TAP <i>fondi ordinari</i>	4,09	63,41	6,87	76,42	3,85	91,67	2,76	52,98	4,76	48,25	0	0
EU calls	0,43	6,67	0,08	0,89	0,05	1,19	0	0,00	0,006	0,06	0	0
TAP calls	1,09	16,90	1,56	17,35	0	0,00	2,45	47,02	4,41	44,70	0	0
Public bodies	0,22	3,41	0,38	4,23	0,12	2,86	0	0,00	0,45	4,56	6	100
Private bodies	0,62	9,61	0,1	1,11	0,18	4,29	0	0,00	0,24	2,43	0	0
Total	6,45	100,00	8,99	100,00	4,2	100,00	5,21	100,00	9,866	100,00	6	100

Source: FEM data

It is impossible to have a reliable track record of the least past years since FEM / IASMA has been widely reorganised into new departments and units.

It is nonetheless easy to note that, except for the Departments Natural Resources and Plant Protection, TAP recurrent funding is largely predominant. TAP calls also provide an important source of funding, EU calls playing a significant part for the Agrifood Department and private funding for the Agricultural Resources Department.

2.6. Coherence: Conclusions and Recommendations

- The two PPD strategic objectives for the system of research & innovation – internationalisation and contribution to local development – should be clearly hierarchised, in order to provide guidelines to the Foundations their specific priorities accordingly.
- Within such a context, Foundations have to decide clearly and explicitly their objectives for a planning period on the basis of the human and financial resources they have and intend to have (external resources).
- TAP objectives concerning contribution to local development should target explicitly specified sectors of the regional economic fabric or sectors that TAP wants to develop (e.g.: sustainable construction and renewable energies with the Technological District).
- Contribution to local development should not limit to relations with the provincial industry and businesses. Exporting knowledge nationwide or at international level to businesses external to the province has to be considered also as a contribution to local development (raising the national and international visibility of the province and strengthening collaborative links with external actors, opportunities of attracting businesses from outside, marketing the knowledge base of TAP, increased turnover of Foundations, ...).
- In the future PA, we consider that it is no more necessary to define common objectives (a useless ‘layer’ of objectives). There must be:
 - the TAP objectives which are public policy objectives and provide the framework which justifies TAP funding (TAP recurrent funding); policy objectives are implemented through contractual agreements
 - The Foundations’ own objectives, which must globally comply with TAP policy objectives, but can also be specific to each Foundations and correspond to the funding they can get for implementing them.
- Future PA must include Action Plans in Annex:
 - stressing the Foundations’ own objectives (scientific quality, scientific objectives, technology transfer, services, export of knowledge, etc.) and referring to scientific priorities
 - defining the road map, actions, instruments for implementing the objectives, and the related allocation of expected resources (distributed into sources of funding).
- Future PA must accordingly include a chapter (and a detailed Annex) dedicated to monitoring and assessment indicators, including indicators concerning the funding sources per activity and per research project on a basis allowing for comparisons and benchmarking (see also § 4. Governance and Efficiency).
- The 22 priorities listed in the Multi-annual Programme for Research should be ranked and streamlined

3. Scientific Quality and Effectiveness

3.1. Foundation Bruno Kessler

FBK has two research departments, each of them divided into 2 macro-labs or centres:

- Science & Technology (ex-IRST):
 - o Information Technology (IT)
 - o Materials and Microsystems (M&M)
- Human and Social Sciences:
 - o Religious Sciences
 - o Italo-German Historical Studies

They are 'networked' with research centres which have an agreement with FBK (*Centri in convenzione*).

The two Centres, IT and M&M, of the former IRST were reorganised with the creation of the Foundations. Within each of them, were created Research Units, Units for Strategic Applications, Exploratory Projects.

3.1.1. Information Technology Centre

The technical personnel is organised into 9 Research Units and 2 Innovation Labs. Additionally, exploratory projects are set up to test extensions of the centre activities into new territories.

The FBK Centre for Information Technology has a technical personnel of about 160, including 62 researchers, 58 developers, and 40 Ph.D. students. Out of 160, 29 are women, 31 are foreign, and 48 have tenure.

The operating budget for 2008 is around 9,8 MEUR (6,9 MEUR for personnel), 46,5 % of which directly funded by PAT (recurrent funding) and 53,5% by other sources (2.3 MEUR by EU projects, 0.16 MEUR by National projects, 2.1 MEUR by Industry and Public Bodies, and 0.68 MEUR by PAT projects through calls).

As a rather rough indicator of scientific output, in the four-year period 2004-2007, the number of publications was around 750, 190 of which in ISI journals.

As indicators of innovation, the Centre claims 7 spin-offs, 2 active Innovation Labs, and several industrial projects.

Observations and Remarks:

As stated in the FBK Plan for Research Activities, the Centre aims at pursuing (a) scientific excellence, (b) impact on applications, and (c) promotion of innovation within the territory. There is a clear effort, by the direction, but also by the individual units, to rethink and refocus their activities toward the stated goals.

The reorganisation into Research Units and Units for Strategic Applications or Innovation Labs is consistent with the broad goals of FBK as well as with the competence and expertise of the personnel of the Centre. The explicit placement of the Units within the engineering-content-interaction space can prove effective in stressing relations and opportunities of collaborations among different units, while keeping the latter at a manageable size (about 15 persons per unit).

Research Units are: Data & Knowledge Management (DKM), Embedded Systems (ES), Human Language Technologies (HLT), Intelligent Interfaces and Interaction (i3), Predictive Models for Biomedicine & Environment (MPBA), Service Oriented Applications (SOA), Software Engineering (SE), Speech-acoustic Scene Analysis and Interpretation (SHINE), Technologies for Vision (TEV).

Units for Strategic Applications are: e-Government (EGO); e-Health.

Exploratory Projects (EP), foreseen in the 2008 budget and currently active, are: Neuroinformatics Laboratory (NiLab), Computational Cognitive Lab (CCL), eDemocracy (ED).

Research Unit	Senior Researchers	Researchers	Developers	Ph.D./post doc	TOTAL
Direzione	1				1
EGO	1		4	1	6
e-Health	1		7	1	9
TEV	2	3	4	1	10
SHINE	1	4	2	3	10
SOA	1	3	3	3	10
DKM	2	3	4	3	12
SE	2	2	5	5	14
PMBA	1	3	6	4	14
i3	2	5	7	5	19
ES	2	7	6	5	20
HLT	4	10	10	5	29
EP	1	1		4	6
TOTAL	21	41	58	40	160

Funding distribution per research group and year

The following tables show the budget of the period 2005-2007 for the IT Centre distributed into the three different old Divisions (Automated Reasoning Systems - ARS, Interactive Sensory Systems - ISS, Communications and Cognitive Technologies - CCT), plus the budget for the activities carried out at the level of the IRST direction (DIRECTION) such as the amounts for the personnel in the direction staff, for the explorative projects, and for transversal projects.

ARS	2005	2006	2007	Total 2005-07
TAP <i>Fondi ordinari</i>	1.706	2.002	1.755	5.463
External resources:				
TAP calls	2.160	1.350	611	4.121
EU calls	463	298	383	1.173
Italian Government	551	80	113	744
Others - Industry and other Public Bodies	336	95	513	944
Total	5.246	3.824	3.375	12.445

ISS	2005	2006	2007	Total 2005-07
TAP <i>Fondi ordinari</i>	2.039	2.386	2.974	7.399
External resources:				
TAP calls	1.183	302	311	1.796
EU calls	1.446	847	623	2.916
Italian Government	258	4	45	308
Others - Industry and other Public Bodies	288	589	415	1.292
Total	5.214	4.127	4.369	13.710

CCT	2005	2006	2007	Total 2005-07
TAP <i>Fondi ordinari</i>	844	1.139	1.026	3.009
External resources:				
TAP calls	516	260	164	940
EU calls	632	388	609	1.629
Italian Government	41	0	142	183
Others - Industry and other Public Bodies	11	4	21	36
Total	2.044	1.792	1.962	5.798

Direction	2005	2006	2007	Total 2005-07
TAP <i>Fondi ordinari</i>	787	823	546	2.156
External resources:				
TAP calls	249	0	0	249
EU calls	34	15	45	94
Italian Government	18	0	41	59
Others - Industry and other Public Bodies	234	107	161	502
Total	1.322	945	794	3.060

Total Funding*	2005	2006	2007	Total 2005-07	Forecast 2008
TAP <i>Fondi ordinari</i>	5.376	6.350	6.301	18.027	6.837
External resources:	8.450	4.338	4.199	16.987	4.417
TAP calls	4.107	1.912	1.086	7.106	683
EU calls	2.605	1.547	1.661	5.813	1.943
Italian Government	868	84	342	1.293	161
Others - Industry and other Public Bodies	870	795	1.111	2.775	1.630
Grand Total	13.826	10.688	10.500	35.014	11.254

*in KEuro

Comments:

- The total funding includes also the amounts (expenses and incomes) for the direction of the centre, the amount for the staff of the direction and the projects at the level of the direction. These amounts are neither included in the reports for the three divisions (ARS, SSI, CCT) in the period 2005-2007 nor at the level of the research units in 2008.

- The foreseen incomes in 2008 are higher than in 2007, in spite of a rather significant reduction of the foreseen incomes from the TAP calls. This decrease is compensated by an increase of incomes from external funding (EU calls and Industry/Public Bodies).
- In 2008, the increase in costs is mainly due to an increase in personnel costs for the personnel who changed the kind of contract from one of TAP to one of FBK.

Projects

The following table shows the number of projects of the IT Centre structured in the three different old Divisions (Automated Reasoning Systems - ARS, Interactive Sensory Systems - ISS, Communications and Cognitive Technologies - CCT) distributed by type of calls for the period 2004- 2007.

Projects 2004-2007	Local	National	International
ARS	5	2	8
ISS	1	2	5
CCT	-	-	7
Total	6	4	20

Overall remarks

All main research areas of the Centre are scientifically significant and have wide potential for applications. They are also consistent with the Centre expertise.

Every Unit shows significant elements of vitality and contributes, in one or more dimensions, to the output of the Centre. There are perceivable differences, but the data currently in our possession do not fully support a comparative analysis among units.

Overall, the publication record of the Centre is good, but there is considerable room for improvement, both in quantity and quality. Quality of publications is of course, as for any research institution, the recommended priority.

The capabilities to secure external funding are excellent. The current split (relatively close to 50/50) between "institutional" or recurrent TAP funding and external funding is probably an ideal situation. Increasing the fraction of external funding, while potentially attractive in the short term, may compromise the very freedom essential to creative and innovative research.

The Centre has a good potential in terms of innovation and impact on the industry; this potential would be strengthened through collaboration with Create-Net (see below § 3.1.4). Several of the research programmes have a solid link to applications and are carried out in collaboration with companies. Some of these companies are from outside the province of Trento. In a few cases, new enterprises have stemmed from research activities and results of the Centre.

The training of Ph.D. Students is also a key factor, as they are ultimately the best carriers of innovative ideas to the world of products and services. FBK is not a Ph.D. granting institution, hence the training of Ph.D. happens in the context of agreements with the University of Trento or other universities. For this reason, the synergy with UoT is particularly relevant, and cooperation should be further extended and developed.

The ambition of the Centre to play an active role in promoting innovation within the Trento territory is understandable and appreciable. Substantial work is needed, both in terms of internal organization and in terms of network with other key entities, if this goal has to be pursued systematically. A delicate point that the internal model has to manage is how to pursue the objective of local impact in harmony with that of scientific excellence.

The Centre includes a number of scientists of international value and recognition, who contribute to its output, impact, and prestige. But considerable progress could and should be made to ensure that (almost) all (tenured) researchers of the Centre fall in such a category. It should be considered to implement an incentive system stimulating excellent research performance. The creation of the Foundation has removed some of the constraints, unfortunately common to most Italian research institutions, to hire researchers aggressively in the international market. Going forward, it is crucial that the new degrees of freedom be systematically exploited to hire only top quality people in all ranks, the ultimate trademark of world-class institutions. Target measures should be developed in order to raise the visibility and attractiveness of Trentino as a location for excellent research and technological development.

3.1.2. Materials & Microsystems Centre

Within M&M, Research Units are: New Materials and Analytic Methods for Biosensors and Bioelectronics (M2B2), Plasma and Advanced Materials (PAM), Bio-Micro-Electro-Mechanical Systems (Bio-MEMS), Smart Optical Sensors and Interfaces (SOI), Micro-Electro-Mechanical Systems and Radiation Detectors (MeMSRAaD). The Research Units can be divided into 2 groups, Microsystems and Materials.

Innovation Labs are: Microtechnologies Lab (MTLab), Renewable Energies and Environmental Technologies (REET).

There is one Exploratory Project : Computational Physics (CTP).

REET and CTP are new in the M&M Centre and were not identified in the PA. They formerly belonged respectively to the Microsystems and Materials groups.

The evaluation of the scientific quality of FBK M&M Centre aims at defining the quality of the work performed by the R&D personnel of the institution, but also the degree of dependence of this work on the basic funding coming from TAP under the PA (recurrent funding). Another related aspect that is being addressed is the level of internationalisation of the activities, as it can be generally accepted that international success is only achieved if the institution has previously reached a certain level of excellence:

- Funding obtained and distribution between TAP '*fondi ordinari*' (recurrent funding) and competitive funding through calls
- Number of R&D projects and distribution between national and international projects
- Technology transfer activities, patents and spin-offs
- Quality of publications
- Training and teaching activities
- Other indicators of excellence and internationalisation: international networking, number of visitors, researchers visiting other institutions.

For achieving proper conclusions, not only absolute values have to be taken into account but also relative ratios considering the number of researchers and technologists working in the M&M Centre (see table below).

However this information is only available at July 2008, and thus it will be used qualitatively when getting conclusions. We can observe that the number of researchers and technicians is comparable to other institutions of similar size, but the number of technologists is relatively low for the size of MTLab. The number of Ph.D. and Post Doc is also considered low as commented later. 41% of the personnel correspond to the Microsystems group, 27% to the Materials group, and the rest (32%) to technological support through the Innovation Labs; these differences have to be taken into account when looking at the funding sources of the different groups.

Research Unit	Head of Unit	Senior Researchers	Researchers	Technologists	Technicians	Ph.D./post doc	TOTAL
REET	1	2	3	1	3	0	10
MEMSRAD	1	3	7	0	0	2	13
MTLAB	1	5	8	5	5	1	25
M2B2	1	5	9	0	2	1	18
PAM	1	2	1	3	0	2	9
SOI	1	2	11	0	1	5	20
BIOMEMS	1	1	3	0	1	5	11
Comp. Phys.	1	1					2
TOTAL	8	21	42	9	12	16	108

Funding Distribution per research group and year

The following tables show the budgets of the period 2005-2007 for the M&M Centre distributed when possible into the different groups (Microsystems, MTLab and Materials). The tables have been filled in with data received directly from FBK. When reading the data, some considerations have to be taken into account:

- for 2005, no detailed information on budget is available between MST and MTLab; the same for the 2008 budget forecast;
- in 2005 and 2006, data are from IRST while for 2007, there is a mixture of IRST and FBK;
- in 2008, the incomes (and expenses) for salaries (included in '*fondi ordinari*') have noticeably increased due to the change of nature of the contracts of the personnel).

MST Funding	2005	2006	2007	Total 2005-07	Forecast 2008
TAP <i>Fondi ordinari</i>		1.993.000,00	1.921.000,00		
External resources :					
TAP calls		502.000,00	550.000,00		
EU calls		102.000,00	288.000,00		
Italian Government		433.000,00	412.000,00		
Others - Industry and other Public Bodies		939.000,00	245.000,00		
Total		3.969.000,00	3.415.000,00		

MTLab Funding	2005	2006	2007	Total 2005-07	Forecast 2008
TAP <i>Fondi ordinari</i>		558.000,00	1.083.000,00		
External resources :					
TAP calls		2.186.000,00	137.000,00		
EU calls		20.000,00	24.000,00		
Italian Government		18.000,00	71.000,00		
Others - Industry and other Public Bodies		449.000,00	504.000,00		
Total		3.231.000,00	1.819.000,00		

MST+MTLAB Funding	2005	2006	2007	Total 2005-07	Forecast 2008
TAP <i>Fondi ordinari</i>	1.947.000,00	2.551.000,00	3.004.000,00	7.502.000,00	5.478.000,00
External resources:				0,00	
Tap calls	1.165.000,00	2.688.000,00	687.000,00	4.540.000,00	292.000,00
EU calls	217.000,00	122.000,00	312.000,00	651.000,00	370.000,00
Italian Government	1.602.000,00	451.000,00	483.000,00	2.536.000,00	623.000,00
Others - Industry and other Public Bodies	727.000,00	1.388.000,00	749.000,00	2.864.000,00	1.501.000,00
Total	5.658.000,00	7.200.000,00	5.234.000,00	18.092.000,00	8.264.000,00

Materials Funding	2005	2006	2007	Total 2005-07	Forecast 2008
TAP <i>Fondi ordinari</i>	2.082.000,00	1.892.000,00	2.245.000,00	6.219.000,00	1.937.000,00
External resources:				0,00	
TAP calls	631.000,00	746.000,00	338.000,00	1.715.000,00	0
EU calls	-	28.000,00	203.000,00	231.000,00	193.000,00
Italian Government	35.000,00	-	-	35.000,00	0
Others - Industry and other Public Bodies	163.000,00	123.000,00	245.000,00	531.000,00	361.000,00
Total	2.910.000,00	2.790.000,00	3.094.000,00	8.794.000,00	2.491.000,00

Total Funding	2005	2006	2007	Total 2005-07	Forecast 2008
TAP <i>Fondi ordinari</i>	4.029.000,00	4.443.000,00	5.248.000,00	13.720.000,00	7.415.000,00
External resources :					0,00
TAP calls	1.796.000,00	3.435.000,00	1.024.000,00	6.255.000,00	292.000,00
EU calls	217.000,00	151.000,00	515.000,00	883.000,00	563.000,00
Italian Government	1.636.000,00	451.000,00	483.000,00	2.570.000,00	623.000,00
Others - Industry and other Public Bodies	890.000,00	1.510.000,00	1.058.000,00	3.458.000,00	1.862.000,00
Total	8.568.000,00	9.990.000,00	8.328.000,00	26.886.000,00	10.755.000,00

The following conclusions can be drawn from the data analysed:

- It is difficult to obtain an average budget for MST and MTLab, as for example in 2006, it seems that MTLab benefited from a special TAP call
- In spite of the difficulties of calculating average data, TAP (*Fondi Ordinari*+ Calls) funding ranges between 68% and 78% for the 2005-2007 period depending on the importance of the non-TAP incomes
- Globally, incomes from Italian government calls and other sources show a high variability among the period, which means that it is somehow difficult to make provisions for the future with these incomes
- In general, incomes from EU FP calls have been increasing in the last years, especially for the Microsystems group, but also for the Materials group, which shows the interest of the FBK managers and researchers in increasing their international activities to the benefit of the diversification of funding sources. This is confirmed by distribution of projects obtained in competitive calls (see below).
- The Materials group has got little funding from the Italian calls, but no major conclusions on the reasons can be drawn from the data available.
- As there is no disaggregated information for the whole period concerning the Microsystems group and MTLab funding, it is only possible to compare funding obtained by the Materials group (about 23%) with the rest, which mainly corresponds to the same proportion in terms of personnel of both groups.

To sum up, the amount of funding received per researcher, highly depending on the PA signed with TAP, is well above the average of other international research institutions of the same level in Europe. This has allowed for achieving a degree of excellence that will help the M&M Centre to be successful in the future in international calls.

In the recent years, an already increasing interest has been shown for being more active in EU calls, especially for the Microsystems group.

Projects

The following table shows the number of projects of the two main groups of the M&M Centre distributed by type of calls for the period 2004- 2007, that are related to the funding achieved in the same period and already presented above. While information on the distribution of personnel between the two groups is not available at this stage, it can be observed that MST is in general more active in projects resulting from competitive calls, both areas of research (microsystems, and materials) being similarly prioritised at national and international level by the EU and many countries.

Projects 2004-2007	Local	National	International
Microsystems (MST)	4	2	10
Materials (MAT)	2	5	2
Total	6	7	12

Data on projects were directly provided by FBK. It is assumed that this information only deals with the results from the different research units (*unità di ricerca*), and that in addition more activity is performed under the other instruments defined in the organisational model of the institution: Strategic Application Units, and Exploratory Projects. Thus, no commercial contracts with the industry are included in the table. The figures provided can be considered as important despite the fact that the size of projects cannot be concluded from the table.

We also highlight the number of international projects, as a measure of the quality of the research being performed by FBK M&M. It can be seen that the higher amount of personnel of the Microsystems group has allowed it for being more active in projects, especially international.

Technology Transfer activities, patents and spin-offs

In the period 2004-2007, a list of five patents has been provided by the Microsystems group, which is a continuation of the outstanding activity done in the same direction in the past by IRST.

No spin-off was created in the period, but it has to be taken into account that it is difficult in the areas of Materials and Sensors dealing with hardware: the best business model for transferring technology is not through spin-offs. However, FBK personnel has shown in the past that they have been successful in the creation of new companies when feasible.

Publications

The following table summarises the figures in terms of publications, papers and international conferences for the two main groups of M&M for the period 2005-2007.

Activity	Microsystems	Materials
Publications	90	84
Int'l Conferences	119	51

These figures are well in line with the size of the groups and the quality of research and also takes into account the difficulty of publishing results from research on disruptive technologies, like sensors and microsystems. For Materials research, as it is in general a more basic activity, it is possible to deliver a larger amount of publications if good characterisation tools are available. This seems also to be the case for FBK as a whole, taking into account the number of researchers.

FBK also provided full details of the Quality Factors of all the papers published in the period 2005-2007. A set of three Quality Factors are proposed that are different from the traditional Impact Factor of the magazines, as this is not considered very representative for different reasons. Average values calculated from the data provided are presented below:

Quality Factor	Materials			Microsystems		
	2005	2006	2007	2005	2006	2007
IQR	69,67	63,71	70,54	77,32	65,23	63,67
IQA1	50,16	49,04	31,06	62,19	35,10	20,93
IQA2	0,69	0,57	0,29	0,89	0,36	0,16

We can conclude that factors IQA1 and IQA2 are not yet relevant, as depending on the number of citations, and this number is not representative until a certain number of years have passed after the publication, as in the first years it is possible that many publications are not yet cited. Thus, looking only at the factor IQR, we can see that for the two groups the average values range from 63 to 77, which are significant and important values for the research carried out. It can be also stated that the publications are mostly made on magazines that are in the list of the most used in the field of Microsystems and Materials.

Quality of research is also confirmed by the number of awards obtained at conferences and also by the number of invited speakers, especially for the Materials group.

Definition of the Quality factors proposed by FBK:

Acronym	Indicator	Operating definition
IQR	Journal Quality Index	<i>Impact Factor ranking of the journal, measured on a 0 – 100 percentile scale according to the Impact Factor distribution of the journals falling in the same ISI category. A value of 90 indicates that 90% of the journals falling in the same category have lower impact factors than the one at stake.</i>
IQA1	Article Impact Ranking	<i>Citation ranking of an article, measured on a 0 – 100 scale according to the citation distribution of the articles of the same year falling in the same ISI category. A value of 90 indicates that 90% of the articles of the same year falling in the same category have a lower number of citations than that at stake.</i>
IQA2	Article Impact Index	<i>Number of citations of an article divided by the average number of citations of all articles of the same year, falling in the same ISI category. A value of 1.40 indicates that the article was cited 40% more often than the average.</i>

Training and teaching activities

The educational activities of M&M Centre are mainly focused on national and international courses. We highlight the Master of Micro-Nano given by the Microsystems group and also an important number of lectures and tutorials given by the personnel of the Materials group.

Concerning the training of Ph.D. students, it is considered that the number of students and post docs, compared to the number of permanent researchers is low, and an action for increasing it should be addressed in the future, as this would help increasing international activities, mobility, and the mid-term increase of the number of publications, etc...

Other indicators of excellence and internationalisation: international networking, number of visitors, researchers visiting other institutions

Both Microsystems and Materials groups have provided a long list of collaborations with international institutions which demonstrate the capability of networking of the two groups and thus are also good indicators of scientific quality. However, the number of researchers visiting the institution is low compared to that networking success, especially for the Materials group, which is somehow surprising. On the other hand, the Materials group compensates this lack with a significant number of researchers of the group visiting other international institutions. The foreign staff is also very important for the Microsystems group.

Other indicators for year 2008 (up to date) of FBK M&M research distributed by Research Units

The following table summarises the additional information received from FBK that regards the current activities. It can be observed that the indicators for this year show an improvement compared to the indicators of previous years, also because, especially in 2007, the groups and research units have suffered from the uncertainties resulting from turning to the FBK model.

	MTLab	SOI	MEMSRad	BIOMEMS	PAM	M2B2
Foreign Staff %	20	15	11	23	5	5
International Papers	9	4	24	7	9	13
International Conferences	5	6	6	19	9	6
Patents	0	0	1	1	1	0
Projects	2	6	10	5	1	8
Funding of projects	280.000	590.000	327.400	258.800	432.000	510.000
Industrial contracts	5	2	10	3	0	3
Funding of contracts	180.000	81.000	61.500	75.600	0	120.000

3.1.3. Human and Social Sciences Department

As a premise, we consider that the rationale for supporting two social science centres in the frame of the other activities of the Foundation is not totally clear. Besides the plans of a third center (IRVAPP) in the same disciplinary areas are quite extended, and while it is difficult to say something now about it (IRVAPP was created only in March 2008), they somehow profile a general purpose Social Sciences institute, but in another and separate location in the general system of research institutions. Probably, even allowing for a reasonable degree of redundancy which, in organisational design is not always to be ruled out in an absolute way, it would better to have an ideal canvas with a light frame in which the social science effort finds a clearer position. Otherwise the risk is that Social Sciences are understood as some kind of inevitable old relative that must be invited, but nobody knows why.

The need for social science in the regional research system, characterised by an economic structure of SMEs and therefore highly osmotic with social norms and lore, is indisputable. In such a situation, the social sciences input in the fields of innovation and its culture, labour and production organisation, political exchange and the like, is strategically important, and it would be important to redesign the social sciences area in a more consistent design.

Centre for Religious Sciences

While consistent with the local cultural history, a Centre on Religious Sciences appears in principle as somehow on the edge of the research system under evaluation. In concrete terms, however, the visit to the Director and its staff left the impression of a very lively and productive institution. First of all, the Director Antonio Autiero and governing body are enthusiastic and quite open to explore and able to establish contacts locally and internationally with different realities. Particularly interesting and well chosen appeared the initiative in the field of bioethics, because it allowed the Centre to connect, in its own proper terms, with the area of natural sciences. Also positive is the judgment on the international exchange activities entertained by the Centre, which seems to be recognized as an important intellectual node in a wider community.

Centre for Italo-German Historical Studies

This Centre is as clearly a product of a local tradition, and an important one at that. The policy stated by the Director, the highly respected international scholar Enrico Rusconi, is a more traditional strategy of high academic quality rather than of outgoing reach toward other disciplines and institutions. There has been notably little international scholars activities in the Centre itself, despite the intellectual specificity of the institution, and the Director himself stressed very strongly the interest in producing a limited number of top level scholars, rather than in expanding the activities and the reach of the institution. From this point of view, this Centre is the one in the system that more closely resemble an university institute and in abstract terms the more viable recommendation seems to be that of suggesting a transfer to the University. There are, however, provisos that need to be taken care of. The Italian university does not necessarily guarantee always automatic high level quality, and the issue of personnel is particularly touchy. If the mainstream thinking of the PoE is to favour greater integration with the University, which seems a reasonable direction, a great deal of care will have to be put in the transfer protocols, particularly for what concerns the research level which means material research conditions and personnel management.

Another solution would be to give greater autonomy to social sciences within FBK.

3.1.4. Research Centres with an agreement with FBK (*Centri in convenzione*)

These Research Centres are not *stricto sensu* part of FBK. They appear however in the FBK Plan of Research Activities 2007-2008 and PoE members had meetings with heads of some of them.

There are five such Research Centres:

- Centre of Physics of Aggregate States (CeFSA)
- International Centre for Research in Mathematics (CIRM)
- Centre of Research and Telecommunications Experimentations for Networked Communities (Create-Net Services and Create-Net Technologies)
- European Centre for Theoretical Nuclear Physics (ECT)
- Research Institute for the Evaluation of Public Policies (IRVAPP)

Members of the PoE had meetings and interviews with CeFSA, Create-Net, ECT and IRVAPP.

CeFSA

The *Institute for Photonics and Nanotechnologies* (IFN) consists of a head section in Rome and two branch sections in Milan and Trento. IFN was established in 2002 by the merging of the *Institute for Solid State Electronics* in Rome, the *Centre for Quantum Electronics and Electronic Instrumentation* in Milan and the *Centre for Aggregate State Physics* (CeFSA) in Trento.

The section in Trento is also linked to the Institute for Bio-Physics of CNR, which carries out about 50% of the Italian research in biophysics. Both institutes of CNR are located at Bovo, in the same building as the FBK IT Centre.

- Personnel: 16 scientists, 6 technicians, 8 post docs, 3 Ph.D.. Numbers fluctuate from time to time. They have recently experienced difficulties in recruitment, both for students and for staff. It is apparently a problem at European level in this field.
- Funding: 1/3 local, 1/3 national, 1/3 European. Local funding comes from FBK (€600,000/yr) and pays for salaries of scientists who founded CeFSA in the 1980s. National funding comes from central CNR (€1,200,000/yr) and pays for salaries of younger people and people on temporary contracts.
- Areas of work: Innovative materials for sensing (e.g., refractory sensors for difficult environments) and photonics (e.g., photovoltaic); optical (e.g., optoelectronics) and spectroscopic imaging. Many sectors are in collaboration with FBK, also because they do not have construction facilities and need to collaborate with FBK when this is necessary. They position themselves at the border between basic research and applications but always try and develop a 'functional' prototype.
- Besides FBK, collaborations are active with University (Physics and Engineering) and also FEM (one of their physicists now works at FEM on the measurement of volatile organic compounds at ppt level in fruit and cheese preservation, etc).
- Advancement of prototypes beyond initial phase takes place thanks to the network of alliances with FBK and, partly, the local industry. Our impression is that the networking could be much improved.
- They consider themselves not very capable of handling patenting, partly because the central offices of CNR in charge of IPR have been weakened over the years by the lack of funding, partly because CNR does not have this sort of culture, and partly because CeFSA is too small in itself. There are examples in the past of discoveries which were not properly protected by CNR and went lost to industry.
- Internationalisation consists of: 1) continuous flow of Ph.D. students and post docs from various parts of the world coming for periods of a few years; 2) visiting professors coming for much shorter periods of 1-2 months; 3) occasional longer visits by CNR scientists to institutions abroad. However, several of their scientists have done their Ph.D. abroad.
- Their future work will largely be within the framework of the other institutions present in Trento (FBK, University), although they think they have identified areas of work for which they have a unique positioning.
- They give a cautious, but essentially positive assessment of the restructuring process of the Foundations, partly to take advantage of research opportunities (strengthen links) and partly because elements of selectivity and research assessment needed to be introduced in former institutes.

Create-Net

It is a non-profit association with FBK and UoT as founding members. Scientific members are: Technion (Israel), Budapest University of Technology (Hungary). The role of these foreign partners had been important at the beginning, but is now much less important.

Create-Net declares developing research of excellence in ICT, and especially in telecommunications.

It started to operate in January 2004 and has now entered a phase of consolidation as a permanent centre.

Its current strategy is to have more and more external sources of funding (TAP has provided 'seed funding' in the first phase), through projects with industry, EU programmes (Information Society) and exploiting IPR. For the moment, Create-Net has projects with industry (half in the Province, half outside); it has been rather successful with EU calls (leader

in 3 FP projects); it has filed five patents (not yet exploited). There have not been spin-offs from research so far, but it is an objective (they consider having two potential spin-offs).

Within Create-Net, there is a separate group, the Engineering Competence Centre (ECC). While research groups are highly internationalised in terms of personnel, the ECC has a fully Italian staff. There is accordingly a risk of having two classes of personnel. Create-Net management is conscious of the risk: there are incentives for research who work with ECC, and there is an effort to integrate both classes through the use of experimental facilities and FP projects.

Regarding evaluation of research, there is a Scientific Committee which uses performance indicators.

Asked if they consider that their future was to become a FBK department, they answered that it was not on the agenda, and the coordination between FBK IT Centre and Create-Net had started only one year ago, because of the PA. They are trying to develop a common vision and common practices; for instance, when a company is interested in collaborating, a common meeting is organised together with FBK IT Centre and UoT for addressing industry needs.

The question is open of their future with respect to the FBK IT Centre. At the same time, they have a 'competitive model' significantly different from the IT Centre model, which offers a promising approach for long-term sustainability on the basis of external funding sources. However, the strict splitting between research and services may be counterproductive in the long run.

ECT

The European Centre for Theoretical Studies in Nuclear Physics and Related Areas is a European research institution established in 1993 thanks to the effort made by Prof. Renzo Leonardi from UoT. The Centre is not a legal body and is supported by FBK for administrative and financial management tasks, while at the same time it is scientifically under the umbrella of the European Science Foundation (ESF).

The Centre 'was given' to TAP after a European competition with other research groups from other countries, because of the quality of the proposal of Prof. Leonardi but also because of the full support given by TAP from the beginning.

The institute is internationally recognised and also financially supported by different European countries, apart from the EC and the PAT. The budget for direct costs per year is around 1 MEUR and funding sources are as follows:

- TAP: c. 50%
- EU: c. 20%
- France-Germany-Italy: c. 20%
- Other countries: c. 10%

The main goals of ECT are:

- to develop in-depth research in theoretical nuclear sciences;
- to foster interdisciplinary contacts between nuclear physics and neighbouring fields;
- to encourage talented young physicists by organising training projects and Ph.D. activities;
- to strengthen interaction between theoretical and experimental studies.

Thus, the main activities are training, workshops (15 per year of one week duration on average) and visitor stages. Around 700 visitors per year are hosted in ECT with short and long stages summing up to 5000 days/year. ECT also provides access to its supercomputer

There is no permanent personnel. All researchers are in the institution for a fixed period of time. Even the director is elected only for four years and replaced after that period. There is a Scientific Board composed of the heads of the different departments (from different European universities, etc..) that support the activities of the Centre and decide on the projects and workshops to be carried out every year.

The activities of ECT look for the international scientific excellence and do not have a specific mission of impacting directly on the activities of the province.

The only positive impact results from the visibility of Trentino within the Nuclear Sciences community because of the establishment of ECT in Trento. There is also an impact on Tourism as many of the international researchers come with their family during their stages. There are no scientific collaborations with FBK groups, due to the different nature of the research performed up to now. There are only collaborations in sharing facilities, etc... for workshops.

However, FEM/IASMA uses the supercomputer and is committed to the development of the new computing systems of ECT.

ECT has an activity which is independent from FBK, but it gives a good added value to the research activities of the area because of the excellence and visibility at world level.

It does not seem feasible and necessary that this changes in the near future. TAP funding through FBK works well up to now

However, ECT would like to have a well established long term roadmap in order to give more stability to the researchers working under contract. This is not possible as the PA of FBK with TAP is on a short term basis. Thus, the extension of the PA to 5+1 years for FBK should be supported, as this is also important of ECT and potentially other related centres.

IRVAPP

IRVAPP was established in March 2008 and started its activities in April. It is a non-profit association the members of which are FBK and the Regional Institute for Social Research.

IRVAPP wishes to extend its membership to other organisations, in particular the Italian Council for Social Sciences, the Cattaneo Institute (Bologna), the College Carlo Alberto (Torino, Istituto San Paolo).

IRVAPP considers that it could become a pole of social sciences within FBK. There are expectations of synergies with FBK on data archiving.

They do not want to be limited to local issues, even if they are working on the Trentino case. They consider that it is very difficult in Italy to have a 'private' approach of the evaluation of public policies (the culture of evaluation is poorly developed).

For the moment, funding comes from FBK, but IRVAPP tries to sell training courses to the Bank of Italy, searches for contract research opportunities, and intends to apply to national and EU FP calls. However, no business or financial plan was drafted. IRVAPP Director thinks that in the future 50% of the budget will go to salaries, and 50% to research projects.

The agreement with FBK is that IRVAPP is on a 3-year 'testing period'.

Funding is channelled through the FBK-PA with 800 000 EUR this year for carrying out research. This is a huge amount of money for a newly created centre of social sciences, and IRVAPP managers were not very clear about how they would use this money. The amount is all the more impressive since there are only 2 permanent staff (one secretary, one researcher).

IRVAPP has no formal convention with UoT, while its Director is Professor at UoT.

The PoE considers that IRVAPP should have a clear financial plan for 2009-2011. Anyway, a budget of 800 000 EUR should lead TAP to expect important outcomes and results from the research carried out by IRVAPP.

Moreover, there is no clear perspective on how to position IRVAPP at regional, national and international level.

3.1.5. Conclusions and Recommendations

FBK: M&M Centre

Comments on scientific quality

- The M&M Centre in FBK has a set of international recognized researchers that drive a set of research groups of good average scientific quality. Not all groups have the same size in terms of the number of researchers, but most of them seem to be of a minimum critical mass for carrying out the associated research.
- The research areas covered by the different groups are based on the experience of 25 years of IRST and are well in line with the scientific priorities of the European Commission and the Italian Microsystems research programme. It is important to highlight that not only IT applications but also others in very important fields like Health, Food, Energy, Environment, and Production Systems are addressed.
- However, it is sometimes difficult to match the priorities of such scientific objectives with the impact in the province, as not all subjects covered by the M&M research units have direct impact in the local or regional industry. We think that these differences among research units are acceptable as far as the expected equilibrium is achieved at the higher department level.
- The changes introduced by the direction of the M&M Centre on the internal organisation of the different research groups have improved the chances of success, as in most cases the reduction of the number of research lines have increased the human resources and thus the minimum threshold level is being achieved, compared to the former IRST groups.
- Computational Physics is however a very recent and very small unit born from PAM unit. If research performed by Computational Physics is considered to be of importance for the future of FBK, this unit should grow fast in the near future incorporating new researchers and Ph.D. students.
- SOI unit is the opposite example with 20 members. However, we do not see any problem with the work carried out by the bigger research units of FBK.
- Most of the research units have clear and differentiated activities within the research programme of M&M. However, there is the specific case of the MEMSRad unit that deals with two different subjects (MEMS and radiation detectors) that apparently does not show any synergy within both sub-units. For the future the real need of conducting both activities within the same unit should be clarified.

- The M&M Centre has a differential fact that is directly supported by the MTLab. This gives a good advantage as demonstration activities can be carried out in house, but also forces somehow to address activities with a high degree of technological development, which means that the research is more difficult to give results at short term compared to other types of research that can be on the same subjects but conducted on a more theoretical level.
- In conclusion, the international networking of M&M Centre is good and the institution is usually well seen as a good partner in international projects because of their scientific level and degree of national funding, which supports their micro-production facilities.

Short list of recommendations

- Practically all groups have both scientific and technical support personnel. It is highly recommended that this remains in the future, as it is seen as one of the best ways of involving both types of work on the same project objectives and missions. However, while it is clear that scientific personnel of the M&M Centre may have clear career opportunities, this has to be also ensured for the technical personnel. Thus, not only metrics based on publications and patents should be devised for the future for the rest of personnel.
- The degree of external funding is good despite it may improve for some units that are more related to national funding programmes. However, these research units may require the help of a centralised department that would help them on the dealing of the complex European Commission calls and proposals.
- The need of increasing the external funding should be seen not for decreasing the level of internal funding, but as a way of avoiding loss of competitiveness.
- Efficiency of the scientific production process may be increased, by focusing funds in the areas most likely to produce important results, and by encouraging the shift to publishing in ISI-rated journals.
- Push for increased effectiveness in the scientific arena should remain balanced with current attention to society and/or local industry.
- The number of Ph.D. students is low in most cases and should increase in order to be well prepared for future changes on the research priorities of FBK. A special action at internal level should be planned to increase the number of students. Deeper collaboration with University of Trento would help.
- Research on nano-materials and nano-devices is performed hidden in different units and is not explicitly publicised, which is somehow a lost opportunity for addressing new projects, especially at European level, because of the increasing interest of the “nano” aspects in all current international research.
- The Materials groups should try to be more active both at national and international levels, as the subjects being carried out are in line with the priorities of MIUR and European Commission.
- Packaging and systems integration seem to be topics less developed than materials, technology or device research. However, it is expected that research at systems level will be a must in the more and more competitive European research arena. Thus, more effort should be devoted to reach system-based solutions for achieving a higher industrial impact. This seems to be the case of the radiation detectors activity.
- A final concern refers to the clean room facilities of MTLab. Such high tech facilities are in general very expensive and also require high resources for daily running. But in

addition there is also the need of a mid to long-term plan of refurbishment in order to avoid lack of competitiveness in the future.

Overall comments and recommendations concerning FBK

While the PoE has been provided with a wealth of information on the FBK, some of this information, especially some key quantitative metrics regarding publications, funding, etc..., was not systematically broken down at the level of individual research units.

This is particularly true of the former IRST. It is understandable that a substantial reorganisation (from six divisions to two departments with nearly 20 units) makes a detailed reconstruction of the historical scientific performance rather difficult. Accordingly, while a global assessment of FBK can be safely developed, an assessment of the individual components has to remain at a qualitative level and would need considerable refinement, based on further information, if it were to provide a comparative evaluation of the components of the Foundation and a basis for resource (re)allocation.

Based on publications, projects, funding, international reputation of some key researchers, attractiveness for foreign researchers and students, facilities, etc... the PoE ranks the Information Technology and the Material and Microsystems Centres as good research organisations with a reasonable balance between basic and applied research. Their capability to attract third-party funds (mostly from the EU Framework Programme) is excellent. Some promising directions of improvement and development are outlined below.

- In some areas (e.g.: Ambient Intelligence), a synergy with other Trentino actors (like Create-Net) can place the IT and M&M departments at the top level in Europe.
- The pervasiveness of the managed technologies (microelectronics, ICT, ...) provides ample opportunity for the IT and M&M departments to strengthen their interactions with the University of Trento, with FEM (on biosensors, advanced automation, ...), and with Habitech (on energy, building automation, etc).
- The regional impact could grow. In particular, a synergy with Trentino Sviluppo could make it attractive for a higher number of high-tech start-ups to choose Trentino as the place where to settle and grow.
- A refinement of the recently adopted matrix organisation could better enable the full exploitation of the above opportunities.
- An internal system of self-evaluation ought to be put in place and perfected in time, beginning with the collection of data according to some homogeneous grids that make it possible to compare the performance of different units and different individuals. Ideally, a common framework ought to be developed for all research entities of the Trento Province.
- The definition of objectives, standards, and policies for future hiring of researchers is also recommended; the management of the human capital being an essential step in the transition from good to great.

3.2. Foundation Edmund Mach

In 2007, FEM was organised into five departments: Agri-food Quality (QAA), Biology and Molecular Genetics (BGM), Valorisation of Productive Agricultural Resources (VRP), Plant Protection (PP) and Valorisation of Natural Resources (VRN), to which the Centre of Alpine Ecology (CEA) was then added in 2008.

The PA between TAP and FEM (FEM-PA) was signed on 1st February 2008 and will be valid only until the end of the legislature (end of 2008). The 2008 FEM-PA common objectives have been indicated above (§ 2.3.1).

FEM itself declared its intention to pursue the following objectives:

- a) Develop innovative knowledge;
- b) Increase the number of peer-reviewed publications on international journals;
- c) Develop activities of technological transfer and patent development;
- d) Increase visibility and transfer of FEM activities and results to the Province;
- e) Train new scientists and
- f) Provide technical and scientific support for Provincial policies in the areas of agriculture and environment.

The following sections are structured to provide: a) a review of the available quantitative data for each of the five former departments of IASMA (the level of information provided by CEA has been quantitatively and qualitative of much lower value), with each review followed by some points of analysis and conclusions related to each department; b) an analysis of the effectiveness of the activities carried out in FEM relative to the objectives set out by the Province in the Provincial Programme for Development; c) a summary of our main recommendations.

3.2.1. Review of data for the six FEM departments

Structure of the data

Three sources of information were initially provided to us: 1) the list of financed projects (active in 2007) with the specification of the duration, amount and funding body; 2) the list of publications from 2005 to 2008 (subdivided into types, e.g., ISI-rated, non-ISI-rated, conferences proceedings, etc.); 3) the masks for the assessment of the impacts of research, prepared by the CIVR (the Committee for the Assessment of Research). These three sources however proved insufficient to carry out a detailed analysis at the Department or Research Unit level, since they reported data aggregated for the whole of IASMA. CEA provided only a preliminary version of source #3) separately from IASMA.

We therefore requested additional data (referred to 2007), disaggregated at the level of single research units for each of the former IASMA departments (CEA did not provide this information). This allowed the extraction of the following types of information for each of the five ex-IASMA departments: 1) the number of people employed (subdivided according to the time spent in research and non-research activities); 2) the sources of financial support for R&D (subdivided into: TAP-PA i.e. recurrent funding; TAP-OC – Provincial open calls: other public funds, EU, private companies and industry); 3) the number of publications produced (subdivided into ISI- and non-ISI rated and, for the first type, with the relevant Impact Factors IF of the journals in 2007 as an indicator of the scientific ‘visibility’ of the research carried out¹²); and 4) the list of collaborations active during 2007 (subdivided into those internal to the Province system, e.g., other departments in FEM or the University of Trento, those with other Italian institutions outside the Trento R&D system and those with international institutions).

¹² The Impact Factor of a scientific journal is a measure of the number of citations which the ‘average’ article published in that journal obtains over the subsequent two years. It is not a direct measure of the quality of the science performed, rather of the quality of the journal in which the science is presented.

Reviews of individual departments

✓ AGRIFOOD

This department has the mission of improving the sensorial aspects, nutritional value and health qualities of food products grown in Trentino. It is organised into four research units and employs a total of 57 persons (with the equivalent of 34 people being research active), with an overall 2007 budget for R&D of around 6,5 MEUR. Of this amount, over 80% comes from TAP, 3% from other public sources, around 8% from the EU and 9% from private companies. This department shows a good number of national and international collaborations (13 and 6, respectively), with additional local collaborations with FBK and University of Trento. The total number of ISI publications in 2007 was 29, with an average IF of 2.6. This department emerges, compared to the other departments in ex-IASMA, as the only one with a significant, albeit still quite low, proportion of funding from EU sources (around 8%, compared to an overall average of 2%) and from private sources (around 9%, compared to an overall average of 3%). The presence of a relatively high amount of international funding is also reflected in the number of external collaborations, although there is large variability among research units in the sources of income, the scientific productivity and the degree of aperture to external collaborations.

Two of the research units are heavily involved in non-research activities (50% of their time or over), although one of them (Quality Lab Analyses) appears able of maintaining a high number of collaborations, while carrying out a high proportion of non-research work. The second unit with a high proportion of service work (i.e., Food Technology and Microbiology), which is also the smallest unit of the department, appears to have produced no ISI-rated publications and only one non ISI-rated publication in 2007, with very little evidence of the existence of a network of collaborations at all levels.

Overall, this department shows good signs of an effort towards an increased presence in the European scientific arena, which needs to be expanded and consolidated. There is however concern that some of the other units more heavily involved in service work to the local and national industry do not appear able to join in this expansion of the scientific endeavour. At the same time, FEM needs to find mechanisms to preserve the close links between the analytical services facilities and the state-of-the-art expertise available in the research units.

✓ GENETICS AND MOLECULAR BIOLOGY

The mission of this department was not stated in the IASMA Annual reports for 2006 and 2007. The various units carry out research on the genomics and bio-informatics of apple and grapevine, development of molecular maps and markers for molecular breeding, gene isolation and characterisation of gene function.

It is organised into four research units and employs a total of 37 persons (all of them research active), with an overall budget for R&D of around 9 MEUR. Of this amount, around 93% comes from PAT (almost entirely made up by the element of core funding), 4% from other public sources, around 1% from the EU and 1% from private sources. It is thus heavily dependent on the core support from the Province. This department is fully committed to research activities, with no component of services. It shows a good number of internal and national collaborations (17 and 9, respectively), although the number of international collaborations is still, and rather surprisingly, relatively low. On the other hand, the department is rapidly growing through active international recruitment. This is expected to result in an increased number of international collaborations in the near future. The total number of ISI publications in 2007 was 30, with an average IF of 2.1.

This is the flagship department for FEM in terms of international visibility, because it carried out the genome sequencing of grapevine and is currently involved in apple genome sequencing.

Significant investment in instrumentation and technological support has taken place recently to allow expansion in areas of bioinformatics, molecular biology and functional genomics. This department has the potential to become a research centre of international relevance. To achieve this, it has, in our opinion, to: a) improve the quality of its publications in terms of their impact factors; b) further develop national and international collaborations; c) establish and retain its presence within international networks to allow it to enter into EU-level consortia and bring in external cash; d) develop second-level University courses and Ph.D. programmes, in collaborations with the University; and f) develop a strategy to retain its research momentum in the long-term, via the promotion of synergies between high-quality research and local development (i.e., patent development, spin-off companies, etc).

✓ **AGRICULTURAL RESOURCES**

This department carries out research on the physiological, biochemical and nutritional factors for grapevine, apple and soft fruit, breeding and clonal selection, development of agricultural techniques and diversification of mountain agricultural systems (animal husbandry, grassland management).

It is organised into three research units and employs a total of 55 persons (with the equivalent of 26 people being research active), with an overall budget for R&D of over 4 MEUR. Of this amount, over 92% comes from TAP (entirely made up by recurrent funding), 3% from other public sources, and around 1% from the EU and 4% from private companies. This department has a low number of national and international collaborations (three and five, respectively), with the local collaborations limited to the other departments within FEM. The total number of ISI publications in 2007 was only 6, albeit with an average IF of 3.2 (the highest of all five departments).

This department emerges, compared to the other departments in ex-IASMA, as the one characterised by a marked profile towards the provision of services to the agricultural industry, rather than fundamental or applied scientific research. In addition, many of its personnel are directly involved in the management of experimental farms and field trials. The number of external links is also generally rather low, in some cases extremely low, possibly reflecting the past difficulty of integrating traditional breeding trials within larger research networks (either national or international). Much of this resource is now acquiring a new value, thanks to the rapid advances achieved in collaboration with the Genetics and Molecular Biology Department.

In addition, the vast collection of grafted materials has proved of value outside of the Province's territory. Nonetheless, a point of reflection for this department is whether the effort currently required to manage all these trials is justified and whether resource use is already optimised. In general, all research units are heavily involved in non-research activities with a relatively small number of people carrying out most of the ISI-rated research output for this department. In some cases however, even this distribution does not appear sufficient to explain the observed levels of publication. For instance, the data for Fruit Tree Farming show an annual investment of above 2 MEUR in R&D for 2007, with a corresponding production of only two ISI-rated publications (plus 5 non ISI-rated ones) in the year. While we acknowledge the many limitations of our analysis (e.g., lack of correspondence between yearly funding streams and publications), the figure remains far too low, also considering that 2007 was a bump year in terms of publications (see section below) and that the unit employs 12 research-equivalent (six of whom senior) people.

The integration between traditional plant breeders and molecular biologists should be further encouraged for its potentialities. It should also be recognised that the diversification of mountain agricultural systems (and the research necessary to support this) is a fundamental component to allow retaining a vital mountain economy, with its reflections on the ecology of alpine landscapes and on tourism. However, such research should be encouraged to assume more of an international perspective, as, e.g., such problems are likely to be shared across much of the Alpine region (i.e., crossing several borders), yet little evidence of internationalisation was found.

✓ **PLANT PROTECTION**

This department has the mission of providing support and improved control strategies for integrated plant protection based on new knowledge and new technologies. It is apparently organised into one large research unit (now also incorporating SAFECROP) and employs a total of 41 persons (with the equivalent of 37 people being research active), with an overall budget for R&D of over 5 MEUR. Of this amount, 100% comes from TAP (roughly equally balanced between recurrent funding and open calls), with no contributions from other public sources, the EU or private companies, making this department currently entirely dependent on the PA and the TAP-OC. It provided no evidence of currently active national and international collaborations (zero for both categories), with the local collaborations limited to two examples with other departments within FEM and one example with the University of Trento. The total number of ISI publications in 2007 however was 19, with an average IF of 1.7 (the median was 1.1, reflecting the presence of two much larger values, the result of work first-authored elsewhere; 1.1 is the lowest IF recorded among all the departments). The lack of active international collaborations is all the more surprising since SAFECROP was launched as a joint venture between IASMA and several other European institutions. This may be taken to indicate either that the data given to us contain some significant errors or that past active international projects have dried out and have not led to further developments.

✓ **NATURAL RESOURCES**

This department has the mission of advancing ecological knowledge for the purposes of understanding, managing and conserving biological resources for their natural, aesthetic, recreational and economic values. It incorporates the largest number of research units (five) which also appear to be internally wide-ranging, covering a suite of areas from limnology, forest ecology and physiology, agro-meteorology, climatology and aerobiology to biomass and renewable energy. Some of these areas have obvious points of contacts also with activities carried out by CEA. It employs a total of 52 persons (with the equivalent of 37 research-active people), with an overall budget for R&D of over 10 MEUR. Of this amount, over 93% comes from TAP (roughly equally balanced between recurrent funding and open calls), 5% from other public sources, 0% from the EU and 2% from private companies. This department has the largest number of internal, national and international collaborations (29, 23 and 23, respectively), although as said above, this does not seem to have led to high levels of external funding. The total number of ISI publications in 2007 was 17, with an average IF of 1.7 (among the lowest).

Not surprisingly, given the large number of activities, large variability was found among research units in their performance. In general, the values of indicators such as the number of ISI-rated publications/active scientist or the amount of money spent per single ISI-rated publications were within the range found for the other departments, with the exceptions of the two research units of Biomass and Renewable Energy and Molecular Ecology. These two departments had very low values for the first indicator (0 and 0.2 ISI 2007 publications/scientist, respectively) and very high values for the second one (0,8 MEUR spent

with zero publications produced and 4 MEUR spent with one ISI-rated publication produced, respectively). Even considering non ISI-rated publications (four and one, respectively), the numbers remain extremely low.

✓ **CENTRE OF ALPINE ECOLOGY**

The quantity and quality of data available for CEA were significantly lower than for the other ex-IASMA departments, making our analysis all the more difficult. We base our conclusions on the scattered information contained in the preliminary version of the research masks submitted to us, the talk gave by Dr. A. Rizzoli on 24 July 2008 during our visit to IASMA and various talks with other people during our visits in July and September.

The mission of CEA is the study of alpine natural ecosystems and cultural landscapes. It focuses on three major research areas: Animal ecology and biodiversity; Forest ecology; Human ecology and sustainable development. In the last 3-4 years, CEA has undergone a traumatic restructuring phase, with a significant reduction in the number of people employed (from 51 to 38) and the departure of key research figures, which had been very successful in attracting externally-funded grants (especially from the EU) in areas of significant public interest. Much of the reduction in personnel has taken place in the category of the non-permanent staff (employed using the 'co-co-co' scheme), which has declined from 33 to the present 17, now employed using the new contract scheme for the Foundations. The funding has also declined tremendously, down from a peak of four active EU-funded grants and one important national project in the period 2002-2006.

The figures quantifying the full economic cost sustained by the province to support CEA in 2007 (either via the TAP recurrent funding or TAP-OC) were not available to us, although the PA for 2008 gives a figure in excess of 3 MEUR. The number of publications also appears to have declined dramatically during the last 3 years (from a peak of 18/year in 2005 to about 12-14/year in 2007-2008). The ISI-rated articles for the period 2004-2006 was 63 (i.e., a mean of 21/year), while the value for non ISI-rated one was 161.

Overall, we underline the poor policy choices which have led to the loss of important scientific figures in the provincial landscape in this field and the presence of significant overlap of competences between areas of work carried out by CEA and by some of the departments in the ex-IASMA, especially by Natural Resources. The current process of restructuring, which has followed the suppression of CEA and its incorporation into FEM is likely to continue in the future and opportunities to allow the formation of more homogeneous groupings within FEM should be exploited.

3.2.2. Overall remarks on the Foundation Edmund Mach

Productivity

Overall, FEM employs around 240 people for a total operating budget in 2007 of around 35 MEUR (numbers for 2007 of course do not include CEA). The masks providing data separately for each research unit give a total number of 104 ISI-rated publications for 2007. This number however is likely to be a gross overestimate of scientific productivity for 2007 for the following reasons: a) it was obvious from close inspection of section 4 submitted by each department ('Publications and IF in this unit of research') that some publications were either in press or published in 2008 (not 2007) volumes; b) it is also likely, given the degree of integration among units in FEM, that individual publications were included in multiple units at the same time. We cross-checked our totals with the total given in the document 'List of Publications' of Edmund Mach Foundation, separately for ISI- and non-ISI-related

publications. For ISI, the numbers were as follows: 32 in 2008, 61 in 2007, 38 in 2006 and 36 in 2005, supporting our arguments that overall FEM-level productivity for 2007 was much lower than indicated by the sum of the numbers provided by each Department separately. The number of 61 also agrees well with the number of 56 given in Table 0 of the CVR masks, under the heading of Total Number of ISI articles. In addition, it is also obvious from the numbers above that our analysis of productivity for the single year of 2007 reflects the rather unusual productivity registered in that year, with a number of ISI-rated publications about 40% higher than in any of the preceding years. On the other hand, the trend for 2008 (the publications were supplied to us during the summer period, which extrapolated to 12 months would give a total of about 50 publications) appears to support the contention that productivity during the last two years has been increasing significantly.

Efficiency

The trend of increasing recent overall productivity needs to be considered in the context of the significant increase in public spending in R&D for IASMA and now FEM, which has brought in an increased number of personnel during the last few years. Also, the overall number of 240 personnel for 2007 incorporates a significant proportion of time involved in non-research activities (primarily extension), with variable proportions from department to department, as has been remarked above. Correcting the number for the figures supplied of percentage of time dedicated to non-research activities gives a figure of research-active person-years of around 171 for FEM as a whole in 2007. Hence, productivity in terms of ISI-rated publications per person per year (corrected to avoid the double-counting problem mentioned above) gives a figure of about 0.36 ISI-rated publications/ research active person/ year. As mentioned above in the analysis of individual departments, this average (which is already quite low compared to international standards) hides a large variability among research units, with values ranging from 0 to slightly over 1.0 ISI-rated publication/ research active person/ year.

As mentioned above, total IASMA spending for 2007 reached almost 35 MEUR. Given that 61 ISI-rated publications were cited for 2007 (with much lower numbers for earlier years), this gives a figure well in excess of €500,000/ISI-rated publication. Even considering the significant recent spending in facilities for new laboratories, the number remains well in this region of very high spending per publication, particularly for some research units, with values occasionally as high as €1,000,000 to €2,000,000 /ISI-rated publication.

Quality of scientific production

An additional element to consider is the overall quality of the scientific production, as estimated via the Impact Factor IF of the journals where the publications were lodged. This averaged around 2.2 for all the departments (with a range from 1.7 for Natural Resources and Plant Protection to 2.9 for Agricultural Resources). Another metric of productivity could be the amount of spending for one publication of IF=1. This measure equals about €250,000/ISI publication of IF=1. Hence, even considering research quality, all measures of spending agrees that, relative to the significant investments carried out so far, international recognition of scientific productivity (via publication in peer-reviewed journals of high quality) is still very low, in terms of quantity and quality.

Research outputs by FEM are not limited to ISI-rated publications. For the years 2005 to 2008, our data showed a total of 223, 252, 250 and 65 non-ISI-rated pieces of work (i.e., conference proceedings; publications in journals with no IF, book chapters, publications in

non-specialised journals; but excluding oral communications, abstracts of papers and posters), showing a very large prevalence of non-peer reviewed work over internationally recognised production. Overall productivity (the sum of ISI and non ISI-rated publications) varied between two and four articles per scientist per year for all departments, which is a more acceptable measure of overall productivity, even considering the double-counting problem mentioned above.

In addition, over these four years, the ratio of ISI-rated to non-ISI-rated publications has changed from 0.16 to 0.15, 0.24 up to 0.49 for the incomplete figures in 2008, showing a clear trend towards a more balanced ratio between the two types of scientific output.

Publications in journals with no impact factor or in journals with low impact factor can occur for a variety of reasons, but principally either: a) because of a low scientific quality overall of the research project (no clear hypothesis, bad project planning, bad project management, lack of awareness of current scientific debates); and/or b) because the research project (although well planned and carried out) was largely confirmatory, as opposed to cutting-edge science. Both causes are possible and they cannot be separated using our data.

3.2.3. Recommendations

- If a formal separation between services and research is carried out by division into different departments, points of contacts and information transfer between the two components must be encouraged, e.g., by providing opportunities for the ‘service’ people to be temporarily seconded to the ‘research’ teams and vice versa. This will avoid the risk of the two components of the system drifting apart over time in their objectives and approaches to the problems.
- The push to promote the development of external funding must be facilitated by establishing an office dedicated to supporting applications to external bodies (e.g., EU) and reviewing the upcoming grant opportunities. Measures should also be taken to train researchers with the same objective
- For those without a Ph.D., existing staff must be encouraged to obtain this level of postgraduate training (e.g., by allowing them to set time aside towards it) to increase the quality of the research carried out and increase the likelihood of publication in high-impact journals.
- Whenever scientific excellence is an objective, performance (i.e., the capability of attracting external funding and producing high-quality results published in top-class journals) must be rewarded by appropriate mechanisms, e.g., by awarding additional financial support to those groups, by giving them more external visibility and by providing career advancement opportunities. Performance should be rewarded for both permanent and non-permanent staff.
- Efficiency of the scientific production process must be increased, partly by focusing funds in the areas most likely to produce important results, and partly by encouraging the shift to publishing in ISI-rated journals as opposed to non ISI-rated publications.
- The reasons why so many articles are currently submitted for publication in non ISI-related journals or in conference proceedings must be identified and tackled.
- The collaboration with the University should be expanded with the activation of new programmes of postgraduate training (particularly Ph.D. programmes) in appropriate disciplinary areas.
- Push for increased effectiveness in the scientific arena should remain balanced with current attention to society and/or local industry.

4. Governance and Efficiency

The reform of the Trentino Research & Innovation System is very recent. It has only started to be implemented. The PA with the Foundations were signed 1st February 2008. The new labour contracts between the Foundations and their personnel are only partially applied. In addition, various initiatives have been launched in the very last past years, such as the Technological District Habitech, IRVAPP, giving the impression of some confusion.

As a consequence, the governance issue appears as a key issue for the future of the Provincial System, and in particular for achieving higher efficiency¹³.

We consider that the governance issue has to be addressed at the level of the Foundations and at the level of the entire Trentino Research & Innovation System through the relationship that the Foundations have with the other actors of the System.

With respect to the previous chapters of the present report, this one has no descriptive part and is mostly focused on recommendations.

4.1. Governance and Efficiency at Foundation level

4.1.1. Clarification of objectives

A first point was already addressed concerning the clarification of objectives (above: § 2.6), which has a direct relation to the governance system of the Foundations.

Besides the TAP policy objectives, the Foundations have to determine by themselves their own objectives. The existence of two groups of objectives has to be directly linked to funding sources. The TAP policy objectives have to be implemented by the Foundations : a) for institutional reasons (the President is appointed by TAP and TAP retains a key role); b) in so far as they get recurrent funding through PA. Foundations are expected to develop their own strategic and scientific objectives through their capacity to get funding from various calls (EU, national, provincial, others) and from the industry.

However, determining objectives is not sufficient: the Foundations must precise their roadmaps and action plans to achieve these objectives, as well as the human and financial resources they intend to devote to implementing them. At the same time, appropriate indicators and monitoring measures have to be defined (see below).

This does not mean that there is no relationship between the two groups of objectives. For instance, TAP may encourage some Foundations' objectives through matching funding (e.g.: providing seed money for preparing FP proposals, allocating extra money when Foundations win EU FP projects). However, it must be made quite clear that the Foundations have from now their own strategy and are no more part of TAP public administration.

¹³ This is a general problem in Europe as put in evidence in the study "Strategic Evaluation on Innovation and the Knowledge-based Economy in relation with the Structural and Cohesion Funds for the Programming Period 2007-2013" (European Commission, DG REGIO, 2006) realised by Technopolis Group, Ismeri Europa, Lacave Allemand & Associés, Logotech, and MERIT.

4.1.2. Monitoring and assessment indicators

At TAP level, two committees are implementing evaluation tasks: the Technical and Scientific Committee for Research (CTS: projects evaluation, including selection, monitoring and check-up of results); the Research Evaluation Committee (CVR: ex post evaluation of results, analysis of effectiveness). They have elaborated their own Impact Evaluation Model.

Monitoring and assessment indicators have to be defined according to the types of research and the objectives of the Foundations. The clear definition of the Foundations objectives is thus the pre-requisite for an adequate measurement of performance.

Both PA with FBK and FEM have an article 8 dealing with the evaluation of the results of research activities. In addition, the FBK-PA puts among the expected results the setting up of “an experimental system of internal evaluation and measurement of impact”. FEM has started working on indicators. FBK has presented a first mapping of intellectual capital¹⁴ (there are well established examples of good practice of research centres, e.g. Research Centres Seibersdorf and Salzburg Research Centre in Austria¹⁵; an overview of all intellectual capital reports of all Austrian universities is provided on the website of the University of Innsbruck¹⁶).

We consider that it is urgent that the Foundations define and adopt a coherent and articulated batch of monitoring and assessment indicators regarding quality of research as well as results and impact at department level, and as far as possible at unit level. This batch of indicators has to be defined with respect both to TAP policy objectives (as criteria for recurrent funding) and with Foundations objectives.

Results and impact have to be put in relation with funding allocated, at research project level, and for what regards extension services, per type of services.

We suggest that the batch of indicators should be discussed and finalised with CTS and CVR and should be globally the same for both Foundations.

The definition and adoption of indicators is a condition for an efficient management of research activities and extension services of the Foundations.

4.1.3. The Scientific Committees of the Foundations

Each Foundation has a Scientific Committee.

For instance, FBK has a Scientific Committee composed of 7 members, appointed for a 4-year term, which provides advice to the President and to the Board. Formal advice is requested for multi-annual programming. Members have to be of high and recognised competence in the scientific fields which are of major importance to the Foundation. It must be noted that this raises a specific problem for FBK with respect to the two research centres of the Human and Social Sciences Department. They had their own Scientific Committee before FBK was set up, and now there is a single FBK Scientific Committee which, not surprisingly, does not address the particular needs of the two centres. The result is that the two centres have no external ‘scientific referees’ at the moment.

¹⁴ Prima mappa del capitale intellettuale Fondazione Bruno Kessler. Versione 3 Julio 2008

¹⁵ http://www.salzburgresearch.at/newsroom/gfx/salzburg_research_jahresbericht2007_web.pdf , especially pp. 38-47; http://www.arcs.ac.at/downloads/ARC_Wissenbilanz_2006_englisch.pdf

¹⁶ <http://www.uibk.ac.at/fakten/leitung/rektor/sim/wissensbilanz/wibi-andere.html>

The situation of the '*Centri in convenzione*' is variable: Create-Net has a Technical Scientific Committee, while IRVAPP seems to have none.

On the whole, we recommend, due to the objectives of internationalisation and scientific quality stated in various documents, that the Scientific Committees should be open to high-level non-Italian scientists (when it has not yet been done).

4.1.4. Management of personnel

With the transformation of IASMA/CEA, and Istituto Trentino di Cultura into Foundations, the employees could choose between retaining their status of provincial civil servants and having labour contracts under 'private law' with the newly created Foundations¹⁷.

While this creates two categories of personnel with a different status for some years, it must not prevent the Foundations from thinking of a strategy towards its personnel on a mid- and long-term basis.

Relying on the experience of a number of research organisations, we formulate the following recommendations.

Across all hierarchies of the Foundations, employment contracts should be designed as being performance-related. Salaries should be composed of a basic fixed part and of a variable part. The amount of the variable part should reflect the performance of the researcher/ manager. Its level should be determined by "classical" research parameters as well as by the income generated by the employee for the institute, his/her patenting activities, international networking, technology transfer actions, etc.

Human resources development should be a high priority of the management of the Foundations.

Only in exceptional cases, research staff should be employed under contracts limited in time. In the area of contract research, labour contracts limited to the duration of the projects are in general counterproductive in terms of productivity and results, and create problems regarding the continuity of contacts with the industry. Researchers often look for other job opportunities before the termination of projects and related labour contracts.

It is thus important to propose them flexible career plans that would allow for mobility of researchers (e.g.: going to UoT, to industry, or to organisations such as Trentino Sviluppo).

Management skills

Vocational training in management of research should be provided to the first and second level of management of the Foundations. Whenever managing personnel will be recruited, demonstrated management skills should be a major criterion of recruitment ahead of research skills.

¹⁷ See : « Contratto collettivo provinciale di lavoro per il personale delle Fondazioni di cui alla legge provinciale 2 agosto 2005, n. 14; FEM/IASMA, "Incontro con il personale 18 giugno 2008".

4.1.5. Governance issues specific to each Foundation

FBK

FBK is facing two problems: the first one concerns the coexistence of a Science & Technology Department and of a Human and Social Sciences Department under the same roof; the other one regards the presence under FBK umbrella of the category of '*Centri in convenzione*'.

The two research centres operating in the field of Human and Social Sciences are very targeted and have *a priori* few scientific opportunities of developing interdisciplinary projects together with the S&T Department. We already mentioned the issue of FBK Scientific Committee. Its President comes from the humanities side, but this may appear in the mid-term as an alibi, and does not solve the issue of the ex ante assessment of research projects in the Department.

Human and Social Sciences should be treated in a separate way and should be given a larger autonomy within FBK or, perhaps, be under the umbrella of UoT, with which they could probably find more solid ground for collaborations through some of its departments or research labs. On a more general basis, human and social science labs, from UoT as well as FBK, should be encouraged to develop interdisciplinary projects with FEM and other FBK Centres.

Research centres with an agreement with FBK ('*Centri in convenzione*') seem to be a sort of 'black box'.

However, a difference should be clearly established between:

- research centres which are linked to national or international research institutions (CeFSA, ECT): TAP support is justified by the role they play in internationalising the Trentino Research & Innovation System and raising its scientific level, as well as by the positive image given to it;
- research centres coming out from local initiatives (Create-Net, IRVAPP).

The latter should be integrated in FBK, and submitted to the same obligations concerning monitoring and evaluation, since nothing really justifies their specific status, and in particular because they are funded by TAP '*fondi ordinari*' through FBK-PA.

FEM

There seems to be today a strong divide, which could become even stronger in the future, between cutting-edge research, in particular research developed in the Genetics and Molecular Biology Department and the Departments and Units oriented toward providing services to local target groups, such as farmers.

FEM governance system must pay particular attention to the risk of having the two blocks shifting apart. It is surely true that services are all the more better since they are supported by high quality research, but ensuring that this 'virtuous circle' is implemented at operational day to day level requires strong governance and vision as well as management talents.

FEM educational and training activities should be developed in closer relationship with universities, and in particular UoT.

This remark is to some extent also valid for FBK. The splitting of research activities and services as currently practiced produces a high risk of segmentation and separation which may

lead to two different cultures within the Foundations. The knowledge flow from the research section to the service section would require further efforts which are not yet specified.

4.2. Relationship of the Foundations with other actors of the Research & Innovation System – Governance and Efficiency of the Trentino System

The 2005 Provincial Act intended to create a ‘cooperation framework’ for setting up a provincial system of research, interacting with the national and international levels, with all actors involved in provincial development.

The PoE members had the opportunity to meet with the Vice-Rector of UoT, and the heads of the Technological District and of the Regional Development Agency, Trentino Sviluppo. The meetings allowed for having a vision of their relationship with the Foundations and formulating recommendations concerning the governance of the Trentino Research & Innovation System.

4.2.1. Relationship with UoT

The FBK-PA explicitly mentions, among its expected results, “the rationalisation of the present system of alliances and collaborations and the structuring of an innovative model of cooperation with the UoT”.

This is understandable since TAP is an important funding source for UoT (due to the special status of TAP and a corresponding special status to some extent of UoT). It is thus normal for TAP authorities to be concerned by a good cooperation between the Foundations and UoT.

Collaborations currently exist in particular for applying together to TAP open calls – which, by the way, have not been really selective so far. The scientific field in which collaborations have been so far rather poor is that of Human and Social Sciences.

Globally, UoT considers that coordination on scientific thematic areas could be improved, even if they seem to be already of a good level in some fields such as computer science. In particular, there is room for improvement concerning scientific equipments (buying and sharing) in order to achieve better efficiency and benefit from economies of scale in their use.

There are some conflictual situations regarding training courses and lectures delivered by researchers of the Foundations at UoT. There have been in the past specific problems with FEM since FEM has a teaching mission and collaborates with other universities (Udine); it seems there was an attempt of FEM to create a second university which caused a strong reaction in UoT. Now, contacts have been resumed and collaboration appears possible for creating a Research Doctorate. It is recommended to consider an alliance between FEM, UoT and University of Udine as appropriate to the specific complementary strengths of the organisations.

UoT position is that Foundations and UoT must not be in competition (in particular concerning equipments) and that there is room for developing further cooperation, in particular in biology. Cooperation can also aim at internationalisation of the Trentino System, for which UoT has strong points: participation to FP, important number of visiting professors,

agreements of double diplomas with foreign universities, high number of Erasmus students, and a significant number of Ph.D. students coming from India.

4.2.2. Relationship with the Technological District ‘Habitech’

The Foundations and UoT are partners in the Technological District (TD), which targets sustainable construction and renewable energies. The TD intends to collaborate with them for building an integrated knowledge-based cluster. Due to the importance of the construction sector in the Province industrial fabric, the creation of the TD is quite understandable.

However, the areas of scientific & technological collaboration with the Foundations and UoT seem so far relatively limited:

- With UoT: standards; technology for solar photovoltaic cells and fuel cells
- With FBK: micro-electronics (new photovoltaic cells); control systems for solar technology
- With FEM: biomass: pilot ‘green farm’

The TD has accordingly to pick competences and technologies outside of the Province. At the moment, the TD cannot be completely satisfied with the local scientific & technological resources and its managing staff concedes that it is a “very complex and risky project”.

A common agenda and roadmap should be agreed upon with the Foundations and UoT for merging competences and technologies. The question however is : can the Province afford to enter a new scientific & technological field without being over-stretched ? In any case, vision and leadership by the provincial government are required.

4.2.3. Relationship with Trentino Sviluppo

Trentino Sviluppo (TS) is organised as a company owned at 98,5% by TAP. It has been established to play a key role to support technology transfer and innovation.

It has six business incubators which are hosting mainly ‘mid-technological level’ companies. It operates as an equity investor (a seed capital fund is expected to be created by the Province within a few months). It also helps companies to sell their technology outside (e.g.: in Israel) and provides consultancy on IPR for companies.

In the field of technology transfer, it realises technological audits of companies and directs them to Foundations and UoT for solutions. TS personnel does not include technicians (there are however some elderly, and retired, innovation managers, on part-time missions), which means that it is not in competition with Foundations in the field of technology transfer services: it limits its role to “make companies speak with research”.

Management of IPR

The real key issue with TS regards the management of IPR on behalf of TAP. A special fund for IPR was created by TAP which gives money to TS for managing the fund which in its turn is to be fed by IPR acquired out of research funded by TAP.

In the PA signed with both Foundations, an article 9 “Ownership of results” stipulates that inventions or patents are owned by TAP and the relevant Foundation in proportion of their contribution (economic and financial) to the results, taking into account the rights of the

individual researcher; it also stipulates that the Parties, through TS, will agree, with separate agreements, upon the ways to protect their rights, and use and commercialise them. This article, combined with the role entrusted so far to TS, is not really ‘crystal clear’.

As no separate agreement has been signed so far (as far as we know), the PoE considers that it would be wiser and more efficient to entrust the Foundations themselves with the management of IPR¹⁸. In effect, it appears that the researchers are in general in a better position to commercialise research for they know which are the potential ‘clients’. However, they need legal and management advice, which could be provided by TS. Moreover, TS should have the exclusive access right to non-patented results from the Foundations and assess further exploitation options.

In general, the Foundations should develop extension services going beyond traditional technology ‘transfer’ activities that strive for transferring ‘ready-made’ research results to the ‘real world’. Such services should facilitate interaction and communication between the researchers of the Foundations and carefully identified targeted companies as well as with the farmers’ community in the province and where possible also from outside the province. Interaction should cover the whole cycle from identifying problems to developing promising solutions.

For example, such interactive approaches could have the form of ‘mini-foresight exercises’ around well defined topics or technologies involving researchers from the Foundations, UoT professors where appropriate, representatives from industry and SMEs, representatives of industrial associations as well as from TAP. A step-wise approach should be followed assessing the state of the art and the foreseeable future perspectives of specific technologies in Trentino and at international level. On that basis, proposals for well defined collaborative activities involving the Foundations, where appropriate other Trentino R&D actors and companies should be developed.

In addition, the Foundations should provide also platforms for informing their target audiences on their present activities and develop dialogues on future directions. These activities should take into account the potential in the region and the international state of the art. Furthermore, outreach activities should include also company visits and open days in the Foundations and maybe also UoT. Thus, a climate of openness should be developed and an understanding the Foundations are there to serve the province.

All the activities at the interface between the Foundations and the province should be designed in a way that there are close links between the excellent research activities and the provision of research and consultancy services is ensured. In addition, it should be considered by the management and the researchers of the Foundations that the input stemming from the requirements of the outside world may also provide interesting ideas for the shaping of future scientific directions.

A reasonable level of awareness of the activities of the Foundations and their relevance for the province has to be ensured in the possible target groups and the general public. Adequate activities should lead to a sense of general ‘ownership’ of the Foundations as important R&D actors in the province contributing to societal welfare by the relevant target groups and the general public.

¹⁸ See the 1980 University and Small Business Patent Procedures Act or Bayh-Dole Act (USA).

4.2.4. Recommendations concerning the governance of the overall Research & Innovation System

Cooperation areas within the System

As a consequence, we consider that the ‘cooperation framework’ of the 2005 Provincial Act should cover at least the following areas:

- Training courses : at Research Doctorate and at ‘*laurea magistrale*’ levels (FEM and UoT could develop jointly a Faculty of Biology)
- Scientific equipments: acquisition, shared use, rationalisation
- FP calls: setting up a common dedicated staff, well-trained and professionalised, for providing targeted information on forthcoming calls and supporting research units applying to FP calls (in support of internationalisation and diversification of funding sources); training researchers
- Attraction of high-level researchers from outside (in support of internationalisation and quality of research), and agreements with research institutions at European level and exchange programmes

Cooperation at international level

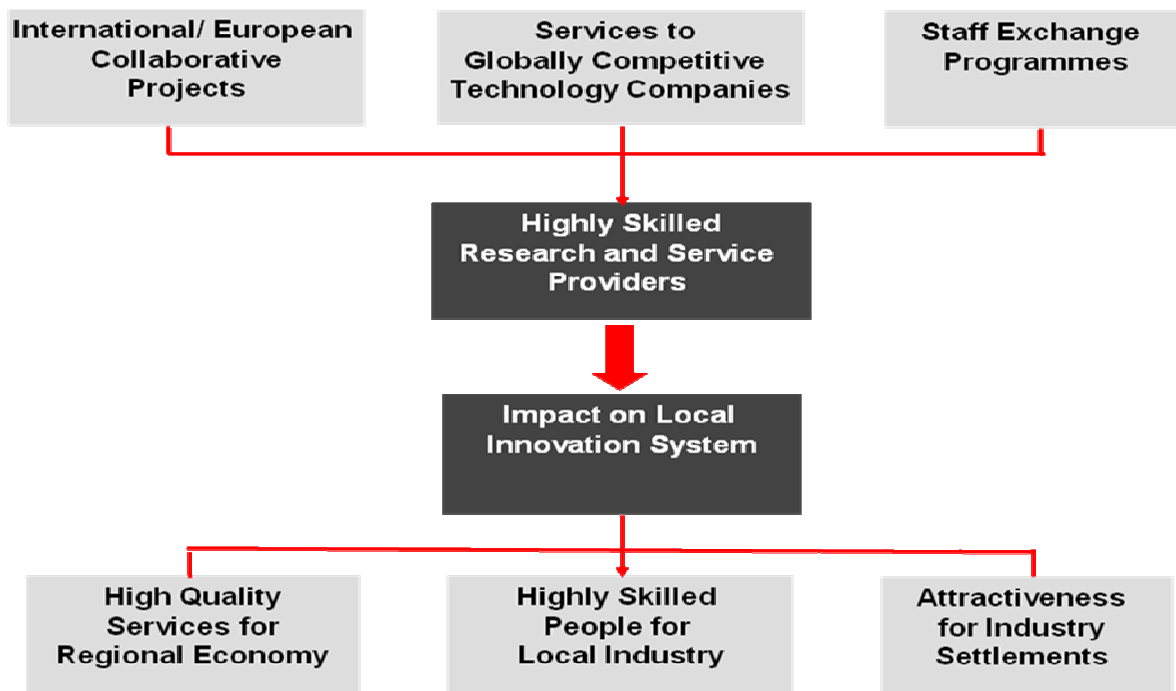
The benchmarks for quality of research are determined at international level, i.e. the context within which the Foundations have to demonstrate their competitiveness. Consequently the range of action of the Foundations has to be extended beyond the regional limits and their integration into an international context has to be a primary objective. Therefore the Foundations have to make all possible attempts to participate in European R&D programmes. Contemporarily they have to enhance their activities in participating in national programmes, e.g. Industria2015. Furthermore the (now) rather modest exchange of students and post-graduates has to be intensified.

Having an international reputation will help the Foundations to provide contract research services to companies outside the regional and national territory. The favourable geographical position of the Trento Province offers within a radius of only 400km a potential of industry clients ranging e.g. from Fiat, Olivetti, STM, Pirelli to Siemens, EADS, and many others.

Contract research for this more demanding clientele will produce a significant positive impact on the Foundations’ themselves and on the regional innovation system as a whole.

It will increase the Foundations knowledge basis in general, it will help them to understand what industry requires and it will position them as research and technology providers in the market. There will be considerable repercussions on the industry structures of the Trento region, because the Foundations will be enabled to provide high quality services to their regional customers and because it will increase the attractiveness of the region by offering a suitable environment for industrial activities. Furthermore it will develop the necessary skills for researchers who intend to move from the research world to (local) industry.

This is illustrated on the scheme below:



Governance at TAP level: scenarios for a governance system

Enhancing cooperation and extending it to the areas above-mentioned requires establishing a governance mechanism at provincial level.

Two scenarios can be envisaged which do not exclude each other, but could evolve from the short to the mid-term.

The first scenario, very easy to implement, consists in setting up an annual “Trentino Research & Innovation Conference” which would gather representatives from Foundations, UoT, Technological District and Trentino Sviluppo, together with TAP minister for Research & Innovation, with the objectives of taking stock of past and current research activities and deciding upon a common agenda and roadmap for the year to come, and in particular of developing and implementing cooperation areas.

The second scenario, more ambitious, consists in the creation of a Foundation of Foundations which will include FBK, FEM and UoT, the objectives remaining the same.

Whatever the scenario, TAP, due to its size, cannot afford in the incoming years the fragmentation of its research resources, capabilities and potential. It has to push for the constitution of research groups having a critical mass, being visible at international level and part of international networks, with a high level of scientific quality. This is a prerequisite for delivering services to the community and to the provincial economic fabric (technology transfer, innovation, entrepreneurship) which are up to its needs in the context of globalisation.

TAP Planning process

The future PA should, as already stated, determine on a multi-annual basis the global funding provided by TAP to the Foundations for what the Foundations will do for contributing to TAP policy objectives (research and extension services). The Foundations remain free of having their own objectives which can be within the range of TAP policy objectives or outside. In the latter case, they have to secure resources for achieving them (FP 7, national calls, contracts with industry, ...).

Allocation of TAP funds will be submitted to the condition that the Foundations will have established an internal evaluation system with a complete set of indicators allowing for monitoring the effectiveness, efficiency and overall performance of their research units, as well as the outputs and costs of research projects carried out.

Starting from these general conditions, two scenarios should again be envisaged.

A first scenario corresponds to keeping the present system, i.e. PA with each Foundation (and with UoT).

A second scenario is more complex, but would allow for developing more easily the ‘cooperation framework’ which the 2005 Provincial Act aimed to achieve.

In this second scenario, research and extension activities would be treated separately.

For extension activities, PA would be signed with each Foundation and involve Trentino Sviluppo in order to make clearer than it is today the respective role of the Foundations on one side, and of TS on the other. In effect, we consider that there is today a ‘missing link’ for what regards technology transfer and support to innovation. Users are not fully satisfied with the situation and, to our opinion, TS is not sufficiently related to the Foundations system (it seems that it has few links with the research community).

For research, PA would be signed on the basis of each priority scientific area (to be re-shaped as wider than the 22 presently listed) with the research institutions where competences can be found (e.g. for biology with FEM and UoT), which would favour cooperation between them. The new ‘Research PA’ would merge the two current financial instruments ‘*fondi ordinari*’ and large projects. They would include incentives for internationalisation, interdisciplinary studies and collaboration with industry (by the way, incentives to research organisations could be put in relation with incentives to personnel: see above § 4.1.4 Management of personnel). Of course, open calls would stay as an alternative source of funding (‘competitive’), in particular for ‘exploratory projects’, as would stay grants for postdocs.

5. Impact

As previously stated, it is difficult at this stage to provide detailed elements on the impact on the provincial society and economic fabric of the 2005 Reform and of the research activities carried out within the new Research & Innovation System.

Notwithstanding, the members of the PoE concentrated their approach on three aspects:

- The impact of the activities carried out in different scientific fields within FBK and FEM
- The impact in terms of entrepreneurship through the creation of ‘academic spin-offs’, i.e. spin-offs from research
- The vision that business and farmers organisations have of the impact of research
- The perception of the impact of scientific research by TAP citizens

5.1. The impact of the activities carried out in different scientific fields within FBK and FEM

5.1.1. FBK

Information Technology

An assessment of the impact is outlined in the table below for the 9 research units and the applied research units of the IT Centre.

The assessment is of a qualitative nature, since the relevant systematic and homogeneous quantitative parameters are not always available at the level of the individual research units. Nevertheless, the exercise can be a useful starting point for further refinements.

In particular, a quantitative normalisation of the impact to the amount of resources spent by each unit has not been attempted. Similarly, it would have been difficult to take into proper account the historical continuity of the research units, some of which are more recent than others, as actual collaborations among team members, if not formally. The assessment is mostly based on whether the unit does demonstrate significant strength in a particular category.

The two applied research units on e-Government and e-Health have been included for having the table complete. However, given their nature and their stage of development, the format of the evaluation might not do full justice to these units.

In general, the ‘national impact’ appears to be significantly lower than the international and regional ones. A likely factor is the scarcity of resources at national level, from both public and private sources.

Impact of Research Units	International level (FP7, Eureka,...)	National Level	Regional Industry	Society
Data & Knowledge Management	HIGH Very good publication record. Good citations. Several collaborations	MEDIUM Several collaborations	LOW But can support units with more direct impact	LOW Long term research with indirect links to social impact
Human Language Department	HIGH Good publication record. Very good citations. Excellent placement in international competitions. Several collaborations (e.g. Siemens)	MEDIUM Collaboration with Comdata. Other under discussion	HIGH Collaboration with PerVoice and Meteo Trentino	LOW Potential to improve
Predictive Models for Bio-medicine and Environment	HIGH Good publication record. 3 FP7 projects. FDA (USA) partnership	MEDIUM/HIGH Collaboration with National Institute of Health	MEDIUM/HIGH Project MISTRIS and UXB-Trentino	MEDIUM Projects MISTRIS and UXB-Trentino can impact safety of citizens
Software Engineering	MEDIUM/HIGH Good publication record. Collaboration with CERN	MEDIUM Possible lack of data	HIGH Projects with IBT	LOW Possible lack of data
Embedded Systems	HIGH Good publication record. Highly cited. ESA and EU projects. Intel grant	MEDIUM/HIGH Collaborations with Ansaldo SF, Alenia Aeronautica	MEDIUM Collaboration with Heidi SpA	LOW Possible lack of data
Service Oriented Applications	HIGH Good publication record. Several projects from EU and companies	LOW	HIGH Projects ROWS (with Verso21), ASTRO and RISICOM (with DEDAGROUP)	LOW Indirect impact
Intelligent Interfaces & Interactions	MEDIUM Good publication record and some EU project participation	MEDIUM Israel-Italy FIRB project	LOW Potential to improve in relation to IT industry	MEDIUM Project Netcarity can impact senior citizens
Technologies for Vision	HIGH Good publication record. Several EU projects	LOW Possible lack of data	HIGH Eyepro System (start-up 1999). Collaborations with Neuricam, Tips Engineering	MEDIUM PEACH project on cultural heritage
Speech-Acoustic Interpretation	HIGH Good publication record. EU project DICIT. Several collaborations (IBM Research-US, NTT-Japan, Elektrobit-Germany)	MEDIUM/HIGH Industrial partnerships (Fracarro Radioindustrie, Amuser, Centro Ricerche Fiat)	MEDIUM Collaboration with COGITO	MEDIUM/LOW Very good potential for applications
e-Health	MEDIUM/LOW	LOW Current focus on local territory	MEDIUM Good potential to impact IT industry	MEDIUM Very good potential to impact population
e-Government	LOW	LOW Current focus on local territory	LOW Some potential to impact IT industry	MEDIUM Very good potential to impact population

Materials & Microsystems

The different research topics addressed by the Research Units have different impact at different levels (international research, national research , on existing Trentino industries,...) The next table summarises the degree of relevance (low, medium, high) of the research conducted by the different teams at four different levels, from international to local and societal impact.

Although there is not enough information available now on the national programmes, a column is also included that could be filled later by the provincial administration after a more in-depth study of the Italian programmes on M&M, if possible.

Impact of Research Units	International level (FP7, Eureka,...)	National Level	Regional Industry	Society
Plasma and Advanced Materials	Potentially HIGH Topics in line with EC-FP/ NMP theme priorities, but low participation in research projects in spite of a high number of international contacts	Potentially HIGH Topics in line with MIUR priorities, but low level of funding coming from national calls, in spite of a high level of national collaborations	LOW No Micro/nanoelectronics industry in the province. No patents	LOW No direct link are observed because of the “basic and long term” nature of the materials research
New Materials for Biosensors/ Bioelectronics	Potentially HIGH Topics in line with EC-FP/ NMP theme priorities, but low participation in research projects in spite of a high number of international contacts	Potentially HIGH Topics in line with MIUR priorities, but low level of funding coming from national calls, in spite of a high level of national collaborations	LOW No Bio/electronics industry in the province. No patents	LOW/MEDIUM But can have an impact on citizens via their use in new biosensors for health and Ambient Assisted Living ¹⁹ . Some projects for Life Sciences
BioMEMS	HIGH Topics in line with EC-FP/ ICT, Health and KBBE themes priorities. Good participation in EU projects	Potentially HIGH Topics in line with MIUR priorities. Some projects and national collaborations	LOW/MEDIUM depending on area: Medical industry is not yet important in the province but increasing. Wine cooperatives are of high relevance in PAT and biomems can help a lot	MEDIUM Through the development of new sensors applicable in health and food safety and quality
MEMS RAD Radiation Detectors	HIGH Especially for the good participation in CERN and ESA R&D activities and calls	Potentially HIGH Topics in line with MIUR priorities. Some projects and national collaborations	LOW Mainly addressing CERN applications but with some chances of addressing also radiation for medical applications (i.e. mammographies,...)	LOW Mainly addressing CERN and ESA applications but with some chances of addressing also radiation for medical applications (i.e. mammographies,...)
Smart Optical Sensors and Interfaces	HIGH Topics in line with EC-FP/ ICT theme priorities	Potentially HIGH Topics in line with MIUR priorities. Some projects	HIGH Some spin-off on optical and chemical sensors benefit from the activities and facilities of FBK-MST	HIGH Impact through the research on Optical sensors for wellness and AAL applications
MTLab	MEDIUM But not directly. International impact made through the research liens but not directly as for example (international large scale facility)	HIGH The clean room is providing microfabrication services to many research institutions at national level that do not have these capacities	HIGH MTLab is providing prototyping and small/medium series of devices to local SMES and spin-offs that commercialise the products	Not directly but through the Spin-offs and SMES

¹⁹ See also the Ambient Assistant Living (AAL) Joint Programme (<http://www.aal-europe.eu/>).

5.1.2. FEM

These will be analysed following the subdivision of FEM into departments and by looking at impacts at different scales, from the international one to society as a whole.

Impact of research at Departments in FEM	International level (e.g., FP7)	National level	Regional industry	Society
AgriFood	MEDIUM overall. HIGH for some units currently active in FP7.	MEDIUM overall for scientific impact with variability among research units.	HIGH for the units providing analytical services.	HIGH for the units working on sensory properties and the impact of their work on local produce and tourism.
Genetics and Molecular Biology	MEDIUM / HIGH The significant investments carried out should lead to important advances in the next few years beyond the already achieved sequencing of the grapevine genome.	HIGH The availability of state-of-the-art equipment should provide this department with significant leverage for national scientific collaborations.	Potentially HIGH The agricultural industry does not appear to back this research.	MEDIUM Attention should be paid towards public perception of GM crops and the potential that this research is regarded as similarly unsafe by the public.
Agricultural Resources	LOW Field trials and grafting collections have so far failed to attract EU funding. Levels of ISI-rated publication are low.	LOW Levels of scientific collaboration are low even at national level.	HIGH The improvement of agronomic practices and the research on alpine economic systems are strongly linked to the local economy. Bank of grafted material has proved to be a precious source of selected grapevines for industry	HIGH The link with the tourist industry (via the production of local produce and the contribution to the conservation of alpine landscapes) is obvious.
Plant Protection	LOW / MEDIUM Funding entirely limited to PAT. Lowest mean IF for publications in 2007. Collaborations with foreign partners entirely paid by PAT.	LOW No evidence of national funding nor of national collaborations.	HIGH Research is important in helping reducing the load of pesticide employed in apple and grapevine cultivation.	HIGH Research is important in the medium term to develop products free of pesticides for the organic food market.
Natural Resources	LOW / MEDIUM Low mean IF for 2007. No evidence of international funding although networks have been established.	MEDIUM Large network of collaborations. Overall level of publication is good for most units with evidence of external funding.	LOW	HIGH Studies of alpine landscapes/ biodiversity/ecology are important in sustaining tourism and in relation to climate change. Studies on pollen important for public health.
Centre of Alpine Ecology	LOW currently, as capacity is much reduced. HIGH in the past for some areas.	MEDIUM currently. HIGH for some areas in the past.	LOW	HIGH Studies of alpine landscapes are important in sustaining tourism and in relation to climate change.

5.2. Entrepreneurship and spin-offs from research

There is a list of 13 spin-offs from research activities carried out within FBK (and formerly IRST).

Three of them have today more than 10 employees:

- Gruppo Soluzioni Tecnologiche (GST), created in 1994, with currently 18 employees: voice recognition, speech processing
- NeuriCam, created in 1998, with currently 14 employees: design, manufacturing and marketing of electro-optical sensor systems
- Optoelettronica Italia srl, created in 1995, with currently 20 employees: micro-electronic packaging, production of silicium sensors and Microsystems

The more recent companies employ less than 10 people.

There is no formal incubation system within the Foundations, for instance supporting business projects until the proof of concept and the legal creation of a company. However, it seems that this exists more or less on an informal basis in FBK, but it should be clarified.

Support to new innovative companies is under the responsibility of Trentino Sviluppo as already explained, for facilities ('physical' incubators) and support services as well. TS can also invest in companies (equity investment).

Seed capital is not available for the moment in the Province, but TAP is expected to create a seed fund within a few months according to TS.

5.3. IPR generated by FBK research units and researchers

The FBK IPR portfolio currently includes 9 patents already filed. Two are in negotiation, one is under a process of evaluation, and a last one is in negotiation as resulting from a EU-funded project carried out with an Israeli company. Seven patents belong 100% to FBK. The ownership of the others is shared with UoT or other research organisations or companies.

In addition, seven patents were filed by individual researchers, out of which 3 are considered as potentially leading to creation of spin-offs.

5.4. The vision of business and farmers organisations

A roundtable was organised by the Unit 'University and Scientific Research' of the Provincial administration to which participated representatives of :

- Confindustria Trento
- Associazione Artigiani e Piccole Imprese della Provincia di Trento
- Cooperative agricole
- Coldiretti

The outcomes of the roundtable can be summarised as follows.

5.4.1. Confindustria

The representative of Confindustria is a member of the FBK Board. He is very interested in the potentialities of the research carried out by FBK. However, he considers that the consequences on the local industry are “absolutely insufficient”. The business community does not really know what happens in the scientific community and views it as more interested in scientific excellence than in local development. The potentialities of FBK are poorly known in general.

The representative of Confindustria considers that the relationship between UoT and the Foundations should be improved and synergies should be developed in particular for diversifying funding sources out of TAP funding. He thinks that the Human and Social Sciences Department should be separated from FBK.

5.4.2. Associazione artigiani e piccolo imprese

For the representatives of the association of craftsmanship, there are few examples in the Province of small companies who want to make research. Small businesses have evidently even more difficulties to know what happens in the scientific community than the industry.

The association has mainly relations with the Technological District ‘Habitech’ and Trentino Sviluppo. Crafts businesses from the construction sector are very happy to participate in the activities of the Technological District. What has been done with the project “Casa Sofie” is a good illustration: the project has led to a patent, and TAP put the patent at the disposal of wood construction companies for exploiting it. Another good illustration is the certification system organised on a ‘private’ basis.

There are no relations with FEM. There are some informal relations with FBK, but a clear mapping of research carried out is missing. A ‘correspondent’ (liaison officer) has recently been appointed within FBK for dealing with demand coming from business, who is expected to be able to direct companies to the appropriate research unit or researcher.

Anyway, impact on the provincial economic fabric is considered as being on the long term.

There is some fear of an ‘academisation’ of research: Foundations must not turn into University labs.

5.4.3. Coldiretti and Cooperative agricole

FEM resources are sufficient (and even more than sufficient) for having good level research. Coldiretti has a highly positive vision of FEM educational as well as research activities. One of the main difficulties is to make farmers understand that research has a time horizon different from that of farmers (especially for what regards genomics).

The relationship with UoT has to be strengthened.

There have not been so far efforts for valorising the by-products of farming (internal valorisation). It would also be useful to find solutions for agricultural waste. There is room for more research in these fields.

Globally, Coldiretti and Cooperative Agricole consider that the previous situation, i.e. with IASMA, was better than it is now with the creation of the Foundation. The creation of FEM is deemed as having represented a step backwards. The farmers organisations think they have

suffered from this change, in particular in terms of governance and management. For instance, the Certification Agency, which is useful and is a 'jewel', is expected to be 'sold out'.

It is important that FEM stays as an instrument to the benefit of the local community.

Concerning researchers, it would have been better having specific incentives to run a 'quiet change' than turning everything upside down.

For Cooperative Agricole, S. Michele has had so far a key role in the training of cooperatives managers. There is a lack of understanding with respect to the transformation of IASMA into FEM. Research is becoming more and more important, but it is necessary to address the problems and concerns of farmers (in particular: day to day technical assistance), which means establish a linkage between high level research and impact on the territory. There is today a real anxiety about how to conciliate the two issues.

Globally, the farmers organisations considers that there is a high level of conflict potential between world-class research (e.g. genome sequencing) and day to day services. This situation has always existed more or less, but it has now reached a climax with as a consequence two groups of researchers: first-class researchers with international publications vs. Second-class researchers.

(This problem is specific to FEM. Confindustria considers it is not an issue with FBK which can fulfil the two missions due to its resources, and has mainly to strengthen the strand 'technology transfer and services').

5.5. The perception of the impact of scientific research by TAP citizens

A survey on a panel of 1205 people was conducted by the Department of Human and Social Sciences of UoT in 2008 and its results were presented to the PoE on 29 September 2008 in Milano²⁰.

Globally, Trentino citizens consider that the attention paid to research and to the quality of the educational and university system is larger than in the rest of Italy. TAP support to scientific research is assessed as positive by a majority (in general, the efficiency of the public sector is considered as relatively high and research is a part of it). Trentino citizens also consider the present state of scientific research in Trentino as better than the national average.

Scientific research carried out by Trentino research institutions is positively perceived by a large part of the panel. Environment is considered as the more relevant scientific field, and the one which should be further developed. There is also a high propensity of Trentino citizens for being donors to research institutions (higher than the national average).

These positive facts are counter-balanced by some negative ones. Knowledge of Trentino research institutions is poor: in particular, 65% are not able to cite one research institution. In addition, people are essentially familiar with the ancient names (S. Michele, Istituto Trentino di Cultura), and only few know the names of the Foundations.

The survey led to identifying four groups of citizens: well-informed enthusiasts (30,3%); rather informed quasi-enthusiasts (34,4%); critical quasi-informed (24%); critical not informed (11,4%).

The category 'critical quasi-informed' appears as a key target for improved communication in the future; it is mainly composed of young educated people to whom a better communication and larger information should be provided in order to get an enlarged consensus on TAP policy objectives and achievements in the field of research.

²⁰ La percezione dell'impatto della ricerca scientifica nella Provincia di Trento, Rapporto di ricerca a cura di Lorenzo Beltrame e Massimiano Bucchi.

6. Final Recommendations: a synthetic summary

Recommendations are divided into: recommendations to researchers, to Foundations, and to TAP policy-makers. They are voluntarily formulated in a concise and synthetic way, since details can be found all over the report. Some of them may be relevant to more than one group.

6.1. Recommendations to researchers

- Shift publications as far as possible toward ISI-rated journals
- Present research results at international conferences in order to increase the visibility of the Foundations
- Profit from opportunities of mobility (international, industry)
- Go at international level, in particular through applying for EU FP calls
- Develop cooperation with other research teams
- Prevent a deepening divide between researchers and staff in charge of extension services
- Get familiar with patenting mechanisms

6.2. Recommendations to Foundations

- Define and adopt on a multi-annual basis the Foundations own objectives (apart from TAP policy objectives) and establish roadmaps and action plans corresponding to each objective
- Define and adopt internal monitoring and assessment indicators allowing for:
 - Comparability of data within each Foundation (at research unit level) and between Foundations
 - Assessing the effectiveness and efficiency at Foundation and research unit level, and for each research project as well as for extension services
- Define and adopt a human resources and personnel policy in accordance with objectives:
 - Recruitment (standards)
 - Career plans allowing for mobility of personnel
 - Incentives related to performance: quality of research (e.g.: articles in ISI-rated journals), contribution to internationalisation, contribution to local development, and provision of services
 - Securing management skills of executive staff
 - Staff exchange programmes with research organisations outside Italy
- Prevent a deepening divide between units carrying out world-class research and units in charge of contribution to local development: stress that world-class research and contribution to local development are not antagonistic, but that local development needs world-class research; ensure close cooperation and interaction between the two groups of units
- Strengthen the relationship with UoT:
 - In general for going more at international level

- At recruitment level: coordination for recruiting top level scientists and young high-flying researchers (profiting by the autonomy of the Foundations)
- At educational level: Ph.D. and *laurea magistrale*
- At research level: coordination and cooperation on thematic areas of common interest, in particular in areas related to the interests of the Technological District; develop complementarities for creating a critical mass
- Concerning scientific equipments: coordination, cooperation and mutual access
- Modify and strengthen the relationship with Trentino Sviluppo:
 - Create the ‘missing link’ between the research community and industry through improved collaboration and clearly defined and accepted distribution of tasks between Foundations and TS
 - Develop interactive approaches such as ‘mini-foresight exercises’
- Promote public awareness of the activities of the Foundations and their relevance to TAP objectives and needs:
 - Publications of research and successful results for transfer and services in local media and involve successful beneficiaries / ‘customers’
 - Organise ‘Open days’ for the public
- Concerning FBK:
 - Encourage synergies between centres and units and pool resources, in cas of lack of critical mass
 - Find a proper way of transferring Human and Social Sciences under UoT umbrella (taking into account the interests of the personnel) or turn FBK into a sort of ‘federation’ giving more autonomy to components, in particular Human and Social Sciences
 - Integrate within the ‘*centri in convenzione*’ which are not linked to some national or international organisation (ECT, CeFSA): this specific status does not seem justified for Create-Net or IRVAPP which have been developed on a local basis

6.3. Recommendations to TAP policy-makers

6.3.1. Introduction: back to the basics

First of all, it must be stressed that the scientific quality of research activities carried out in the Foundations is of good, and in a number of cases, excellent level, as stated in the chapter dedicated to scientific quality.

Second, the PoE is aware that the Trentino Research & Innovation System is in a transitory phase with the recent creation of the Foundations as spin-offs from the provincial public administration.

The following elements have been considered by the PoE as key factors to be taken into consideration to formulate recommendations to TAP policy-makers:

TAP has defined its policy objectives:

- a) A ‘governance’ objective: setting up a ‘cooperation framework’ between actors of the system
- b) Strategic objectives: quality of research and internationalisation; contribution to local development

At the same time, the decision to make TAP-funded research ‘autonomous’ with respect to the provincial administration through the creation of legal bodies, i.e. Foundations, requires drawing the consequences of this policy choice.

This leads to make a clear distinction between:

- TAP policy objectives
- Foundations strategic and operational objectives

As a result, funding will in the future be granted to the Foundations by TAP according to the fulfilment by the Foundations of TAP policy objectives and verification of this fulfilment through strict monitoring and assessment indicators. TAP will, if it deems it necessary, give incentives for the achievement of specific objectives (such as participation in FP7 projects) which can be also Foundations objectives. Foundations will have to get funding for achieving their own objectives when they do not correspond to TAP policy objectives.

However, the present situation is not fully satisfactory concerning the articulation of the objectives at policy-making level. The PPD is a ‘horizontal’ document which is stating global objectives concerning research. The Multi-Annual Programme for Research is a ‘sectoral’ document which is highly detailed in particular concerning the funding instruments and the priority thematic areas.

To address this problem, it could be for instance useful to build up a ‘meso’ linkage aimed at facilitating bi-directional relations between the different levels of programming and information flows to the benefit of a good management and monitoring – and, by the way, of programming itself.

We accordingly suggest to establish a **policy-making matrix** as follows:

Programme for Provincial Development (Global policy objectives for research)	Multi-annual Programme for Research (Specific objectives of the Research & Innovation sector)	Programming Agreements (Implementation)	Foundations
<ul style="list-style-type: none"> Increasing internationalisation Increasing the proportion of external sources of funding Implementing an assessment system of quality of the research system (quantitative indicators and peer review) Promoting synergies between the research system and local development with a dimension of attracting businesses (+ Cooperative framework: 2005 Provincial Act) 	<i>Detail the specific objectives corresponding to each global policy objectives and the measures that have to be taken in consequence</i>	<i>Translation of specific objectives and measures into PA for implementation</i>	<ul style="list-style-type: none"> Objectives within the range of PPD global objectives and MAP for Research specific objectives to be implemented through PA
			<ul style="list-style-type: none"> Own objectives outside of TAP objectives

6.3.2. Recommendations

Recommendations concerning strategic objectives

- Rank and streamline the priority thematic areas: priority thematic areas require some critical mass and it is not all evident that TAP can afford 22 priority areas
- Focus ‘contribution to local development’ on explicitly specified economic sectors
- Explicitly include in ‘contribution to local development’ the export of knowledge and services outside of the Province and international collaborations

Recommendations concerning TAP planning process

- Two scenarios should be envisaged:
 - Continue the present formula, i.e. PA negotiated and signed with each Foundation (and with UoT) within the framework indicated above
 - Having two types of PA:
 - PA for extension services negotiated and signed with each Foundation, involving Trentino Sviluppo, with the objective of re-shaping the distribution of tasks and build the ‘missing link’
 - Research PA based on scientific priority areas, or groupings of scientific priorities, negotiated and signed with the research institutions where relevant competences can be found, and aimed at favouring the development of a ‘cooperative framework’
- Whatever scenario, TAP open calls should stay as an instrument for funding ‘exploratory research’ or research of a very specific interest for the Province on a competitive basis
- Whatever scenario, the funding of postdocs should also stay

Recommendations concerning governance

- TAP should support some recommendations directed at the Foundations (see above § 6.2):
 - Integration of the Human and Social Sciences Centres with UoT or turning FBK into a ‘federation’ with large autonomy to components
 - Integration of some ‘*centri in convenzione*’ in FBK (Create-Net and IRVAPP)
- Set up a governance system at the level of the Trentino Research & Innovation System with two possible scenarios aimed at favouring general coordination and projects in cooperation (the ‘cooperative framework’):
 - An annual conference chaired by the provincial minister in charge of Research & Innovation gathering: the Foundations, UoT, the Technological District, Trentino Sviluppo
 - The creation of a ‘Foundation of the Foundations’ gathering at least FEM, FBK and UoT, and possibly the Technological District and Trentino Sviluppo
 - A possible concrete outcome of the ‘cooperative framework’ could and should be the creation of a common office for supporting the preparation of EU (and national calls): drafting applications and seed money
- Re-consider article 9 of the current PA in order to give to the Foundations the management of the IPR originated in their research units without prejudice to the distribution of rights and royalties between TAP, Foundations, and inventors
- Maybe revive the Research & Innovation Observatory under the umbrella of both the Unit ‘University and Scientific Research’ and CTS/CVR

ANNEX – List of meetings and interviews

Trento – Valutazione Fondazioni

Incontri panel:

23 -25 luglio 2008

11 – 12 settembre 2008

Data	Research organisations	Persons met
23 luglio	Fondazione Edmund Mach (presentazione istituzionale)	Alessandro Dini: Direttore generale Roberto Viola: Direttore Centro sperimentale
	Fondazione Bruno Kessler (presentazione istituzionale)	Andrea Zanotti: Presidente
24 luglio	Fondazione Mach (visita)	Roberto Viola: Direttore centro sperimentale - Fulvio Mattivi: Coordinatore del dipartimento Qualità Agro-Alimentare - Riccardo Velasco: Coordinatore del dipartimento Biologia e Genetica Molecolare - Claudio Ioriatti: Coordinatore del dipartimento Protezione delle Piante - Marco Stefanini: Coordinatore del dipartimento Valorizzazione delle Risorse Produttive - Claudio Varotto: Vice-coordinatore del dipartimento Valorizzazione delle Risorse Naturali - Annapaola Rizzoli: Direttore sostituto del Centro di Ecologia Alpina All'incontro era presente anche Roberto Maffei (Segretario Viola)
	Fondazione Kessler (visita): Centro per le Scienze Religiose	Antonio Autiero: Direttore
	Fondazione Kessler (visita): Centro tecnologie dell'Informazione *** Fondazione Kessler: Centro materiali e Microsistemi	Paolo Traverso: Direttore Andrea Simoni: Direttore
25 luglio	Fondazione Kessler: Centro per gli Studi Storici Italo Germanici	Gian Enrico Rusconi: Direttore
11 settembre	Centri in convenzione. FBK: Create-net	Imrich Chlamtac: Presidente Zorer
	Centri in convenzione. FBK: IRVAPP	Antonio Schizzerotto: Direttore
	Trentino Sviluppo	Stefano Robol: Direttore generale Luca Capra: Direttore area Imprenditorialità e Sviluppo
	Distretto Tecnologico	Paolo Gurisatti: Presidente Gianni Lazzari: Amministratore delegato

	Università	Giovanni Pascuzzi: Prorettore (Prof. facoltà Giurisprudenza)
12 settembre	Confindustria Trento:	Giulio Bonazzi: Membro Giunta esecutiva
	Associazione Artigiani e Piccole Imprese della Provincia di Trento	Franco Grasselli: Responsabile area studi Renata Diazzi (Presidente CEii – Centro Europeo di Impresa e di innovazione del Trentino)
	Cooperative agricole	Michele Girardi: Responsabile settore Cooperative agricole
	Coldiretti	Gabriele Calliari: Presidente
	Centri in convenzione. FBK ECT*:	Jean-Paul Blaizot: Direttore Marco Traini: Vice Direttore
	Centri in convenzione. FBK: CEFSa (ist. CNR)	Salvatore Iannotta: Dirigente di ricerca
11- 12 e succ.	Inoltre: <ul style="list-style-type: none"> - Un incontro aggiuntivo del Presidente Airaghi con Paolo Traverso (FBK) - Un incontro aggiuntivo della prof. Tonelli con Riccardo Velasco (Mach) - Il prof. Bilardi ha condotto, in coordinamento con Paolo Traverso, numerosi incontri in FBK: Bernardo Magnini & Marcello Federico (Human Language Technologies); Luciano Serafini (Data & Knowledge Management); Cesare Furlanello (Predictive Models); Paolo Tonella (Software Engineering); Alessandro Cimatti (Embedded Systems); Marco Pistore (Service Oriented Applications & e-Government); Massimo Zancanaro (Intelligent Interfaces & Interaction); Stefano Messelodi (Technologies for Vision); Maurizio Omologo (Speech-acoustic Interpretation); Stefano Forti (e-Health) - il prof. Canè ha avuto un'intervista per mail con Andrea Simoni (FBK) 	