

Organisation for Economic Co-operation and Development
Directorate for Education
Education and Management and Infrastructure Division
Programme on Institutional Management in Higher Education (IMHE)

**Supporting the Contribution of Higher Education
Institutions to Regional Development**

Peer Review Report:

Trøndelag (Mid-Norwegian Region), Norway

Markku Sotarauta, Patrick Dubarle, Magnus Gulbrandsen and Claire Nauwelaers

July 2006

The views expressed are those of the authors and not necessarily those of the OECD or its
Member Countries.

This Peer Review Report is based on the review visit to the Trøndelag (Mid-Norwegian Region) in February 2006, the regional Self-Evaluation Report, and other background material. As a result, the report reflects the situation up to that period. The preparation and completion of this report would not have been possible without the support of very many people and organisations. OECD/IMHE and the Peer Review Team for Trøndelag wish to acknowledge the substantial contribution of the region, particularly through its Coordinator, the authors of the Self-Evaluation Report, and its Regional Steering Committee.

TABLE OF CONTENTS

PREFACE.....	5
EXECUTIVE SUMMARY	6
ABBREVIATIONS AND ACRONYMS.....	9
1. INTRODUCTION: PURPOSE AND METHOD OF THE PEER REVIEW	10
1.1. Evaluation context and approach	10
1.2. The conduct of the evaluation	10
2. THE CHANGING SPIRIT OF THE TIME IN TRØNDELAG AND ITS EFFECT ON DEVELOPMENT VIEWS	14
3. THE POSITION OF THE TRØNDELAG REGION	17
3.1. Trøndelag and the Norwegian “inverted innovation paradox”	17
3.2. Trøndelag: a region with a relatively transparent innovation system.....	19
4. INSTITUTIONAL SET-UP OF THE HEI/RESEARCH SECTOR: PAST TRAJECTORY AND RECENT DEVELOPMENTS	23
4.1. Important national policy developments.....	23
4.2. Research institutions in Trøndelag – a historical overview	26
5. INCREASING INTERACTION BETWEEN HEIs AND THE REGION.....	32
5.1. New initiatives for HEI–regional interactions in Trøndelag	32
5.2. Four local pathways of innovation-led growth	38
6. CAPACITY BUILDING FOR REGIONAL CO-OPERATION	42
6.1. City of Trondheim.....	43
6.2. Regionalisation.....	43
6.3. Creative Trøndelag – a new strategy?.....	44
6.4. Challenges of joint strategic awareness and co-ordinated action.....	47
6.5. National influences on the building up of a “knowledge region”: tensions between innovation and regional policy.....	49
7. REGIONAL DEVELOPMENT AND HEIS IN TRØNDELAG: CONCLUSIONS AND RECOMMENDATIONS.....	51
7.1. General observations.....	51
7.2. The role of higher education institutes in Trøndelag	52
7.3. Development trajectories for the future	53
7.4. Summary of recommendations	57
REFERENCES	59
APPENDIX 1. THE OECD REVIEW TEAM.....	61
APPENDIX 2. REGIONAL COORDINATOR, REGIONAL STEERING COMMITTEE, AND THE AUTHORS OF THE REGIONAL SELF-EVALUATION REPORT	63
APPENDIX 3. PROGRAMME OF THE REVIEW VISIT	64

Figures

Figure 3.1. The regional innovation system in Trøndelag	22
Figure 7.1. The innovation system in Trøndelag with three new liaison offices (option A).....	55
Figure 7.2. The innovation system in Trøndelag with a new joint service unit (option B).....	56

Boxes

Box 4.1. The FORNY programme (Research Council of Norway).....	25
Box 5.1. Venture Cup / An effective way to promote entrepreneurship.....	33
Box 5.2. NTNU Technology Transfer Office	33
Box 5.3. Experts in team / Preparing students for work life	35
Box 5.4. Verdal – on a good track / example of co-operation and commitment of a firm to local economic development.....	36
Box 6.1. Regional Development Plan 2005-2008 – Creative Trøndelag: where everything is always possible.....	45
Box 6.2. Technoport – a technology festival / a way to increase strategic awareness in the region.....	47

PREFACE

We have written this report with three main audiences in mind. First of all, we aim to provide the actors in Trøndelag, a relatively small Norwegian region that is still “under construction”, with food for thought and a positive contribution to their development efforts. Secondly, we hope that this report reaches readers in the national policy spheres and in other regions in Norway. There are also many interesting developments in Trøndelag that national policy makers would find worth considering. Finally, this report is written for the OECD, which is aiming to better understand the role of higher education institutions’ (HEI) in regional development and to provide the different regions in OECD countries with practical and policy guidance.

We believe that this report, in concert with the other reports of the IMHE project, has initiated an extensive and substantially strong base for further developments and an ongoing learning process, both within and between regions. Our aim is to support the development of the HEIs’ regional engagement in Trøndelag and also to suggest ways forward. Therefore, we raise both positive and negative points.

We have departed from the OECD reporting template to give more emphasis to issues linked to technology and research based innovation, regional capacity building and more systematic organisation between the key stakeholders. They are the issues that we believe will have most leverage in the future for region building in Trøndelag and for the HEIs’ increasingly active role.

The region is on the move, old ways of thinking are being challenged, new coalitions and more intensive co-ordination between disconnected actors are not only hoped for, but also searched and created. The changing spirit of the time has not left Trøndelag untouched. In this respect, this OECD peer review became timely.

We are grateful to the Regional Steering Committee for all the assistance rendered to us, and to Peter Lykke and Kristin Wergeland Brekke, who took care of us during the site visit. We appreciate the generous hospitality given to us during our week long stay in Trøndelag. We are grateful to all those who were willing to share their time and views with us and impressed by the sense of the positive and the self-confident mood in the region.

We also wish to express our gratitude to the OECD project task group for selecting us to review the interplay between the HEIs and there stakeholders in Trøndelag. We have learnt a lot, not only about Trøndelag, but also about the role of HEIs in regional development, HEI and industry interaction, and HEIs’ internal developments, to name only a few of the many issues.

EXECUTIVE SUMMARY

Background: OECD/IMHE review

This review of Trøndelag (Mid-Norway) in Norway is part of the OECD/IMHE project entitled *Supporting the Contribution of Higher Education Institutions (HEIs) to Regional Development*, which embraces fourteen regions throughout twelve countries in 2005-2006. The IMHE thematic review project was launched as a response to a multiplicity of initiatives across OECD countries to mobilise higher education in support of regional development. The aim was to synthesise this experience into a coherent body of policy and practice to guide higher education institutions, and regional and national governments. At the same time, the IMHE project was designed to assist with capacity building in each country/region through providing an opportunity for dialogue between HEIs and regional stakeholders, and clarifying the respective roles and responsibilities.

Review process

The Peer Review drew on a self-evaluation process guided by an OECD template. This asked HEIs to critically evaluate with their regional partners, and in the context of national higher education and regional policies, how effective they were in contributing to the development of their regions. Key aspects of the self evaluation related to: the contribution of research to regional innovation; the role of teaching and learning in the development of human capital; the contribution to social, cultural and environmental development, and the role of the HEIs in building regional capacity in order to act in an increasingly competitive global economy.

The self-evaluation process was co-ordinated by the Norwegian University of Science and Technology (NTNU). A Regional Steering Committee comprising key stakeholder groups concerned with higher education and territorial development was assembled. The Mid-Norway Committee included eight stakeholders and was chaired by the Confederation of Norwegian Business and Industry. In addition to collecting and organising the necessary information, the self-evaluation process can also be characterised as a process of mutual learning and capacity building.¹

The OECD peer review visit took place in February 2006. The Peer Review Team – Markku Sotarauta (FIN), Claire Nauwelaers (NL), Magnus Gulbrandsen (NOR), and Patrick Dubarle (OECD) – met about 80 people, including university managers, directors, teachers and researchers from the faculties of the NTNU, the University colleges, the University College of Sør-Trøndelag (HiST) and the University College of Nord-Trøndelag (HiNT), representatives from national agencies such as the Research Council of Norway, Innovation Norway and the Industrial Development Corporation of Norway (SIVA), administrators from the Mid-Norway Chamber of commerce, representatives from the two counties and the City of Trondheim, business managers and programme directors from large and small firms, and representatives from student groups.

Region: Trøndelag

Trøndelag is a region of 400 000 inhabitants, with the city of Trondheim at its centre. It is the third largest city in Norway and a major centre for higher education. In the European context, it is a wealthy region with close to full employment and with no evidence of industrial decline. Its population enjoys the

1. The resulting Self-Evaluation Report, along with this Peer Review Report, is available at the OECD website www.oecd.org/edu/higher/regionaldevelopment.

high educational and living standards found throughout Norway. Moreover, Trøndelag has considerable public R&D resources.

Trøndelag is also a small region “in construction”, with a relatively weak identity and fragmented governance. The lack of immediate problems and shared ambitions has resulted to a low level of strategic awareness and the absence of development coalitions. The lack of institutional powers conferred to local and regional actors in Norway is also a barrier to more proactive moves from the regional level.

Trøndelag, like Norway in general, faces a major challenge to develop sources of growth and added value other than the resource-based oil and fishing industries, which have contributed to its wealth for the past century and still do. This success and the excellent socio-economic performance of the country have, until recently, overshadowed the need for more knowledge-based development. Nurturing new, knowledge-based industries and services is a key ingredient of sustaining wealth and employment prospects in Trøndelag. This underlines the need for a sustained and broadened innovation dynamic within the region.

The challenge has been recognised by the key stakeholders in the region. However, the weakness of Trøndelag as a region and the absence of a strong regional governance system have, until now, prevented the definition of a genuine collective vision for the future for regional development. A fragmented regional innovation system, the existence of parallel “worlds” and the mismatch between the spirit of the times and the development goals of these actors are a hindrance towards a coordinated strategic move towards regional development in Trøndelag.

The key question that emerges is how far is the beneficial development sustainable in the medium and long term? What will happen when oil exploitation starts to be phased out and its revenues therefore lost? What consequences should be expected at a national level and for a region like Trøndelag? And, in particular, what role could HEIs play in the development trajectory of such a region, which is strong in public research, but weaker in private, knowledge-based activities?

Higher education institutions’ contribution to region building

The recent changes at national level emphasise, on the one hand, the universities’ responsibility for national and international excellence, and, on the other hand, university colleges’ responsiveness to the local and regional needs.

The NTNU and the Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF), the largest independent research organisation in Scandinavia, form the core of the region in many ways. By definition, and due to historical reasons, they have a national role. The NTNU and SINTEF interact with large enterprises at national and international levels through a multiplicity of channels, *e.g.* student mobility between the university and industry. Many new, promising initiatives have been launched, such as the NTNU’s technology transfer office.

The two regional university colleges, the University College of Sør-Trøndelag (HiST) and the University College of Nord-Trøndelag (HiNT,) are mainly engaged in educational tasks. They cooperate with companies and regional working life in student training and life long learning provisions, but not so much in R&D and innovation provision.

In general, the collaboration between the HEIs and local and regional authorities has become much closer during the last few years. The absorptive capacity of the region is, however, low. Furthermore, the system of incentives from the national level is not sufficiently conducive to integration of all HEIs into regional development strategies. Most importantly, universities’ international and academic excellence

goals have been reinforced. In addition, innovation policy is dominated by regional policy and is conceived as a redistributive policy rather than as a knowledge building policy.

The way forward – key recommendations

The translation of visions into concrete actions implies a reinforced dialogue and strong commitment from all regional actors, as well as a collective strategic and implementation capacity, better co-ordinated co-operation between the HEIs, and a set of support mechanisms, such as industrial liaison offices, a science park and an elaborate city development plan (space for industry, office space, etc.). There is also a need for a “grandier” vision for the future.

Therefore, the Peer Review Team recommends:

- That the Norwegian Government critically assesses the relationship between regional and innovation policy and if possible, releases innovation policy to some extent from its territorial chains.
- That the public sector, the HEIs and industry become more closely integrated in the planning and implementation of regional development policies and strategies.
- That the NTNU and SINTEF continue to build their international and national role and reputation with the view of achieving international excellence in close co-operation.
- That the NTNU continues to develop its key role, in close partnership with its stakeholders, in the strategic planning for economic development of the region, and that it continues its efforts to encourage a culture of entrepreneurship, invention and innovation.
- That the region considers two options:
 - a) The establishment of separate, but co-operating liaison offices (the “first stop shop” model). Each HEI sets up a service unit with a formal industrial liaison function or the TTO (Technology Transfer Office) and/or Innovation Mid-Norway are combined more formally into one entity.
 - b) The establishment of a joint unit (the “one stop shop” option). The NTNU, HiST and HiNT will set up a joint industrial liaison office to systematise their regional engagement. The one stop shop would have a matchmaking, co-ordination and quality assurance role and would provide a visible and single access point to the three HEIs’ whole resource base.
- That the NTNU and the City of Trondheim investigate the possibility of establishing a science park with space that could be both rented or bought, and which would contain all the TTO’s pertinent services in the vicinity of the NTNU.

ABBREVIATIONS AND ACRONYMS

ARENA	A partnership programme between RCN, Innovation Norway and SIVA, oriented at improving collaboration between companies, knowledge centres and the public sector at regional level
AVH	Teacher Training College of Trondheim
DMF	Medical Faculty
EU	European Union
FORNY	A programme of the Norwegian Research Council focusing on enhancing creation of research-based new businesses
GDP	Gross domestic product
HEI	Higher Education Institutions
HiNT	University College of Nord-Trøndelag
HiST	University College of Sør-Trøndelag
ICT	Information and communication technology
IMHE	Programme on Institutional Management in Higher Education
IM-N	Innovation Mid-Norway, a regionalised national innovation support programme
IPR	Intellectual property rights
LEN	Leiv Eiriksson Nyskaping AS
MOBI	A programme for mobilisation for R&D related innovation in SMEs
NTF	North Trondelag Research Institute
NTH	Norwegian Institute of Technology
NTNU	Norwegian University of Science and Technology
OECD	Organisation for Economic Cooperation and Development
PRR	Peer Review Report
PRT	Peer Review Team
RCN	Research Council of Norway
R&D	Research and Development
SER	Self-Evaluation Report
Sintef	The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology, the largest independent research organisation in Scandinavia
SIVA	Industrial Development Corporation of Norway
SME	Small and medium sized enterprise
TTO	Technology Transfer Office
TØH	Trondheim Business School
VM	Museum of Natural History and Archeology

1. INTRODUCTION: PURPOSE AND METHOD OF THE PEER REVIEW

1.1. Evaluation context and approach

This review of the Mid-Norway region (Trøndelag) in Norway is part of the OECD/IMHE project entitled *Supporting the Contribution of Higher Education Institutions to Regional Development*. The project embraces fourteen regions across eleven OECD countries and Brazil in 2005-2006.

IMHE launched the project in spring 2004 as a response to a wide range of initiatives across OECD countries to mobilise higher education in support of regional development. There was a need to synthesise this experience into a coherent body of policy and practice that could guide institutional reforms and relevant policy measures, such as investment decisions, and seek to enhance the connection of higher education institutions (HEIs) to regional communities. Current practice needed to be analysed and evaluated in a way that was sensitive to the varying national and regional contexts within which HEIs operate.

The aim of the IMHE project is to compare and evaluate the efficiency and effectiveness of regional initiatives and partnerships, to provide an opportunity for a dialogue between higher education institutions and regional stakeholders, to assist with the identification of the roles and responsibilities of stakeholders, to provide advice at national level on the impact of policy initiatives at a regional and institutional level, and to lay the foundations of an international network for further exchange of ideas and good practice. Hence, the focus of the IMHE project is on collaborative working between the higher education institutions and their regional partners. It seeks to establish a regional learning and capacity building process.

Each of the participating regions engaged in a self-review process, followed by site visits by international review teams. Participating regions have designated Regional Co-ordinators and Regional Steering Groups to oversee the process. Each regional review is conducted by an International Peer Review Team (PRT) with two International Experts, one being the Lead Evaluator, as well as a Domestic Expert and Team Co-ordinator. The entire project is coordinated and led by project management at the OECD secretariat and a Project Task Group, which is also charged with the task of nominating the members of the Peer Review Teams.

Each regional review produces two independent reports, a Self-Evaluation Report (SER) and a Peer Review Report (PRR). The present document is the latter report. All reports are published online on the OECD project website for the benefit of the participating regions and a wider audience. A final OECD synthesis report, drawing from the experiences of the participating regions and a comprehensive literature review, will follow in 2007.

1.2. The conduct of the evaluation

1.2.1. Self-evaluation process

As requested by the OECD, participating regions were responsible for the preparation of the Self-Evaluation Report (SER). Each region appointed a regional co-ordinator. The regional coordinator was Mr Peter S. Lykke, Deputy University Director, NTNU, assisted by Ms Kristin Wergeland Brekke, Adviser at the Organisational Division at the NTNU. Their responsibilities included managing the preparation of the Self-Evaluation Report and organising the regional dialogue to this aim.

To this purpose, regional co-ordinators ensured co-operation between all stakeholder groups in the region (HEIs, regional authorities, industry, etc.), as well as the key Ministries and agencies (the Ministry

of Education, and other ministries such as Finance, Labour, Industry, Research, Science and Technology, depending upon the country concerned). The region was required to assemble a Regional Steering Committee, comprising key stakeholder groups concerned with higher education and territorial development. The Committee included eight stakeholders and was chaired by the Confederation of Norwegian Business and Industry (see Appendix 2 of this report).

The Regional Steering Committee played an important role in ensuring that a variety of perspectives were reflected in the report. One of the regional co-ordinators' key tasks was to consolidate these different perspectives in order to provide the OECD with a single, integrated response. The different views of stakeholders at a national and regional level needed to be clearly articulated in the report, notably if there were any conflicts between the main stakeholders on certain aspects of the role played by HEIs in regional development. Conflicts between stakeholders would be a major barrier to regional collaboration. The methodology used ensured the involvement of different bodies in the preparation of the Self-Evaluation Report.

A working group was formed by the region (and the HEIs in it), co-ordinated by the regional co-ordinator and steered by the Regional Steering Committee. The Mid-Norway working group included six representatives (see Appendix 2).

The self-evaluation process included several phases. The first one was devoted to responding to the key issues provided in the OECD template. This asked HEIs to critically evaluate with their regional partners and in the context of national higher education and regional policies, how effective they were in contributing to the development of their regions. Key aspects of the self evaluation related to: the contribution of research to regional innovation; the role of teaching and learning in the development of human capital; the contribution to social, cultural and environmental development, and the role of the HEIs in building regional capacity in order to act in an increasingly competitive global economy. In the Mid-Norwegian region this was carried out by circulating a questionnaire to HEIs and to a number of regional stakeholders. An initial, facilitated workshop was held in the region to ensure that HEIs and regional stakeholders were aware of the requirements of the project (including definitions, etc.).

The second phase was launched by a second regional workshop. This workshop identified the contribution of the HEIs to the region, highlighted the issues, impediments and opportunities for greater collaboration locally, and sought consensus on the future role of the HEIs in the region from the perspective of a learning and knowledge agenda. In this last phase, the region was expected (a) to finalise the draft regional Self-Evaluation Report for the site visit; and (b) to prepare a short note on the specific issues and policies that each region would like to discuss with a team of international experts during the review visit.

1.2.2. The Self-Evaluation Report

In line with the OECD template, the questions addressed in the Self-Evaluation Report were grouped around a number of common problems and issues on the regional role of higher education, which all regions were asked to address². This provided a common structure for each Self-Evaluation Report. This

2 . The Self-Evaluation Report provides an overview of the region: its geographical and demographic situation and its economic base and governance structure. It analyses and describes the characteristics of the higher education system in the context of regional policy and provides an analysis of the key factors that are influencing the commitment of HEIs in the region and an analysis of key policy concerns in a number of specific areas, *e.g.* the contribution of research to regional innovation, the contribution of teaching and learning to the labour market and skills, the contribution to social, cultural and environmental development, and capacity building for regional cooperation. Finally, it draws some conclusions about lessons to be learned from the self evaluation process.

common framework facilitates comparative analysis and maximises the opportunities for regions to learn from each other. Some flexibility in the handling of the questions was left to the regional teams, to ensure that these correspond to the regional context and capture key issues.

1.2.3. International peer review

The international Peer Review Team was established by the OECD secretariat in 2005. Professor Markku Sotarauta (FIN) was nominated Lead Evaluator, Senior Research Fellow Claire Nauwelaers (NL) the International Expert, Dr. Ing Magnus Gulbrandsen (NOR) the Domestic Expert, and Mr. Patrick Dubarle (OECD) the Team Co-ordinator (see Appendix 2).

The Lead Evaluator and the Team Co-ordinator visited Trondheim in December 2005 to introduce the project in more detail to key regional stakeholders, to agree on the procedures for the review, and to give feedback on the draft of the Self-Evaluation Report.

Some additional information was required during and after this pre-visit. This included detailed indicators on the regional context and more in-depth quantitative and qualitative information on key issues, such as the degree of autonomy of the main HEIs (as illustrated by budgetary figures), the human resources flow between HEIs and business and industry, and more detailed information on the city and regional strategies (also in the cultural domain). In January 2006, a revised Self-Evaluation Report was submitted to the Peer Review Team, supplemented with additional background material.

The OECD review visit took place from 12 to 18 February 2006. It was organised by the regional coordination team, who took into account the requirements of the Peer Review Team. The regional coordinator succeeded in ensuring cooperation from all the stakeholders.

During the review visit, the PRT met about 80 people, including university managers (NTNU deans and professors), directors, teachers and researchers in the faculties and the University Colleges HiST and HiNT, representatives from national agencies such as the Research Council of Norway, Innovation Norway and SIVA, administrators from the Mid-Norway Chamber of commerce, representatives from the two counties and the City of Trondheim, business managers and programme directors from large and small firms, representatives from student groups, etc. On the basis of wide ranging discussions, the PRT gathered a mass of new information and increased its understanding of the regional innovation system and HEIs' role.

The peer review visit ended with a meeting with the regional steering committee, during which the first impressions from the Peer Review Team were expressed and discussed. (For the review visit programme, see Appendix 3.)

1.2.4. The nature and structure of the report

In this report we rely both on the Self-Evaluation Report and our own interviews and other data collected during the review visit. We focus on the analysis and areas of progress and therefore do not reproduce or summarise the descriptive work reported in the SER. We assume that the readers of this report either are familiar with the situation in Norway and in Trøndelag and/or the SER, which is very rich in detail.

As with all the review teams of the IMHE project, our primary consideration is to give back to the region something of value, something that will contribute to further development and be evaluative in this particular sense. To do that we also refer to contemporary research and policy approaches elsewhere to contextualise the development efforts and the governance system in Trøndelag. Our aim is to support the

development of the HEIs' regional engagement and also to suggest ways forward. Therefore, we raise both positive and negative points.

This report has a strong focus on technology based innovation, whereas the OECD/IMHE briefing notes suggest a wider interpretation of the HEIs' role in regional development. We do not extensively cover aspects linked to the social, cultural and environmental development in the report. In addition, we do not explicitly discuss the contribution of teaching and learning to labour market and skills – we simply refer to this important subject in connection with other issues.

On the basis of our analysis we believe that the key issues for regional development in Trøndelag are linked to technology and research based innovation, regional capacity building and more systematic organisation between the key stakeholders. They are the issues that we believe will have most leverage in the future. They are also the issues in which the role of HEIs will be strongest. Trøndelag is one of the most important locations for research and education in science and technology in Norway (but not in industrial development). Therefore, research, technology and innovation are the major driving forces for regional development. While the region is also “under construction”, it is important to be able to define visions and priorities.

This focus does not imply that the wider contributions to development, *i.e.* social, cultural and environmental issues, are unimportant or that HEIs should not engage in them, on the contrary. The growing attention to creative industries in Trøndelag is a sign of this. Those interested in the Mid-Norwegian HEIs' role in social, cultural and environmental development should refer to the SER, which includes a thorough description of these aspects. In our analysis, however, these issues emerged only in an indirect way.

The report is organised as follows. In Chapter 2 we begin our assessment with more general, but fundamental issues, by discussing the changing spirit of the time in Trøndelag and reflecting on the development views of the key actors. In Chapter 3, we first place Trøndelag in the national context by discussing contemporary developments in Norway. We then present an overall view on the regional innovation system to set the scene for the actual analysis. Chapter 4 describes the situation of the higher education institutions (HEIs) and the research sector in Trøndelag, and raises the recent changes in legislation and policy initiatives affecting these institutions. We also note the importance of the historical context in relation to contemporary developments by highlighting the key events of the most important higher education institutions and research institutes in the region. In the historical overview, we put most of the weight on analysing the trajectories of the two dominant institutions NTH/NTNU and SINTEF, which, in many ways, play a key role in the region.

In Chapter 5 we move to issues that we see as the most central initiatives in driving change in the relationships between the HEIs and the region, and HEIs and industry. We build upon these changes to discuss possible pathways and strategies through which HEIs can influence and take part in regional development. Chapter 6 deals with capacity building for regional co-operation and under that rubric we discuss regionalisation as a way forward, other regional governance issues, collective strategy-making and tensions between innovation and regional policy. In Chapter 7 we summarise the whole report and provide our recommendations for the future.

2. THE CHANGING SPIRIT OF THE TIME IN TRØNDELAG AND ITS EFFECT ON DEVELOPMENT VIEWS

The “spirit of the time”, refers to contemporary values, attitudes, etc.; in other words, the way various issues are generally seen and discussed in a society at a particular time. It is not an exact set of details, but rather a general atmosphere that emerges from the ongoing societal communication in various forums and media. The spirit of the time gives meaning to various policies as well; it often has a decisive influence both on what policies are seen as important in society and on how they are expected to be accomplished. However, the relationship between the spirit of the time and the contemporary way of playing the policy game is not a static relationship; there may always be a saturation point hidden in the midst of the processes and thus the spirit of the time will change, sooner or later.

This seems to be the case in Trøndelag: this region is experiencing an evolution in its spirit and is on the threshold of changes in the prevailing development view of many of its actors.

If the spirit of the time refers to the general atmosphere, the “development view” refers to the thinking patterns of individuals and groups. It may be seen as a more or less detailed system of beliefs and values. It consists of a world view (what the world is like), knowledge (how knowledge of the world is acquired and justified) and values (what the world ought to be like) (Niiniluoto 1989). The dominant development view of the key policy makers, together with the general spirit of the time, greatly influences how the resources are directed and thus what tools are made available. It also affects issues such as: who should partner who (that is, how networks take shape), what kind of power and influence leaders have, and who will emerge as the leaders. It seems obvious to us that, during the last few years, a search for new coalitions and schemes for the economic development of the Trøndelag has begun. It is especially affected by the changes in national policy spheres.

The previous Norwegian Government had greater emphasis on innovation policy than its predecessors, and it seems that the same emphasis will continue. The role of regions is also changing, as moves are underway to give more responsibility to the regional level. As a result of these changes, innovation and regional collaboration were introduced in 2005 as explicit mandates in the Act regulating the HEIs. The Government has substantially increased funding for industrial research and innovation activities with regional partners. Funding is channelled through the public policy instruments, of which the Research Council of Norway, Innovation Norway and SIVA are the most important ones. These institutions are present in all Norwegian regions and operate a range of programmes to foster dialogue and cooperation between HEIs and regional stakeholders.

Mariussen and Fraas describe the development of the Norwegian policy thinking as follows:

“...the post world war period was characterized by a state led thrust towards technological development and modernization. In the 1980s, this was developed further, in the direction of regional policies promoting industrial restructuring, as well as R&D policies inspired by the international trend called ‘technology policy’. Whereas technology policy during the 1990s was followed up with innovation policy as a specific policy sector in many European countries, this did not happen in Norway. Hence, in the beginning of the new millennium, it appeared as if Norway had missed many of the opportunities which had been exploited in several other countries, relating to the ‘new economy’ thrust of developing ICT, and other innovation policy success stories told at the time. During 2001-2004 a sustained effort was made towards developing a ‘horizontal’ or ‘holistic’

innovation policy in Norway. This effort has been to a large extent driven by central government and national politicians.” (2004, p. 5)

In many European countries, innovation and regional development thinking have experienced a major shift from sector and industry-specific subsidies and arrangements towards cluster policies during the last decade or two. The new emphasis stresses the importance of finding synergies between industries, firms and other actors within wide resource areas. The contemporary innovation and regional development policy and the general European spirit of the time also affect the thinking and a search for new modes of action in Trøndelag.

There has been interaction between industry, public development agencies and HEIs in Trøndelag, but not to the same extent as in some other regions in Europe. One reason for this is that such interactions are always mediated by the central government, which is the main referent for all actors. So far the interaction between the three parties – industry, public development agencies and HEIs – has not been institutionalised to form an essential element in regional development. Rather, the development has progressed step-by-step and project-by-project towards new partnerships. All in all, new partnerships are sought for reasons discussed in the following chapters.

In Trøndelag, the regional stakeholders make frequent references to the challenges posed by the intensifying global competition. In addition, many of them are familiar with the prevailing policy trends, including clustering, innovation systems, and the HEIs’ role in regional development in general. Some of them have also read and/or heard their Floridas, and other contemporary gurus, and are focusing their attention on a “creative class”, which is linked to attracting and retaining high value, highly educated labour.

Still, it is obvious that Norway has not faced global competition in the same way as many other (small) countries. As argued in the next chapter, the whole system is relatively protected. The affluent country has not experienced any major economic shocks during the last decade or two to push it and its regions towards new development trajectories. In addition, the global economy has so far mainly benefited Norway and many of its regions. There are not many visible problems or threats to be faced. Quite often, a crisis of some kind is a trigger for change, a trigger to move from rhetoric to action. More often than not, a major crisis is the mobilising force in the emergence of more intensive co-operative patterns between key actors or in the finding of new roles, notably for higher education institutes.

While the representatives of various organisations interviewed by the Peer Review Team were well informed about the challenges posed by globalisation and the new development trends, somehow this awareness was not translated into immediate challenges for their own situation. One might argue that many actors are striving for new modes of action because they are supposed to do that, but, in practice, a real momentum for change does not seem to be there. There is no urgent need to renew the governance structures and processes for the immediate future. However, there are many initiatives and schemes that have been implemented in Trøndelag that somehow herald a more widespread change in development views.

The changing spirit of the time – referring to the pressure for innovation, a changing, multi-level governance context and increased globalisation trends – has had an effect on Trøndelag too. One could still argue that the development view of many of the key actors has not yet matured, and many of the new development efforts have not yet had a significant effect on the development of Trøndelag. If the collective strategic awareness and capabilities to strategically adapt to a changing environment do not develop, there is a danger that the commitment to long-term collective initiatives and investments in science, innovation and technology may be threatened whenever an economic and/or social downturn makes more immediate

problems pressing. The focus of attention of the key stakeholders may turn inwards again, instead of focusing on joint border-crossing development efforts.

All in all, many new processes have been launched and new modes of organisation found. Most of the new initiatives are actually so new that it is quite difficult to assess their functionality and impact on the region yet. The region is on the move, there is no doubt about that; old thinking patterns are challenged, new coalitions and more intensive co-ordination between disconnected actors are not only hoped for, but also searched and created. The changing spirit of the time has not left Trøndelag untouched. In this respect, this OECD peer review seems to come at an appropriate time.

3. THE POSITION OF THE TRØNDELAG REGION

In this chapter, we first place the Trøndelag region in its national context, in a small, centralised country (section 3.1.). We then present an overall view on the regional innovation system (section 3.2.), to set the scene for the analysis of the following chapters: the role of the HEI in regional development.

3.1. Trøndelag and the Norwegian “inverted innovation paradox”

3.1.1. *The national context*

While most European countries – in particular, Norway’s neighbouring country Sweden – are said to suffer from the so-called “Innovation Paradox”³, Norway is enjoying the opposite situation: despite the relatively low investments in R&D and innovation, Norway has a very favourable macroeconomic situation and strong economic performance. Norway’s situation thus poses a challenge to the proponents of knowledge-based development strategies, as it demonstrates that economic growth and employment (the Lisbon objectives) can be reached without embarking on an R&D intensive and technology-based development path.

The macroeconomic performance of Norway is impressive: in 2004, GDP per capita reached a value of 147, compared to an average of 100 for the EU25; the unemployment rate was at 3.5%, much lower than the EU25 mean of 9%; and the employment rate⁴ was at 75%, compared to 63% in the EU25 as a whole. All indicators of quality of life place Norway among the top countries worldwide, and such is the case for most country ranking exercises using competitiveness, attractiveness and governance indicators.

On the other hand, technology and innovation performance, as measured by traditional indicators, is modest: business R&D expenditures reach a level of 87 compared to an EU mean of 100, the share of employment in medium and high-tech industries is only 4.5% – a level of 69 compared to an EU mean of 100 – exports of high-tech products are extremely weak at 3.7% – 21 points compared to the EU index of 100 – and new products sales figures from the Community Innovation Survey, as well as patenting statistics, are equally very low in comparison with other EU countries. However, all indicators capturing the level of education of the workforce show excellent achievements (apart from the availability of science and engineering graduates).

There are several possible explanations for this “inverted innovation paradox”. First, most knowledge economy and innovation indicators are heavily biased towards formal R&D and high-tech development and, therefore, they measure only one type of knowledge-based development. There are many ways for an economy to be innovative that are not adequately illustrated by the available indicators: companies innovating through new organisational forms, smart commercialisation strategies, the introduction of technologies via the purchase of new equipment, etc.. These are all strategies that can pay off, but do not translate into R&D and high-tech measurement figures. Given the industrial composition of industries in

3. The “innovation paradox” states that Europe has excellent research capabilities, but is less able to transform these assets into commercially successful applications.

4. The employment rate is calculated as the share of the population between the ages of 15 and 64 in employment.

Norway, dominated by SMEs in traditional sectors, there is certainly a lot of truth in this argument: the country is successful in creating value based on “innovation without R&D” strategies.

Second, the oil and gas sector provides a substantial contribution to Norwegian wealth, and in Norway these sectors are highly involved in the technological improvement of production processes. Indeed, Norwegian oil companies are relatively R&D intensive, compared to other companies in the same industry. Drilling in the North Sea is a great technological challenge.

When measuring achievements towards the Barcelona target (R&D expenses / GDP), the picture gets gloomy both because of low numerator (non-R&D intensive industry composition) and because of high denominator (high GDP thanks to the oil and gas revenue). Indeed, when measured on a per capita basis, R&D expenditures in Norway are above the EU average. Some argue that the success of the oil and gas sector may be attributed to the investments in technology made in the 1950s (Aanstad, Koch and Kaloudis, 2005). The creation of a strong research institute sector to support these industries is still bearing fruit today, even though this does not translate into high R&D investment figures.

Third, Norway stands out as a high productivity country and this high productivity provides a strong contribution to wealth and economic competitiveness. It can be explained by several factors linked to the quality of the workforce: high investments at all levels of education, very strong participation of the population in lifelong learning activities, and a high level of employment, particularly for women. Hence, this workforce, even if not engaged in R&D or technology development activities, and despite its high costs, is able to lead the country to the development high road.

Another key element is the inward orientation of the country. Despite the recent changes, Norwegian public research and higher education institutions still enjoy, to a certain extent, formal or informal protection from the State, and are thus not exposed to international competition to the same degree as some other countries in the European Union. The system of “technology agreements” for collaborative research between science and industry lowered the competition even further by introducing compulsory national priorities in these relations. While research institutions elsewhere in the European Union face pressures to reach critical size in a European Research Area context, their Norwegian counterparts are not directly subject to similar imperatives. Norwegian HEIs, though affected by internationalisation pressures, can be seen as followers rather than frontrunners in this respect.

To sum up, Norway provides a (perhaps extreme) case demonstrating that long term economic growth could go along with a development path that does not rely on the creation of advanced new technologies. However, if R&D intensity is adjusted for industry profiles, Norway ranks quite high among OECD countries. In this sense, the innovation paradox discussed above should be seen as a relative phenomenon. All in all, the negative impacts of globalisation have not hit the country as hard as elsewhere.

3.1.2. The regional context

Trøndelag is a small region of 400 000 inhabitants in Mid-Norway, centred around the city of Trondheim, the third largest Norwegian city and one of the country’s major university centres.

Trøndelag is representative of the “inverted innovation paradox” situation described above, even if the observed characteristics are less extreme than at country level: R&D investments are somewhat higher and economic performance somewhat lower than nationally.

The composition of the productive fabric in Trøndelag is not oriented towards knowledge-based activities. As indicated in the SER⁵, employment in high-technology manufacturing is remarkably low,

5. See Annex II: The economic and social base.

even lower than the Norwegian average, while employment in high-tech services equals the national value. Knowledge-intensive services are better represented in the region, due to the high share of employment in education, health and social work, and recreational and cultural activities. The export value from Trøndelag is lower than the national average, the predominant export sectors being farmed fish, processed wood and other processed products. The industrial specialisation is skewed towards primary industries. The region hosts many small and very small firms, and only a few companies with more than 100 employees. The fastest growing sector in the region is oil and gas, which provides a major contribution to regional employment and growth. An emerging layer of small, new-technology-based firms might emerge as spin-offs from the research institutions, but this is not yet documented.

The region is, however, over-represented nationally when it comes to R&D activities: 11.4% of Norwegian R&D is carried out in Trøndelag, while the region has only 8.7% of the population. 80% of the regional R&D expenditure is made in the public sector (split equally between HEIs and research institutes) and 20% in industry. This orientation towards public research is much higher than elsewhere in Norway: indeed, in Trøndelag, 30% of the R&D expenditure is made in private businesses while the national average is 50%. Thus, the region's favourable position in R&D figures is mainly a consequence of the strong presence in the region of major public research institutions, especially the NTNU and SINTEF, the largest independent research organisations in Scandinavia. In terms of patents registered at the Norwegian Patents office, Trøndelag is a little under-represented.

In terms of economic performance, unemployment and employment figures are close to the national average, though a little less favourable. GDP and GVA per capita are lower than national average (87% in 2003), but give signs of catching-up. This is mainly explained by the high share of employment in traditional primary industries and public sector.

Like the rest of the country, participation in tertiary education in Trøndelag is high and increasing: the share of regional population with a college or university degree is just below the national average. Due to the presence of the dominant third level education institution delivering engineering degrees in Norway, the share of the population with a science and engineering degree is more favourable in Trøndelag than on average for the country.

Placed in a European perspective, Trøndelag appears as a wealthy region with close to full employment, a population enjoying high educational and living standards, no industrial decline problems, benefiting from the oil and gas industry, and with a large endowment of public R&D resources. Its weak orientation towards high-tech and R&D-based activities in the private sector, and limited outward-orientation do not seem to have hindered its development so far.

The key question that emerges from this picture of the Norwegian inverted innovation paradox is how far is this situation sustainable in the medium and long term? In particular, what will happen when oil exploitation starts to be phased out and its revenues therefore lost? What are the possible scenarios in the case of the introduction of other energy sources? What consequences should be expected at a national level and for a region like Trøndelag? And, in particular, what role could HEIs play in the development trajectory of such a region, which is strong in public research, but weaker in private, knowledge-based activities? We return to that key question in Chapter 5.

3.2. Trøndelag: a region with a relatively transparent innovation system

A large part of the above discussion was devoted to national issues. This is deliberate: compared to many other European countries, the role of the regions in Norway is limited, for two reasons. First, as mentioned already, because Norway is a centralised country and much of what happens at regional level is determined by decisions taken at the central level. Second, the regions, as they are currently and

provisionally defined, are small entities and cannot be expected to take on roles similar to, for example, those of the German Länder or Belgian regions, which are of a larger size and enjoy a broad degree of autonomy in shaping their regional development policies.

But this does not mean that regional entities cannot, over time, develop into significant actors in their own right and in the country's economic future. There is a trend towards growing roles for the regions in Norway, as in many other countries. This touches on the question at the core of this OECD project, which aims at contributing to better definitions of possible strategic options for regional development, taking advantage of the presence of HE and research institutions in the region. In order to make progress in this direction, it is important to get a picture of the overall regional environment in Trøndelag.

The region of Trøndelag is defined as the “reunion” of two counties, Sør- and Nord-Trøndelag. The definition of this region is based on a common historical culture and “identity” as “Trøndere”. The dialect in the two counties is also very similar, whilst being quite dissimilar to those of the surrounding counties. So, even though the new definition of the region appears as somewhat artificial, there are historical roots for the new development.

On almost all indicators referred to above, the Sør-Trøndelag County, including the city of Trondheim, is dominating the picture. Economic performance, the level of disposable incomes, the share of the employed workforce, the level of educational achievements, the presence of high-tech industries and services and of larger companies, the intensity of R&D activities, and the patenting, etc., are all more favourable in the Sør-Trøndelag county than in Nord-Trøndelag. The Northern part of the region appears mostly as a rural area, with an ageing population, and less attractive than the South.

The question of the definition of regional boundaries is currently the subject of debate in Norway. The analysis provided by this review does not demonstrate that those two counties form a “natural” or “functional” region, and it is obvious that the Trøndelag region as defined today is still very small from an international perspective. Since it is not the objective of this review to come up with recommendations on this aspect, we will, in the rest of this report, treat the Trøndelag region as defined currently; but it is important to point out this limitation at the outset.

3.2.1. Trøndelag innovation system

The regional innovation system in Trøndelag can be qualified as transparent, thanks to its small size and the presence of a few well-identified key actors playing a leading role in the region. Figure 1 presents a simplified picture of this system. The main characteristics of Trøndelag are, in a nutshell, as follows:

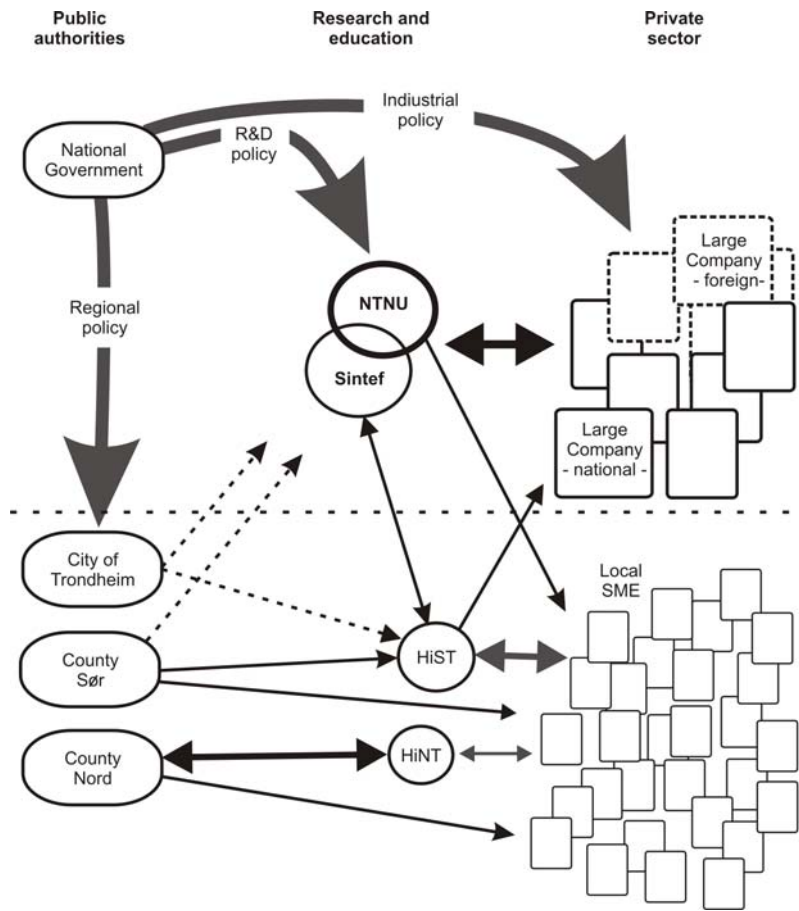
1. The system is divided in two different “worlds”, with limited intersections between them:
 - The first world includes the “movers” and is dominated by the NTNU-SINTEF, which mainly interacts with large enterprises, big players at national and international levels. Strong interactions traditionally exist between the NTNU-SINTEF and the business world. These interactions flow along a multiplicity of channels, the most powerful being the students’ mobility between the university and industry.
 - The second world includes the vast majority of companies, mostly in traditional sectors, of very small size and with limited or no links with the first world. The two regional university colleges, HiST and HiNT, and in particular the former one, are developing some interaction with these companies, but these are rather limited in terms of R&D and innovation, since the university colleges have been so far mostly engaged in educational tasks.

- The university colleges are positioned as regional actors, while the NTNU and SINTEF are national actors located in the region.
2. The NTNU is a key actor in the region. In the absence of a strong regional government, it is, in many respects, the “regional organiser”.
 3. The counties and the city have limited powers to influence the regional system: the strongest influence comes from the national level. Industrial and economic policy, and R&D policy and regional policy are all designed at a national level, and despite recent moves towards more responsibilities for innovation policy at county level, the dominant influence and the origin of instruments used in the region are all found at the central level.
 4. The delivery system for the various instruments of industrial, R&D and innovation policies is relatively straightforward, as they are gathered in a few institutions (Research Council and Innovation Norway, both with regional offices, and SIVA). Their visibility is good and the delivery system has become transparent after the merger of several agencies into a handful of one-stop-shop agencies.⁶
 5. Counties are connected to colleges, which have a mission of service to local community, especially in Nord-Trøndelag. They are not important partners for the NTNU, SINTEF or the large companies. The City of Trondheim, despite being the host of most regional HEIs, has traditionally had only a few links with the HEIs.

Thus, Trøndelag appears today as a small region “in construction”, with a relatively weak identity and fragmented governance, but with considerable potential due to its rich endowment in public research resources and student population, and its possibility to build up strategies involving a circle of key stakeholders. We shall return to the question of capacity building at regional level in Chapter 6.

6. However, the question of the efficiency of the system will be discussed in section 5.

Figure 3.1. The regional innovation system in Trøndelag



4. INSTITUTIONAL SET-UP OF THE HEI/RESEARCH SECTOR: PAST TRAJECTORY AND RECENT DEVELOPMENTS

In this chapter we shall provide an analysis on the Trøndelag higher education and research sector. We shall discuss the recent changes in legislation and the policy initiatives affecting these institutions (section 4.1) and review the key historical points affecting the interplay between the region and the institutions (section 4.2). In the historical overview, we shall focus on the analysis of the two dominating institutions, the NTH/NTNU and SINTEF, which play a key role as “organisers” in the region.

4.1. Important national policy developments

In line with our analysis in the previous chapters, the most recent White Paper on Research (“Commitment to Research”, Report no. 20 to the Parliament 2004-2005) does not have a clear set of priorities: everything is seen as important for the development. Norway will focus on both basic and applied research, universities, colleges and research institutes, disciplinary and cross-disciplinary research and so on. The White Paper, nevertheless, has some key messages, not least the increasing use of competitive and performance-based funding.

4.1.1. Dual system of higher education and roles in region building

The White Paper on Research, in line with the previous one, endorses a dual higher education system in Norway. While the universities have national responsibilities for basic research and education, the university colleges have a strong regional role. Yet both types of HEIs “have a particular responsibility for carrying out long-term basic research and for ensuring that the Norwegian research system maintains an appropriate academic breadth.”

There will be continued support for a programme to “enhance the quality and scope of research activities at state university colleges, while business-oriented college programmes will enhance collaboration and mutual competence development between state university colleges and small and medium-sized companies.” Further, “The state colleges will be central actors in regional development and innovation and support industry and the public sector. Also the universities ... are well placed to contribute to industrial development in their own regions. They will deliver this through educating graduates for regional working life and industry and through research collaboration and commercialisation of research results. Based on their roles in the national research and innovation system, together with their own needs and assessments, universities and colleges must develop collaboration regionally, nationally and internationally when it comes to research and innovation.” In other words, the universities may also play a regional role, although they are not formally expected to when compared to the university colleges. In addition, they are granted the autonomy to make regional initiatives themselves rather than to follow centrally defined programmes and guidelines. This distinction in the roles of the universities and university colleges was endorsed and supported by the industry representatives during the review visit.

4.1.2. Changes in funding system for HEI in Norway

The distinctive roles of the two types of HEIs are also reflected in the recently suggested funding systems. While both types of institutions will be subject to a funding system based on research results – scientific publications, PhDs and success in the acquisition of EU and research council funding – a set of

“dissemination indicators” will be developed. The dissemination indicators will include the university colleges’ responsibilities for relations to regional small and medium-sized enterprises. At the time of the review it was not yet clear what the dissemination indicators would be nor how they would be applied to different HEIs.

The research results component has been utilised since the 2006 national budget, where it influenced 0.9% of the HEIs’ total budgets (it is likely to double in 2007). Although it only involves a small fraction of the budgets, there has been a heated debate surrounding the counting and ranking of publications. In practice, the state colleges have relatively modest research budgets. The new funding system has therefore only a limited impact on them (their results-based share of the research budget is even smaller).

For the universities, on the other hand, the system has noticeable impacts. The NTNU fared poorly during the first year the system came into effect (2006 allocation based on 2004 publication data). Although the NTNU is the second largest university in the country, based on student numbers and total budget, it scored well behind the universities in Oslo and Bergen in terms of scientific publications. This brought along a reduction of funding (minus NOK 40 million). NTNU’s modest performance was partly due to the criteria, which did not cover all publication channels essential to technological universities. However, the preliminary figures for 2005 publications show that the NTNU’s score has increased considerably, by nearly 50%, and that it has already passed the University of Bergen (see <http://dbh.nsd.uib.no/pub/>).

Another incentive for the NTNU to focus more on traditional academic work was provided by the recent extensive evaluation of the engineering disciplines at the NTNU. According to the evaluation outcomes, many NTNU research units are excellent, but have too strong a focus on applied research, and too little on international publishing.

4.1.3. Stronger focus on commercialisation of research at HEIs in Norway

The White Paper on Research and the plan for an “Integrated Innovation Policy” emphasise “commercialisation of research results” and the need to build-up a support system in or close to the universities. This is not so much based on arguments that the Norwegian universities are under-performing when it comes to commercialisation or university-industry relations, but rather on the need to develop high-tech industries and partly the lack of an efficient support structure for public sector researchers interested in commercialisation.

The new emphasis has a close relation to the legislative changes that came into effect in 2003. There were two changes. First, the so-called “teacher exemption clause” or “professor’s privilege” was removed from the “Worker’s Invention Legislation”, meaning that the ownership of research results was transferred from the individual researcher to the institution. Second, the university and college legislation was changed in order to give the HEIs a formal responsibility to utilise patentable research results (the law formally mentions “patentable” although the Ministry has emphasised that this includes a broader responsibility for ensuring knowledge transfer to the society’s benefit). These changes followed similar initiatives in other countries, such as the United States, Denmark, Germany and the Netherlands.

In Norway, the changes were supported by additional funding streams. The FORNY commercialisation programme of the Research Council of Norway almost doubled its funding during the last two years (see Box 4.1.). The Ministry of Education and Research has allocated special funds to support the development of university Technology Transfer Offices (TTOs) of various types (see chapter 5.1). In addition, the White Paper suggested that the government should finance seed capital funds in the university cities to cater for early phase needs for commercialisation funding. Funding has later been allocated for this purpose, too. There was some resistance to the legislative changes, particularly from the

NTNU professors with experience in commercialisation. They had objection to a “privilege” being removed and also feared that the TTO structure was likely to become bureaucratic and inefficient burden. It seems that the resistance has decreased over the last couple of years.

Box 4.1. The FORNY programme (Research Council of Norway)

The objective of the FORNY programme is to increase value creation through commercialisation of research based business ideas with a substantial market potential. Since the programme was launched in 1995, 350 ideas have been commercialised, including 125 licences. The current stock of active companies is 174 companies. A substantial share of the results is from Trøndelag. FORNY funding may be obtained for the following activities:

Infrastructure measures at the R&D institutions

The R&D institutions may obtain funding for measures which are to develop the staff and students' competence and interest in commercialisation. The NTNU has obtained such funding since 1995, while HiST and HiNT came along in 2003 and 2005 respectively. For 2006, the NTNU has been assigned NOK 4.1 million, HiST NOK 0.6 million and HiNT NOK 0.25 million. With 50 % self-funded, the infrastructure activities of the three HEIs will reach NOK 10 million in 2006.

Assistance from professional commercialisation units

Professional commercialisation units may obtain funding to provide assistance to the owners of R&D based ideas and help them to commercialise the ideas in terms of patents, licenses or new business development. In 2006, LEN obtained NOK 3.65 million, the NTNU TTO NOK 5 million and SINVENT NOK 3 million. The commercialisation units thus obtained nearly NOK 12 million, a substantial increase from NOK 8.5 million in 2005. The commercialisation units are to add 50 % in self-funding.

Verification of commercial potential of technological ideas

While funding is not available for product development, it may be obtained to verify if a technological idea has commercial potential. NOK 30 million is set aside nationally for such verification in 2006. The commercialisation unit in Norway with the best competence in the given field will take responsibility for such verification.

Source: SER

4.1.4. Enhanced competition in the higher education sector

The formal criterion for transforming a university college to a university is to have at least three approved doctoral training programmes. Some state colleges have struggled to become upgraded to universities. The one in Stavanger became a university in 2005. Agder will most likely be the next college to transform into a university, while Bodø is on its way. The National Institute of Agriculture became the University of the Life Sciences in 2005.

This does not seem to be an immediate ambition for the Trøndelag university colleges, although they, like other state colleges, have a strong focus on upgrading the staff competences. At HiST, in particular, there are some thoughts of evolving towards a university in the medium or longer term. (It has expressed interest in merging with the NTNU, thus, in practice, becoming a university). This is partly related to the idea that all higher education should be “research-based”. In addition, strengthening the research part of the university colleges means that they may be able to build up “pockets of competence”, where they can attract national funding and play a role as a national or regional centre of expertise. The creation of the University of Stavanger means that there were two universities with a strong interest in technological disciplines. For the time being, the University of Stavanger is concentrating on fewer areas than the

NTNU, but, with time, it may become a strong competitor, particularly in training engineers and attracting students. The same partly applies to the University of the Life Sciences, which, like the NTNU, has a high share of professional training (engineers, etc.) and close relations to companies.

The competition between HEIs is also becoming international. The so-called “quality reform” should be mentioned in this respect. Its main aim is to improve the quality of teaching and to ensure that more students finish their studies on time. However, the reform has also brought along increased autonomy and responsibility for the HEIs and a new degree structure (3 plus 2 plus 3 years) similar to what is found in other countries. This means that the HEIs are subject to greater international competition, they have seen increased teaching loads and an increasing pressure to concentrate research resources in various ways.

4.1.5. Impact of the recent changes in HEI’s strategies in Trøndelag

The above changes are likely to have impact on the HEIs in Trøndelag. The nature of this impact will depend on the profile of the institutions. A key conclusion is that the NTNU has only a few direct incentives to develop strong links with the industry in the region:

- The universities’ national orientation and responsibility for fundamental research has been emphasised in the two last White Papers on Research.
- The new, results-based component of the HE basic funding has increased the incentives for the universities to strengthen their traditional academic publishing.

On the other hand, there are other developments that may lead to strategic changes:

- Commercialisation of research results, including the build-up of TTOs and seed capital funding, have been an important element of research and innovation policy during the last five years. It is envisaged that these phenomena will bring along benefits to the regions.
- The perspective of using “dissemination-based” indicators as a complementary basis for HEI basic funding might create incentives towards change in behaviour within the NTNU.
- Increased national and international competition in technological research and education may lead the NTNU to seek more regional partnerships to maintain its position, but probably even more international academic and industrial partnerships.

HiST and HiNT have strong regional obligations. While they are subject to growing expectations from the regional stakeholders, they are also subject to more general trends of increasing academic competences within the university college sector.

As argued in Chapter 2, the Norwegian system is in a state of flux. Its evolution will depend on the extent to which HEIs integrate the changes in the spirit of the times in their development views, and on the possibility for regional and local authorities to influence these views. We shall return to these questions in Chapters 5 and 6.

4.2. Research institutions in Trøndelag – a historical overview

Before turning to the current strategies at HEIs in Trøndelag, it is useful to take a short detour into the history of the HEIs in order to understand their current situation.

4.2.1. The origins of the NTNU, 1910-1930

The NTNU is the result of a merger between several institutions, the two most important being the Norwegian Institute of Technology (NTH) and the College for the Sciences (AVH). The NTH was opened in 1910 after a century long debate. Few industrial companies, a weak urban bourgeoisie and very strong political power with representatives of agriculture and fishing were the key reasons why the Parliament rejected many proposals for establishing a national institute of technology during the 19th century. A geographical struggle took place, primarily between the three cities Bergen, Oslo and Trondheim, all hosting technical schools worthy of upgrading. The stakeholders in industry wanted the new organisation in Oslo, where most of the industry was located, but they had to give up the location battle to be able to get a technical university at all. From the outset, the NTH was therefore inclined to serving the needs of companies throughout the country and to show “national relevance”, despite its location in a region with limited industrial activity.

For the first three decades, the NTH struggled to find its place in the national innovation system. Few companies showed interest in the activities of the university. Some professors had their own consultancy companies “on the side” and/or tried to start spin-off firms. However, the university developed stricter guidelines against such activities in the 1920s, and the NTH went into a period of “academic isolation” instead of being the main partner of industry, as intended at the outset. Still, the desire to “be useful to industry” remains a central part of the professional culture of the institution.

4.2.2. The rise of connections with industry, 1930-1950

During the 1930s, the NTH tried to come out of its academic isolation to offer technological solutions to industry. It had employed a new category of professors with excellent academic credentials and little industrial experience who were, nevertheless, eager to help out with industrial development. This strategy of “technology push” received little support in the firms, which were mainly interested in incremental improvements of existing competencies.

There was a significant general increase in industrial activity during the 1930s. The economic crisis resulted in a major restructuring of the private sector. Many older/larger companies went bankrupt, but a vibrant small firm movement created an annual growth in industrial employment of almost 7%. This also meant that the mean size of the companies decreased (Sejersted, 1993, p. 181-182). The structural change is an important precondition for the later establishment of an institute sector. The restructuring of industry implied that new firms were formed with more modern production methods (Hanisch and Lange, 1985, p. 138). In the second half of the 1930s, the NTH was blessed with a sharp increase in “no strings attached” private funding, often for a certain category of laboratory work. A wave of goodwill led to new contacts with industries that previously had little interest in university partnerships.

4.2.3. The creation of SINTEF and the emergence of an entrepreneurial university, 1950-1970

Plans for a “central institute” for industrial research emerged early in the 20th century. This was intended to be an institution that could offer R&D based services to firms in all industries and geographical locations in Norway. The plans did not come into effect until the end of World War II, when the Central Institute for Industrial Research was established in Oslo in early 1950. The initiative suggested a certain lack of faith in the NTH’s ability to provide useful advice to industry and in the opportunities for close industrial collaboration for research units in a “remote” location like Trondheim. This provoked the NTH into action. Only a few months later it established its own “central institute”, SINTEF (The Foundation for Technical and Industrial Research at the NTH).

This marked the beginning of a new era with the NTH as an entrepreneurial university (see Clark, 1998; Etzkowitz, Schuler and Gulbrandsen, 2000). “The pressure from competing groups released a will to act and ability for renewal that has later been one of the technical university’s main characteristics.” (Hanisch and Lange, 1985, p. 213). SINTEF was a continuous positive influence on both research and teaching at the NTH. Perhaps the most important aspect was that the considerable income from industry contracts made the technical university less dependent upon the budgeting process and ministerial routines. Positions could be created for talented researchers without the Ministry creating new professorships. SINTEF was, furthermore, a highly efficient administrative operation, suitable for handling large numbers of industrial contacts and also for planning and implementing new building plans.

SINTEF soon hired its own seniors and built its own labs, rather than merely operating as a transfer mechanism for the NTH professors. Most new SINTEF departments were still started as linked activities to NTH departments, and the two were often located within the same buildings. SINTEF grew quickly and had close to 2 000 employees in 1993 when it merged with its main competitor in Oslo, who at that time had around 300 employees.

The Oslo institute was founded on a more traditional “science push” model, whereas the SINTEF model was really more an education policy initiative than a research or industrial policy initiative. SINTEF was created as an outreach tool for NTH professors and was thus forced to cover the whole breadth of the technological spectrum at the university. Companies partnering with SINTEF thus gained access to a wide range of engineering graduates who could later start working for the companies. The institute was also characterised by a bottom-up and more haphazard growth, frequently based on individual professors’ initiatives and preferences, which generated a strong supply side mechanism that, in time, created its own market.

4.2.4. Growing connections of the NTH/SINTEF with industry, 1960-1980

During the 1960s and 1970s, the NTH became increasingly more connected to a national network of industrial companies and large-scale technological development projects, the latter not least through the initiatives of defence-related research co-ordinated by the Defence Research Institute outside of Oslo. Important NTH/SINTEF inventions provided the basis for high technology clusters in towns like Kongsberg and Horten, which were selected as part of a combined regional growth and national champions policy. The research institutions thus helped promote regional development, but, significantly, also promoted regions other than Trøndelag.

The NTH and SINTEF (as well as most of the other research institutes in Norway) benefited also from the development of a petroleum industry in the 1970s. Foreign companies gained drilling rights in the North Sea if they promised to carry out at least 50% of their R&D activities in Norway.

4.2.5. Evolving relationships between the NTH and SINTEF and the creation of the NTNU, 1980-2000

In 1980, SINTEF was changed into a foundation with a more professional organisation. This was the beginning of a long line of reorganisations. The old model with NTH professors as SINTEF group leaders was abandoned, although some continued to have dual positions. Later in the 1980s, the SINTEF Group was established as a private foundation.

The relationship between SINTEF and its “parent”, the NTH, fluctuated over the years, but the research institute continues to maintain a dual goal: first, to cover needs for R&D in private and public sectors and, second, to promote technological and industrially oriented research at the NTNU and to help induce collaboration between the NTNU and other actors, including industry, work life in general and other research organisations.

The links between the NTNU and SINTEF are now closer than a decade ago. In 2003, more than 500 people had a position in both organisations. In 2005, the boards of the research institutions agreed to develop a common strategy and to promote themselves as “one actor” to the outside world. SINTEF, also has extensive links with other academic institutions, not least with the University of Oslo.

Presently, SINTEF is the largest independent research organisation in Scandinavia, with approximately 2000 employees: 1 400 in Trondheim and 500 in Oslo. There are branch offices/laboratories in Bergen, Stavanger, Ålesund, Houston (United States), Skopje (Macedonia), Hirtshals (Denmark) and Warszawa and Krakow (Poland). The group consists of several research divisions, some of which are organised as independent limited companies:

- SINTEF Building and infrastructure
- SINTEF Health research
- SINTEF ICT
- SINTEF Marine
- SINTEF Materials and chemistry
- SINTEF Petroleum and energy
- SINTEF Technology and society

In addition, SINTEF owns Sinvent AS, which is the institute’s “commercialisation office”, *e.g.* helping spin-off companies and taking care of shares in start-ups. Sinvent is located in the same building as the NTNU TTO.

The NTNU was created in 1996, through the merger of the NTH and the AVH, which was, formerly, called the Teacher Training College of Trondheim. The AVH had teaching and research duties within the social sciences, humanities and the natural sciences, and it was scattered around Trondheim with Dragvoll as the main campus⁷. The natural sciences moved to the “NTH campus” at Gløshaugen in the new Science building in 2000. In addition to the NTH and the AVH, the NTNU consists of the former Museum of Natural History and Archeology (VM), the Medical Faculty (DMF), The Arts College of Trondheim and The Music Conservatory of Trondheim. The NTH, AVH, VM and DMF were autonomous parts of the loose organisation University of Trondheim (created in 1968), but the NTNU is a far more unitary organisation.

4.2.6. The current profile of NTNU

When the NTNU was created, a key motivation was to exploit the opportunities for teaching and research at the intersection between the technological disciplines and other disciplines. Although the creation of the NTNU was met with some resistance, the protests seem to have ended. The university stands out among other similar institutions in Norway as more proactive and opting for different models for organisation and leadership, *e.g.* having an appointed rather than elected rector and having a common course for all students to promote interdisciplinarity (see Box 5.1. “Experts in team”). It also has a tradition for involving industry representatives in boards and advisory panels on different levels in the organisation.

7. Dragvoll is still the main campus for the social sciences and the humanities.

The NTNU is now the second largest university in Norway, with 20 000 students and 4 700 employees. It has 52 departments organised into seven faculties:

- Faculty of Architecture and Fine Art
- Faculty of Engineering Science and Technology
- Faculty of Arts
- Faculty of Natural Sciences and Technology
- Faculty of Information Technology, Mathematics and Electrical Engineering
- Faculty of Medicine
- Faculty of Social Sciences and Technology Management

The NTNU is host to four of the country's thirteen Centres of Excellence in Research. The profile is strongly oriented at natural sciences and technology, with a main responsibility for training of chartered engineers (*sivilingeniør*) in Norway. About half of the students are enrolled within the natural sciences and technology.

4.2.7. HiNT and HiST, the university colleges of North- and South-Trøndelag

The two University colleges *Høgskolen i Nord-Trøndelag* (HiNT) and *Høgskolen i Sør-Trøndelag* (HiST) were created in August 1994 as part of the “College Reform”, when 98 smaller colleges (engineering colleges, nursing colleges, state colleges, business colleges, teacher training colleges etc.) were merged into 26 relatively large units named as state colleges. In practice, all the counties got “their own” college, like the two Trøndelag counties (some got more than one). The “college reform” aimed to reap economies of scale by having smaller administrative units. This aim has not been fully realised, partly because most colleges initially opted to keep all former campuses.

HiNT is the smaller of the two colleges, with about 4 600 students and 390 employees. It is the result of a merger of colleges in the small towns of Steinkjer, Levanger, Namsos and Stjørdal, which still have modest HE activities. The college offers 100 different courses within health work/nursing, teacher training, social sciences and engineering. The study programmes vary in length, with a concentration at the bachelor level and with a lot of further education courses. There are four faculties:

- Faculty of Health Science (Namsos)
- Faculty of Society, Industry and Culture (Steinkjer)
- Faculty of Nursing, Engineering and Teacher Training (Levanger)
- Faculty of Driving School Teacher Training (Stjørdal)

Next to the Steinkjer campus we find the institute Nord-Trøndelagsforskning (NTF) which is typical of several Norwegian regional institutes started in the 1980s. The NTF was established in 1983 as an independent foundation. The research institute is now organised as a limited company partly owned by the foundation (interestingly, SINTEF is a part owner). It has approximately 30 employees doing contract work for industry and the public sector. The recent reorganisation of the institute has involved the county's

electric power company becoming the majority shareholder and many other actors (HiNT, local cities, etc.) as other shareholders. This has most likely strengthened the regional profile of the organisation.

HiST is the larger of the two university colleges with around 8 000 students and 700 employees. It has several campuses in Trondheim which largely reflect the colleges before the merger. HiST is in the process of examining the possibilities for locating the whole college at a single campus. The college offers study programmes within the health sciences, informatics, teacher training, food science, nursing, technology and business administration. A few masters' programmes are offered, although bachelor programmes dominate. There are seven faculties: Health Science, Informatics and e-learning, teacher and interpreter training, food and medical technology, nursing, technology and Trondheim Økonomiske Høgskole (TØH), which is a business school.

To sum up, the key institutions the NTH/NTNU and SINTEF have, since their inception, had a clearly defined national role. They have had to overcome the scepticism about institutions placed well away from national industrial centres being able to be efficient partners to firms. The colleges HiNT and HiST have a regional justification and role – and their students also largely come from the region.

5. INCREASING INTERACTION BETWEEN HEIs AND THE REGION

During the review visit, the Peer Review Team was told of many initiatives to strengthen the relationship between the HEIs and companies/other actors in the Trøndelag region. In section 5.1, we shall focus on what we see as the most important initiatives driving changes in these relationships. In Section 5.2, we shall build upon these changes to discuss possible pathways through which HEIs can influence and take part in regional development.

5.1. New initiatives for HEI–regional interactions in Trøndelag

The collaboration between the HEIs and local and regional authorities has become much closer during the last few years. The key reason for this is an increasing recognition that the HEIs and the regional stakeholders are facing the same challenges and have to work together to maintain the attractive aspects of the Trondheim region. In line with the regional *Zeitgeist* (see Chapter 2), the interviews pointed towards an emerging change of mentality and attitudes with key regional actors. The NTNU is processing the idea that national/international aspirations are not in conflict with closer regional engagement. The city and counties have increasingly understood that the NTNU/SINTEF face many challenges that the research institutions might need help to meet. In addition, the legislative changes in 2003 (see Chapter 4) gave the NTNU a stronger obligation to commercialise research. There is also an increased interest in HiST among the local and regional authorities, attention that was absent only a few years back.

Regional university–industry collaboration and the creation of spin-off companies locally are not new phenomena in the Trondheim region. Many local companies owe their existence to research at and/or graduates from the NTNU/SINTEF, and collaborative projects have ensured regional employment in, for example, the instrumentations and metal industries. But memory is short and nobody has systematically collected information about past linkages and initiatives. One interviewee estimated that at least 2 000 people in Trondheim work in companies created by NTH/SINTEF personnel from the start of the 1980s and supported by the former research council's (NTNF) entrepreneurship scholarship programme.

The main difference between earlier initiatives and the contemporary ones is perhaps that earlier collaboration and innovation largely happened bottom-up, based mainly on the personal networks of researchers. Newer initiatives appear to be institutionalised, and centrally funded and managed. This is not just the case with activities like technology transfer and incubation, but also with regular university–industry collaboration, which is increasingly defined within arrangements like “Centres of expertise” and “Centres of research-based innovation” (two national programmes). It will probably be essential that the new, more formalised ways of doing innovation through actors like the TTO and the Innovation Mid-Norway project would not discourage the bottom-up initiatives of the researchers and their partners themselves.

In the following, we describe these initiatives one by one, while the concluding paragraph indicates perspectives for structural interactions between HEIs and the region.

5.2.1. *Commercialisation initiatives at the NTNU (including the TTO unit)*

As stated in Chapter 4, the NTNU has, for decades, been known as a proactive university, oriented towards industry interaction and cross-disciplinarity. This is obvious when it comes to the plans for

supporting research-based commercialisation. While the other universities made plans for commercialisation after the legislative changes in 2003, the NTNU had developed its own strategy in this area several years before. In a way, SINTEF was established as a technology transfer organisation almost 60 years ago.

At the NTNU, the aim has been to stimulate entrepreneurship among students, employees and in society and to contribute to Norway's increased competitiveness, as well as to be a leading university in Europe when it comes to commercialisation and industry linkages. A concrete goal was established to have 30 new firms every year based on knowledge from the NTNU and other research organisations in Trondheim (mainly SINTEF). In retrospect, people were not happy with this goal, and presently the attention is to create fewer firms, but with a clearer international growth potential.

Box 5.1. Venture Cup / An effective way to promote entrepreneurship

Venture Cup is a business plan competition with the aim to stimulate innovation and new ventures. Venture Cup Trøndelag is open to all participants with a good business idea, including students and academic staff from the NTNU, HiST and HiNT. Several student teams from the region, mainly with an education in natural science and technology, have won recognition for their ideas and venture capital to further develop their business plans.

In 2004 and 2005, HiST also organised its own "ideas competition" called *HiST Gründerstipend*.

Source: SER

In 1995, the NTNU and SINTEF established Nyfotek as their instrument for commercialisation of research-based ideas. Later it was merged with Leiv Eiriksson Nyskaping AS, which took over its activities. In October 2003, after the legislative changes, the limited company NTNU Technology Transfer AS was established by the university board. The TTO has been operative from June 2004. The NTNU owns all the shares and selects a board where the university director is the chairman. The TTO's main goals are to contribute to wealth creation in Norway, to strengthen teaching and research at the university and to contribute to the NTNU's obligations to society.

Compared to the other universities, the TTO model is quite "commercial" – the NTNU TTO is the only TTO in Norway where ownership of the research results is transferred to the TTO. In other Norwegian universities, the TTOs only manage ownership on behalf of their universities. This again signals that the NTNU wants to be "best in class" in Norway in such activities, and that it has established a support structure to create new activities and not just because the Ministry gave it money. The NTNU also spends around NOK 5 million on the TTO. Although this amount is modest compared to the total budget of the institution, it is larger than at other Norwegian universities. The TTO is in itself a relatively complete support structure for innovation and not just a patent office or a service unit for the researchers. The unit's total budget is around NOK 15 million, and it has just below 20 employees. According to TTO staff, the unit's main challenge is the lack of entrepreneurs locally with international experience. Some efforts have been made to attract such individuals from other regions and countries, particularly "serial entrepreneurs" with a track record from technology development projects.

Box 5.2. NTNU Technology Transfer Office

Following changes in the University Act, the universities in Norway in 2004 established technology transfer offices to release the commercialisation potential from their research activities. The TTOs are, to some extent, expected to take on a regional role. The NTNU Technology Transfer AS is to serve Trøndelag, Møre and Romsdal and

may assist the university colleges in the region, which, in terms of size and capacity, cannot operate their own TTOs. Another important role is to develop relations with existing trade and industry to promote the realisation of research based ideas. Regional industry is important, but the TTO also cooperates with other regions (e.g. the Kongsberg region which is a stronghold in advanced technology). It has also established a network with relevant actors around the world to benefit from international experience and market developments.

In its first year of operation, the NTNU Technology Transfer Office focused on establishing trust internally and building external networks towards industrial partners and financial investors. A key element in this strategy has been to establish close relations to other IPR-owners, such as SINTEF and St. Olav's Hospital and other commercialisation actors. In comparison with the TTOs at the other Norwegian universities, NTNU TTO has put greater emphasis on proactive search for ideas in the research communities. Together with the researchers, ideas are concretised and registered in the TTO database for further processing and scrutiny regarding their commercial potential. The challenge is to develop business concepts with sufficient commercial potential to attract further funding. This normally demands both unique research results, as well as a team of people with complementary knowledge and experience. When these factors are in place, a concrete commercialisation project is established, with the aim of creating new businesses or licence agreements with existing industry in or outside of Norway. In their first full year of operation in 2005, the NTNU TTO received 158 business ideas, registered 2 patents and helped establish 5 new companies. Several licence production agreements were also being processed.

In a national perspective, the Trondheim community leads the way when it comes to new start ups. Nevertheless it is a challenge to find more entrepreneurs that want to establish new businesses. The TTO has its own programme with eight trainees, who have completed extensive training and who represent an important resource in value creation from specific projects. Many of these trainees are about to start new enterprises. Regional incubators such as the Innovation Centre Gløshaugen also contribute to ease the start-up of new companies and bring the entrepreneurs in touch with funding agents and industrial environments.

Source: SER

Since the beginning, the TTO has been very active in outreach activities, first and foremost to the research units at the NTNU but also more broadly to, for example, regional and national industry and sources of capital. This is also evident from the review visit interviews. Many actors in many sectors had heard about and/or been in touch with the TTO, and the general message was that this was a good new support actor with many interesting activities. Originally, the main intention with the TTO was to help researchers commercialise their ideas through patenting, licensing and entrepreneurship and the like. Several interviewees claimed that the unit is starting to function as a resource base for industry. Some industry representatives said that they were regularly in touch with the TTO to hear about new ideas and technologies that might be relevant to them. In this manner, the TTO functions as a kind of "idea portal" for research, just as the formal "Idea Portal" (see below) is a window into the student world for the companies. In addition, it is interesting that the TTO's own example of a very promising idea – the creation of electricity from ocean waves – originated in a local company and not in the NTNU/SINTEF.

Only a few incentives exist at the individual level for researchers to commercialise. Researchers, for example, retain part of the income if they choose to commercialise through the TTO system. In addition, the Faculties receive some extra funding for each idea that is reported to the TTO. Patents, spin-off companies, etc. are not taken into account when applying for academic positions or promotion at the NTNU, although a change is considered for the future.

There is an on-campus incubator at Gløshaugen. The students at the NTNU seem very active in entrepreneurship through the Start NTNU organisation and various business plan and idea competitions.

Before the TTO was created, researchers used SINTEF's transfer unit Sinvent and/or Leiv Eiriksson Nyskaping (LEN), an incubator-like organisation in Trondheim. There is undoubtedly some tension between the commercialisation actors. LEN has recently reoriented its activities and is now the main

partner of HiST, HiNT and regional industry in commercialisation processes. Some ideas from HiST have, nevertheless, been developed further in co-operation with NTNU TTO.

Innovation Mid-Norway

Innovation Mid-Norway (IM-N) is a regionalised national innovation support programme, funded by various national and regional actors, including the Research Council of Norway (RCN), SIVA and the two Trøndelag counties. It is a part of the regional ARENA programme, which is a partnership between RCN, Innovation Norway and SIVA and is oriented at improving collaboration between companies, knowledge centres and the public sector at regional level. IM-N has a special focus on three municipalities of the Trøndelag region and the needs and ideas of the companies there. It offers some funding for idea development, helps with writing business plans and provides a means for the companies to get in touch with the SINTEF/NTNU cluster and also with large companies like Statoil.

Interviewees described how IM-N creates an “innovation space” where companies that have difficulties in defining their own research needs may still be able to get in touch with the advanced research units in Trondheim. The project defines itself as on the lookout for “social entrepreneurs” who want to do something special to develop their local communities. They have, however, found it difficult to find funding for these entrepreneurs, as Innovation Norway and other actors fund companies, not individuals.

Experts in teams

All students at NTNU are obliged to take the course “Experts in teams”. The intention is to promote cross-disciplinarity, to introduce new teaching methods and to prepare the students for the type of teamwork that is common in working life. The students are organised in “villages” and “tribes” with a scientific employee as “chief of the tribe”.

Through “Experts in Teams” students also get in touch with companies (even smaller ones) for project work/assignments. This is also the case for many of the students from the social sciences and the humanities, strengthening the impression of the NTNU as the most important “private sector university” in Norway.

Box 5.3. Experts in team / Preparing students for work life

“Experts in team” (interdisciplinary team work) is a project assignment for students at Master’s level. It is organised as project work in teams of five students from different disciplines, where the professor operates as facilitator. Each team member ensures that his/her know-how and expertise contributes to the mutual problem solving process. In this way students are trained in multidisciplinary communication and to operate in a multidisciplinary environment.

The programme has developed from the engineering degree programme at the NTNU, and is now in the process of being extended to all masters programmes at the university. Between 2001 and 2005 the number of students attending the programme grew from 780 to 1 300. It is the largest pedagogic development project in the history of the university.

Source: SER

The Idea Portal and students work in industry

This is a web portal where small businesses can announce a need for project ideas that students can assess. Such ideas can be the starting point for project work and/or for summer jobs. One goal is to make the students familiar with regional industry. The PRT heard that many engineering students are not aware that there are interesting industrial companies just outside of Trondheim. The Idea Portal is a partnership between HiST, HiNT, the Molde College (in the neighbouring county southwest of Trøndelag) and the NTNU. But the projects are not regionally limited, and the intention is to extend the database to cover the whole country.

There were earlier attempts at the NTNU to subsidise summer jobs and trainee positions to get chartered engineers out into small businesses. The Research Council has run several programmes supporting such mechanisms.

The colleges in particular seem very eager to use students as a linkage mechanism to local and regional industry. At HiST alone there are several hundred student projects each year carried out in collaboration with a company in the Trøndelag region. 55% of the project assignments for the HiNT students have an external “owner” or “interested party”. Industry representatives see this as vital, but they are also concerned with capacity issues – there is a great need for personnel, for example in the oil and gas industry around Stjordal, and they want the colleges to increase their capacity in this respect. Increased project work and summer jobs may, nevertheless, mean that more of the graduates consider staying in the region instead of moving to Oslo, Stavanger and elsewhere.

Box 5.4. Verdal – on a good track / example of co-operation and commitment of a firm to local economic development

During the shipbuilding industry crisis in 1999, Aker Verdal was hard hit. The management at the shipyard realised that a lack of orders quickly could drain the yard of key personnel. They decided to go for a comprehensive skills upgrading programme. The public labour exchange office (Aetat), Verdal Upper Secondary School and HiNT became partners to Aker Verdal in the skills upgrading programme. The tasks of HiNT were to organise university college courses and act as an intermediary to other HEIs. Altogether, the yard invested 2 500 months of coursework during the project period 1999-2001. 87 % of the employees took one or more courses. The project turned out to be a success: the yard managed to create a united perception of the situation and the challenges ahead. Through early action and involvement, a deep crisis was avoided. With upgraded skills, the yard was well prepared for new contracts. After the project period, the yard kept on cooperating with the partners to ensure continuous upgrading of skills for its staff.

In 2002, localities no longer needed by the yard were turned into an industry park (VIP centre) operated by Indpro Verdal. With 43 new companies here, the industry structure is far more diversified today than only a few years ago, making the community less vulnerable to fluctuations in the global shipbuilding market. The shipyard has become more competitive and has full order books today. The municipality has also contributed in several ways, turning Verdal from an industrial town to an attractive place to live. The main road no longer runs through the town centre. The town is visually upgraded, a new cinema draws a wide audience, a new cultural garden is emerging in the old mill and nearby, the Stiklestad Culture Centre has made the Stiklestad Viking battleground an all-year attraction.

Source: SER

NTNU 2020/ HiST 2020

This is a project examining the costs and benefits of a possible co-location of the state college HiST and various parts of the NTNU around the Gløshaugen area close to the city centre. As the name indicates, this is a long-term project and process. The starting point is increasing global competition and a need to

maintain the NTNU as a leading international university when it comes to cross-disciplinary research, for example. The vision is that the NTNU, SINTEF and HiST will, together, constitute a competitive environment for research and higher education in the coming decades. Co-location of higher education institutions is seen as one possible way of achieving this with a broader supply of study programmes and improved opportunities for co-ordination and collaboration through the creation of an attractive research milieu.

There are many proponents of this project at HiST. Some even go further and defend a vision of a merger between HiST and the NTNU. However, this is not on the strategic agenda of the NTNU. At HiST, too, there is resistance, as some fear that the technological activities will become less practical and be harmful to the comparative advantage created by HiST. Getting the “university name” is also a matter of prestige. Currently, the mood is to develop stronger complementarities between the HEIs, rather than to realise a full merger. In any case, it is recognised at HiST that it will take some time before the research capacity is developed to the level needed to claim that university status.

The city authorities are involved in the co-location project. They see it as an opportunity to make the city into a creative and dynamic region, inspired by examples in Piemonte and elsewhere. Developments like the quality reform have also increased the need for new office space for the students at the NTNU and HiST. The first step will be to create what is called the “Innovation Village” close to SINTEF/NTNU to try to attract high-tech activities. The co-location project has met strong resistance among the academic personnel, and the NTNU board meeting in May 2006 concluded with suggesting a continued two-campus solution.

Our impression is that the two Trøndelag colleges, and in particular HiST, collaborate a lot more with the NTNU than they do with each other (most likely they partly compete for the same students; only the Master’s of Public Administration programme and some teacher training activities are carried out jointly by the two colleges). Many of the study programmes at HiST involve partnerships with NTNU, and the full professors at HiST all come from the university. There is an increasing need for master’s degrees and other specialisations for bachelor-level professionals (nurses, etc.), which is fundamentally the responsibility of the universities. However, the colleges increasingly take care of this themselves, but in collaboration with the universities. However, to date, collaboration between HiST and NTNU has concentrated on training and education activities rather than on research.

5.1.2. Conclusion: perspectives for structural interactions between HEIs and Trøndelag

All in all, and despite the existence of the above initiatives, which all point towards an enhanced regional role for HEIs, there is still a gap in the context in which HEIs, and in particular the NTNU, operate.

As argued in Chapter 4, this context is by and large determined by the national government and the rules of the Ministry of Research. Until now, only a few incentives are in place to promote regional involvement of universities. This is confirmed in the recent plan for the NTNU “NTNU 2020 International excellence” (the Hestnes II Committee report), which is a remarkable exercise to develop an integrated long term strategic plan for the university, jointly with SINTEF. It is obvious from reading this plan that the current development view of these major actors for Trøndelag does not include contribution to regional development as strategic issues. International excellence is the key driving force, and the co-location issue is seen in this perspective. Cooperation with the business community is part of the strategy, but the regional dimension of such cooperation is not mentioned in the strategic plan. The possibility of building up such linkages through the mediation of HiST is not mentioned either, since the university college is mostly seen as a partner in education rather than in research or business support activity.

Therefore, a challenge exists to integrate the above initiatives at the core of the HEIs' strategy. From the triad of changing visions of the time – globalisation, innovation and regionalisation – only the first two pillars are translated into development views.

5.2. Four local pathways of innovation-led growth

We shall now briefly discuss the prospects of the Trøndelag region in relation to the four local pathways of innovation-led growth identified in the Local Innovation System project (Lester 2005). The purpose of this taxonomy is to elaborate the many roles HEIs have in different regional development pathways, ranging from more radical to more incremental strategies.

5.2.1. Type I - Indigenous creation of new industry

This is about the emergence of an industry that has no technological antecedent in the regional economy – that is, it entails the local creation of an entirely new industry. This is the kind of process that tends to be associated with universities, even if market dynamics might also be at the root of such new industry creation. Knowledge, both codified and embedded in students and researchers, is seen as the driving force for such a development path.

In Trøndelag, the NTNU and SINTEF have been the sources of indigenous creation of new industry, but perhaps not as strongly as their potential might indicate. As discussed in the historical overview in Chapter 4, these research institutions have played a key role in supplying existing industries with new technology developments, but the intensity of their contribution to a renewal of the productive fabric in new activities is less clearly recorded.

Nevertheless, all the HEIs have lately become more active and have established infrastructures for the commercialisation of research results and ideas. As noted above, the NTNU especially makes a considerable effort with the establishment of its own NTNU Technology Transfer AS with 16 experienced entrepreneurs and trainees, and an on-campus incubator (Innovation Centre Gløshaugen). Building on a long tradition at the NTNU, we find the newly established Technology Transfer Office (TTO) as a new step forward, a promising endeavour. It will, in all likelihood, strengthen considerably the potential for indigenous creation of new industry. However, the whole constellation would benefit greatly if it were easier for the firms to locate themselves close to the NTNU and SINTEF. In NTNU's vision for *Innovation Village*, one idea is to set up a "research hotel" on campus as a low-threshold offer to companies. It is questionable if this will be a sufficient measure in the long run. In Trondheim, a lack of larger available industrial areas and also of office premises is a particular challenge. If indigenous creation of new firms is really to catch on, as hoped for, and if the NTNU and SINTEF continue to attract firms from elsewhere, lack of space may lead to a situation where emigration of R&D intensive companies to Oslo (or abroad) continues or the lack of land and space may prevent some firms locating in Trondheim.

Another important bottleneck might exist on the financial side, since one recurrent theme in our interviews referred to the lack of adequate sources of finance for new ventures. This would need to be given the utmost attention if such a path is followed.

Bottlenecks on the labour market are also likely to occur in such a scenario, since Mid-Norway is a small region, rather peripheral to the core urban areas of Norway and Europe. Therefore, despite the large presence of high-level of education institutions, it is not likely that the labour pool would be large enough to meet all needs of entirely new industries in a timely fashion. Thus, the region needs to co-evolve with the emerging industries.

5.2.2. Type II - Exogenous creation of new industry in the region

This type of process is about the development of an industry that is also new to the region, but in this case it is imported from elsewhere and hence represents a foreign-investment led industrial development.

Due to the high labour costs in Norway the creation of new industry based on foreign investment in the region may be possible mainly in the knowledge intensive sectors. Indeed, in the early 2000s there have already been positive developments in this respect. Google, Yahoo and General Electrics locating in Trøndelag because of the knowledge base provided by the NTNU and SINTEF is a promising sign. The ICT/search technology cluster is interesting in many ways, also because a key Norwegian company, Fast Search & Transfer, is practically a spin-off from the NTNU, but has Oslo as its main location. It retains a development unit in Trondheim, however, like Yahoo and Google. Trøndelag may want to decide whether attracting these important, yet relatively small, company units is good enough or if attracting larger industrial firms and facilities is the goal. If this is the case, different programmes and support structures are, most likely, needed.

If the present direction continues in Trøndelag, the plan to establish an Invest in Trøndelag agency with the specific task of attracting talents and companies to Trøndelag becomes necessary. However, Invest in Trøndelag is mainly oriented at marketing and branding rather than any other services. This may, therefore, prove insufficient and more hands on services for firms may also be needed. “Footlose” research and development units tend to cluster in science parks and other modern facilities close to university campuses.

The “Type II” strategy also has a lot of implications on many policy areas, since localisation criteria from foreign companies encompass a wide range of factors, such as the labour market, quality of life, presence of supporting infrastructures, regulatory and fiscal environment, etc. This would entail strong involvement of the national government, as all these matters are either entirely or predominantly under national control. Therefore the negotiating power of the region in national arenas may become a key success factor under such a strategy.

5.2.3. Type III - Diversification of existing industries into new ones

This refers to transitions in which an existing industry in a region goes into decline, but its core technologies are redeployed and provide the basis for the emergence of a related new industry.

Thought should be given here to the situation of the oil and gas industry, a major player in the economy of the region. The perspective of substitutes to this energy source might be an occasion to diversify the industrial structure into other sources of energy production. Ongoing experiences in hydrogen technology by Statoil and in wind power might pave the way towards such a diversification strategy.

Such a path would be well in line with the traditional role played by SINTEF and the NTNU towards the industrial leaders, supplying them with original technological development in order to support their evolution. Industry leaders would be the natural partners for the NTNU and SINTEF in a diversification strategy. The main bottleneck here may be the limited presence of knowledge-based industries, and thus the restricted basis on which to draw candidates for diversification.

5.2.4. Type IV - Upgrading of existing, mature industry

This type of transition entails the upgrading of an industry in a region through the infusion of new production technologies or the introduction of product or service enhancements.

In Trøndelag, 84 % of the enterprises have less than 5 employees and only few companies are internationally oriented. There are only few industry locomotives and little R&D-intensive industry. In addition, the international marketing and commercialisation competences of the firms in the region are mostly weak. In addition to measures supporting the Type I pathways, Trøndelag needs especially concerted measures to support the upgrading of existing firms. The Type IV strategy provides HiNT and HiST with a number of opportunities, but this would entail more cooperation and structuring of the service offer of the two university colleges, also in cooperation with the NTNU/SINTEF. Better co-ordinated and more systematic efforts are needed to serve the industries.

Of course, many measures according to the Type IV strategy are already taken; the metal industry collaborates with the NTNU and SINTEF, and in Verdal, Aker Verdal has been able not only to upgrade itself, but it has also built new activities around it in the form of an industrial village. In addition, research-based competence brokerage programmes have been in operation for 20 years (by the Research Council of Norway). In the current programme, MOBI (mobilization for R&D related innovation in SMEs) three researchers from SINTEF and the Nord-Trøndelag Research Institute have called on SMEs in the region to identify and describe R&D opportunities. Already 80 project proposals are identified and 40 projects started. The selected companies obtain project funding from the Research Council of Norway. Researchers from R&D institutes, as well as HEIs are engaged to assist the companies.

The Self-Evaluation Report notes that “the HEIs in the region have always cooperated with regional enterprises and public authorities in terms of teaching and research, often on an individual basis, but also under formal cooperation agreements.” The Norwegian HEIs have a general mandate to develop and disseminate knowledge to meet the needs of industry, public sector and society, and here HINT and HIST could take a stronger co-ordinating and organising responsibility in their respective counties and the NTNU and its departments would be able to provide regional development efforts with only substantial expertise if needed, and thus save time and energy for other endeavours not being engaged in administrating the regional development projects. This kind of arrangement might also strengthen the role of the University Colleges and the relationship between them and the NTNU, and further systematise their engagement with region. Therefore, the region should take advantage of HiST and HiNT as NTNU “channels” to the region and hence strengthen their role and allowing NTNU to focus on strengthening its role as a national and international player without abandoning the region around it. This possibility needs, however, to be put in line with each of the HEIs’ strategic goals.

The experience of the Oi! Cluster initiative at HiST, geared towards the introduction of new technologies in small companies in a traditional sector (food) may well provide a blueprint for initiatives that might nurture a Type IV strategy for Trøndelag in many traditional sectors of the industry and public service.

5.2.5. What is the most appropriate strategy for Trøndelag?

The choice between the above four types of development strategies for Trøndelag is today largely open, as they all have their drivers and constraints.

The creation of new research-based industries from the NTNU and SINTEF (Type I strategy) is already partly under way through the natural process of the creation of spin-offs and further supported by the various initiatives that have flourished in recent years. But it is still modest in size and the weak absorptive capacity of the region makes it doubtful that such a route could be sufficient to shape the future of the region. All in all, the NTNU and SINTEF have great embedded potential.

At the other extreme, the upgrading of existing traditional companies towards more knowledge-intensive activities (Type IV) seems to be consistent with the current development view of regional

colleges, and in particular that of HiST. Here again, attempts are still modest and it remains to be proved that adequate leverage effects on regional development could be obtained that way.

A foreign-led strategy (Type II) might also be relevant in view of the local actors' wishes to reinforce Trøndelag's attractiveness from an international perspective and in line with the co-location strategy. As discussed extensively in the next Chapter, the regional governance system is still weakly empowered to pursue such a strategy effectively and current branding strategies are only a (minor) part of the story of an effective foreign investment attraction policy.

Finally, a diversification strategy of type III is perhaps more dependent on private initiatives, but here again the couple NTNU/SINTEF can play a key role.

In all cases, it seems that the current division of labour within the HEI sector between, on the one hand, the NTNU/SINTEF and, on the other hand, the university colleges, is there to remain at least for a number of years, and the question posed here is, can Trøndelag and the HEIs afford to maintain the status quo for long? We address this question in our recommendations below.

None of the above alternatives offers an easy route or a magic recipe for successful regional development, and much will depend on the congruence of development plans amongst key actors in the region. This links us to the subject of the next chapter: capacity building for regional cooperation.

6. CAPACITY BUILDING FOR REGIONAL CO-OPERATION

Earlier chapters have described Trøndelag as it appeared to the review team in early 2006. Our analysis pointed towards a relatively weak identity for Trøndelag. The region has, however, recognised a need to move towards new policy regimes, where such concepts as knowledge city / creative region form the core, and where being a stronger region is seen as a precondition to counterbalance the current situation. To support this move, a more intensive interaction between industry, public sector and HEIs is sought for.

Institutions like the NTNU, SINTEF and, to lesser extent, university colleges, are now seen in a new light. Due to the changes in the dominant development view, policy makers are beginning to recognise them as a key asset in the efforts to build a regional knowledge economy. It may well be that the relocation of the units of international companies, such as General Electric, Yahoo and Google, to Trondheim made the local and regional authorities recognise the embedded potential of the NTNU/SINTEF. It became, therefore, more natural for them to start identifying how to promote such development and how to become more proactive.⁸

In this chapter we focus on three issues: a) regionalisation as an effort to increase the institutional capacity; b) strategy making as an effort to find new collective modes of action and new directions for more co-ordinated development action; and c) challenges of leadership and new coalition building.

As noted above, the NTNU is a key actor in the region and, in its own right, and in concert with SINTEF, it is the engine of the region. However, because of the NTNU's mainly international and national scope and orientation, it has traditionally been distanced from the regional development planning.

The NTNU leadership is positive about the city and county plans and initiatives: "at least they have entered the playing field". Thus far, it is difficult to say much about the final outcome or implementation of the plans, but the activities to promote Trondheim as a good place to be a student and as a good place to live, are welcomed by the NTNU leaders. It will be easier for the university to attract researchers, students, etc. when things like city branding, infrastructure, housing, child care, for example, are systematically and thoroughly taken care of. The NTNU would, however, like to see that the city and the region would take better advantage of the university, particularly in strategy making, and that the city development and campus development were regarded as linked, not as separate processes (as has been the case until recently).

As indicated in Chapter 5, the NTNU has also become more active in its efforts to reach out to the region. The question is not so much about the NTNU's willingness, or lack of it, to engage more with the region, but about the regions' poor absorptive capacity to reach into the university and utilise its unique capabilities. In the past, this has not, perhaps, caused any major difficulties. The universities and SINTEF have provided highly-skilled people with jobs, attracted students and also more mature talents to the region from all over Norway and beyond, and hence the region, and especially the city, is distinctively characterised as a strong science and educational city.

8. It is worth noting that these investments were not the result of government initiatives. The city administrators read about the Google move in the newspaper.

6.1. City of Trondheim

The City of Trondheim appears to be somewhat passive in its local economic development policy. There appears to be insufficient strategic understanding on the business development in the city region and the city's possible roles in promoting it. Inactivity may be due to the fact that there has been no real reason for more proactive local economic development policy. Unemployment is low and the city has a strong educational and research base. It is evident that the City, County and many other actors have taken the NTNU, SINTEF and university colleges for granted and they have not aimed to reach into the HEIs.

In the promotion of local economic development, the City of Trondheim restricts its inputs – with limited interest – mainly to infrastructure building. The development of strategic deliberations on the role of the City in regional economic development is not only needed in order to have a more focused local economic development strategy, but also to send a strategic message to the other stakeholders about what kind of efforts the City is engaged in, and what kinds of activities it is not so actively involved in. At the moment, the City's commitment and role remain ambiguous.

If the situation has not been a source for much concern in the past, it is changing with the current economic tide. However, the situation is quite paradoxical. In our opinion, the region has only recently awakened to the existence of the knowledge economy, which has already been in place for some time thanks to the NTNU and SINTEF. Gradually, the two worlds are starting to come closer to each other, but the gap between them is still visible. The problem has been that, in contrast to the science and education base, the regional governance system is relatively weak and has not been able to provide the HEIs with credible partners that would provide not only encouragement, but also invest money, time and expertise. The situation has been recognised, and regionalisation and collective strategy making can be seen as main ways to find more power behind new efforts in the region by the regional authorities.

6.2. Regionalisation

Norway is a geographically vast and sparsely-populated country with a harsh climate. It is also distant from the main European population centres and other international markets. The spatial development patterns have been affected by the historical advantages offered by the natural resources (fishing grounds, sub-sea oil fields, water falls making local sources of energy, mines, etc.)

As Mariussen and Fraas (2004, p. 18) have noted, the peculiar geography has modified, and in many regions, prevented, the development of a “natural” regional centre structure. They question whether this kind of lack of a “natural” regional centre throws the idea of the “region” into doubt in Norway and, further, whether Norway actually **has** regions at all, or whether the country just consists of a collection of localities, towns, and minor cities, interconnected through a complex, far-reaching, and expensive transportation system.

In spite of the challenges, regionalisation is a trend in Norway and it is part of the spirit of the times. The aim of the Norwegian Government is to develop larger regions by 2010. It is anticipated that the Mid-Norway region is likely to emerge, based upon some form of identity with Trøndelag. In a way, all this represents efforts to reverse the prior trend that has been based on placing responsibilities with national bodies. It also seems that, due to European and global policy trends and developments, the Norwegian regions themselves have become more active. Many counties have considered co-operation with other regions and, as already referred to above, Sør-Trøndelag and Nord-Trøndelag are also aiming for more intensive co-operation, if not a merger. In addition, counties are in a search of new, more active roles in regional development and the aim clearly is to gain more strength in regional development efforts. The progress in the merger or more intensive co-operation between the two Trøndelag counties has been relatively slow. Resistance from other actors in the region has significantly delayed the process.

The new approach is challenging. Firstly, the identification with the old regions is stronger than the identification with counties, and also local identities are stronger and surpass those of the counties (Bukve, 2005, p. 125). Secondly, state agencies and programmes dominate thinking concerning both local and regional development and promotion of innovation, and the development of HEIs' role in these. The PRT gained an impression that basically nothing happens in the region without state intervention. Even in the cases that were clearly initiated by local actors, they were introduced as parts of state policies.

Not knowing all the regional governance nuances it is difficult to assess if the merger of two very different counties is the right way to find more regional power behind new development efforts. The "right" size of a region is also an issue, as we noted in Chapter 3, even a region formed of the two counties would still probably be of a sub-critical size in a European context. It may well be that the struggle to merge the two counties will prove to be such a time and energy consuming effort that more substantial matters will remain in the background while the political elite focuses on administrative issues. Should this happen, a lot of valuable time spent on the merger process will have been lost. What is clear, however, is that if the region, *i.e.* its key actors, wants to benefit more from HEIs, better co-ordination between the main parties is needed. Furthermore, a greater effort is necessary to engage the firms in these processes as well.

To sum up, in terms of regional development, the Counties' main emphasis is on a) the creation of a new region, b) the launch of a new dialogue (two counties and the city) and c) the building up of the image of the region. In the image building, HEIs form the core. One might argue that one part of the region building is to create a stronger region both to counterbalance the influence of the state and to become a stronger partner for the HEIs.

6.3. Creative Trøndelag – a new strategy?

“Regional authorities look upon the HEIs as important instruments for regional innovation. This is reflected in the Regional Development Plan and the subsequent follow-up activities. The Nord-Trøndelag County specifically integrates the university college in the development and implementation of its county development plans. The public policy and support system recognises the need to strengthen internal coordination to obtain better results in the region and make Trøndelag more visible nationally.” (Self-Evaluation Report)

Even though the development processes have their national, regional and local characteristics, at a general level the nature of transformation from industrial to knowledge economy shows many similarities in different parts of the world. Globalisation seems also to lead towards a convergence of development strategies. A few years ago, learning regions were popping up in different parts of the Europe. In the early 2000s, policy makers throughout the world aim, at least in their main speeches and development documents, to attract a "creative class" by enhancing tolerance and developing cultural services (see Florida 2002).

In these respects Trøndelag is with hundreds, if not thousands of regions all over the world aiming to become the most creative of them all. At the moment, it seems that the global competition between regions for firms and competent individuals will not be won by having the best strategy, but by having the best implementation capacity. In this respect, Trøndelag still has a long way to go.

As an element of new regional identity and capacity building a new Regional Development Plan has also been formulated. The plan has been developed jointly between the Sør- and Nord-Trøndelag counties and the City of Trondheim. The plan represents not only a new strategy, but a new planning philosophy and a more interactive planning process. As the PRT was reminded by several interviewees, the new plan is "not for saying what cannot be done, but where the opportunities lie and what should be done".

Box 6.1. Regional Development Plan 2005-2008 – Creative Trøndelag: where everything is always possible

In the Self-Evaluation Report the plan is introduced as follows:

- The Regional Development Plan is the first *formal* joint regional development plan across county borders in Norway.
- The Trøndelag plan highlights six areas where regional partnerships and actions are encouraged. These are 1) Prioritise wealth creation and innovation, 2) Coordinate research and education policy, 3) Better utilisation of Food from Trøndelag, 4) Prioritise energy for the future, 5) Developing the infrastructure, 6) Promoting Trøndelag as a good place to live.

Source: SER

The “Creative Trøndelag” plan is constructed in the spirit of Richard Florida’s ideas on the creative class and the role talents and tolerance play in the development of technology and city regions. Hence, the plan is a part of the worldwide “creativity flood” dominant in city development during the last few years. Many city regions have changed according to the new development lines drawing on regional innovation systems, creativity, clusters, etc., and most importantly many policy-makers have found new food for thought. However, in practice, the new economic development policies in the city regions range from pure rhetorical gimmicks to dynamic action. Quite often it is difficult to distinguish these two extremes from each other. It remains to be seen in which category “Creative Trøndelag” will fall.

Hence, the content of Creative Trøndelag is not particularly novel in the international context and not perhaps even in the Sør-Trøndelag context. In a way, it recognises the current situation, the strengths of the city-region and makes it more visible and known than earlier. The evidence from other countries – Finland, for example – shows that creative city thinking is hard to operationalise, and policy discourses easily become some kind of chase for buzzwords, with policy makers aiming to show how dynamic their region is. The Creative Trøndelag plan also represents an optimistic policy approach that may even turn against itself if not concretised skilfully. If it remains hollow rhetoric, the representatives of HEIs and other relevant actors may not be interested in participating in implementing it, and if this happens the plan ends up being one paper among a pile of forgotten policy documents. The plan lacks strategic focus; it contains the ingredients, but not the recipe for the future.

One of the main aims in the Plan is to attract “competent people” to and retain them in Trondheim. The region is already attractive to students, but it is less successful in retaining people such as the NTNU graduates. The idea is to create a better environment in Trøndelag with more job opportunities. All in all, Trondheim has relatively good preconditions for attracting competent people. It is among the most popular university locations in Norway – according to many, the best – and the atmosphere towards maintaining this position is very positive. Many interesting developments to further strengthen Trondheim’s and Trøndelag’s position as a “Student Town no. 1” are in full activity or developed.

The two counties in Trøndelag and the City of Trondheim invited the HEIs to cooperate in the formulation of the regional development plan. According to our interviews, this is basically the first time when HEIs have had some kind of role in regional development planning. However, the PRT saw that the HEIs’ role still remains limited to few administrative persons while the academic heartland of the HEIs has not been mobilised. Sustained and solid partnerships for region building are still to emerge. As the planning has been mainly in the hands of the counties and the City, and HEIs and industries have been less involved in the planning process, there is a need to open up the process more. *It is necessary that in the*

near future, the firms and the HEIs should be better integrated not only in the implementation, but also in the strategic discussions on the substantial issues.

The new Regional Development Plan may be a good start in enhancing strategic dialogue between the key actors. For the time being, the planning process is too public sector dominated and the region building oriented to achieve the goals presented in it. Having said that, we also recognise the potential of the plan to become one of the integrating elements and to emerge later as an important political venue for interactions. If this is to happen, the Plan should be seen not only as a plan to be implemented, but as a continuous learning process that provides the region with a cross-sectoral platform to discuss both joint and organisation specific issues, and hence learn from and about each other. This is a precondition for better collective strategic awareness that is often a precondition for collective action.

To summarise the assessment of the Creative Trøndelag plan *we recommend that it and/or related processes are seen as many-sided tools having at least following functions:*

- A strategic plan in which a vision, strategies and adequate measures are presented in order to channel and direct the use of resources. To be functional in the development networks, vision and strategies should be communicable, challenging and appealing.
 - The Regional Development Plan may represent the first step in this direction. There is, however, a need to enforce its visionary power.
- The programme is a legitimate forum for cooperation.
 - The current Regional Development Plan is a legitimate and respected forum only for the two counties and the City. Other actors, especially HEIs and firms, should be more extensively engaged in the process.
- The programme is a way of making sense together, to learn common language and new concepts, to create shared lines of action and thought patterns, and a way of seeing the development and the role of various actors in it, or in other words, to link the spirit of the times to the development views.
 - The Creative Trøndelag plan may represent a first step towards a significant collective learning process. So far, it is has been embraced only by few organisations, and even in their case deeper engagement would be helpful.
- The programme is a means of communication, that is, messages from one group of actors to another group.
 - If developed in a positive direction, Creative Trøndelag may give clear and cohesive guidance to the region's HEIs and industry as to how their regional environment will be developed in the future, and what their position will be. This will happen only if the HEIs and industry have a seat and voice in the process.

High hopes are held for the new Regional Development Plan, Creative Trøndelag. It may represent a new start in more collective strategic deliberations. In addition to discussing what should be done in the region, each of the key organisations should also position themselves more clearly in the regional governance system, not only in terms of the official governance system, but also the informal development processes. Translating such broad vision into operational development requires the full involvement and commitment of all key stakeholders.

6.4. Challenges of joint strategic awareness and co-ordinated action

Raising awareness of a given issue or situation has been identified in regional development studies as one of the key tasks for people responsible for economic development. A major challenge is to draw attention to regional development and then deflect it to the questions and issues that need to be faced. For this purpose, there should be a proper context for the action and a story line that gives meaning to various connected and disconnected measures. Actors need to comprehend the purpose of regional development measures and also the activities of the HEIs. This should focus on the meaning of the new action, and thus various partners need to be actively involved in the sense-making process. This is not the case in Trøndelag. Earlier initiatives have been bottom up and/or have been based on personal relationships between individuals. Now the region is in the process of moving into an institutionalisation phase where the aim is to have many individual efforts pulled together. This requires co-ordinated action and shared strategic awareness.

In Trøndelag there are relatively few interpretive spaces; shared arenas where the key stakeholders can deliberate upon how to develop the region and how to work out the main joint strategies and the roles of the various organisations are in this puzzle. There is a lack of co-ordination and mutual engagement. The Regional Development Plan emerges as one of the few arenas that might develop towards collective interpretive space. *A top-level platform for dialogue is needed so that the leaders of the HEIs, the business world, regional representatives of the state, the counties and the City are able to deepen their informal relationships and launch a series of joint strategic deliberations. In addition, cluster/sector based working groups could be put to work to deepen and concretise the good ideas presented so far for the region. These working groups should be based on the three-partite principle. Here, the groups of the Chamber of Commerce could form the basis.*

In Trøndelag, the strategic awareness of the current situation, the challenges ahead and future visions are shared only at a very general level. Under the surface, the views of the key actors dissipate and reveal the lack of proper strategic discussion. When strategic awareness is good, the opportunity for flexible and fast decision-making opens up. Collective strategic awareness directs individual decisions and measures towards more strategic action without an excessive regional governance system. If there is insufficient strategic awareness, it becomes necessary to engage in time consuming fundamental strategic discussions over every single issue. In this respect, Trøndelag is somewhere in between these two simplified extremes.

The PRT recommends that more attention should be devoted to the construction of a collective strategic awareness. It is one of the key elements both in ensuring strategic focus, and the density and integration of emerging networks.

Box 6.2. Technoport – a technology festival / a way to increase strategic awareness in the region

Trondheim claims to be the technology capital of Norway. When celebrating the centennial of Norway's independence, Trondheim chose to emphasise technology in a historical and future perspective. The technology festival "Technoport" in October 2005 was the result of close cooperation between the city of Trondheim, NTNU/SINTEF, the counties, major regional industry companies and Innovation Norway. The exhibitions, conferences and workshops addressed four important areas in regional development: ICT, Health and Information technology, Innovation, and Energy, Oil and Gas. Technoport also served as a place for networking.

The festival encouraged people from trade and industry, research and development environments, customers, and investors to meet and build new relations. With 15 000 visitors this first year, the festival turned out to be a success and is intended to become a biannual event.

Source: SER

In the efforts to promote regional development one way or another, it is important to create a sense of urgency, an atmosphere that makes people move now rather than some time in the future. Quite often the formulation of a vision or a new strategic plan, or a good economic situation, provides a false sense of security. In Trøndelag, there is none of the sense of urgency, or impetus that can be found in a crisis, great opportunities, or strong regional leadership and the like.

One way forward could be to involve regional and local media more actively in the many prevailing development processes to make the public aware of the regional development objectives, strategies and projects and, most importantly, to provide many groups with opportunities to participate in an ongoing conversation and, hence, also in the continuous shaping of the development strategies.

Effective promotion of regional development requires the ability of the policy network to influence policies across a broad range of sectors and that is usually dependent on the degree to which the key individuals and organisations can claim themselves to be spokesmen for the network. A certain degree of concentration of representative authority is needed. It seems evident that in the many efforts to boost regional economic development and strengthen the role of HEIs, there is a lack of collaboration and co-ordination. There is some evidence that, in spite of a search for more co-ordinated development efforts, Trøndelag lacks a tradition of collective performances and most of the actors usually focus on their own projects only. For example, in his study on local economic development in Trondheim, Bruun (2002) found a clear distrust of the idea of working collectively.

There have been some earlier efforts to launch planning processes integrating key stakeholders in outlining strategies how to promote local economic development in the city-region, and engage various organisations into more collective efforts. It seems, however, that many of these efforts have faded away as a result of the lack of committing mechanisms; the collective planning and development processes have become more of a discussion club for academia, business, and the public sector (Bruun, 2002). The discussion in this Chapter raises some issues to be considered in the region to prevent current processes ending up having the same fate as their predecessors. It also seems that the relationship between the city and the counties has further complicated the question of who should take the policy initiator role. Without any doubt, this has been the case so far.

At least implicitly, a distrust of the idea of working collectively can still be detected in Trondheim. There are some problems of co-ordination between the two counties, the Sør-Trøndelag County and the City of Trondheim, and also between the TTO and Len. However, none of the interviewees in Trondheim was satisfied with the present model of pluralism and distributed solutions. At least implicitly, and in many of the interviews also explicitly, there was a wish for more focus and co-ordination. There seemed to be a lack of wider understanding on how different organisations and sectors can actually cross-fertilise each other and hence create new paths for the future. Basically, there is no evidence of proper collective cross-sectoral policy platforms where these issues could be debated, new identities and modes of action designed.

Quite often in new development arenas, especially in small countries and regions, one of the strongest mobilising forces has been the coalitions of the key actors of the respective regions. The role and activities of coalitions have been important in the mobilisation of resources, people and in the creation of mutual empowerment. Often these development coalitions create many of the new initiatives in informal forums and legitimise them in the formal forums. In Trøndelag, there is no powerful development coalition; instead there are disconnected sub-coalitions for individual projects.

The low level of joint strategic awareness and lack of development coalitions may result from the fact repeated here several times: there are no immediate problems in the region and neither there are such shared dreams, ambitions and visions that would integrate various activities better. The lack of institutional powers conferred to local and regional actors in Norway is also a barrier for more proactive moves from the regional level. The dreams, such as an NTNU/HiST merger, are controversial and not shared. All in all the, *the capabilities and skills of the key actors of Trøndelag should be continuously developed in order for them to be able to see different things as “stakes” in the promotion of regional development and to utilise them in cooperation with other actors.*

6.5. National influences on the building up of a “knowledge region”: tensions between innovation and regional policy

Throughout this report we have implicitly discussed the relationship between the regional policy and innovation policy. The government of Norway and also its regions have explicitly aimed to become more active in the field of innovation. At the same time, Norway has a long tradition in regional policy. The explicit objective to promote balanced regional development is deeply rooted in Norwegian society. We argue that, currently, there is a tension between these two policies at national level, which hamper the achievement of their goals at regional level. Innovation Norway seems to be first and foremost an instrument for regional development policy, and therefore concentrates its action in rural areas, while innovation projects span across all types of territories.

Traditionally, the regional policy in Norway has been conceived as an “assisted district” policy. This view of regional policy is based on solidarity and uses transfer of wealth revenues from richer to poorer parts of the country. The policy uses a classification of zones to define the degree of needs of some districts for this solidarity. It also has an important infrastructural orientation. This approach is at odds with a knowledge-based development policy for a region, in which the target is to focus on growth poles and build networks and linkages trying to incorporate large shares of the economy in a positive dynamic. Innovation is to be promoted based on capabilities and specific assets, but it is difficult to capture this in strict district definitions and dangerous to conceive such a policy in an endogenous mode.

The conflict between the two approaches became obvious throughout the review visit: regional policy dominates innovation policy. In other words, “spatial redistribution” is a stronger guide than “knowledge exploitation” for the implementation of innovation policy. This can be explained by the lack of sense of urgency to develop into a knowledge-based society, as argued before, and it therefore takes time for innovation policy to establish itself while other goals have a much stronger standing and a deeper-rooted integration in policy-making.

If Norway and its regions including Trøndelag want to become major players in the knowledge economy, one must ask if Norway really can afford to target innovation funding mainly to those areas where institutional capacity is low and the capabilities of the actors not so well-developed.

The PRT recommends that there could be two innovation funding categories: The first one would be targeted at players aiming to reach the top internationally and nationally, and here the funding decisions should be based purely on competition between the best ideas and not on the location. So, in the first category the overall objective is to support Norway’s goal to reach the top internationally in what comes to innovation and related fields. The second category would be territorially focused. Its overall objective would be to increase competitiveness and innovativeness of those counties and/or localities that are left behind because the location and conditions set constraints to innovation activity. The most important goal should not be to “assist” these actors with money transfer, but to help them connect to the most dynamic clusters and areas in the country.

Experience from using the European Structural Funds in innovation promotion has shown that it is often counter-productive to limit such support to strictly defined geographic areas: the new directions set up at the EU level now allow for much more flexible definition of the beneficiaries. This allows, for example, support for projects or networks that span “assisted” and central areas.

7. REGIONAL DEVELOPMENT AND HEIS IN TRØNDELAG: CONCLUSIONS AND RECOMMENDATIONS

7.1. General observations

Trøndelag, like Norway in general, faces a major challenge to develop sources of growth and value-added other than the resource-based oil and fishing industries, which have amply contributed to its wealth along the past century and still do. This success and the current excellent socio-economic performance of the country have, until recently, overshadowed the need for more knowledge-based development. Nurturing new, knowledge-based industries and services, is without doubt one ingredient of sustaining wealth and employment prospects in Trøndelag. This underlines the need for a sustained and broadened innovation dynamic within the region.

The challenge has been recognised by key actors located in the region, but the weak status of Trøndelag as a region and the absence of a strong regional governance system have until now prevented the definition of a genuine collective vision for the future for regional development. A fragmented regional innovation system, the existence of parallel “worlds” and the mismatch between the spirit of the times and development goals of these actors, act as a hindrance towards a coordinated strategic move towards regional development in Trøndelag.

In terms of HEIs, the dual picture is being reinforced by the recent changes at national level. On the one hand, universities are taking care of national and international excellence, and, on the other hand, university colleges are looking after the local needs. The system of incentives from the national level is not sufficiently conducive to the integration of all HEIs into regional development strategies: besides the fact that international and academic excellence goals for universities have been reinforced, innovation policy is still dominated by regional policy, conceived as a redistributive policy rather than as a knowledge building policy. At regional level, positive moves are being taken towards the development of cooperation between HEIs and local authorities and among HEIs, and several signs show that commercialisation strategies from HEIs are likely to impact on their regional engagement.

Clearly, times are changing in Trøndelag.

The spirit in Trøndelag is positive and forward-looking, and, as far as we can see, the HEIs' engagement with the region is moving in the right direction. Tensions and resistance are present, but the dominant atmosphere is towards constructive efforts and future-oriented initiatives. The system is, step by step, becoming stronger, HEIs are reaching out to the region, and the city and the counties also seem more willing to play an active role than earlier. Regional actors realise, that “they have closer connections than they thought”. Of course, many of the new initiatives that follow these changes in perception are still modest and fragile. In a period of flux, it is natural that some will fail, but hopefully more will succeed. Local buzz has increased and we have not been able to cover all the relevant activities in this report. Many schemes and initiatives worth mentioning have not been dealt with. We have aimed to provide our external view on the overall situation, analyse the emerging system and raise issues for future considerations.

In this Chapter we summarise the main conclusions and also present our recommendations from the various Chapters.

7.2. The role of higher education institutes in Trøndelag

As has become obvious throughout this report, the NTNU and SINTEF dominate the scene in Trøndelag in several ways. Their scope is both national and international.

The Peer Review Team recommends that the NTNU and SINTEF, in close cooperation with each other, continue to build their international and national role and reputation with the view of achieving international excellence. The aim should be to enhance the role of the NTNU and SINTEF as important regional hubs in international and national knowledge networks in order to mobilise their potential in the research and education not only for the benefit of the wider circles, but for Trøndelag too. We believe that it is the correct strategy not only for the NTNU and SINTEF, but also for Norway and Trøndelag.

At the NTNU, there has been, and continues to be, resistance in the technological research community against directing too much attention to regional industry at the sacrifice of national industry. The main argument is that the NTNU does not have the capacity to engage in industrial development in all Norwegian regions. It must give priority to research collaboration with knowledge intensive industry and the larger industrial locomotives. Engagements that take attention away from international quality development will, in the longer run, weaken both the university and the cooperating institution SINTEF as a national and international research institute. This is a relevant argument that must be taken into account. However, the PRT notes that the alleged precedence of academic excellence and international quality over regional engagement is a simplistic distinction. While we endorse this idea, we also want to point out that Trøndelag is quite a special case among the OECD regions. Relative to the size of the city and regional economy, higher education and research is much more than a sector among many, it literally dominates the scene.

Academic excellence and regional engagement can be, and in many regions are, complementary activities with the one reinforcing the other. In Trøndelag, this is not achieved easily. The main problem is that there are not many firms or other organisations that are at the same level as the NTNU and SINTEF in the country, and *a fortiori* in Trøndelag. We are aware of all the cases across OECD regions where a world class university or its departments gain an international profile by acting in concert with regional actors. We encourage HEIs in Trøndelag to move towards this direction too, and our recommendations are aimed at supporting this kind of development. However, we also see that a world class university needs sophisticated industry around it to make all this happen, and vice versa – world class industry is usually not so interested in local universities, if they are not at the same level as it is. In Trøndelag, one of the main issues is how HEIs can aid SMEs and other organisations to upgrade their skills and to rise to the next level, and here the question is about division of labour between the three HEIs.

All in all, a communication gap between parties is visible and bridging over it requires very subtle understanding on the processes, thinking patterns and future aspirations on both sides of the gulf (see the arguments of the two “worlds” in Chapter 3). Otherwise there is a danger of constructing overly mechanistic structures that do not serve the needs for which they are created. Of course, the NTNU and SINTEF are already engaged in several regional partnerships and for the NTNU, regional engagement is particularly relevant in certain research fields (*e.g.* medicine) and for student projects in the private and public sectors. However, the NTNU and SINTEF are assets that are too important for the region not to be better utilised.

The Peer Review Team recommends that more consideration is given by NTNU/SINTEF strategies to regional interactions, provided that these do not harm their national and international connections. The follow-up of the regional roles of, e.g. TTO and the Centre of Entrepreneurship, is part of this focus.

University colleges are distinctively educational institutions. Research has earlier been almost non-existent, but research activity is also gradually increasing, especially at HiST and, to a lesser extent, at HiNT. University colleges have not designed any special units or any other sophisticated mechanisms to engage better with the region, but the need to develop them is clear. The prospect of establishing more structural interlinkages is also growing.

Clearly, HiNT is an important institution for Nord-Trøndelag; it has close ties with the county administration. One might even ask if the relationship is too close and prevents HiNT taking one of important role HEIs often have, namely acting as a critical counterforce. HiNT clearly has begun to upgrade its capabilities for research too.

The Peer Review Team recommends that both HiST and HiNT continue their efforts to upgrade their capabilities and focus on applied research and consultative project with both public and private partners.

In the National Budget Proposition for 2006, the Ministry of Education sees a need for further differentiation between HEIs. The universities are “to participate in social and business development by means of research cooperation, technology transfer and innovation”, and the university colleges are to “cooperate with regional working life to develop an educational provision that matches the competence that is required in the region” and “cooperate with regional actors in innovation, R&D and development work”. This statement may provide the three HEIs in Trøndelag with a general navigation point for proceeding in both their co-operation and their regional engagement. Thanks to its intellectual leadership in the region, the active participation of the NTNU is necessary in the regional partnerships.

The Peer Review Team recommends that the NTNU, in collaboration with its partners, continues to develop its key role in the strategic planning for economic development of the region. We further recommend that the NTNU continues its efforts to be a source of entrepreneurship, inventions and innovations.

7.3. Development trajectories for the future

As discussed in the report, there are several options open to Trøndelag for its development trajectory. Each option necessitates the involvement of the HEIs and local authorities. The choice of options, but more importantly, the translation of visions into concrete actions, implies a reinforced dialogue and strong commitment from all regional actors. In the following, we summarise the roles of the Trøndelag HEIs from four different perspectives: (1) provision of adequate human resources; (2) adding to the stock of knowledge that can be transformed into wealth; (3) providing research-based services to industry; and (4) providing a public space for regional dialogue.

7.3.1. Educating people

Given the size of the region, Trøndelag has a strong educational capacity. The main challenge in the future is to maintain this position and to continue to attract students from all over Norway and abroad. This is a shared interest for the City, the counties and the HEIs. This challenge has also been identified and will be tackled in the new regional development plan.

Another related challenge is to retain more NTNU graduates in the region. In essence, more jobs for highly-skilled people are needed. This emphasises the need to create proper conditions for the firms moving to Trøndelag because of the NTNU and SINTEF, and for the local start-ups. However, thanks to its strong national role, it is only natural that many of the NTNU graduates leave for other parts of Norway to work. Through the mobilisation of its extensive alumni network, the NTNU's role as a regional hub in the national and international networks could be enhanced.

7.3.2. Adding to the stock of codified knowledge

Adding to the stock of codified knowledge refers to publications in the technical literature, patents, and software and hardware prototypes (Lester, 2005). The NTNU and SINTEF and, to lesser extent, the university colleges, are an important base for many kinds of research-based outputs.

The Peer Review Team strongly recommends the HEIs continue their efforts to raise both the quantity and quality of their patents, publications, prototypes, technology licensing, etc. Those efforts are supported by national incentives.

7.3.3. Problem-solving for industry and public sector

For many firms the main reason for seeking contact with a university or a university college is to enlist university researchers in problem-solving activities directly related to their primary business (Santoro and Chakrabarti, 2001.) Here, the direct impact on the company's bottom line is usually the main goal of interaction. Problem-solving usually includes contract research, cooperative research, faculty consulting, providing access to specialised instrumentation and equipment, and also incubation services (Lester, 2005).

In this category, the NTNU and SINTEF provide the region with a solid source for problem-solving services. So far, the region, its firms and other organisations, have not been able to utilise these opportunities as well as could be hoped for because the absorptive capacity of the region has been low. All the HEIs are developing their outreach activities and hence they are making themselves more available. The most important, but not the only mechanism linking HEIs to the industries, is the project works of students. It may well be that a more systematic mechanism to link the HEIs to the region is needed. It is clear that depending on the industrial trajectories of the region, HEIs can play several roles. Here we recommend that HEIs strengthen their role in the economic development in the region using their complementary assets. The cooperation between the NTNU, HiST and HiNT is still at an early stage. There are some examples of good collaborative practices between the three institutions, but these seem to arise more in *ad hoc* projects of common interest than as a result of any systematically developed mechanisms.

The Peer Review Team recommends that the NTNU and SINTEF are directly connected to the region in the issues where their scientific and educational expertise is needed. HiST and HiNT, through their close contacts with local companies, could help establish such connections and translate their latent demand into relevant questions for the NTNU / SINTEF too. There are many ways to achieve this, but what is important is the recognition of a need to establish an easy access for companies to develop support services, making full use of resources at the university and the university colleges.

Trøndelag lacks an industrial liaison office, an important function that is frequently found elsewhere. Traditionally, the NTNU/SINTEF cluster has been preoccupied with "science push" activities. Many of the current initiatives are, however, focused on "demand pull". For example, the TTO is now taking a wider role than simply transferring technology. Innovation Mid-Norway is acting like a network broker and the IdeaPortal is trying to offer companies a web-based access point to the HEI activities (albeit teaching/students only).

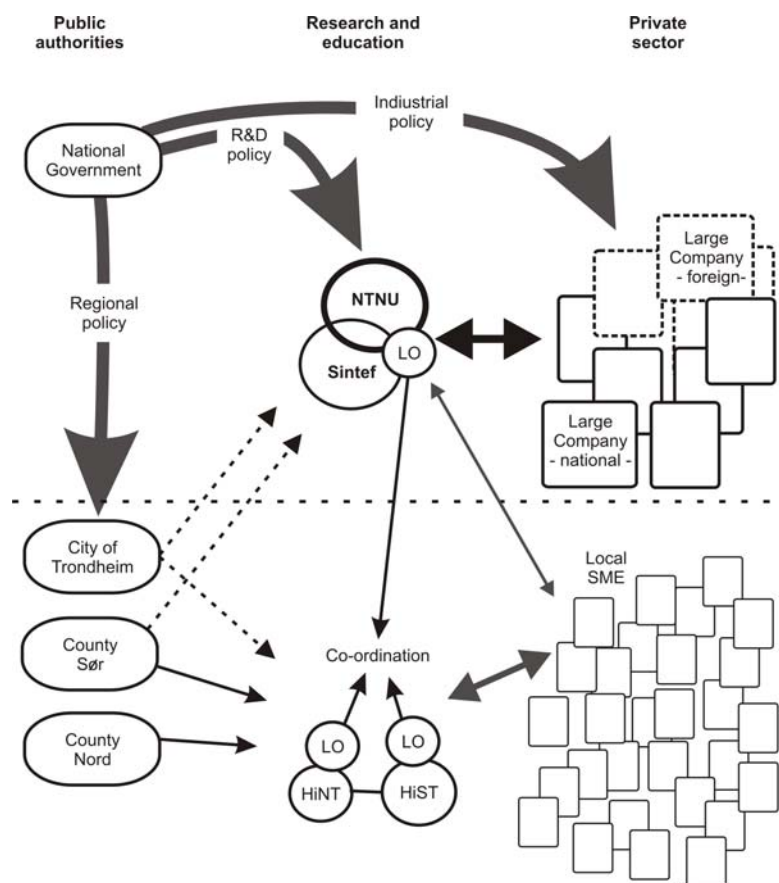
Easy access to the research and knowledge base of the HEIs could take the form of a one-stop-shop. Experience elsewhere in Europe shows that this does not necessarily have to be the preferred option. It requires a level of mutual knowledge, trust and an alignment of goals between HEIs that might not yet be present in the region today. The first-stop-shop model, implying cooperation, but not integration between service providers, and referrals from one to the other, is often a good solution too. While know-how and

various services are provided by the NTNU, SINTEF and the university colleges, it is obvious that for many regional actors the “route in” to these services is not clear. There is, thus, scope for developing the role of the HEIs further to the benefit of the regional economy. For this purpose, *the Peer Review Team recommends that the region consider two options:*

- a) The establishment of separate but cooperating liaison offices (the first-stop-shop model):

The PRT recommends that each HEI sets up a service unit with a formal industrial liaison function. Another option is to develop the TTO, and/or Innovation Mid-Norway more formally into a single office. The liaison functions of the three HEIs should be co-ordinated so that they complement, rather than compete with each other. Incentives should be provided for this cooperation to ensure proper referral of clients from one office to another and the development of possible joint services. The key to success would be to ensure the demand-driven character of the services. Despite the usual name of “industrial” liaison office, the offices would need to be receptive to demands from any kind of company and also from service, cultural and other sectors.

Figure 7.1. The innovation system in Trøndelag with three new liaison offices / LO = liaison office (option A)

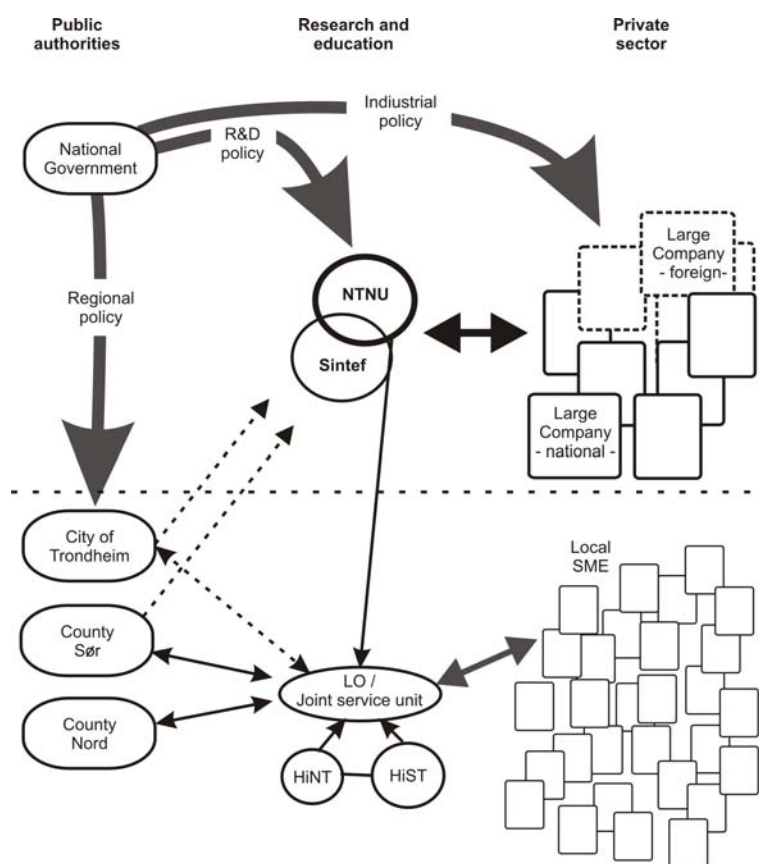


- b) The establishment of a joint unit (the one-stop-shop option)

Another option is to establish a joint industrial liaison office for the NTNU, HiST and HiNT in order to systematise their regional engagement. The shop would have a matchmaking, co-ordination and quality assurance role and would provide a visible single access point to the

resource base of the three HEIs. This could also serve as a medium to channel expertise from Sør-Trøndelag to more rural northern parts of the region. In addition, it might be a way to leave enough space for the NTNU and SINTEF to build their national and international reputation, but also be engaged in projects where their expertise is needed on a case by case basis. It requires a high degree of mutual knowledge and trust between the HEIs, some delegation of missions to this new unit, and the solving of competition issues. The following issues would need particular attention: the institutional set up of the office (closer to the colleges as in the picture below, closer to the NTNU/SINTEF, or completely independent); funding modalities; competence profile of staff, etc.

Figure 7.2. The innovation system in Trøndelag with a new joint service unit of HiST and HiNT / LO = liaison office (option B)



7.3.4. Providing public space

Education is often identified as the HEIs’ most important contribution to society. Another important, but relatively invisible and indirect role is to serve as a public space for ongoing local conversations about the future direction of technologies and markets (Lester, 2005). So, one very important, but often neglected role for the HEIs is to provide their partners, and entire regions and nations with “public interpretive spaces”.

Some of the interpretive public spaces may focus on particular industries, others may be more general, including university-hosted meetings and conferences, standard-setting forums, forums for potential investors, business plan contests, industrial liaison programs, alumni networking activities, and visiting

committees and curriculum development committees involving local industry practitioners (Lester, 2005.) The HEIs in Trøndelag have provided the region with some industry specific spaces of this kind.

The Peer Review Team recommends that the HEIs should more systematically take a lead, or at least participate, in the future horizons opening general conversations and in designing a series of interpretive spaces for more explorative conversations. They are often the soil where more pragmatic and short-term problem-solving oriented partnerships grow. In this respect, the ongoing RIS project might present a good opportunity, to which it is important that the HEIs are firmly associated.

7.4. Summary of recommendations

People in Trøndelag seem content with they way things are at the moment. There appear to be no challenging visions to drive change. However, the region may have the potential for much more growth and a more significant role in Norway: Trondheim might become the second largest city in Norway and major international hub through knowledge-based expansion during the next 2 to 3 decades. We believe that the potential for extensive development is there, evidenced by the endogenous growth of high technology companies combined with increasing foreign investments and some companies moving to Trondheim.

Making these visions materialise would require a different kind of collective strategic capacity for implementation, better co-ordinated co-operation between the HEIs, and a set of support mechanisms, such as industrial liaison offices, a science park, and a further elaboration of the plan for city development (space for industry, office space etc.). In this perspective, the problem is not the lack of a “crisis” to move the development regime into a new trajectory, but the lack of a “grander” vision for the future.

7.4.1. General policy recommendations

The Peer Review Team recommends

- That the Government of Norway critically assesses the relationship between regional policy and innovation policy and, if possible, releases innovation policy to some extent from its territorial chains.
- That the public sector, the HEIs and industry become more closely integrated in the planning and implementation of regional development policies and strategies.
- That the leaders of the HEIs, the business world, regional representatives of the state, the counties and the City of Trondheim deepen their informal relationships and engage in a series of joint strategic deliberations. We further recommend that joint development and regional innovation policy training sessions of the key organisations are arranged.
- That cluster/sector based working groups are set up to concretise the strategic goals of the region. The working groups should be based on the three-partite principle. Here, the groups of the Chamber of Commerce could form the basis.
- That the key stakeholders in Trøndelag design an explicit regional knowledge management system to provide up-to-date information about the state of affairs in the region and future prospects with the aim of:
 - Deepening the pool of commonly held knowledge (explicit and tacit) – the region would benefit from better organised basic data about employment, industries, the HEIs, population,

migration, etc. We further recommend setting up a regional database to support collective sense-making processes.

- Developing innovation capacity, not only in the science and technology arenas, but also in upgrading the existing industries and capabilities of regional authorities.
- That regional and local media become more involved in the development processes to make the public aware of the regional development objectives, strategies and projects and, most importantly, to provide different groups with opportunities to participate in open, ongoing and many-sided conversations and hence also in the continuous shaping of the development strategies.

7.4.2. Specific HEI oriented policy recommendations

The Peer Review Team recommends

- That the NTNU and SINTEF continue, in close cooperation with each other, to build their international and national role and reputation with the view of achieving international excellence.
- That the NTNU, in collaboration with its partners, continues to develop its key role in the strategic planning for economic development of the region.
- That the NTNU continues its efforts to be a source of entrepreneurship, inventions and innovations.
- That more consideration is given in NTNU/SINTEF strategies to regional engagement provided that this does not harm their national and international connections. The follow-up of the regional roles of the TTO and the Centre of Entrepreneurship is part of this focus.
- That the region considers two options:
 1. The establishment of separate, but cooperating liaison offices (the first-stop-shop model): see 7.3.3. a).
 2. The establishment of a joint unit (the one-stop-shop option): see 7.3.3. b)
- That the HEIs continue their efforts to raise both the quantity and quality of their patents, publications, prototypes, technology licensing, etc.
- That the NTNU and the City of Trondheim investigate the possibility of establishing a science park with both space to be rented or bought and all pertinent services of the TTO in the vicinity of the NTNU.
- That HiNT and HiST continue their efforts to upgrade their capabilities and focus on applied research and consultative projects with both public and private partners.
- That HiNT and HiST launch a joint staff upgrading programme including both problem-solving oriented research, and training. The NTNU and SINTEF ought to be involved in planning the programme and also providing their expertise in the industry-specific sub-programmes.

REFERENCES

- Aanstad, S., P. Koch and R. Kaloudis (2005), *Annual Innovation Policy Trends and Appraisal Report Norway 2004-2005*, European Commission, Enterprise Directorate-General, www.trendchart.org.
- Bruun, Henrik (2002), "Building Policy Networks: A Comparative Study of Public Attempts to Create, Coordinate, and Stimulate High Technology in Turku, Finland and Trondheim, Norway", in Sotarauta Markku and Henrik Bruun (eds.), *Nordic Perspectives on Process-Based Regional Development Policy*, Nordregio report 2002:3, pp. 157-184, Nordregio, Stockholm.
- Bukve, O. (2005), "Towards a New Regionalism in Norway", in Sagan, I. and H. Halkier (eds.) *Regionalism Contested: Institution, Society and Governance*, Urban and Regional Planning and Development Series, Ashgate, Aldershot, U.K.
- Clark, B. R. (1998), *Creating Entrepreneurial Universities: Organizational Pathways of Transformation*. Pergamon, Oxford.
- Etzkowitz, H., E. Schuler and M. Gulbrandsen (2000), "The Evolution of the Entrepreneurial University", in Jacob, M. and T. Hellström (eds.), *The Future of Knowledge Production in the Academy*, Society for Research into Higher Education & Open University Press, Buckingham, U.K., pp. 40-60.
- Gulbrandsen, M. and M. L. Ingvild. (2000) *Forholdet mellom næringslivet og UoH-sektoren – et krevende mangfold*, Rapport 7/2000, NIFU, Oslo.
- Gulbrandsen, M. (2003), *Jeg gjør jo ikke dette for å bli rik av det. Kommersialisering av nosk universitetsforskning - en intervjustudie*, Rapport 6/2003, NIFU STEP, Oslo.
- Gulbrandsen, M. and J.-C. Smeby (2005), "Industry Funding and University Professors' Research Performance", *Research Policy*, Vol. 34, No. 6, pp. 932-950.
- Gulbrandsen, M., R. Røste and T.E. Kristiansen, (2005), *Universitetenes og forskningsinstituttene rolle i kommersialisering: Delrapport 2 fra et Innovasjon 2010-prosjekt*, NTNU, Institutt for industriell økonomi og teknologiledelse, Senter for entreprenørskap, Trondheim, Norway.
- Gullowsen, J. (2000), *Bro mellom vitenskap og teknologi: SINTEF 1950-2000*, Tapir Forlag, Trondheim, Norway.
- Hanisch, T. J. and Even Lange (1985), *Vitenskap for industrien: NTH – En høyskole i utvikling gjennom 75 år*, Scandinavian University Press, Oslo.
- High Level Expert Group on Maximising the wider Benefits of Competitive Basic research at European Level (2005), *Frontier Research: the European Challenge*, European Commission, Brussels.
- Kvaal, S. (1997), *Janus med tre ansikter. Om organiseringen av den industrielt rettede forskningen i spennet mellom stat, vitenskap og industri i Norge, 1916-1956*, Doctoral dissertation, Trondheim, Norway.

- Lester, R. (2005), *Universities, Innovation, and the Competitiveness of Local Economies: A Summary Report from the Local Innovation Systems Project – Phase I*, MIT Industrial Performance Center Working Paper 05-010, Massachusetts Institute of Technology, Cambridge, MA.
- Mariussen, A. and M. Fraas (2004), *Development of the Entire Country: Regional and Innovation Policy Coordination in Norway*, Working paper of the MONIT project, Step Group, Oslo.
- Mid-Norway Steering Committee (2006), OECD Project on Supporting the Contribution of Higher Education Institutions to Regional Development: Final Self-Evaluation Report – Trøndelag Mid-Norway Region, www.oecd.org/dataoecd/16/15/36304405.pdf
- Moe, J. (1999), *På tidens skanser*, Tapir Forlag, Trondheim, Norway.
- Niiniluoto, I. (1989), *Informaatio, tieto ja yhteiskunta: filosofinen analyysi* [Information, Knowledge and Society: Philosophical Analysis], Valtion painatuskeskus, Helsinki.
- Santoro, M. and A. Chakrabarti (2001), Corporate Strategic Objectives for Establishing Relationships With University Research Centers, *IEEE Transactions on Engineering Management*, Vol. 48, No. 2, May, pp. 157-163.
- Sejersted, F. (1993), *Demokratisk kapitalisme*, Scandinavian University Press, Oslo.

APPENDIX 1. THE OECD REVIEW TEAM

Lead Evaluator

Markku Sotarauta, PhD, is a professor and director of the Research Unit for Urban and Regional Development Studies (Sente). He holds the Chair of Policy-making Theories and Practices at University of Tampere, Finland. Further work support and funding for the research group is gained through both academic research funding and through other outside contracts. In 2002 he received a nomination for the Docentship (adjunct professor) in Tampere University of Technology. Sotarauta specialises in strategic thinking, leadership, management (particularly the management of ambiguity) in promotion of regional and urban economic development. Currently, he has an interest especially in the invisible dynamics of the economic development processes in city-regions and their relationship to leadership (coevolutionary processes). He has published widely on these subjects in a range of books and journals as well as presented related papers. Sotarauta has consulted for the Finnish Parliament, many Finnish ministries, cities and regions, and other organisations, in economic development, strategic management, strategic planning, leadership in networks, competitiveness of regions, etc.

International Expert

Claire Nauwelaers is Research Director at UNU-MERIT, the University of Maastricht and United Nations University. She is in charge of one of the five research teams: “Governance of Science, Technology and Innovation». Her main areas of research and expertise revolve around the analysis and policy advice about the functioning of research and innovation systems, notably at the regional level. She is working on policy development, analysis and evaluation in the areas of Research, Technological Development and Innovation, for the European Commission, national and regional authorities. She is member of Scientific Steering Committees of several Research Networks, among which the European Techno-Economic Policy Support Network and is regularly invited as expert in High-Level Expert groups for the European Commission or Member States. She has published numerous books and articles on policy aspects of research, technology and innovation.

National Expert

Magnus Gulbrandsen is Senior Researcher at NIFU STEP, a research institute in Oslo with around 80 employees studying different aspects of innovation, research and education. Gulbrandsen's main areas of work are university-industry relations, the organisation and management of research work, and research and innovation policy. His most recent investigations concern academic patenting, technology transfer offices and the internationalisation of industrial R&D. Results from Gulbrandsen's projects have been published in Norwegian and international reports, books and journals like *Research Policy*, *Science & Public Policy* and *Journal of Technology Transfer*. His PhD is from the Norwegian University of Science and Technology, Department of Industrial Economics and Technology Management. Gulbrandsen has been Visiting Scholar at the State University of New York at Purchase and Guest Professor at the Copenhagen Business School, and he is now Chief Editor of VEST Journal for Science and Technology Studies.

Team Coordinator

Patrick Dubarle is a graduate from the French “Ecoles des Mines”, and holds a Master’s degree in Economics from the University of Paris Sorbonne. He joined the OECD in 1978 as Administrator in the Directorate for Science Technology and Industry notably on industrial structures issues and innovation policies. He is the author of documents on high tech policies and sectoral questions including OECD reports on space industry (trade related issues 1985), advanced materials (government policy and technological change 1990) and technology fusion (a path to innovation, the case of optoelectronics 1993). He was appointed Secretary of the Working Party on regional development policies in 1992, where he has been responsible for country regional policy reviews and horizontal programmes. He is now Principal Administrator at the OECD Public Governance and Territorial Development Directorate. He coordinated or contributed to several territorial reviews at the national level, published or on going (*e.g.* Canada, France, Hungary, Korea, Mexico, and Switzerland,) and at the regional level (*e.g.* Champagne Ardenne, Vienna/Bratislava, La Réunion, Oresund, Busan).

APPENDIX 2. REGIONAL COORDINATOR, REGIONAL STEERING COMMITTEE, AND THE AUTHORS OF THE REGIONAL SELF-EVALUATION REPORT

Regional steering group

- Ms. Merethe Storødegård, Regional Director Trøndelag, Confederation of Norwegian Business and Industry (*Chair*)
- Ms. Marit Schønberg, Chief County Education Officer, Nord-Trøndelag County Council.
- Mr. Milian Myraunet, Chief County Executive Officer, Sør-Trøndelag County Council
- Mr. Gerhard Dalen, City Director for Culture and Environment, City of Trondheim
- Mr. Per Ivar Maudal, University Director, Norwegian University of Science and Technology
- Mr. Ole Brønmo, Director, Sør-Trøndelag University College
- Ms. Torunn Austheim, Director, Nord-Trøndelag University College
- Mr. Bjørn Skjelstad, President, Norwegian Association of Local and Regional Authorities in Nord-Trøndelag.

Regional working group

- Mr. Bjørn Øyvind Engh, Adviser, Department of Regional Development, Sør-Trøndelag County Council,
- Mr. Svein J. Almli, Senior Adviser, Department of Regional Development, County Council of Nord-Trøndelag
- Ms. Anne Reinton, Adviser, Urban Development, City of Trondheim
- Ms. Ragnhild Nisja, Senior Adviser, External relations, Sør-Trøndelag University College
- Mr. Bjørn Kämpe, Research Coordinator, Nord-Trøndelag University College
- Mr. Rune Tranås, Adviser, Support unit for research and innovation, Norwegian University of Science and Technology,

Regional Coordinator and his assistant

- Mr. Peter S. Lykke, Deputy University Director, Norwegian University of Science and Technology
- Ms. Kristin Wergeland Brekke, Adviser at the Organizational Division, Norwegian University of Science and Technology

APPENDIX 3. PROGRAMME OF THE REVIEW VISIT

Sunday 12 February – Review Team Arrival in Trondheim

Monday 13 February – Regional Authorities, Public Support System

0900-1100	Regional Coordinator and Working Group	Preparatory meeting
1130-1330	City of Trondheim Lunch with Deputy Mayor Knut Fagerbakke City CEO Mr. Inge Noreide Gerhard Dalen, City Director (Culture, Environment) Project Innovation and Business development: Project mgr. Mr. Birger Elvestad and Adviser Mr. Dag Ove Johansen.	Regional Plan – the city's role Cooperation with HEIs Infrastructure and funding Culture and environment
1400-1530	Sør-Trøndelag County Mr. Tore Sandvik, County Mayor Mr. Milian Myraunet, Chief County Executive Officer Ms. Gleny Foslie, Regional Innovation Strategy project Mr. Bjørn Øyvind Engh, Dept. of Regional Development	Regional Plan – county role Cooperation with HEIs Regional development funding
1600-1800	Innovation Norway Manager: Ms. Vigdis Harsvik Norwegian Research Council Mr. Lars André Dale	HEIs and regional partners: opportunities and funding

Tuesday 14 February – NTNU, State Authorities, Public Support system

0830-0930	NTNU education Mr. Jens Maseng, Student NTNU Board member Drs. Julie Feilberg, Pro Rector (Education) Mr. Åge Søsveen, Education Division Chair Student Council (SC), Mr. Trond Håkon Andreassen Dep. chair SC (Ed) Ms. Uno Myklebust Halvorsen Ms. Line Hafsaahl Johansen (Idéportalen)	Institutional policy Regional opportunities
0940-1045	NTNU2020/HiST 2020 Professor Anne Grethe Hestnes (NTNU strategy) Mr. Arnulf Omdal, Dean Teacher and interpreter Education (HiST strategy) Mr. Inge Fottland (project manager) Ms. Lise Sagdahl (deputy project manager)	Campus Co-location project

1100-1200	NTNU research and innovation Drs. Astrid Læg Reid, Pro Rector (Research) Mr. Per Ivar Maudal, University Director Dr. Bjørn Hafskjold, Dean (Natural Sciences and technology) Mr. Jan-Morten Dyrstad, Dean (Social Sciences and Technology Mgt)	Institutional policy Regional opportunities Industry cooperation
1200-1400 <i>Working lunch</i>	Ministry of Education and Research Mr. Fredrik Dalen Tennøe, Adviser, Dept. of Higher Education Ministry of Regional Development Ms. Kari Mette Lullau, Senior Adviser, Dept. for Regional Policy	National policy. Funding and Incentives
1430-1530	NTNU TTO Inge Hovd Gangås Innovation Mid-Norway Project Mgr. Mr. Jan Onarheim	Commercialiation Technology transfer
1600-1700	LEN Mr. Malvin Villabø (CEO LEN and Såkorninvest Midt-Norge AS (Seed company)	Commercialisation funding
1700-1800	SIVA Terje Handeland, Deputy Director SIVA	Industry parks

Wednesday 15 February – HiST, External Stakeholders

0830-1030	HiST Mr. Ole Brønmo, Director Ms. Ragnhild Nisja, Adviser (external relations) Ms. Arnulf Omdal, Dean Teacher and Interpreter Education Ms Hilde Gade, Dean Food Science and Medical Technology Mr. Per Borgesen, Dean informatics and E-learning Mr. Andreas Bach, Chair Student Council Mr. Ove Gustafsson, Dean Trondheim Business School Ms. Gunnhild Oftedal, R&D coordinator/innovation Technology Mr. John Birger Stav, Associate professor ICT Technology	Institutional policy and regional opportunities: - education, research, innovation
1045-1130	Oi! Trøndersk mat og drikke Mr. Torgeir Salberg, Chair Board Ms. Marianne Østerlie, Senior lecturer Ms Hilde Gade, Dean Food Science and Medical Technology	Food sector
1200-1300	Mid-Norway Chamber of Commerce and Industry Ms. Gunn Kari Hygen (CEO)	Private Sector policy and contribution, Regional clusters involving HEIs
1300-1400	Kantega Dr. Jon Øyvind Eriksen, CEO	Spin-off company (ICT)
1400-1500	Statoil Innovation Bjørn Engdal	Offshore clustre
1500-1600	Voith Siemens Mr. Kjetil Toverud, CEO Mr. Arvid Bratli, Technical director	International Company (electro)
1630-1800	SINTEF (meeting cancelled)	Strategic partnership

	Dr. Tor Ulleberg, SINTEF Teknologi og samfunn	NTNU Regional opportunities Competence brokerage
1930 – 2130	Cultural Sector Kathrine Skretting, Dean, Faculty of Arts Atle Kjærviik (Science Centre)	Cultural sector development and HEIs

Thursday 16 February – HiNT, Regional Authority, External Stakeholders

0810-1016	Train to Steinkjer	
1030-1200	HiNT Mr. Ole Meier Kjekkol, Rector Ms. Sonja Ekker, Pro Rector Ms. Torunn Austheim, Director Mr. Knut Ingar Westeren, professor and Mr. Robin Munkvold, lecturer, Dept. of Social Sciences and Natural Resources Mr. Joar Nyborg, Project manager Ms. Anne Sigrud Haugset, Information Director Mr. Bjørn Kämpé, Research Coordinator	Institutional policy and regional opportunities: - education, research, innovation
1230-1400	Nord-Trøndelag County Mr. Einar Strøm, Cabinet of County Council Mr. Inge Fornes, Head of Dept. of Regional Development Mr. Svein J. Almli, Dept. of Regional Development	Regional Plan – county role Cooperation with HEIs Regional development funding
1400-1500	Nord-Trøndelag Power Utility Mr. Torbjørn Skjerve, CEO	Energy sector Contribution to regional development
1545-1730	Verdal Mr. Pål Hofstad, Director, Inpro Verdal Mr. Jan Selvig, project manager, Inpro Verdal Mr. Atle Dengerud, Aker Kværner Verdal, management team Mr. Bjarne Bjørnbakk, CEO, Vitec AS	Continuing education Industry incubator
1752- 1935	Train to Trondheim	

Friday 17 February – Academic Research, Review Team Internal Work, Wrap up session

0900-1200	Academic research Professor Sigmund Waagø, Centre for Entrepreneurship, NTNU Associate Professor Mr. Espen Gressetvold, Trondheim Business School, HiST Professor Per Morten Schiefloe, Dept. of Sociology, NTNU Professor Ola Svein Stugu, Dept of History NTNU	HEIs and external collaboration
1200- 1300	Lunch	
1300-1500	Review Team internal work	

1530-1700	<p>Regional Steering Committee, Working Group, Coordinator and Editor</p> <p>RSC:</p> <p>Ms. Merethe Storødegård, Chair, Confederation of Norwegian Business and Industry</p> <p>Mr. Bjørn Rasmus Skjelstad, Norwegian Association of Local and Regional Authorities</p> <p>Mr. Milian Myraunet, Sør-Trøndelag County</p> <p>Mr. Per Ivar Maudal, NTNU</p> <p>Ms. Torunn Austheim, HiNT</p> <p>Mr. Ole Brønmo, HiST</p> <p>RWG:</p> <p>Mr. Bjørn Engh, Sør-Trøndelag County</p> <p>Mr. Rune Tranås, NTNU</p> <p>Ms. Ragnhild Nisja, HiST</p> <p>Mr. Bjørn Kämpe, HiNT</p> <p>Ms. Kristin W. Brekke (SER Coordinator/Ed., NTNU)</p> <p>Mr. Peter S. Lykke, Regional Coordinator, NTNU</p>	<p>Review Team Preliminary observations.</p> <p>Plans for dissemination of Final Report</p>
-----------	--	---