:nirpa The Nordic Network for Research Policy Analysis

Nordic Network for International Research Policy Analyses

A Noria-net funded by NordForsk 2009-2011

Participating research funding agencies:
Danish Ministry of Science, Innovation and Higher Education
Academy of Finland
RANNIS, Iceland
Research Council Norway
Swedish Council for Working life and Social Research
Swedish Research Council

Preface

NIRPA was started in 2009 with the intention to study and understand contemporary international research policies. The intention was that NIRPA would assist the comparatively small Nordic countries to understand how other countries govern and fund their research to make efficient use of public money. It has certainly been a very interesting project where discussions with colleagues from other countries and within our Nordic group, continuously have presented new and changed views and interpretations.

Universities are old and conservative structures with strong traditions that have lasted for several hundred years. No doubt, universities have provided society with essential knowledge and showed the adequacy and potential to deal with change and senescence. But how will universities meet the new challenges from the 21st century, with expectations for a new and more demanding role? And research councils? What will be their major mission in the developing knowledge society?

During the project we have shared very stimulating and rewarding discussions within the NIRPA group. We especially appreciate the great work by Ellen Veie, Elisabeth Gulbrandsen and Per Koch (Research Council Norway) whose active authoring, editing and commenting of the report brought forward new and interesting aspects. Further, Leena Treuthardt (Academy of Finland) also contributed most significantly to the finalization of the report.

Professor James Wilsdon, SPRU, University of Sussex, shared and helped developing our thinking in a final seminar in Oslo December 2011. Dr Fredrik Melander, Nordic Council of Ministers, also gave valuable comments to the report.

Swedish Research Council
March 2012

Lars M Nilsson
Project leader

Jan Larsson
Coordinator

Contents

1. Introduction
2. Research policy – state of the art
   2.1 Searching for high efficiency, better productivity and focus on global challenges
   2.2 Riches from science for free? Will openness and transparency persist?
3. Looking ahead 2025. Globalization and its influence on Nordic research funding Systems
   3.1 Changing prerequisites for knowledge- production
   3.2 Changing role for Research Councils - Governance through dynamics?
   3.3 From strategic intelligence to policy learning?
4. Grand Challenges and a global perspective – expectations on research
5. Suggestion for Nordic Cooperation
6. Reflections and recommendations

Appendices
A. Stockholm Workshop
B. Oslo Workshop
C. Helsinki Workshop
D. NIRPA project participants

Executive Summary

The Nordic Network for International Research Policy Analyses (NIRPA) represents a joint two year project involving five Nordic research funding agencies. The objectives of the NIRPA initiative are (i) to enhance joint cooperation within Research Policy Analysis and (ii) to promote understanding of how globalization influences research (funding) systems in the Nordic countries in general. A possible outcome of NIRPA would be (iii) to form a (virtual) Nordic unit for Research Policy Intelligence. NIRPA is funded by the NordForsk Noria-net programme.

This report will focus on current research policies and governance, international trends, as well as the increasing search for efficiency, creating tensions with universities´ quest for autonomy. The project also dives into the future year 2025, by speculating in a future community and the role of research and education. Finally, the grand challenges and how to best address them are discussed.

There is a general and global trend in research policy to make research more efficient (process efficiency) and also more targeted (investment efficiency), explained by the fact that successful national research more and more is seen as a global competitive advantage.

Globalization fosters openness but builds upon the prerequisites that immaterial rights are globally respected. There is a risk that the general openness, that char-

acterizes research, will be questioned if national interests start claiming exclusive intellectual property rights to what have been achieved with taxpayers' money.

The term "research" is used for scientific activities of many different kinds. NIRPA recommends that different kind of research should be identified for its specific role and character. Research policies, on the other hand, should be formulated to better suit these different kinds of research (Science for Science, Science for Society and Science for Competitiveness). As a consequence, the criteria for quality of research should be redefined and diversified (rethinking excellence). The traditional intellectual merits that signify basic science should be combined with other merits, like broader impact, benefits for society, criteria relevant to specific objectives of certain programmes or promoting teaching and training.

Traditional faculty research universities are usually recognized by their collegial management and organic organization. While this organizational governance may be optimal for the "Science for Science" sector, the governance of the "Science for Society" and "Science for Competitiveness" might gain from being reorganized to enable focusing, concentration of resources and optimizing competence.

New missions for research funding agencies are successively introduced, largely as strategic tools in government research policy-making to promote renewal, risk, efficiency, focus, stakeholder and societal influences, etc. In parallel with this development, different quality based performance indicators are introduced in many countries for faculty grants (block grants), diluting the traditional mission (competitive project funding) of the research councils. With a quality based performance-driven faculty grant, other important missions than funding research in national competition, might be assigned to the research councils.

NIRPA considers an important future role for research councils to observe, analyze and understand national and international developments, and suggest new policies to create balance between autonomy and accountability (free and strategic research), as well as fostering excellence in different roles and from different perspectives (performing capacities, stimulating interactions, and outcome in systemic and international perspectives). Such a future role as an agency for adjustment and change would serve a very important purpose in their government advisory capacity as well as in any knowledge development system.

Finally, NIRPA concludes that the Nordic research councils should, either in a national or Nordic setting, provide a forum for international research policy intelligence, analysis, debate, and synthesis, not just internally, but openly in a broad audience of national and international experts, stakeholders and potential partners and competences. NIRPA considers such a mode of policy learning one of the most important missions of future research councils.

1. Introduction

The Nordic Network for International Research Policy Analysis (NIRPA) represents a joint two year project involving five research funding agencies in the Nordic countries (see appendix 1 for partners). Key objectives of the NIRPA initiative is (i) to enhance joint cooperation within Research Policy Analysis and (ii) to promote understanding of how globalization influences research (funding) systems in the Nordic countries in general. A possible outcome of NIRPA would be (iii) to form a (virtual) Nordic unit for Research Policy Intelligence. NIRPA is funded by the Nord-Forsk *Noria-net* programme.

This report reflects the outcome of three workshops organised by NIRPA. The first (Stockholm) focused on the understanding of globalization, on current research policies and governance, on international trends and on the increasing search for efficiency. The second (Oslo) dived into the year 2025, speculating in a future society and the role of research and education in addressing global challenges. The third workshop (Helsinki) dealt with grand challenges as seen from the perspectives of other continents: How does the research community best address and coordinate global system issues and what could be the role of the Nordic countries?

With “globalization” we mean a move towards a greater international openness, with increased opportunities on global markets for goods and services. This fosters companies acting on these markets, competing for the immense economic opportunities. A fair number of such companies come from the Nordic countries, like Nokia, Ericsson, Statoil International, Novozymes, etc.

Several of these companies are building their competitiveness on new advanced technologies and new knowledge, embedded as essential elements in their products or production systems. National research, knowledge and education will therefore be more in focus to support competitiveness in e.g. national companies acting on global markets.

Research is also expected to provide knowledge on new cultural and social aspects of societies in rapid and continuous change and provide guidance to the political system for poverty leverage, equality and democracy development as well as visions for the sustainable welfare society. Recently, the grand societal challenges are presented as important targets for the research community to engage with.

As indicated above, the term "research" is used for activities of many different kinds. It can be groups who use extremely advanced technology to explore unknown conditions in the living cell, or the completely theoretical thinking in so called pure mathematics. But it can also be projects that evaluate the effects and efficiency of different national social security systems, or developing an engine with a very low consumption of fuel. Not to forget the wide range of social behavioral sciences and the humanities as well. It is with regard to such incredibly diverse activities, known as "research", that the national policies are formulated.

In science policy, however, we do not yet find much variation in rhetoric and governance. The same type of follow-up studies, bibliometrics, evaluations, Centers of Excellence and productivity measures are becoming increasingly common features.

The policies are not only about increasing productivity in research. There is also a strong interest in focusing resources on areas of potential economic or strategic interest (picking the winners).

How can a country act to make the best out of research, contributing to the competitive advantage of its economy and welfare and simultaneously contribute to a sustainable development globally? This is what this report is about, providing impressions and reflections from strategies and thinking of major research funders, but also by experts on international R&D-developments. Further, the report presents impressions from a scenario workshop where we first are transferred to the year 2025 and then back-casting to our own time. We also get impressions from two rapidly developing countries, Brazil and South Africa, concerning how research is being regarded and used as a stepping stone for economic and social development.

The ideas of the three workshops were brought forward in a successful proposal to NordForsk, the funder of the project for a two-year period (2009-2011). Its mission is to provide impressions about international research policy development, that is, to give an orientation of what is going on outside the Nordic countries. It is also to develop methodology to study and analyse international research policy and to feed in results to the Nordic research agencies and ministries. Finally, it is to organise an international network of experts in research policy analysis.

2. Research Policy – state of the art

2.1 Searching for high efficiency, better productivity and focus on global challenges

There is a general and global trend in research policy to make research more efficient and also more targeted. This is explained by the fact that successful national research more and more is seen as a global competitive advantage. There is a tendency that politicians more and more analyze the outcome from the research sector, relevant to short and medium term societal needs. Further, policies for funding research seem to follow similar patterns in many countries without solid evidence of improved outcome.

The dawning new era of a knowledge-based society is also an expression of a new knowledge-intensive and more competitive global economic order. This order is characterised primarily by altered and varying patterns of collaborative interaction between academia, industry and national government agencies, each striving to best organise societal and economic returns from investments of public money. The pace of scientific progress continues to accelerate, hand in hand with continued growth in the quest for knowledge and innovation.

Scientific knowledge has become not only a commodity, but an increasingly important resource of strategic importance. Universities are not seldom considered as key actors in the economies of developed countries, because they host and disseminate science to industry and the wider society, together with the providing of qualified high-level learning. There is also a general science policy trend that emphasises the efficiency of the university sector due to dominant new values laid down from over-arching and cost-effective managerial ideals of *The New Public Management* (NPM).

But is it plausible to increase the efficiency and productivity in research to make more efficient use of the money spent? Most people will probably agree that it is quite possible. Accordingly, significant parts of any national research policy does focus upon normal administrative features, recognizable from any kind of work within the service sector (planning, management, organization, networking, budgeting, reporting, evaluating, etc). This is all about *how* research is carried out most efficiently.

However, national research policies also concern *what kind of* research is carried out. Much effort is used to determine interesting areas for research and concentrate resources, to allow end-user and stakeholder involvement, to make efficient use of results, etc. The selection of subject areas often involves stakeholders and other experts or even the public (cf the UK NCCPE, *National Coordinating Centre for Public Engagement* and the *Concordat: Concordat for Engaging the Public with Research* was developed by the UK's research funding bodies. The aim of the *Concordat* is to create a greater focus on and help embed public engagement with research across all disciplines in the higher education and research sectors. The same ambitions are found in the EU Science in Society programme).

Voices from the Stockholm Workshop:
Consequently, research funding agencies, more and more becoming the tool of the political hand, adopt strategies relevant to the political needs. Stefano Bertuzzi (NIH), Steven Hill (RCUK) and Jan Karel Koppen (NWO) all demonstrated programmes sufficiently targeted and concentrated to maximize an anticipated societal benefit within their area of responsibility (medicine, natural sciences, social sciences, etc) or as Stefano Bertuzzi (NIH) puts it:

> *The large budget increase in 2009 was a great public trust given science, being regarded as a major vehicle for recovery from the global economic crisis. To expect further budget increases from the tax-payers' money without good and evidence based arguments showing impact and efficient societal returns from R&D is absolutely out of question…. Funding is spread over a wide range, directed through programs for targeted research fields reflecting the societal needs (Alzheimer, ageing, cancer, heart vascular, etc). Knowledge production is not enough to mission the NIH. Improved health is the goal which also creates economic benefits to society.*

Jan Karel Koppen (NWO) maintains in the same direction:

> *The Netherland has fallen back slightly in the global peck-order. We now work with coordinated programmes. Several funding agencies participate to provide volume and width and make researchers from different environments cooperate. We have noticed the international competition for the best researchers. Further, we actively work with knowledge transfer to society to make immediate use of new knowledge. The NWO has a strong interface to other EU-countries and participate in 26 ERA-nets, a form for co-*

operation we believe in. We adjust our own funding profile to fit the EU with the intention to bring back a maximum amount of money.

Julia Lane (NSF) described the SciSIP-programme (Science of Science and Innovation Policy, www.scisip.nsf.gov), an activity which has attracted a lot of attention. The objective is partly to collect evidence on what research policy and funding policy is most efficient, partly to report and demonstrate the output and outcome from research funded by the NSF and NIH. This rather new interest has also inspired the development of STAR metrics (https://www.starmetrics.nih.gov) run by NSF and NIH, trying to demonstrate the importance and concrete outcome of basic research.

Besides these instruments of research funding, many research councils actively encourage and focus on the excellent individual and the creative environment (RCUK, NWO, Wellcome Trust, etc). This was also the focus of Sven Hemlin (Göteborg University), who brought forward the importance of the *creative conditions* of the research environment, like the encouragement of the individual researchers, the leadership, the motivation, the involvement, etc.

Although similar strategies were echoing at the workshop from some of the world's biggest research councils, describing the same focus on efficiency, targeted areas, and societal needs, Aant Elzinga gave voice to a conflicting opinion stemming from basic university values, arguing that the free and autonomous research is the one best serving the societal needs. Although he provided no solid evidence for this, history doubtless can point at many significant findings made by independent scientists. With the strong traditions of autonomy, many researchers feel uneasy about New Public Management and claim it not applicable to research. Further, universities are very old institutions with certain conservatism and unwillingness to adjust to modern, more managerial principles. However, the significant inflow of public money to research will probably maintain its own expectations for efficiency and usefulness.

A common trend among research funding agencies is, that resources for research in response mode are complemented with a larger and larger share for targeted or strategic purposes. Projecting into the future one may envision research councils more clearly developing into agencies for national policies while universities gradually strengthen their position as autonomous institutions with independent and council commissioned researchers side by side.

2.2 Riches from science for free? Will openness and transparency persist?

Globalization fosters openness but builds upon the prerequisites that immaterial rights are globally respected. There is a risk that the general openness, signifying research, will be questioned if national interests start claiming exclusive intellectual property rights to what have been achieved with taxpayers' money. We see a risk of partial restriction in openness depending on the growing expectations on research to provide competitive advantage.

It is apparent that a large number of countries trust the research community to supply the society with innovations to enhance social and economic development. How will this new attention affect the openness of research, thus regarding every

new finding a Global Good? Governments investing billions of public money in science will perhaps expect more exclusive rights to new knowledge in return?

With all these national expectations from research as a background, it is not surprising to hear Roger Greatrex and James Wilson bring forward the risk of "techno tribalism" and protectionism from the west as a response to possible new global attitudes to sharing data and results and respecting immaterial rights. Will e.g. China, climbing up to the leading five innovative countries of the world and representing a fifth of the world's economic market, adhere to the judicial institutions for patent rights and intellectual property rights? If not, will we then run a risk of restricting the openness of science and perhaps see the formation of global research spheres, like the European, the US, the Chinese, coordinated with major global economic spheres?

One problem related to these issues is that all research policy is mainly national to its character, missions and goals while science as an activity is truly international and cosmopolitan. Scientific knowledge is indeed still in our time being regarded as a global good, organized, kept and perpetually refined in common by scientists. Open knowledge access thus goes back to history, trustfully founded on the collective sharing while accompanied by individual responsibility for the up-holding of the scientific truth. Every tendency to restrict the free flow of knowledge or openness of science is loudly protested against by the science community. An example of this is the drive for open access to publications, put at stake by increasing prices.

Among the new-coming research nations we can observe strong state governance, when setting priorities and allocating investments for applied science and technological, innovative research. Here we find emphasis on immediate social and business returns and the applicability and usefulness of results. Science for society and social engineering is in many emerging nations (like for instance South-Africa, China, Brazil and India) being prioritized for the promotion of economic growth, health and social planning in order to defeat poverty, illiteracy, bad housing and burdens from diseases. We are not for the moment talking about cutting-edge, world leading and ground-breaking research, but rather to be catching up with western world research standards.

But when we look at the Chinese case, for instance, it was contended by Roger Greatrex that weak judicial institutions, lack of general social trust and the country being a dictatorship and an informer-society, makes it a risky business to share the immaterial riches from science in open access. Corrosive social mistrust and strong generic incentives for scientific fraud and the stealing of intellectual property, is hurdling innovation processes and economic and social capitalizing from science. Therefore, in the long run, we should not be convinced that riches from science emanating from, for instance, the US or EU investment in R&D and Innovation, will continue as a freely open intellectual asset to be used anyhow by anyone. An alternative development could be what Wilsdon describes as a western "techno-tribalism".

In a late issue of Nature (479:24 Nov 2011) Colin Macilwain relates a recent foresight by ICSU (John Marks) with two overriding forces after a serious nosedive by

science: (i) engagement with [the global] society and globalization and (ii) increased nationalism. In the foresight (20 yrs) four distinct scenarios were expected: (a) more globalization and high engagement [in global issues] with much more interdisciplinary research, (b) more globalization but low engagement, i.e. continuing disciplinary research targeted to the same society needs as at present, (c) more nationalism with high engagement from individual countries dealing with their own problems, and (d) more nationalism but less engagement, single discipline research on national relevance.

Every restriction in the openness of research would, of course, have more negative effects the smaller the country. The Nordic countries contribute with only a few percent to the world's scientific publications but can freely make use of the rest due to the open access. However, also with the scenario of "Global Research Spheres", knowledge development would probably suffer significantly due to duplication, less cooperation and restricted mobility.

It is difficult to see what counteraction could be taken to neutralize a misuse of property rights and in defense of the openness of science.

3. Looking ahead 2025. Globalization and its influence on Nordic research funding systems

The rational planning approach was up till now based on behavioral scientific knowledge-use for sectorial social engineering purposes (e.g. housing, health, environment and energy, infra-structure and food). There are, however, doubts about its effectiveness, because it is based on the tenets of relative stability and control over a relatively long period of time. Instead, foresight and scenarios are employed, using both analysis and imagination in a systematic way, when constructing a range of prospective, plausible or possible futures to contend with. Taking the Oslo workshop to the fore we will give room for some critical reflections derived from imagined snapshots from the year 2025.

A bearing assumption is that research has an important role to play in building competence for the advancement of the knowledge intensive society; as part of a broader policy initiative to promote learning and new forms of competitiveness in a post-industrial society. That should call for new future modes in research and policy, being transformative and cooperative in approach as well, and relevance-oriented and multi- and cross-disciplinary in scope.

Science policy as we know it in the Nordic countries these days, is displaying different identities. On the one hand, we employ "policy for science" policies seeking to satisfy the immediate interests of the research community "bottom-up". On the other hand science policy is about addressing industrial and societal needs in other policy sectors; "science for policy". Both approaches are well developed and established. Recently there has been a shift towards focusing on strategic research addressing grand societal challenges, where research-based knowledge is

expected to give a substantial contribution. “Science for society” is moving to the fore as the most debated motivation for supporting research in Norway, demanding new approaches to policymaking as well. This was stressed by the Norwegian state secretary, Dr *Kyrre Lekve*, when viewing the “knowledge triangle” at the NIRPA-workshop in Oslo.

3.1 Changing prerequisites for knowledge- production

Research in the knowledge intensive society 2025 is characterized by openness, inter-activeness and by being exuberantly inter-linking when searching for more experimental ways to produce societally robust and responsive knowledge, or “science for society”. The complex matter of addressing grand challenges by research asks for new forms of cooperation between different worlds.

One of the critical tasks for policy (makers) will be to foster the building of new partnerships between stakeholders. Societal challenges are challenges of public interest, so there is a government responsibility in searching for solutions. But the knowledge, expertise and mandate to address these challenges are spread throughout society. Societal challenges are collective challenges and therefore need a collaborative approach in order to achieve coordination, collaboration and coproduction – as signified by the figure of “murmuration”, presented by Riel Miller to the Oslo-workshop.

The discussions at the Oslo-workshop link up to a more general diagnosis concerning the decline of New Public Management regimes. In order to deal with societal challenges in knowledge intensive societies, the more traditional NPM-reflexes of the state - for instance by strong division between political decision-making and policy-execution, by separation of responsibilities and the ensuing emphasis on mechanism for audit and control – are getting less and less adequate. The growing complexity and dynamics of the knowledge intensive society point in the direction of a shift in policy towards more distributed, cross-sectorial and multi-actor cooperation.

The emergence of global civic awareness, through a growing number of bottom-up initiatives, is an example of such new processes. Internet based movements and organizations have brought the debate to the international or global level. Although it has its limitations, this trend is a response to the increasing importance of a new complexity concerning governance issues.

Another aspect is that scale matters. Small countries, like the Nordic, can impossibly be performing all scientific fields by excellence on cutting-edge. Sweden, for instance, stands for one per cent of the world´s research-volume, and might therefore also consider how to promote “winners” from the “second-best” of scholars, for national and local facilitation with existing knowledge for social and business innovational needs. Expected to have access to world-wide networks of science, they should be able to contribute to the transfer of existing science, and bridge the gap between perpetual needs for knowledge in society and transformative research from excellence. But it should be underlined: It does indeed also take expertise by the receiving parties to skillfully handle the transfer of knowledge.

3.2 Changing role for Research Councils - Governance through dynamics?

Research policy agents like EC and NordForsk are increasingly emphasizing the role of research, when addressing and solving global societal challenges. At the scenario workshop a majority of the participants expressed dissatisfaction with the current workings of research councils. Neither the more traditional role of research councils as secretariats for research devising "policy for science", nor the role developed in the 60s and 70s as knowledge managers; securing the fuelling of research results into other societal sectors, devising "science for policy", were seen as sufficient in dealing with present and future challenges.

Participants suggested that this might demand a changed role for research councils towards developing into *knowledge councils.* The following options were discussed:

- Research councils will develop to be **change agents**, shifting attention from research communities to society and important societal challenges.
- Their new performance will go along with **cultural agencies**, based on the understanding of the importance of local knowledge needs and contextualization of knowledge processes.
-Research councils need to interlock with other agencies and redirect the focus to fostering knowledge-production and learning instead of picking winners. Mobility between silos will be important.
-Cooperative and coordinating efforts on the Nordic level will be needed to address societally pressing issues.
-Nordic funding will be directed towards addressing grand and global challenges; basic research will be funded on a European level.

3.3 From strategic intelligence to policy learning?

In the Netherlands, UK and other countries like Norway, much effort has already been put into inviting 'society' to speak back to 'science', of experimenting with different types of stakeholder involvement in order to establish two-way dialogues and the productive interactions and learning between science and society. The re-thinking of stakeholder involvement that we now see e.g. in EC and UK, point out how the infamous 'deficit model' is simultaneously laid to rest and resurrected in these experiment. And the lesson learnt; there seems to be a continuing failure of scientific and policy institutions to place their own assumptions and science-policy institutional culture into the frame of dialogue, as a possible contributory element, that hinders a genuine two-way dialogue and the much sought for learning.

There seems to be a chronic underinvestment in *the learning infrastructure*; in methods and in the quality of learning both in the policy sectors as well as in research. We seldom discuss what we actually mean by learning. Does it entail asking ourselves whether we are doing things right (single loop learning), doing the right things (double loop), or inquiring *how we know* that we are doing the right things (triple loop)?

Triple loop learning allows us to pose questions concerning what does progress mean, as being seen, for instance, in the light of present environmental, developmental and financial crises. How should progress be measured or even evaluated these days? Looking back, there is still reason to raise criticism against so called

scientism and blind faith in science that goes along with the former social engineering rational and associated with predictive “technologies of hubris”.

Research in all fields of science delivers continuous knowledge and innovations which massively shape the ways in which we live in our societies. Research is increasingly involved in every aspect of our lives, *including* what is represented as grand challenges. Societal challenges can therefore be addressed as not only residing “out there”, but “in here” as well, as if research and innovation was in crises itself.

Triple loop learning implies exploring the validity of our own institutional taken-for-granted assumptions and routines taught as suspicious doubts and organized skepticism, through listening and responding to knowledge held by other stakeholders/partners. It involves learning new relationships and responsibilities in-between scientific disciplines, stakeholders and the ‘public’, business as well as politics.

More complex, dynamic and open understanding of the relations between science and society, asks for the development of new competencies and skills, both in the research system and in policy. The challenges are of an institutional as well as of an individual kind. Inviting other parties/publics to participate in ways, that make it interesting for them to stay involved and engaged, seems to be connected to the increased ability of the research system to open up, and recognize the limits and - connected to that – the possibilities of its knowledge reservoir.

4. Grand Challenges and a global perspective – expectations on research

The character of Grand Challenges raises the question whether we are looking for a technological fix or if a much deeper and system oriented approach is needed to change direction of our society aiming at sustainable solutions.

A third workshop was dedicated to the grand challenges of our time and the role of research to contribute to solutions. The workshop provided impressions from several parts of the world: Brazil, South Africa, the US and Europe. It was obvious that Brazil and South Africa had a partly different and challenging approach putting equity, poverty leverage and economic development much in focus. The challenges for US and Europe were more providing energy for the complex society, finding remedies for ageing populations and speeding up productivity of social and business innovation.

Interestingly, while the challenges to the welfare societies very much seem to lean on the trust in technological fixes, another opinion was brought forward by Riel Miller in the Norway foresight workshop. Miller strongly advocates that most grand challenges are the result of systemic malfunction and have to be dealt with holistically, by bringing together a serious of disciplines in cross-disciplinary programmes. Just defining these problems a “challenge” gives the impression, that

they can be describes as a “problem-solution” pair, and that a technological breakthrough is the solution. Miller maintains that we need more of “exuberant experimentation” to approach the solutions to many of the grand challenges.

5. Suggestions for Nordic cooperation

With a recent evaluation of NordForsk it is suggested that NordForsk should contribute by creating a Forum for Research Policy Debate for politicians, administrations, research funders and researchers. This project supports this suggestion and takes it further by adding the responsibility for an international network for research policy observation and analysis.

As a result from more strategic thinking by research funding agencies, policy intelligence and analysis have gained increased interest. The more research is regarded as a competitive resource, the more important it is to follow and understand what is going on in other countries. The timely decision by NordForsk to support NIRPA, has attracted attention by all research councils that were approached for cooperation. Thus, it seems that there is a growing need to observe, discuss and understand what is going on within research policy in different countries.

Within NIRPA it was discussed how a service like NIRPA best could be organized in the Nordic countries. We suggest that there are at least three different models:
1. Each Nordic country set up their own international policy analysis.
2. National policy analysis resources are coordinated by NordForsk providing resources for workshops, conferences and international networks.
3. NordForsk set up a group of people with competence in policy analysis with a responsibility to serve Nordic research councils, ministers and other interested parties. NordForsk also initiate and maintain an international network, arrange workshops and conferences open for international observations, analysis and strategic discussions.

6. Final Reflections and Recommendations

A strong ambition of NIRPA was to establish a wide network of people and organizations with knowledge in research policy. NIRPA is about business intelligence in research policy and research funding, collecting information and impressions and by analysis transforming it to usable knowledge to provide input for different Nordic research policy politics and strategies.

Reflections and recommendations below are the results of impressions, discussions and information exchange within NIRPA, its three workshops and international concluding final seminar. The observations show that there is a strong pressure on the university system to take on the role as knowledge and innovation engine, as well as a new role as a collaborating partner for the entire society.

However, we also conclude that the university system may not be organized optimally to take on its new challenges.

Professor James Wilsdon, SPRU, University of Sussex, who participated in the first workshop and in the final conclusive seminar in Oslo (Dec 2011), provided valuable input about the resilience in the university system. Also Dr Fredrik Melander, Nordic Council of Ministers, gave valuable input to the final seminar.

6.1 Increasing Societal Expectations

New knowledge is generally expected to contribute towards solving societal problems and challenges: Global threats, technological, economic and welfare development, societal and cultural situations. The NIRPA series of workshops stresses the very high and growing global political and societal expectations on research to deliver new knowledge to serve societal needs. Thus, research and education is widely regarded as the major actors in economic and societal development.

Innovation is the catch-word of today, hoping that innovations will foster economic development in a similar way as innovations did in the previous century. The "knowledge triangle"; research, education and innovation, is the new paradigm for maximizing output of innovations, providing global competitive advantages in different sectors.

Along these lines there is a parallel and growing search for efficiency in research and the research system. Instruments from the toolbox of New Public Management are applied to research with expectations of better targeted and organized research processes. How can we organize to reach important breakthroughs, finding the new, how do we best focus hot spots, and how do we best make use of new knowledge and transfer it to potential end users? And, how can cooperation minimize duplication?

In addition to providing global competitive advantages, science is supposed to help solving grand societal challenges by contributing towards turning grand challenges into opportunities; this endeavour is associated with developing science-in-society relationships. Some university representatives consider this invitation from leading policy-makers to be an opportunity of great urgency to engage and continue developing the relationships in-between science and society in an international setting.

With the increasing public investment in science there is a growing concern that money is spent in a good direction (investment efficiency) and used efficiently (process efficiency). Methods and manners to prioritize research, to manage research and to best evaluate research are more and more often in focus at international conferences.

One may however say that the people eagerly arguing for efficiency and focus are using a different conceptual discourse (language) than people from the research community. Representatives for the research community are often heard saying that the free creative process of research does not really fit into other modes of organizing work. It is a long-term process. The course of research is exploring

what is not known and consequently we do not know where it will land or what we will learn. How can you then know the cost or have a time-line? If a test of a hypothesis fails the first time, how do you know when you will be successful? Your findings may even take you in a direction you have not planned. How can you know that or even plan for it or have a budget for it? No matter how well research is managed, the planning is still only a minor part of the activity. Efficiency criteria in ultimate outcome measures cannot be used because they cannot be anticipated.

The same critique of NPM regimes is growing in policy circles these days, reflected in suggestions for new ways of working incorporating complexity, dynamics and wickedness. New figurations, like "the regime of collective experimentation" in a recent expert report *Taking European Knowledge Society Seriously* from the European Commission, illustrates this move.

Is it then really realistic to expect that universities and research can adapt to a changing world and fulfil all expectations? Or is there a mismatch between expectations and realistic possibilities?

In NIRPA we have argued that the conception of "research" contains many very different activities and roles in the production of new knowledge. Especially in the Nordic countries where the incidence of institutes is fairly low (except in Norway), universities are the home for all kinds of research, from the most theoretical basic research to commissioned research with high expectations on relevant knowledge.

You may schematically describe (*sensu* Norwegian State Secretary for Research, Dr Kyrre Lekve) the activities at a university:

Research for understanding <u>fundamental</u> principles	Research for specific economic/technologic relevance	Research for exploring societal challenges
Science for Science	*Science for Competitiveness*	*Science for Society*

Research in the three categories has quite different characters, networks and roles. In Science for Science the internal scientific dialogue dominates and networks are dominated by international peers. The research problem is often formulated by the individual researcher searching for solutions of scientific significance. Science for Competitiveness and Science for Society involve networks consisting of peers, stakeholders, funders and other interest groups. The research problem is often emanating from some societal needs. Albeit the strong difference, we tend to regard universities as homogeneous institutions.

<u>Recommendation:</u> NIRPA recommends that because of the great diversity in research, different kind of research should be identified for its specific role and research policies, on the other hand, should be formulated more to fit the different kinds of research (science for science, science for society and science for competitiveness).

Along these lines, the criteria for quality of research should be redefined and diversified in a broad and extended process of rethinking excellence. The traditional intellectual merits that signify the basic science have to be combined with other merits, like broader impact, benefits for society, criteria relevant to specific objectives of certain programmes or promoting teaching and training. General societal accountability, usage and impact may also be included, as may importance for education.

Recommendation: Reconsider criteria for quality in research. Make it more diverse to better serve different needs.

6.2 Under Pressure

There is a certain tension between the societal expectations on universities and the wish of universities to maintain traditional academic autonomy and freedom of research. Consequently, the research community finds more and more money coming with a tag asking for research deriving from societal needs.

Also the way of doing science and accumulating knowledge has changed. Michael Nielsen, in his book *Reinventing Discovery*, focuses on how cognitive tools enabled by the Internet accelerate scientific discovery and argues that Internet transforms the nature of our collective intelligence.

Further, many of the problems of today are of a new and different character and involve many traditional disciplines. Climate, energy, poverty and food security are all examples of challenges that are of a ”systemic” kind; they extend across established sectors, institutions, professions, expertise, publics and disciplines. They are also full of so-called wicked problems; problems that are difficult or impossible to solve because of incomplete, contradictory, and changing requirements often difficult to recognize. Moreover, because of complex interdependencies, the effort to solve one aspect of a wicked problem may reveal or create other problems. These grand challenges themselves as well as adequate solutions must therefore be identified in distributed processes and dialogues in-between different actors.

The complex matter of addressing grand challenges by research and innovation thus asks for new forms of cooperation between different worlds. Different actors (universities and other stakeholders) need to better understand the challenge of building capacity to work across the boundaries between societal actors, both organizational and individual, and between funding agencies, academic institutions, the ministries, different publics/concerned groups as well as in-between diverse cultural settings.

One may consider whether the organization at the universities is generally optimal for all the new functions universities are expected to fill. The collegial governance dates back hundreds of years and has certainly been successful. But is it actually generally relevant also now when new expectations and roles have been added to the universities?

Universities are also characterized by a very specific organizational context: The organization of a free university, where individual researchers decide on their research themselves, is normally *collegial and organic* and by definition not governed from the top. It is rather the effect of single or many individuals, successfully developing knowledge in individually chosen areas, individually attracting resources for expansion. Universities could be seen as franchise organizations offering individuals a brand (university name associated with strong values) as a platform for their work. In many universities of today, these individuals receive rather small resources centrally from the university. They have an economic independence vis-à-vis their employer, gained by external funding. Their scientific status in the organization is gained by assessments by peers and by their publications.

Organic organizations are typical and, perhaps, also optimal for free research but may be less typical and optimal for programmed, directed or commissioned research. Further, it is of course very unfamiliar for a university management to actively organize and focus research according to needs from society (i.e. grand challenges, societal needs, etc). Still, in many countries the majority of research is carried out within traditional university organizations. However, outside the Nordic region, significant other research systems also occur. An example is the specialized research institutes (with dedicated missions) that occur side by side with traditional universities; like the eighty six specialized German Max Planck institutes, the 21 US National Institutes of Health, and others. As a Nordic exception, Norway has developed a large and strong institute sector.

Of course one may ask whether organic organizations serve the purpose well to respond and deliver according to the new and growing expectations from governments and research funding agencies claiming more relevance driven research orientation. Our reflection from the NIRPA impressions is that they might be suboptimal. Of course there are several individual subject areas (within the traditional universities) organized optimally, and with established networks with end-users and stakeholders. But can a traditionally organized university be expected to respond by focusing, by directing resources, by concentrating staff, in the way necessary to respond to the rising and challenging global societal issues ahead?

Politically introduced programmes and strategies are responded to by individual researchers, but no pregnant systemic changes seem to occur. Traditional universities have a weak central leadership with insufficient free strategic resources. The majority of governmental resources (block grants, etc) are tied up in different internal necessities and commitments. All external resources belong to individual researchers who have applied and received resources for a specific project.

NIRPA believes that change is inevitable. However, while the organizational governance of the “Science for Science” sector may still be largely optimal, the governance of the “Science for Society” and “Science for Competitiveness” has to be reorganized. Winners will be the flexible ones, and those who are willing to adapt to new situations. In the universities for engineering sciences this flexible adaptation is continuously going on. NIRPA suggest that similar discussions ought to start also at the traditional research universities.

Scientific progress and excellence was for long normally a result from extraordinary achievements by individuals. Today, the importance of research teams challenging a mutual problem has grown significantly. Often the problem is of inter- and even trans-disciplinary character putting a pressure on the team to join many competences under a good leadership. These teams may also need to allow very basic research, hand in hand with applied research and end-user applications, thus providing very fruitful feedback loops as important success factors within the team-organization. Consequently, in many research sectors Mode 2 must be adopted in a much more efficient manner to make sure that results from research are co-developed with stakeholders.
With this logic, the linear model (Mode 1) would still be relevant within the category Science for Science.

Finally, NIRPA strongly believes that the unique and important role of the universities as institutions for current up to date *knowledge* is not scattered but rather maintained and developed further. Research is not to be seen as a quick-fix for short-term societal or economic problems but as an institution for independent research, analysis and intellectual considerations.

Recommendation: Identify the different kinds of research within modern Nordic universities and identify what signifies the distinction between different kinds of research. Discuss the relevance and possibility of organizing differently according to missions, but also how to strengthen the interactions between the different kinds. Discuss when and in what form stakeholders, the civil society and other parties ought to be involved.

6.3 Agents for Change

The research funding systems in the different Nordic countries are quite different. In Norway the Norwegian Research Council is mandated the funding of all kinds of research and development; basic, applied and commissioned as well as large programmes, infrastructure and centers of excellence. They receive their financial resources from 15 different ministries, with 15 different tags attached.

In Denmark, research is funded from five different individual bodies all with different missions. It is (i) the Danish National Research Foundation (Centres of Excellence), (ii) Danish Council for Independent Research (Basic Research), (iii) for Strategic Research, (iv) for Advanced Technology (Commercial potential, Technology transfer), and (v) for Technology and Innovation (Research and Innovation close to products).

In Finland there are two main funding agencies for competitive research funding. The Academy of Finland is funding cutting-edge scientific research. Tekes, the Finnish Funding Agency for Technology and Innovation, provides funding for research, development and innovation.

In Sweden there are Swedish Research Council (Basic and Strategic Research) and Vinnova (Agency for Innovation Systems) but also the two sectorial research councils FORMAS (Environment, Agricultural Sciences and Spatial Planning) and FAS (Working Life and Social Research).

The different solutions are probably resulting from detailed considerations about the mission and organization of the funding level ending up with different models. The two most radical funding systems are in Norway and Denmark. In Denmark we see a separation of responsibilities between five different bodies in comparison with Norway, who has these responsibilities in one and the same agency. Finland and Sweden are both in between. However, they all work with research performing systems which are basically the same: Universities with similar traditional organic organizations and collegial governance that offer weak management tools to focus, direct, collect resources and foster excellence to match the policies from research councils and governments.

Further, the old *raison d'être* for a research council, to fund research in national competition has gradually been complemented with other missions of funding. New missions are introduced as strategic tools in the government research policy: renewal, risk, efficiency, focus, stakeholder and societal influences, etc. Parallel with this development, different quality based performance systems are introduced in many countries for faculty grants (block grants), diluting the traditional mission of the research councils. With a quality based performance driven faculty grant, other important missions than funding research in national competition, might be assigned to the research councils. NIRPA has identified research policy discussions and considerations to be a vital and neglected such mission.

<u>Recommendations:</u>
NIRPA suggests that research councils should, either in a national or Nordic setting, provide a forum for international observations, analysis, debate, reflections, and synthesis, not just internally but openly in a broad audience of stakeholders and potential partners and competences. Triple loop learning in self-reflection will increase the ability to understand the consequences by different modes of action. The two-way communication between science and society is here an essential component that has to be integrated into an efficient and respected paradigm. NIRPA considers this mode of *policy learning* one of the most important missions of future research councils.

NIRPA has noticed that research policy is largely dominated by two dominating paradigms to foster excellence. One builds on the traditional view of the free university, allowing knowledge development to occur along its own path with as few directing tool as possible. The other builds on a belief in focusing, collective efforts, concentrating on certain challenges. In the second paradigm, relevance is very much present. We argue that both these paradigms are legitimate, but for different kinds of research. They have to be balanced and positioned in relation to each other. NIRPA suggests that research councils should be the home for continuous consideration of the balance between free and directed research looking at performance, interactions, and outcome in systemic and international perspectives. This future role as an agency for adjustment and change would serve a very important purpose in their government advisory capacity as well as in any knowledge development system.

NIRPA further recommends that when research councils introduce programmes, strategies or other funding opportunities besides the funding of investigator initi-

ated projects, these opportunities should be accurately specified and motivated in detail. The aims and ambitions of the funding opportunity should be stated, not only from a scientific perspective but also from an efficiency and societal perspective.

Appendices

A. The Stockholm Workshop 7-8 April 2010:
Globalization and Research Policy: Actors, Ambitions and Tools

B. The Oslo Workshop 1-2 December 2010:
The future of Nordic Science Policy: Back casting from a scenario 2025

C. The Helsinki Workshop 22-23 September 2011:
Research policies for grand challenges – strategies and tools

D. NIRPA project participants

A. The Stockholm Workshop 7-8 April 2010: Globalization and Research Policy. Actors, Ambitions and Tools

A.1 Summarizing: Global and Nordic Research Policy development
Prof Sverker Sörlin, Swedish Royal Engineering University, Stockholm

A.2 Introductory background

A.3 The concept
Dr Lars M Nilsson, Swedish Research Council

A.4 Globalization affecting politics and state governmental structures
Prof Christer Jönsson, Political Science University of Lund, Sweden

A.5 Globalization, New Public Management and traditional university values
Prof Aant Elzinga, University of Göteborg, Sweden

A.6 Emerging China. Impressions and reflections on major research policy developments
Prof Roger Greatrex, Centre for E & SE Asian Studies, Lund Univ., Sweden

A.7 Making research policies work: reflections on change in the European Research landscape
Prof James Wilsdon, Science Policy Centre, Royal Society, UK

A.8 Promoting scientific creativity: A research Council's UK perspective
Dr Steven Hill, Strategy Unit RCUK, UK

A.9 Science Policy, strategies and tools within the National Institutes of Health (NIH)
Dr Stefano Bertuzzi, Office of the Director, US NIH, USA

A.10 Strategies and tools within the NWO
Dr Jan Karel Koppen, Director, Policy, development and support, NWO

A.11 Creative research environments. A research group perspective
Dr Sven Hemlin, Dept of Psychology, University of Göteborg, Sweden

A.12 Why big is better
Prof Mathias Uhlén, Swedish Royal Engineering University, Stockholm

A.13 Metrics to underpin efficiency in science policy
Dr Julia Lane, US National Science Foundation, USA

A.1 Global and Nordic Research Policy Development

Professor Sverker Sörlin reflecting on the workshop:

Research policy-making in a multi polar world means that not only research systems are being affected to be re-shaped by globalization. It does also mean that performance, strategies and tools operated in traditional modes by research funding agencies no longer fit into the new era dominated by business competitive strives. This will bring systemic pressure on performers and funders of research to adapt to the new situation from ongoing change and transformation of faculty research into a strategic option. The changing economic world-order forces governments to mobilize national resources for national economic re-vitalization and competitiveness. One such competitive resource being tapped by governments is the power of science and results from scientific research and technological innovation.

Also the relationship between funders and performers of research is being affected. University change in the cultural meaning of organizations does not come easy, not even by governments trying to make them act more strategic. New prerequisites, demands or scenarios made by government or society, are not swiftly followed. It takes time to do away with the "dead flesh" in organizations carrying a heavy load. Universities are no exceptions.

Do we therefore have to reconsider the balance between basic and applied/innovational research? We usually refer to the three hump model for research performance: Universities doing basic science and acting upstream, while institutes are to be seen as relevance driven, and companies are managing development activities to be attractive "downstream". But along comes a challenging question: Should governments in the 21st century continue their role as a trustful investor in research on the same level like before, when the new era raises dawning questions on the size of public money to be spent by governments for scientific research, to whom and under what forms? We can indeed trace a steady increase in public investments in research since WWII, but this might now be followed by a period of steady-state, and new demands for evidence-based performance of R&D.

Also research funders might strive for more immediate impact from science investment when targeting i.e. Grand Challenges by developing different funding tools. However, the outcome from science, when taking on these challenges that are global in nature, cannot easily be measured and evaluated globally, beyond national borders. World-wide impact indicators seem to be hard to find.

Grand Challenges may also be looked upon from the eyes beholding the controversy between basic and applied science. When so, do we then touch upon the power over research, concerning what is to be funded? Research performers are being pushed back from its traditional power position when deciding on which research should be funded? One might say that they could feel themselves robbed of the instruments for making decisions on research investments and funding.

Current priority-settings also seem to give room for discussions on public engagement in science. Stakeholders and societal actors seem to get more and more involved in funding-agency activities and there seem to develop a new kind of alliances connecting universities and society claiming for accountability of researchers when responding to public demands and expectations. We have heard on such strives from the EU-Commission, The Netherlands and the US, for instance. Might be there is reason to suspect "market failure" in basic science, which could have made the investors in science more oriented towards investments in applied research.

What is the role of funding agencies if we are speaking about globally identified strategic research needs and priorities like the Grand Challenges? Do we face an era of creating national highly skilled arenas for competitive research performance? Funding agencies seems to be more and more featuring the characteristics ascribed to the model of Mode 2. If so, the performing universities have to reshape and reorganize themselves and also develop their capacity form new alliances for cooperation.

Indeed we do still have to keep in mind that research and science policies are first and foremost very nationalistic in frame. Maybe we could speak of a dilemma here: Research is on the one hand supposed to be internationally orientated, cutting-edge competitive and cooperatively striving for world leading excellence, but at the same time sharing its results in open access. But on the other, it is also considered as a strategic and competitive resource, bringing on knowledge into business advantages to industry, economic growth and industrial re-vitalization to nations, and thus returning value for tax-payers money to national society as a whole. The latter does even raise the question on how open the access should really be, if competitive strength at the same time is aimed to be gained from national investments in science and innovation for future knowledge advancements?

And accordingly we might ask: to what extent is national R&D policies focusing on nationally considered needs and strives for social and economic returns. We do not usually expect strategic research policy priorities to be formulated out of international considerations. Global challenges, for instance, might indeed generate advantages locally for investigator driven research to develop into excellence. We could only consider the excellence of the two Norwegian researchers, Arne Naess and Johan Galtung, who reached world-famous celebrity by performing bottom-up basic research in their different fields. Their success was, however, not due to the public launching of Grand Challenges according to some Mode 2 strategy.

Thus, if we are searching for advancement in science for science only, and not for society, there is absolutely a strong need to end nationalisms in research. Otherwise the differentiation of scientific work might not be enhanced, but rather to be duplicated by mainstreaming prioritizations, taken from a mutually close watch by all research nations, hoping for researchers to follow.

Thus, there might be a good point if we could take on more joint programming on the Nordic level by furtherance of more cooperative strategies among funding

agencies and other public research bodies. Or should each of the Nordic countries make their own way when acting strategic? The Nordic countries do have a lot in common and have successfully been cooperating in many research fields for a long time. That has also created a strong reservoir of mutual and general trust among the research councils, just like it has simplified ways in working together as well. That is for real a strong asset waiting for to be turned into new knowledge-advantages.

There are also many levels at which cooperative initiatives are taken internationally. But still we should map and monitor research areas where there are vast common needs for knowledge, or define the ones, where there is top quality competence at disposal in the Nordic countries for enhancement by cooperative efforts for added-value-reasons when creating Nordic strength by strong synergies.

A.2 Introductory background

This workshop is about research policy. Not creating research policy but studying it. Learning about it and understanding its rationales. Looking for the reasons behind activities, tools and ambitions. This is what this workshop is about: *Research policies, actors, ambitions and tools* and how it is best studied and understood.

It is apparent that more and more societal expectations are connected to research since the last decades. Research is no longer only supposed to create new basic knowledge to feed into university courses. It is more and more expected to create new knowledge that can readily be used in the societal development at large. It is supposed to promote innovations and provide breakthroughs in economically interesting areas, to underpin different societal sectors with new critical knowledge or to generally shape and profile the knowledge society giving national competitive advantages in significant areas.

No doubt, universities and researchers have always provided society with significant knowledge. However, while contributions previously was occasional and unexpected, it is at present more and more expected as regular and anticipated.

Consequently, increasing investments of public money in research tend to come with increasing expectations to generate more welfare for the society and provide support to the private sector on different international markets. In this intensive global development of the science sector, different countries, governments and research agencies use many different methods to maximise the outcome from research. This “audit” process focus both on the performance of individual researchers and teams but also on the function of the entire research system. How should agencies with different missions (free, strategic, applied research) be organized? Should they be kept specialized for different funding missions or merged into integrated units? And what can be done to make new knowledge reach the potential end-users as quickly as possible? Should stakeholders and civil societies or even the public be part of the discussion on scientific priorities and later at the lab bench?

All this is research policy. How politics try to maximize the outcome from the provided resources with different targets, different tags and different tools. This politics sometimes reveal unrealistic expectations or bring up conflicting interests.
The research community often advocate a certain academic freedom which sometimes is rapidly lost in the new and growing governance of research. It is not enough anymore just to publish in prestigious journals and getting cited often. Quite often you can hear politicians say "what's in it for the tax-payers?" Glauco Arbix, Brazil, Jan Karel Koppen, NWO, Stefano Bertuzzi, NIH). The question of course reveals the great divide in opinion on what research policies would be most efficient to generate expected outcome. Governance or freedom?

It is in this context this workshop, the first in a set of three, is being organized.

The Workshop

Day one, 7 April 2010:
Professor Pär Omling, Director General, Swedish Research Council opened the Workshop and spoke about the Nordic and European development with the establishment of European Research Council.

Dr Lars M Nilsson, NIRPA project leader, described the rationale and objectives of the NIRPA project and two graphic models describing different stages and actors but also funding mechanisms and tools in a generalized research funding system.

The day continued with two key notes:
A general overview (Professor Christer Jönsson, Lund University) of what we call globalization and how it differs from internationalisation. How will globalization affect our societies in general terms and in the way people, capital and production tend to move. Are there winners and losers? How will the political systems react? The smaller, highly-developed-country-scenario will be of interest.

Continuing with a perspective on research (Professor Aant Elzinga, Göteborg University), how conditions for research have changed and how research policies have developed gradually towards more management or governance. Are expectations on research well-grounded and are the policies applied well adapted to result in positive results on investments? Will research actually more and more serve the short term purpose to deliver economy or will it still also provide other assets?

Three introductory talks followed:
Scenarios for the Chinese (and Asian) development (Professor Roger Greatrex, Lund University). How can we expect China's impact on research to develop, on researchers' mobility, on research agendas, on innovation systems, on collaborations, on publication patterns, on transparency?

The European Union perspective (Dr Paraskevas Carakostas, DG Research, Europaean Union): How will EU-27 be using its scientific resources to maintain and develop its

knowledge base? The ageing population, the Lisbon 3%-targets, the European Research Area, the infrastructure, the ERC, the EU-budget for research – how will it all develop?

As the last talk we got an independent view (Professor James Wilsdon, UK Royal Society) on the global development and on the future role of and conditions for research. Can we expect an emergence of a new Cosmopolitan Innovation order? Or will the strongly developing China, with its different cultural heritage, influence the western research community to be more protective? Will we see emerging techno-tribalism in the west or will research still provide its knowledge to the Global Common Good? And, how will other new nations like Brazil, India and Qatar (with its emerging "science economy") influence the International research community?

Day two, 8 April 2010:
If the first day was on perspectives, scenarios, developments and interpretations, the next day was on pragmatic policies, tools, priorities, programmes, etc.

Three major research councils and their strategic priorities were presented. First out was Research Councils UK (Steven Hill, RCUK), an umbrella organization for the seven independent British Research Councils.
The US National Institute of Health (Stefano Bertuzzi, NIH) followed, with a special focus on a new commitment to results on investments.
Number three was the Netherlands Research Council NWO (Jan Karel Koppen), who was just finalising their new 5-year strategy.

The third and final session reflected on policies and tools:
What do we know about our policies and tools (Dr Julia Lane, US National Science Foundation)? Do we really improve efficiency, output and outcome by making groups bigger or by establishing Centres or Networks of Excellence? Where is the evidence in support of our policies and tools?
And, the creative environment (Professor Sven Hemlin, Göteborg University), what do we know about that? Do we at all consider the working climate in the particular research group?
(Professor Mathias Uhlén, Swedish Royal University of Engineering)
The workshop ended with a final discussion on findings and impressions. If research continues to develop as a more recognized national competitive resource, will research politics also develop and be more profiled? Will we see politics coaching researchers and adopt financial support in a more individualised way? And, will the signum of science, the transparency, continue and deepen with Open Access, or do we see politically induced changes with restricted access to new findings?

The NIRPA objectives of the workshop were three:
1. Offer two interesting days, with presentations and discussions about relevant and interesting issues. The Swedish Research Council has a special unit for Research Policy Intelligence, i.e. what is going on and why? What can small Nordic countries do to be best prepared?
2. Gain interest for a collegiate intellectual network with focus on research policy development. Such a network could be very "low-budget" but still "high-tailed" ambulating between network members twice every three years.
3. Feed in impressions when preparing for the next NIRPA workshop in Oslo 2010 (scenarios for the future).

A.3 The Concept

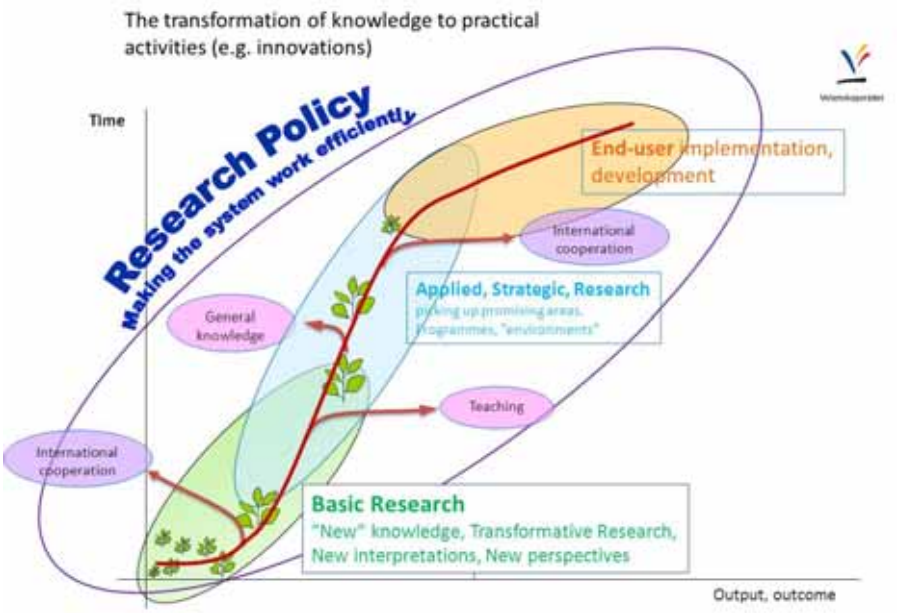
Dr Lars M Nilsson, Swedish Research Council

During the preparations for this workshop several different international studies were carried out. It was on e.g. how different research councils prioritize and select focus for programmes, or how research proposals are reviewed and selected or how "high-risk, high-pay-off" research best is identified and funded.

When collecting information about these programmes, methods and tools, two new models were developed visualizing the objectives of a certain policy instrument. The models allow different policy instruments to be fit together with other instruments, to form a logic pattern.

The first, Research System Model is understood in a 2-d diagram with Time on one axis and Expected Outcome on the other. It is very simplified and describes the development from "new knowledge" to an end-user application. Of course the graph could be understood as a traditional linear model (Mode I) which we think still exists in many cases. However, we also find many research environments resembling the so called Mode II model where knowledge production occurs in a mixed environment with basic and applied research joining hands and in the presence of end-users and practitioners. These environments, however, are typically within the more industry-relevant areas: Pharmaceutical research, sectors of biomedicine, biotechnology, engineering sciences etc. However, we argue that large areas of the natural sciences, humanities and social sciences, continue to publish scientific results in international journals without efforts to bring the outcome further to end-users. Naturally, the borders between these two models (Mode 1 and Mode 2) are not definite and absolute.

When discussing the Triple Helix (in the Science-Industry Nexus), Aant Elzinga recently raised reason to believe that only about 20% of research is typical for the policies applied. By far the largest share of researchers is working in environments where a lot of the current policy rhetoric is an alien.

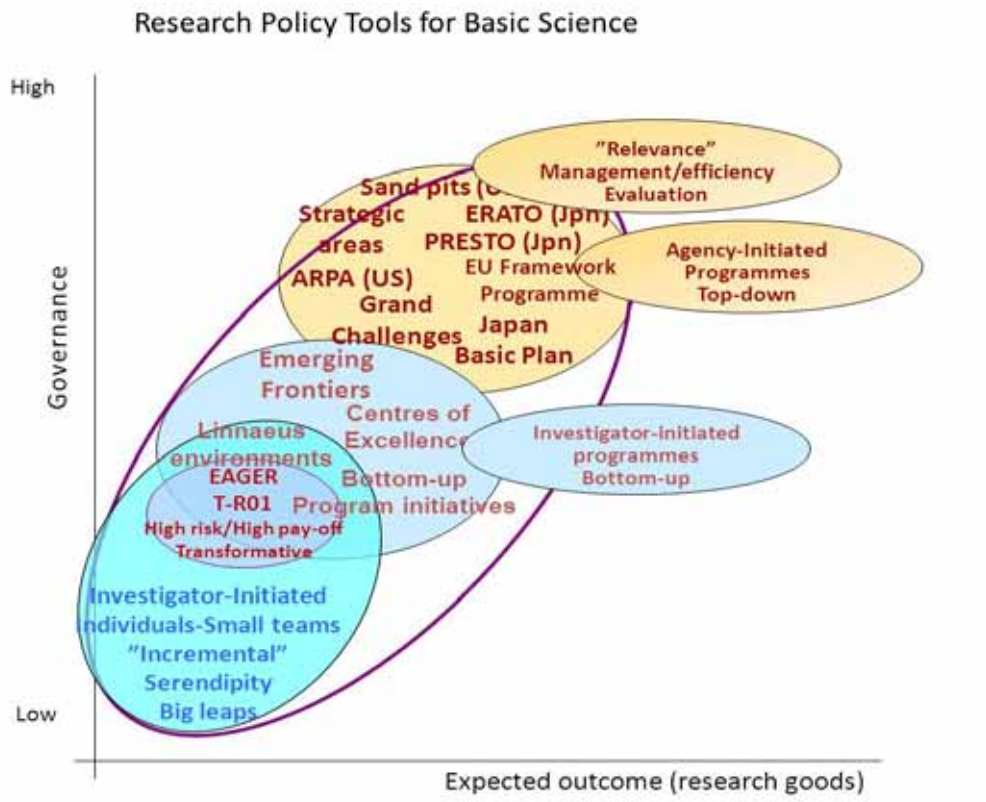


Our Research System Model describes a sequence of interacting domains, from the exploratory basic science to end-users integrating the new knowledge, often with a domain with applied science in between. Sometimes the three are very integrated (Mode II), sometimes they are very discrete (Mode I).

In fact, in many national research funding systems responsibilities are separated between different agencies, giving different roles to different agencies. This of course, acts in a conservative way making integration of knowledge more difficult.

There is reasons to believe that research policy has to be much more diverse than today, identifying a much wider variety of research situations, and modify policy accordingly. Regarding the entire system for knowledge production, it is of course also very important to increase efficiency by closing systemic gaps by making one sector more aware of neighbouring sectors. The more integrated the sectors, the more Mode II, the more spread out, the more Mode I.

The other model, the Basic Research Model, was developed during our international mapping of different instruments for basic research. The tools were generally all applied because they were thought to increase the efficiency in the process of generating new knowledge within the basic science sector.



In all of the studied research funders the "traditional" investigator-initiated research (response mode) also existed. The "response mode" relies on the individual researcher to identify interesting and relevant areas (Mode I). But, we have also seen a large variety of programmatic policies or tools which are understood as more efficient in leading to expected results.

We define basically three types of tools:
(i) Tools relying on bottom-up initiatives: money for traditional project funding "response mode" but also *Environments* or *Centres of Excellence*, suggested bottom-up and selected on scientific excellence. Research groups propose areas and the best groups, regardless of subject, are selected. Normally, such programmes run on a set of cyclic events (3-5-years) like reporting, evaluating, closing/renewal, new money.

(ii) Tools supporting potential high-risk, high-pay-off research. The issue was brought up intensively in the US in 2004 as a result of many researchers criticizing the US NSF and NIH for only giving support to safe, traditional research. The research that was challenging established paradigms were often left without support. As a result, both the NSF and the NIH (and several other research funding agencies) introduced new programmes for high-risk research.

(iii) Tools relying on methods identifying interesting areas (picking the winners). For these programmes a certain area of interest is selected. The selection is made in many different ways but very often stakeholders and researchers interact (organised by a research council or ministry) to select interesting and rewarding areas. It can also be "sand-pits" with real-time decisions after several days of interactions by relevant people. The resulting programmes are e.g. the Japanese PRESTO and ERATO programmes, the US ARPA programmes or the Swedish or European Union Strategic Areas and FP VII.

Two basic funding models seem to be critical to research policy: One model believes that better research governance will increase outcome and the other believes more or less that research performs best, particularly basic research, when it is left alone. There is generally rather little evidence for increased governance leading to increased outcome but some programs have certainly turned out to be successful (e.g the Japanese and the US ARPA).

Key Notes

A.4 Globalization affecting politics and state governmental structures

Professor Christer Jönsson, Political Science, Lund University

Initially we are reminded that "Globalization" is a newly invented concept but still a buzzword or cliché of our time. As such, it lacks precision. In the contemporary world the very word globalization is arguably the most globalized phenomenon; it exists in every major language in the world and no country in the world can no longer stand apart from global processes of change.

Globalization is a dynamic concept designed to catch an ongoing process – or, rather, a complex combination of partly contradictory processes – rather than an attained condition. It implies change in a certain direction, but we still lack a clear picture of a truly global or fully globalized world.

One could, however, make a distinction between the concepts of *globalization*, *internationalization* and *trans-nationalization*. Internationalization usually denotes expanding interrelations and tightening links between states (trade, standardization, intergovernmental organizations etc.). Internationalization also includes so-called *trans-governmental* relations, that is, interactions across state boundaries between subunits of governments; for instance, between ministries of education and research in different countries.

Trans-nationalization implies growing flows and relations across state boundaries beyond government control. Increasing collaboration between researchers from different countries are prime examples of trans-nationalization. Interactions between different national research councils, like the arranging international workshops or meetings, might be seen as an example of either internationalization or trans-nationalization, depending on whether we regard the research councils as government subunits or independent bodies beyond government control. That could be an indication that the border between internationalization and trans-nationalization is fluid. In any case, both concepts can be seen as steps on the road to globalization, which presumes states linked through internationalization and societies linked through trans-nationalization.

Christer Jönsson mainly focuses on the implications of globalization for ingrained conceptions of *geography* (distance, place, flows etc.) and *politics*, or political geography. One basic feature of globalization is *deterritorialization*, implying that social space is no longer wholly mapped in terms of territorial places, distances and borders. Whereas the territorial state holds centre stage in our conventional understanding of political geography, globalization entails a proliferation of social, political and economic connections and transactions that are detached from the territorial logic, and thus from the state.

But globalization forces us to transcend those intellectual boundaries. We have become increasingly dependent on flows across geographical boundaries, and our security is today more dependent on defending these flows than on defending territory. Our welfare has become increasingly dependent on undisturbed air, sea and land transports of goods and people as well as uninterrupted flows of communication via the Internet. Terrorists, pirates and criminal networks are, of course, well aware of this. Cyber war and cyber crime, might therefore cause great damage to our economic, social and political fabric. At the same time, the state's ability to control and regulate flows of people, goods, money, pollutants, diseases and ideas across its borders has diminished with globalization. It has not entailed the demise of the state, as some had predicted, but a changing role for the state.

The term Governance, in short, is a broader notion than government and "global governance" has gained wide adherence as an effort to capture the complex global patterns of authority in our times. *Governance* implies processes of formulating, implementing, monitoring, enforcing and reviewing rules and regulatory institutions. On the global scale, governance is about coordinating multiple, interdependent actors, including but going well beyond states. It has emerged as a key concept in the vocabulary of international relations, not least in UN circles.

Globalization has entailed growing global consciousness, manifested in an increasing number of transnational social movements. The idea that these movements and organizations together constitute a *global civil society* has taken root. But transferring the notion of civil society, usually understood as a sphere between the market and the state, from the national to the global level can also be questioned. Critics contend that the concept is a child of "the West" and reflects liberal, market-based rather than universal values. Can we really speak of one global *society*? Isn't it really a plurality of movements and organizations that in essence share very little? And how *civil* is global civil society? Civil society might even be described is a bewildering array of the good, the bad, and the outright bizarre.

The wide variety of civil society organizations (so-called CSOs) that exist today can be characterized as both "watchdogs" and "working dogs"; some even taking on governmental missions as international organizations to deliver services and implement development programs around the world ("tamed" social movements).

Network structure is another organizing feature emerging under globalization, becoming the chief alternative to territorial units and is characterized as *informal*, *non-hierarchical* and *non-territorial*. Specialized transnational *networks* contribute to the sectorisation of politics. Nordic civil servants, for example, often have more contacts with colleagues in the EU within the same policy sector than cross-sector contacts within their own national administration.

The borderline between the public and the private sector is becoming blurred under globalization. The public is going increasingly private, and the private is going increasingly public. At the same time, the notion of Corporate Social Responsibility implies that businesses have responsibilities, and are accountable, beyond the market. Internationally, public-private partnerships have emerged in the fields of public health, human rights and the environment, in particular. They typically engage governmental, business as well as civil society actors.

Public-private partnerships can take many different forms, and are allegedly based on win-win logic. However, they might also raise intricate problems of accountability, representation and legitimacy. Both the public and the private sector have well-established mechanisms of accountability. In the public sector, civil servants are accountable to governments which, in turn, are accountable to voters in democracies. In the private sector, management is accountable to shareholders.

But the question "accountable to whom?" has no unequivocal answer when applied to public-private partnerships. The inclusion of civil society and private-sector delegates in partnerships also raises the question of how representative they can be. Why these, and not others? How are they selected?

Finally one could also speak about globalization as the mother of new kinds of cultural conflicts and tensions growing: one could claim that fear dominates in the West, hope in Asia and humiliation in the Arab-Muslim world. These different conceptualizations indicate, according to Jönsson, that we have to think anew about peace and war as well in a globalizing world.

A.5 Globalization, new public management and traditional university values

Professor Aant Elzinga, Political Science, Göteborg University

Aant Elzinga keeps the two notions globalization and internationalisation apart divided by their significance. Instead the term "globalization" is used in a very restrictive sense, referring only to the phenomenon of economic globalization. As a meaningful analytical tool he signifies the meaning of globalization as a growth of "planet-wide interconnectivities". Further he distinguishes four such processes, each with its own "logic". They are schematically pointed out as follows:

1. Non-governmental (NGO) social movements interacting locally and globally are associated with human aspirations to enhance solidarity and justice.
2. The logic of Intergovernmental Organizations (IGO's) with a focus on science operate on the principle of cost-sharing and mutual benefit for the countries involved when it comes to advancing scientific knowledge, but also using it to monitor global phenomena. Examples are CERN, ESO (the European Southern Observatory) and the IPCC (the Intergovernmental Panel on Climate Change).
3. Scientific non-governmental organizations (scientific NGOs) comprising national academies of science, international scientific unions under the auspices of ICSU, and many more bodies that interconnect scientific communities across the world, are motivated by the pursuit, exchange and dissemination of scientific knowledge and scholarship (the logic of truth seeking).
4. Economic globalization, finally, is a process involving a for-profit nexus. Thus it follows the logic of capitalist wealth accumulation marked by an uneven development and ironclad mechanisms of inclusion and exclusion that tend to influence and intervene in most other areas of life, including the other three processes just mentioned.

The first three of the aforementioned forms of increasing numbers of planet-wide interconnectivities, follow, respectively, three systemically specific logics that are more properly classified as different modes of "internationalisation". According to Elzinga, "Internationalisation" therefore is a term that should *not* be conflated with "globalization".

Elzinga reminds us that in the long-term historical perspective, transformation of universities in the Western world used to mean reshaping older institutions into a modern form, spurred by the European Enlightenment movement. In Europe the transformation was not seldom the result of a tenacious struggle for freedom of thought and the right of scholars and scientists to undertake research unconditionally *without* an eye to predetermined outcomes. It meant breaking with an older academic regime, one of tutelage and censorship at the behest of Church authorities and an absolute monarch who could hold prefects and faculty deans accountable for the content of academic dissertations. In case of major deviance they could at worst lose their positions.

The process that led to the new form and ethos of the university coincided with the emergence of rights and freedoms of a liberal bourgeois society and was to serve it. Therefore it is loaded with a deeper range of political symbolism and hard won progress that has to be kept in mind, when discussions nowadays primarily

focus on the economics and organization of research or funding mechanisms. Today he says, perhaps more crucial for academia, however, are the pragmatic calls for efficiency and effectiveness and society's so called "need" to circumscribe conditions of research and redirect efforts in tune with the logic of economic globalization, a process that brings with it new mechanisms of inclusion and exclusion, the belief being that market-steering is superior.

Economic globalization has increased the role of market mechanisms in the provision, steering and organization of higher education and research. Research councils have shifted from issuing traditional calls for unsolicited proposals to a mix of these and targeted research. On top of this comes the "strategics". University is being put under pressure when alien values of academic capitalism are imposed by extra-mural actors, Elzinga holds. Research that is funded should more and more lead to patents, the creation of companies and emergence of strong scientific leaders. Relevance pressures associated with the logic of globalization contribute to an orientation of efforts to generate revenue rather than a general not-for profit expansion of knowledge traditionally associated with universities.

There is also the effect of policy doctrines emanating from supranational bodies like the OECD, and the mimic of management fashions. Such factors must be taken into account since they help induce streamlining. Furthermore, national characteristics play an important role in how internal reform systems are legitimated. One particularly important aspect in the reorientation away from the traditional university system to a new one is the international trend in public administration called the New Public Management (NPM), crashing through governments worldwide and in close correspondence with increasing globalization. NPM is shorthand for applying private sector or market-based techniques to public services. Some of the features of NPM may be summarised in key words like agencification, contractualisation, quasi-markets, entrepreneurialism, profiling, strategic behaviour, new incentives to induce competition, to "produce more with less".

One other aspect, however, is that researchers and university administrators – whether they like it or not – are drawn into evaluation exercises that target specific performance measures and crunch numbers as a tool for reallocating segments of funding in a chain of contracts from government downwards to the rector's office, the faculty deans, and research and teaching units at the heart of university departments – classrooms, laboratories and seminars. Whereas faculty funding and even basic (as well as some sectoral) research council funding in the traditional university system is based on the government's trust in professors as academic civil servants, NPM is ultimately premised on *systemic* mistrust of contract workers on tap, whence a ritual auditing of performance is brought in to check (or "secure") accountability.

Another side of this critical stand turns to the claim of an ongoing second academic revolution, put forth by *Henry Etzkowitz*, one of the inventors of the triple helix metaphor that refers to the symbiotic interplay of configurations of university-industry-government triad interaction as the drivers of a new order meaning that university management has changed from the previous collegial model towards a managerial model. To summarise then: The emerging moral economy of research politics, emphasizing revenue creation, accountability, efficiency, cost-

effectiveness, marketization and quality assessment in academic work, in a way threatens to turn academics into state-subsidized entrepreneurs.

Elzinga takes his critical perspective very far, also stressing the impacting factor of the bibliometric auditing system of performance indicators, meaning that the new audit system and management technique is seen to function as ”political technologies” for introducing neo-liberal systems of power into faculty research. If so, however the new initiative to develop performativity metrics to improve the evidence base for policy-making, according to Elzinga, has to be combined with (a) independent arms-length-from-decision-making studies, (b) critical ones on the meta-theory of metrics as well as (c) both traditional historical and newer oral history case studies and reviews to look at longer term trends in various disciplines and epistemic specialties.

Session 1
International Policy Setting: Actors in a globalizing competitive world

A.6 Emerging China. Impressions and reflections on major research policy developments[1]

Professor Roger Greatrex, Center for East and Southeast Asian Studies, Lund University

The Chinese R&D and Innovational research system may be characterized by its lack of transparence and its absolute comprehensive state-involvement pressing for applied science, innovation and immediate social returns for “the social engineering” of society. Research institutes are the major vehicle for research, not universities. Government policy claims that China by the year 2025 shall be an innovation-oriented society with 2,5 % of GDP investment rate and being ranked among the five top innovative countries also performing a vast amount of relevance-driven innovational research and development. But there is also haunting uncertainty and fear for a falling behind the rest of the world in R&D-spending. However, available statistics on patents and cutting edge knowledge-transfer for innovation are not transparent and reliable.

In China the production of automobiles is organized on the basis of joint-ventures. But there is a current on-going shift from foreign to domestically owned brands. The merger of Volvo and Geely automobile companies is a very talkative illustration of the Chinese strategy for world market entrance. And there is no doubt that China is moving ahead in a knowledge-based societal direction.

[1] Professor Greatrex set his starting point by referring to the relevant document **2009 REPORT TO CONGRESS** *of the* U.S.-CHINA ECONOMIC AND SECURITY REVIEW COMMISSION. ONE HUNDRED ELEVENTH CONGRESS. FIRST SESSION. NOVEMBER 2009 [http://www.uscc.gov/annual_report/2009/annual_report_full_09.pdf].

However it should be kept in mind that there are and have been serious doubts about the judicial institutions for patent rights and intellectual property rights in China, held to be weak and unreliable and easily penetrated by state government-agencies. One current example is where Toyota, the Japanese automobile manufacturer, lost a many-year-trial in China on its claimed patent ownership-rights. Internationally confirmed, but out-of date, patents are attractive to be further copied for domestic productive reasons.

The patent success-rate for Chinese innovation is only about 25 %, and before 2005 China´s patent strength was very weak. In fact more than 50 % of all patents are classified as worthless or duplicates. Civil cases suite on patent-rights favors Chinese since its procedures for documentation are less demanding and carefully performed. The official statistics are to be viewed upon with a strong skeptical eye if you want to have a true picture of the economic and scientific activity in China. Tracing actual technological spin-offs makes IT&T statistical exploration R&D funding-efficiency impossible. Crime against protected trademarks and brands are frequently committed, and that is being dealt with outside the Chinese system of criminal justice. This kind of misconduct affects innovation capacity in China negatively.

A lack of general trust in Chinese society, weak and even corrupt institutions and the vast amount of privileged researchers, now returning from the Chinese diaspora, where a mass of young scholars were encouraged by the government to go abroad for university and PhD studies, has also turned out into scientific misconduct, the fabrication of fake results, ghost-writing (for money) and even fraud because of the lack of adequate academic mechanisms for control. The strong pressure from above, coupled with huge rewards is a severe temptation to fraud. It is sometimes said that strive for “scientific citations has become a national obsession” thus corrupting the Chinese research system.

The frequent existence of scientific misconduct erodes public engagement and general trust in science and it is badly developing features of systemic drift too. Misconduct also contradicts scientific cooperative efforts. And besides, there are no rules regulating transparency and open access. How can we be sure of the Chinese willingness to share data and scientific results with others?

It is a long way ahead before China can take a world-leading position among strong countries in the field of ST&I activities. Thus China will have to change its R&D funding strategy from Top-down and large scale projects in a direction of bottom-up and the research system has to be reorganized and more transparent as well. Probably might even the dominant focus on “science for policy” move in a more “favoring Basic research direction”. But the major mission of societal modernization by using scientific progress for the improvement of health, housing, agriculture, climate change, etc. will dominate for many years to come.

However the good side of this coin is that Chinese R&D will be sharpened. And there are indeed great possibilities that the current state of art in Chinese R&D will be improved by the growing amount of international research cooperation. The return of foreign trained researchers, familiar with western collective academic faculty values with roots in openness and sharing, will probably contribute to a more

compatible and open research system. But it will remain to be seen if there will be autonomy for the university-system performance of R&D.

An old Chinese culture stressing the avoidance of "loosing face" might as well contribute to a domestic "house-cleaning" developmental enforcement of western-style peer-review assessment of research. The furtherance of these necessary developments in China urges the West to continue their scientific cooperation with the East.

A.7 Making research policies work: Reflections on change in the European research landscape[2]

Professor James Wilsdon, Director, Science Policy Center, Royal Society, UK

In summary five dimensions of change was extracted from the report.

1. Climate for investing in science through the downturn.

The UK government´s prioritization process puts severe political and economic pressure on available funding resources in every area of societal resources available to politics.
That has brought the social returns from investing in science to the fore. Quite different from Germany for instance, there was no science investments launched for government spending in UK through the downturn from the financial crisis.
Though the R&D budget has doubled since 1997 but for the time to come the prospects for renewed growth of investment in science are very bleak in the UK.

2. The shifting geographies for science.

Although there are systemic drifts in Chinese science and innovation developments, there is no doubt about an ongoing tendency of growth in quantity to world leading performing scale in scientific production. But we may be a bit too optimistic about China´s near future scientific competitiveness, when we consider the science and innovation-system as a liquid modernity flow, and comparing the developments in emerging research-nations entering the research arena as new players, such as Brazil, India and for instance an economic powerful Qatar at the Persian Gulf who puts heavy investments in innovation. Another example is the King Abdullah University of Science and Technology (KAUST) in Saudi Arabia. It is an international, graduate-level research university dedicated to inspiring a new age of scientific achievement representing eager state efforts to cultivate prosperity through creation of science and innovation. And there are, of course, many more of these arising universities, located in countries such as Brazil, Ethiopia and even Rwanda and Mozambique.

3. What are the responses to these developments?

Is there risk for techno tribalism in the west when facing competitiveness from changing prerequisites from innovational change from a globalized world production system. And what strategic mechanisms and options will be used for government efforts when mobilizing science and innovation to be put at the heart of a

[2] James Wilsdon referred to the very statistical well-fed report **The scientific century: Securing our future prosperity**, by Royal Society, 2010, and produced within a network of 1 400 academic *Science for policy* expertise [http://royalsociety.org/the-scientific-century/].

strategy for long-term economic growth to cope for a brighter future, when struck by the gathering storm from simultaneous collapse of general trust shaking the Globe all around. We cannot yet overlook the economic and political consequences impacting science and innovation from the world in change. But we do have to define the global challenges also by bringing the public into science much earlier to concert upstream activities.

4. Cosmopolitan innovation

The following recommendations were proposed in UK by Royal Academy Report, mentioned above: the prioritization to invest in excellent people; the strengthening of government use of science; the reinforcement of UK´s position as a hub for global science and innovation; the bettering alignment of science and innovation with global changes; the revitalization of science and mathematical education.

Cosmopolitan innovation is about the new and grand challenges facing the world and of course tangible to Europe. Take for instance The European Research Area and FP7; Food, Health and Aging population are hubs for interdisciplinary collaboration. And what are the available metrics to be used in order to shape robust measuring systems (such as the SciSIP-programme of NSF and these invented in Brussels)? Not to speak of the efficiency of politically launched programs to create societal commercial value and public returns from R&D-funding. Along with that goes the need to make research more transparent, available and attractive by open access (not only to expertise), but for public engagement in science and policy for science as well, not to mention the deeper understanding of the way it can benefit to social and economic life. This is a new and constraining aspect calling for new structures to be created for the governance and renewal of science by upstream policy action hoping for downstream returns.

5. In Helga (Novotny and head of ERC) we trust

The formation of the European Research Council (ERC) represents a tremendously encouraging happening for Europe. This new form of a joint research-funding structure for curiosity-driven, bottom-up, basic science will attract European top-research cooperation and the formation of new international alliances to approach the grand challenges for research of our time. ERC manifests a strong pull for joint vigorous funding-initiative taken by the European Union in making strong efforts to further social and economic innovation goods to come. It might be naïve not admitting that science must contribute to strengthen the science for policy knowledge-base to handle great challenges. These cannot push new research to the fore. There might rather be pull-effects made by new government funding to facilitate new basic research. There is no faculty divine right to oppose righteous demands for public influence striving for tapping riches from science.

Session 2

Promoting scientific creativity: Tools and trends in national research policy

A.8 Promoting scientific creativity: A Research Councils UK Perspective
Dr. Steven Hill, Director, Strategy unit RCUK, UK

The RCUK cooperative approach is to develop an evidence based portfolio contending different funding tools applicable for each of the seven autonomous councils being incorporated in the agency body. Common objectives to produce excellence with impact are the funding of basic strategic and applied research (and development) for the whole range of science; postgraduate training; facilities and infrastructures; and to deliver impact and not least the encouragement of public engagement into a deeper understanding of the role of science in society. The RCUK budget is nearly £3 bn (around €3 bn) per year. Science is funded by public investment primarily to deliver of impact on society and social and economic returns. Not to promote science to come first. But it should be kept in mind, that there is also an even bigger non-profit R&D-funding sector in the UK. Before the crisis there was a steady increase of the RCUK budget, but public spending for basic research is decreasing since then. And success-rate is falling contrary to the growing mass of applicants.

Great efforts are being made by the UK to enhance and encourage creativity in research and avoid hindering barriers. *Thomas Kuhn´s* classical work on revolutionary changes in science was mentioned as a major source of understanding the prerequisites the unexpectedness of scientific work. And supporting creativity is turned into the major challenge to RCUK. But how is creativity to be measured. Developing metrics might be about knowledge of the knowledge production process and where different kinds of involvements and interactive action took place. Measuring citation impact only, might not secure a hold on creativity, and some relevant criteria seem hard to come by.

RCUK policy-interventions to avoid barriers are hampered by the uncertain conditions when funding-decisions on adventurous research ideas are to be made and, of course, in accordance with assessing and managing embedded risk, but also carrying potentially high pay-back. However the RCUK wants to increase the interest for daring research at high risk among politicians and performers. Other ways are longer funding periods (least five years), fellowships and by demanding professional project management and audition. The policy made is strategic: defining larger research programmes with extended budgets (at least £ 2 millions) and longer funding-periods.

Other pathways for trial is to fund people rather than projects (as is done by the Welcome Trust) funding Fellowships and allowing liberties in their scientific work. Another option is to find ways to decrease the number of applications by for instance enforcement of quarantine rules for applicants rejected. The RCUK is also putting applicants with technological and engineering sciences provenience on trial by pioneering so called *sandpits,* e.g. intensive interactive events where a diverse group of people get together for 5 days to immerse themselves in order to

uncover innovative ideas and performing real time peer-review and funding decision-making. There is also a variant called *Dragons Den* modelled for oral presentation of ideas to expert panels. Still another one is called *Learning about the public knowledge and expectations of research*, meaning that representatives are brought together from funders, researchers and public in order to communicate options and calls for science.

There are also programmes for great challenge-led themes focusing on targeted basic research and pointed out by government, such as for instance Energy; Global uncertainties; Lifelong health and well-being; Food-security (a new research area); Environmental change; resilient economy. For that purpose 15 % of the total budget is allocated, meaning a rapid mobilization in urgent research areas. New opportunities are also knocking, when different research communities are connected and brought together for cooperative purposes and joint science creative thinking, when approaching many of the relevant societal problems urgently needed to be dealt with. On the governmental level there are many ongoing strives to integrate and coordinate the flows of money for efficiency reasons, That goes for Innovational research activities too where organizational changes are carried out on the ministerial level to increase the ST&I capacity strength of UK.

A.9 Science policy, strategies and tools within the National Institutes of Health (NIH)

Dr. Stefano Bertuzzi, Office of the Director, US National Institutes of Health

The NIH is a federation of 27 research institutes and Centers and the Office of the Director oversees the whole structure. Since 1945 there has been an incredible growth of public spending for R&D in the US. For the fiscal year the NIH distributes 31 billion dollars for extramural and intramural research funding. It supports more than 350 000 scientists and research personnel and 3 000 institutions in 50 states as well as abroad (e.g. in the Nordic countries). 53 % of the budget funds individual research project grants, meaning also a large portion to non-profit academic institutions.

In 2009 The US Congress passed the American Recovery and Reinvestment Act, where President launched a 10.4 Billion dollar increase to the NIH budget for the strengthening of scientific research priorities, declaring research to be a major vehicle also for recovery from the global economic crisis. This must be regarded in terms of public trust given and a very big challenge to science. To expect further budget-increases from the tax-payers money without good and evidence-based arguments showing impacts and efficient social returns from R&D is absolutely out of question. We must even be prepared to cope with a steady-state situation.

Thus, NIH funding policy is guided by two main criteria: *Public health societal needs* on the one hand and s*cientific opportunities* (by bottom-up and peer-review) on the other. There is no contradiction between if science comes first or if the society relevance need for better health does, the main avenue is the applicative use of scientific results to improve public health in the US. But the appropriate increase also calls for new evidence-based proof on the social impact and efficiency of

spending public money for research investment and the gained social and economic returns to come.

Furthermore the NIH funding is distributed over a wide range, directed through programmes for targeted research fields reflecting the societal needs, for instance cancer, heart- and vascular diseases, lung-disabilities, Alzheimer, aging and pediatric diseases. Life-science and Bio-medicine are core funding areas. There is no doubt about the public´s engagement for medical research, not to mention the big pharmacologic and drug industry, demanding research results for innovation and development of more effective medicine to extend healthy life and reduce the burdens of illness and disability. Knowledge production only, is not enough to mission the NIH. It shall only be seen as the product. Improved health is the important added value from knowledge transfer of product. NIH works pro-actively to disseminate and implement the riches from science, aware of that a healthy population fosters wealth and productivity. Research funded by NIH thus creates economic benefits to society.

Bio-medical research, for instance, shows high social returns from risky funding input and high success-rate and has tremendous impact on patents for drugs in Big Pharma industry. Other programme-evaluations show efficiency to justify how the NIH-money is used and it is important to understand the steering efficiency of NIH money-flow. For that a transparency policy is a very powerful tool. And NIH collects a huge amount of data for follow-up assessments to drive policies based on evidence and facts. Transparency is also used in a targeted way for health-policies too, for instance perils from smoking.

We have to develop adequate programmatic evaluative statistical tools that could really serve as a basis for funding decision-making. Measuring social returns from R&D investment in the 21st century demands the gathering of data relevant for various policies for innovation and research and behind which there are many stakeholders to connect when developing impact criteria from funding. Measuring publications and citations is not enough. NIH runs a variety of case-studies evidencing impacts and values also including regional economic effects when targeting impacts from R&D and innovation ecosystem.

One example is ROI think tank and especially developed so called ROI Analyses to study the impact of NIH-investments to inform policy making (referring to the book by *Archong Fung, et al.,* Full Disclosure. The Perils and Promise of Transparency). A good source presenting data and tools is available on the website www.report.nih.gov showing powerful tooling methods and presenting knowledge-management tools, arranged to understand what´s going on and what is the use of what´s been done. And new tools are being developed in order to facilitate a diversity of policy-settings on an evidence-based ground.

A.10 Strategies and tools within the NWO

Dr. Jan Karel Koppen, Director, Policy, Development and Support,
Netherlands Wissenschaft Organization (NWO)

The Netherland economy was severely hit by the global crisis and there have been general cut-backs in the government spending and more are expected for the R&D-sector within the years to come. That is a major feature which also has made politicians more alert in calling for social and economic returns, social impact from science investment and more activity from the NWO to bring the public engagement more close to research. This change in government policy put pressure on the Dutch research system and might bring about change in funding policies as well. The balance between basic curiosity driven research and applied relevance-driven R&D is continuously shifting following the science & society-debate, and is now advantageous for the pressure coming from industry and state.[3]

According to changes in the research funding landscape you can still never tell what new funding tools to be needed, these have come and gone over the years. But we are looking very close at scientific progress and try to detect and follow carefully weak signals indicating emerging progress. The Netherlands tends to be lagging behind as research-nation over the last years with a slight drop in ranking position, even though great progress is being made in innovational and applied research. Internationally The Netherlands keeps a number ten position within a ST&I focus. However, NWO is not concerting the total investment flow of funding resources, but is strongly advocating the need for more co-ordination in funding combined with systemic reform and changes.

The future improvements are to be made within a ten years-continuity by forming a coalition of many partners for the enhancement of innovative entrepreneurship and existing scientific and economic strengths. The overriding goal is set: take the Netherlands to perform among the top-five internationally. State and industry investments will strengthen the research climate and science is to be facilitated with new infra-structures. Major efforts are needed for
the research system to recover from cut-backs, and at the same time keep up its competitiveness and attraction internationally towards new emerging nations and others (e.g the US), successfully undertaking pulling efforts in order to attract talented and leading Dutch researchers.

The Netherlands has adopted the EUROHORCS roadmap, Open Access, Connecting Research to the World, Lund Declaration and do also participate in 26 ERA-nets. Excellence and creativity in science have to be enforced and knowledge-transformation to society improved. Public engagement and trustful understanding of science must be promoted by improvement of innovation platforms and outreach in cooperation with Royal Academy and the Dutch universities and other partners not least to overcome the “Valley of Death”.

[3] Netherlands Organization for Scientific Research (NWO) has recently worked out a new strategy plan for the period of 2011-2014, setting the course of direction for funding policy settings to come.

Building the new strategic framework is organized in a consulting way. Inquiring processes to map expectations and demands are running alongside with investigating talks and interviews over a broad contact-area with stakeholder circles and politicians. In this process it should have been a good thing to gather the funding and performance actors to speak for science with one voice, together with the Royal Academy as well, when presenting new roadmaps calling for new expectations and future needs with arguments for further increase, rather than reduction of resources to science. But the Dutch government is also energetic in acting for science to advance upstream by funding interdisciplinary initiatives in order to promote science and innovation of importance for societal reasons.

These moves affects funding tools and agenda-settings when NWO acts strategic and takes on response modes for funding social challenge themes, talents, mobility, careers, national networks-initiative and increased budgets for open competition or recruiting from abroad (the funding tool schemes as Veni, Vidi, Vici, Spinoza, Rubicon). Not to mention use of research results, internationalization, large scale facilities and the NWO research institutes.

The affecting globalization and international crisis has also made it necessary to consider what could be an optimal research climate in Europe seen from national and European level. In particular this is about the ERA concept, which is watched with keen attention. Thus there should be no Dutch reduction of national public investments, but the need is stressed to bring national and European efforts to reinforce one another. Thus granting schemes are being revisited to promote larger grant sums, longer periods and to fit into this point of view and the NWO has developed a national open competitive scheme also for the sake of furthering a breeding ground and give strength to the Dutch position in the ERC competitive grant scheme system.

Strategic work within the NWO also means targeting *six research themes* for funding. Thus the grand future challenges for research has been collected as a prioritized area. It associates with other thematic fields and to knowledge production asked for by stakeholders and actors in society who also takes part in identifying and development of societal needs. More efforts will be needed for knowledge transfer to society. Achievements will be made by separate criterion in selection process; tailored Valorisation grants, Open access, and by connecting to relevant organizations also for the mobility between industry and public research institutions.

The new strategy thus prioritizes the strengthening of the Dutch research climate focusing the creativity of researchers as the driving force behind scientific advancement. So, there shall be room for both curiosity driven and societal inspired research in close interaction. Excellence by national competition is a prime strive. NWO will also increase its presence internationally, by encouraging transnational research projects and programmes, cooperating with emerging research nations and by acting pro-actively in international policy making.

Session 3

Promoting efficiency: Management, evaluation and metrics

A.11 Creative Research Environments. A Research Group Perspective

Dr Sven Hemlin, Dept of Psychology, Göteborg University

Making creativity work to flourish among researchers being gathered in minor or bigger groups is crucial, when science is to be performed within a community built on academic leadership, and cooperative research for common aims and challenges. We shall now look into some basic environmental factors (in-house) affecting and inspiring research group-dynamics to perform, in terms of individual devotion, synergetic effects and encouragement.

The environment for research creativity can be expressed by the following matters.

- The quality of climate
- The quality of leadership
- Size and composition of the group
- Knowledge access
- Motivation
- Resources, equipment and facilities
- Networks, contacts and communication
- Internationalization

Considering climate, positive impacts stem from psycho-social prerequisites. Climates with atmospheres showing to be open, allowing, free, communicative, respectful, secure, joyful and tense are enhancing. Strongly corrective, risk-avoiding, time pressured, conflictive personal constellations and not supportive leadership are often oppressive to creativity.

Positive academic leadership is chiefly characterized by acquired expertise in one domain (the key factor) and the ability for coordinative goal-setting- collective and individual - and to see and support each individual in the group - both intellectually and emotionally. Further needed is ability to secure them by confirming, to reward and encourage brain-waves when generating ideas and problem search for creative returns for the group as a whole and to convey organizational goals for innovation. Especially valuable is to set a balance between research problems and optional approaches within the group.

There are convincing findings that the size of the group does not matter for the creative per researcher. The economy of scale fits in for the production of goods, rather than for creative processes in groundbreaking and transformative scientific knowledge-production. This also contradicts basic assumptions behind policies for cutting-edge stimuli by funding larger milieus like Centers of Excellence and the like.

Neither does the scale of localities, facilities and equipment show sufficiency to impact on creativity. There is no linear relation. Design of facilities may increase

communicative exchange. But so called open landscapes does that in a negative way. There are also findings on the role of occurred so called social capital and network-affiliations showing a positive connection to creativity.

Knowledge access is about expertise and extensive acquired knowledge and ability to develop new thinking from multi- , inter- and trans-disciplinary angles of approach and flat or steep association hierarchies. Not to mention the growing importance of ICT (e.g. databases) for promotion of creativity. These aspects are essential when organizing knowledge-management in the group. However there is no secured evidence connecting inter-disciplinary efforts and creativity. There is also to be said that *cultural heterogeneity* in group-dynamics is essential for creativity, but is rarely used as a science policy tool.

Research performance is by definition always intrinsically motivated for creativity. There are also other incentives: scientific recognition, funding agency-communication (!), salaries and careers. Networks, contacts and communications are, not unexpectedly, crucial vehicles for creativity and promotion of unexpected leaps forwards.

R&D performance activities related to industry are strongly dependant on external communication with stakeholders and other extra-mural agents. And visible as well as invisible networks do foster prestigious social capital to the group. That in turn might in many cases stimulate increased scientific cooperation and co-authorship with others.

Internationalization, finally, means meetings, travelling and visits abroad. Basic requisites are face-to-face meetings, the growth of insights and further creativity leaps. Therefore generous travelling resources are a strategic necessity.

A.12 Why big is better

Professor Mathias Uhlén, Swedish Royal Engineering University, Stockholm

Discovery driven research is strategic and depending on large scale in facilities and funding. Technology-driven life-science research, based on the connecting of data from various sources, has brought about brand new opportunities and a veritable explosion when it comes down to the management of bio- and lab data, along with a great need to gather them for research within an e-science concept. Internationally competitiveness in science is settled by having access to strong resource centers. This specific on-going research represents “Big science” in Sweden and it is largest scale individually granted project ever. Here we find performance of high-throughput biology (i.e. genome sequencing) difficult from standard funding agency schemes connecting multi-disciplinary projects (translational medicine) and highly skilled technology competence for data management as well as qualified competence of bioinformatics and systems biology.

Swedish bio-banks together with record linkage to 200 years of public demographic data-production in Sweden is a tremendous goldmine for research, meaning opportunities that will give future advantages to come for Swedish R&D within the

Science for Life area. The good supply of data has already created groundbreaking hypothesis driven research on proteins in a way never seen before. Patent striking companies are successfully founded in co-work with partners from industry, enables intellectual property rights to be instantly commercialized as results from R&D. Future intra project expectations are to develop a consortia out of multi-minor groups to perform more of applied and targeted infra-structure driven Big science. Large scale milieus absolutely fosters scientific creativity among researchers, but this is, of course, a complex stuff to be handled when acting skillfully as academic leaders in multi-hundred people scaled groups, and this experience do not necessarily has to over-rule diverse experiences from others.

We are about to see a veritable paradigm shift in science when mapping out all the building blocks of life. A barrier, however, are unavoidable controversies on intellectual property rights.[4]

A.13 Program Portfolio: Metrics to underpin efficiency in science policy

Dr Julia Lane, US National Science Foundation, USA

Although science policy studies have been conducted for decades, interest in such studies is currently on the rise in the United States, as well as other countries. This is evidenced by the number of recent workshops highlighting "science of science policy" as well as the establishment and funding of a Science of Science and Innovation Policy (SciSIP) program at the National Science Foundation (NSF). Despite the long historical interest in science policy, quantitative input-output studies establishing the impact of programs at different agencies and institutes have been very difficult.

Julia Lane referred to the Federal Context of Driving forces in the US policy for tremendously increasing R&D public investments as:

- Investment in Science (laid down in Federal investment in science by the American Recovery and Reinvestment Act)
- Openness and transparency
- Evidence based policy (Science of Science Policy, SciSIP)
- Accountability of Scientific Research (Putting scientific performance first, while sharpened by evidencing measurements)

Research cannot in the future expect unceasing federal budget increases without evidencing support from impacts on society from social and economic investment returns. Competitive resource needs from all policy-areas, when prioritizing for public spending, forces science to advocate from evidence based facts to prove societal impact and utility. Therefore there is coercive need to improve assessment of science policy efficiency. If we do state that public investment of tax-payers money into the R&D-sector will create new jobs that must also be shown, as well as the impact on society from that spending. But researchers do not like to be held

[4] Professor Uhlén gives his over- all description of this project on video uptake [www.nirpa.org]

accountable within their own domain, because there is no liking of being measured. Anyhow full transparency is still urged.

Science of Science Policy, SciSIP, is the new science based program for developing science metrics developed by the NSF. It is held to be a possible way to assess and prove impacts from science on society. It could be seen as a powerful vehicle to motivate increased future budgets and to advocate science policy means. Narrow and biased metrics will yield narrow and biased science, good metrics should be grounded on theoretical framework, include scientific, social and economic outcomes and it must be generalizable and replicable. It must be developed from the bottom up and minimize the burden on researchers. Thus I hold for sure that you cannot manage what you can´t measure and that is why we have to develop science based metrics.

Therefore we must develop a theoretical context of the knowledge production process, as a framework for our scientific understanding of how social and economic added values and returns are created out of the production of ideas and knowledge. That is in the same way that social thinkers and theorists before us contributed to mankind´s understanding of industrial capitalism as a mode of production of goods and before that established a theory of feudal productive land-interest on behalf of agriculture. Current resistance among researchers emanates from our collective lack of specific knowledge on how value is created in the emerging knowledge society.

One could suggest a systems analysis based approach when collecting relevant data for auditing impact, and built on automatic tools. We talk about organizing a process which could support analyzing flows of people who in a way are affected by R&D investment funding tools. NSF calls for the organizing of cooperative system of work, where public agencies and universities cooperate in order to create the automated common empirical data infra-structure for scientific analysis on impacts. It should be collaborative and bottom-up for SciSIP. Such an initiative should also call for a joint international effort, since the mission is bigger than what could be managed by on single actor. All national funding agencies should follow internationally.[5]

B. The Oslo Workshop 1-2 December 2010: The Future of Nordic Science Policy. Back-casting from a Scenario 2025

B.1 Session 1: Expectations, visions, hopes
B.2 Session 2: What will happen – policy options – different dimensions
B.3 Session 3: The role of research councils in the future knowledge creating system
B.4 Next step – Notes for reflection and further learning
B.5 Policy snapshots from the future: Nordic research, innovation and

[5] A modeling scheme for how this might be organized and developed is further presented in the video uptake by Julia Lane [www.nirpa.org]

Higher education policy Governance

B.6 Knowledge and competence policies in 2025

Competence policy becomes part of economic policies

B.7 The new role of institutions for research and higher education

B.8 The global market of education and research

B.9 The role of the EU

B.10 Nopoli: Establishing the basis and the framework for a new Nordic knowledge policy

B.11 Research Councils and social transformation: What is a "grand challenge" and how can collective efforts to encourage research make a difference?

Dr Riel Miller, xperidox. Global specialist in strategic foresights projects

The scenario workshop was organized as a mixture of plenary sessions and group work. Scenario material was distributed before the workshop as background papers and stimulus to innovative future thinking. The plenary session (day 1) started with presentations from the Norwegian Ministry of Education and Research – Kyrre Lekve, and by one of the foresight experts – Riel Miller. Invited foresight experts were group leaders, and all groups had rapporteurs appointed to secure documentation from the group work.

Report from the work groups

The group work (3-4 groups) was divided in 3 sessions focusing on different topics:

Session 1

B.1 Expectations, visions, hopes

Initial reflections:

Science in the knowledge intensive society might be figured as science in unprotected spaces" (A Rip) or "science in the context of application" (Carrier & Nordmann eds) Typical characteristics are complexity, openness, interactiveness/interlinkages pointing in the direction of more experimental ways of working, of strongly decentralized cross-institutional and multi-actor practices.

- The context where knowledge is created is becoming increasingly complex; science and technology is interlinked with society in many ways, which poses new challenges as to how the research questions are defined, decided and developed, and the importance of involving different actors in all parts of the research process. The boundaries between research, innovation and society are becoming increasingly blurred stimulating the need to invite and engage a wider range of perspectives.
- New knowledge creating agents outside the traditional research society will become more important actors; they have to be integrated into the research and innovation processes. Societal challenges are collective challenges and therefore need collaborative approaches.
- Research and innovation processes will be more experimental, open and flexible to secure that knowledge creating processes address important research challenges in a societally responsible way.

- Cooperation and competition will coexist in a constructive way to foster innovation. We need a different innovation governance – 'governance through dynamics', more open interaction between government, industry, knowledge institutions and social organizations/NGOs.
- The educational system will be open and experimental and much more interlinked with working life and society at large.
- Technology will increasingly be used to create a more sustainable growth system based on individual and societal responsibility.

Citations from group work:
A better integrated society, borders are becoming obsolete, more free flows of information, new media like Facebook and Google provide better facilities for discussions of research results….
The future is about transcending borders of the mind – intellectual boundaries; need a more open and experimental education system…
More flexible forms of learning, more integrated in society; the distinction between education and work is becoming blurred.
The old university culture is under attack – new players doing research and knowledge-based work.
A more diverse set of organizations are important players in funding research (ex Bill Gates Foundation)
Nordic countries as a "living lab" - testing the system (education, government, health & ICT, public reforms)
The Nordic countries have developed (in 2025) into a region for technology evaluation and experimentation; a research and innovation policy experimentarium.
Feedback loops in organizational change – the new "business-as-usual" characteristics: solve the problem with different attitudes, create a symphony of different identities, openness across institutions, search for added value, and scarce resources as a basis for policy and action.
People with scientific competence will be more integrated in economic and innovation policy – science-society interactions are becoming more advanced.
We need to think about how we want to live our lives in the future, make use of technology and ways of living to create another sort of growth…liberate people from material life – consumerism.
Transition management – challenges the traditional equilibrium model-based role of economists.
Internationalisation of education and research is gaining increasing significance and attention.
We have an influx of young researchers, enhanced mobility between Nordic countries.
Need for pooling of resources between nations is necessary to cope with global challenges.

Session 2

B.2 What will happen – policy options – different dimensions

Initial reflections:
The governance system will develop to be much more horizontal and reciprocal, based on responsibility for everyone, more dependent on transparency and trust in-between different societal actors/stakeholders. There will be a need for global governance to secure a development towards a greener, sustainable and more learning-intensive society.

Governance by design? Building a sense of global community and establishing a policy to frame the emergence of global governance will not be easy as we have not invested in creating the coherent values and norms that bind communities together, allowing divergent interests to be balanced, and disputes to be resolved. Because of the heterogeneity of collective preferences, which are enduring despite globalization, the homogenization process is difficult. Americans and Europeans provide a good example of this point: they have found practically no common ground in terms of the division between the public and private spheres, tolerance for inequalities and the demand for redistribution, attitude to risk, and the conception of property rights. In certain cases, globalization even serves to accentuate differences rather than being a force for homogenization.

Governance through dynamics? The global challenges facing the world call for the organization of collective action to be prioritized. The emergence of global civic awareness, through a growing number of bottom-up initiatives. Internet based movements and organizations, has taken the debate to the international or global level. Although it has its limitations, this trend is a logical response to the increasing importance of world governance issues.

Citations from group work:
Governance is about capacity to make decisions, competences needed, arrangements and examples of new practices.
Governance will be the responsibility of everyone. Transparency and information is at the core of this. How to organize spontaneously and still reasoned? How to create trust in institutions in an increasingly complex world?
LIS (learning-intensive society) is anarchist, plus global networks connecting the mavens (a person of good knowledge or understanding of a subject).
The capacity to make decisions; how can more people be involved? Ex. experiments with direct democracy in the municipalities.
Good governance is about keeping good ties between communities.
LIS – the economy of experience, taste, life style, identity, of sense and sensibility.
Scale of social affiliation/ diversity (juggler competence, independence, variety) will increase.
Collective multiple identities stimulates the capacity to embrace differences to create experimentation.
Global incentive structures are developed to be able to address global challenges successfully.

- No roadmap today – needed as basis for an effective incentive structure (the role of foresight)

- Ex NIH: medical road map (grand scale initiative)
o Give people a dream/hope – positive feedback loops (unpack issues)
- Ex solving the environmental crisis and also having better lives, something to believe in transcending cultural differences
o Death of institutions, ideas, structures as a basis for new creative solutions (undiscussables)
o Experimentation step-by-step, low cost, low risk, embracing the differences
o How to create positive feedback loops (unpack issues, elderly as a resource)

What did we do? LIS is about the professionalization of knowledge – what should universities and research councils do? How to survive – if the world is moving to LIS?

Session 3

B.3 The role of research councils in the future knowledge creating system/LiS

Research councils[6] will in the years to come develop their role as **knowledge councils** with a focus on strategic priorities, and the challenges attached to it as described above. The knowledge system will be based on open, plural, experimental ways of working and ways of knowing, where different stakeholders within society will participate on equal terms. Research councils in this knowledge creation system will have a role as **change agents**, fostering "collective experimentation" through "learning ecologies"; there will be a shift of attention from research communities to society and important societal challenges. Research councils will also have a role as **cultural agencies**, based on the understanding of the importance of local knowledge needs and contextualization of knowledge processes. There will be no "best practice" independent of the local context. We need to imagine learning in different ways; research councils need to interlock with other agencies and redirect the focus to fostering knowledge creation and learning instead of picking winners. Mobility between silos will be important.
Cooperation on the Nordic level will be important for addressing societal pressing issues in a holistic way. NordForsk may develop as a **think tank** (like DEMOS). Nordic funding will be directed towards addressing grand and global challenges; basic research will be funded on a European level.
Research councils need to change to survive. Should we go on repairing the system?
Question: Do we want to change science as we know it?

[6] For an explication of different roles for research councils, see chapter 2 "Are Research Councils Necessary?" in *A Singular Council*, the synthesis report presenting the evaluation of the Research Council of Norway by Technopolis, 2001.

B.4 Next steps - Notes for reflection and further learning[7]

We highlight the following elements from the NIRPA Work plan;
- to identify key policy issues for R&D policy making in the future; prepare the ground for future oriented dialogue, and advice on orientation for Nordic research policy intelligence including tools for Nordic cooperation; e.g creating a virtual center of excellence for Nordic research policy analysis.

What we see emerging through the NIRPA endeavors may be a shift from talking about 'research policy intelligence'/strategic intelligence over to the necessity to discuss what it might entail to explore 'policy learning'.

Science policy, as we know it in the Nordic countries, is struggling to find a consistent identity; on the one hand it seeks to satisfy the interests of the research community "bottom-up", on the other hand science policy is about addressing industrial and societal needs to stimulate innovation and competitiveness in the industrial sector ("demand pull"). In the last years there has been a shift towards focusing on strategic research addressing global societal challenges (grand challenges), where research-based knowledge is expected to give a substantial contribution.

Kyrre Lekve's presentation of three possible orientations for science at the outset of the workshop; (i) science for science, (ii) science for competitiveness and (iii) science for society, may be seen as one way of representing this development.

These different positions reflect different (often implicit) conceptions or "cultures of understanding", concerning the actual and proper relations between science and society; between research and politics. Correlating to such different conceptions, there will also be different institutional, organizational set-ups and decision-making procedures. These different positions represent diverse and partly contradictory expectations regarding research councils' role(s) and modes of working.
In the scenario workshop a majority of the participants expressed dissatisfaction with the current workings of research councils. Arguments reflected different visions and positions. However, the suggested future figures of either "knowledge councils" or "cultural councils" together with the proposal concerning the setting up of a Nordic Fund for grand/global challenges, point in the direction of research councils as <u>*societal actors*</u> and <u>*change agents*</u>. Neither the more traditional role of research councils as secretariats for research devising "policy for science" nor the role developed in the 60s and 70s as knowledge managers; securing the fuelling of research results into other societal sectors, devising "science for policy", were seen as sufficient in dealing with present and future challenges.[6]

Developing research councils as change agents/societal actors – what would it entail? What would it take in terms of capacity building, competence and skills, reinvented ways of working as well as institutional/organizational set-ups? What would it entail in terms of explication, transformation and change concerning underlying assumptions or models? We think this might be a vital point: "If the mod-

[7] The project group in RCN (Ellen Veie, Elisabeth Gulbrandsen) is responsible for the following notes.

el is too simple (as we have argued) the diagnosis and policy measures linked to it will not be productive, but will still shape society" (*Taking European Knowledge Society Seriously*, page 22).

Expectations concerning research councils as change agents/societal actors have been around for a while – at least as a buzzword (ref Technopolis' evaluation of RCN (2001), 'Between child and grown up' (2004) by Hanne Foss Hansen concerning Swedish Research Council). Growing expectations concerning such a role connects to grand/global challenges; ref Norwegian White paper on research (and innovation), OECD's new innovations strategy as well as EC from the Lund Declaration onwards (see Riel Miller's intervention). Complexity and dynamics characterize systems for production of knowledge, technology and innovation, demanding new approaches in order to ensure a societally robust impact. Climate, energy, poverty, food security are challenges of a systemic kind; they extend across established sectors, institutions, professions, expertise and disciplines. They are also full of so-called wicked problems; problems that are difficult to solve because of incomplete, contradictory, and changing requirements often difficult to recognize – upfront.

Moreover, because of complex interdependencies, the effort to solve one aspect of a wicked problem may reveal or create other problems. This indicates that the grand/global challenges themselves - as well as adequate solutions - must be identified in distributed processes and dialogues in-between different societal actors.

BUILDING NEW PARTNERSHIPS FOR RESEARCH AND INNOVATION TO ADDRESS SOCIETAL CHALLENGES

The complex matter of addressing societal challenges by research and innovation asks for new forms of cooperation between different worlds. It asks for more open interaction between government, industry, knowledge institutions and societal organizations. It is this interaction that defines the success. One of the challenging tasks for policy (makers) will be to foster the building of new partnerships between stakeholders. The last decade 'open innovation' has become widely introduced as a new innovation strategy. It stems from the thought that businesses can no longer innovate on their own. Interaction and cooperation with other partners is necessary for companies' growth strategies in an ever globalizing world.

In the same way, to be able to successfully address societal challenges through research and innovation, actors can no longer operate in isolation. Governments need to cooperate with knowledge institutions, businesses, organizations and - not to forget - with each other. We might call this 'collective innovation'. Societal challenges are challenges of public interest, so there is a government responsibility in searching for solutions. But the knowledge, expertise and mandate to address these challenges are spread throughout society. Societal challenges are collective challenges and therefore need a collaborative approach.

Yet, despite the widespread acknowledgement that more distributed approaches is the way forward, achieving co-ordination, coherence and co-production contin-

ue to be a challenge. In many cases, research and innovation policies remains compartmentalized in different departments and agencies that face obstacles to cooperation. The often heard call for more co-evolutionary approaches seems hard to realize in practice and as culture. The recurrent question we are met with in our own institutions is; "but what do we do, then?" Or; "how to walk the talk" of co-evolution, co-production.

We have come to suspect that this question may be a symptom of a need for change at another level. Maybe it is not so much about what we do or the instruments that we employ, as much as it concerns *the mode* in which we employ them. Maybe it is not first and foremost a question of designing *new* tools, instruments and mechanisms? We borrow a conclusion from an EC-report on science and governance[8] stating: "… that questions have to be kept in mind as an on-going element of policy itself, while we nevertheless have to act, suggests that science and governance institutions need to learn to make a shift in policy and practice towards more inclusive, reflective and open forms of *learning*" (our emphasis).

POLICY LEARNING, WHAT COULD IT MEAN?

In the Netherlands, UK as well as the Nordic countries, much effort has been put into inviting 'society' to speak back to 'science', of experimenting with different types of stakeholder involvement in order to establish the much sought for two-way dialogues and the productive interactions and learning between science and society. The re-thinking of stakeholder involvement that we now see e.g. in EC and UK, point out how the infamous 'deficit model' is simultaneously laid to rest and resurrected in these experiment. And they draw out a lesson; there seems to be a continuing failure of scientific and policy institutions to place their own science-policy institutional culture into the frame of dialogue, as a possible contributory element that hinders a genuine two-way dialogue and the much sought for learning. As Brian Wynne puts it; we are 'hitting the notes, but missing the music' failing to acknowledge the deeper challenges of opening up our institutions and assumptions to critical debate.

Through employing our already established tools, instruments and mechanisms, we can learn more about the dynamics which we are attempting to modulate (if not steer), as well as learn about the premises of our interventions, our own institutional taken-for-granted assumptions. There seems, however, to be a chronic underinvestment in *the learning infrastructure*; in methods and in the quality of learning both in the policy sectors as well as in research. We seldom discuss what we mean by learning. Does it entail asking ourselves whether we are doing things right (single loop learning), doing the right things (double loop) or inquiring how we know that we are doing the right things (triple loop)?

Triple loop learning allows us to pose questions concerning what is progress these days – in the light of present environmental, developmental and financial crises –

[8] Taking European Knowledge Society Seriously, 2007 EC

as well as questioning how to evaluate and how to measure progress. Triple loop learning also means exploring the validity of our own institutional taken-for-granted assumptions and routines. Triple loop learning represents a possibility to engage our own established institutional assumptions and imaginations through listening and responding to other stakeholders/partners' situated knowledge. As a consequence of engaging in triple loop learning, our governance practices and routines may also be opened up for collaborative experimentation; in order to support ongoing dynamics rather than containing them.[9]

The literature is full of testimonies concerning the challenge of sustaining such open forms of learning processes in organizations. E.g. one quote from the DEMOS-report (2007) *The Collaborative State: How working together can transform public service*: "Collaboration has been slow to take hold in large part because it is easy in theory, but fiendishly difficult in practice". It is also insistently present in a recent report from EC *Challenging Futures of Science in Society* (2009) concerning how science must become *reflexive* in order to support open learning processes in policy development and decision-making. It requires what the report calls "further skills" as scientists must be able to explicate their premises, conditions of validity, uncertainties, areas of ignorance, values and conditions of applicability to certain contexts. As: "Involving publics …, can be more productive if not only the knowledge at the object level is presented and discussed, but also the related meta knowledge". (Ch 2 The place of science in society)

This challenge applies to social scientists and humanists as well as to other scientists and technologists. It involves learning new relationships and responsibilities, with the 'public', with the natural sciences, industry as well as policy. And it involves social scientist and other 'softer' disciplines becoming actors in those worlds as well as commentators (*Governing at the nanoscale*, DEMOS, 2006).

IMPLICATIONS FOR POLICYMAKING

While employing our established instruments, tools and mechanisms in order to learn more about the dynamics they modulate as well as our own institutional taken-for-granted assumptions and routines, there are some directional pointers we might observe on our way "between the no longer and the not yet"; towards a more *collaborative and learning mode*. Even if there are no blueprints or recipes available, there are *questions* with implications for policy that need to be fostered and sustained. When a policy seems to work well, it is still possible to ask both; what does it work *at* (context of implication) and; how could it have worked *differently*. And then of course, there will always be questions concerning the balance between opening up learning spaces and closing them down.

Then there are questions of pace and patience. If we should suggest one heading that cover many of reports we have today from experiments trying to foster complex interaction of multiple dynamics, it will be; "slow innovation". For an instructive e.g. of what this might entail, see e.g. how Melissa Leach explores what she

[9] See Arie Rip's «A co-evolutionary approach to reflexive governance – and its ironies" for an exploration of what "governance through dynamics" might entail for the policy maker.

frames as “the slow race” in the chapter on “Technological Innovations” in *Fostering innovation for global health* (The Global Forum for Health Research, 2008).

And then there is a question concerning of what *kind* of visions or figures that can guide our efforts towards more collaborative and slow innovations. We should opt for figures of a *procedural* kind, helping us towards “getting at the world as verb” as one of our collaborators once phrased it. Consider e.g. the figuring power of “technologies of humility” suggested by Sheila Jasanoff as opposed to the regulatory and predictive “technologies of hubris” that she contends we lavish too much attention on these days.

The PUBLIN report[10] brings up suggestions concerning how to develop our policy institutions in the direction of learning institutions; e.g. make active use of workshops, sabbaticals, courses and other forms of training, exchanges of employees for limited periods of time so that policy makers may learn to know other cultures more intimately, more radical recruitment policies in order to avoid the “clone problem” (leaders employing people sharing their belief system or educational background only). Institutions could also consider making policy learning an obligatory part of work description and employment contracts, and should identify the resources that are to be allotted to such learning. The establishment of informal social arenas where people involved in innovation processes may meet and brainstorm, will also be valuable. This may include workshops, conferences, but also the establishment of venues like house cafés, regular dinners etc. where people can meet.

Then there are vital questions concerning indicators and accounting procedures. One suggestion about what we can do differently– that may have a large impact – concerns supplementing (if not reinventing) our audits as to aim at finding out how the original plans had changed. As stated in an experiment conducted in the UK (taken from the *Collaborative State*): “We wanted to know how the emerging learning was shifting spending decisions over time”.

B.5 Policy snapshots from the future: Nordic research, innovation and higher education policy governance

The NIRPA project is to help Nordic policy makers in their development of future research, innovation and higher education policies. What kind of knowledge and what kind of competences will we need in the future, and how do we build these competences? Needless to say, research will be an important part of this competence building, but then as part of a broader knowledge policy initiative.

In order to make policies for future needs, you need to have an idea of the future. The future is not here, so you cannot see it, but based on historical experience

[10] Innovation in Public Sector, report D24; Summary and policy recommendations

and certain knowledge of social, cultural and economic processes, it is possible to make some educated guesses about what may happen.

Foresight is not in any way an exact science, nor is it supposed to be. Foresight-exercises are to help us identify and discuss the different variables that will influence what is to come, and they may also help us understand how such factors interact, If you change one variable you may actually change the whole system. Think, for instance, about how the Second World War changed the dynamics of world history. By turning the different "wheels of history", you may develop different scenarios – or narratives about what will happen in the future. This helps us prepare for different outcomes, bearing in mind that the policy decisions we make today will also influence what will happen.

The NIRPA working group has, on the basis from work done in the Norwegian Ministry of Education and Research, and with very valuable input from selected experts and researchers, developed some snapshots depicting how knowledge policy making may appear in the Nordic area in 2025.

The goal of these snapshots is to generate discussions regarding what has to be done to reach some overreaching objectives that we believe we have in common:

- The development of economies that can serve as the foundation of welfare and sustainable growth
- Ensuring the continuing development of democracy, cultural and social creativity, dynamism and variety in the Nordic area and the world at large.
- Working for peace, health, well-being and social justice everywhere.
- Avoiding harm to our environment.

We believe that these overreaching objectives can only be reached through the use of human creativity, innovation and critical reflection, based on competences, experience and knowledge. An important part of this competence base will be science and technological development.

The main question in this exercise is: *How do we build a Nordic competence base capable of handling the challenges of the 2020's?*

Among the follow up questions that we believe need to be answered are:

- What did the Nordic governments do in order to facilitate the development of these knowledge based societies?
- What did we do with our institutions of knowledge and innovation, including universities, colleges, institutes and companies, and to the interaction between them?
- In what way did the Nordic research councils contribute to the further development of our knowledge based societies?
- What happened in the rest of our societies, socially, economically and culturally, that helped us achieve some of our goals?
- How did global developments influence these processes?
- How did we handle the obstacles and the unintended consequences of our actions?
- To what extent did Nordic collaboration help us get there?

- What was the role of the European Union and international collaboration in the fields of research, education and innovation?
- To what extent have we changed our view of science the relationship between science and society?
- What are the key requirements for high-level research policy intelligence within the Nordic countries in 2025?

By answering these and other questions we believe that the conference will provide important input to the discussion on what we need to do in the years to come.

Snapshot 1:
B.6 Knowledge and competence policies in 2025 Competence policy

In 2025 research policies have become more integrated into innovation policies. The example set by Denmark at the beginning of the century – gathering science and innovation in one ministry – has been followed up by several Nordic countries by 2025, although on a larger scale. The Nordic Council of Ministers now talks about the need for broad based competence policies, which encompass all types of competence development, learning and innovation.

Iceland is going to arrange a conference on the role of kindergartens in the development of entrepreneurship and the absorptive capacity of firms in November 2025. The argument is that creativity and the ability to proactively solve problems is a cultural phenomenon. Independent thinking and initiative are skills that develop early.

The new focus on learning and innovation has led to a strong interest in the role of universities and colleges as developers of competences as opposed to developers of codified knowledge. “Our most important product is not research per se,” the Rector of the University of Oslo said in an interview in January 2025, “but the skills our students develop while studying here.”

One of the major strengths of the Nordic economies is the ability of highly skilled employees to find, understand

and make use of knowledge developed elsewhere. This has, for instance, lead to a large number of highly knowledge intensive and innovative companies. Not all of them do their own research, but they all make use of research done elsewhere and they do employ highly skilled expertise well versed in the ins and outs of science and technology.

These kinds of competences are not easily outsourced to other countries, and one of the reasons Chinese, Russian, Indian and Thai firms are establishing research units in the Nordic area is the wish to tap into the Nordic competence base.

In the late 2010's several Nordic policy makers argued that the need for socially and industrially relevant research required a transfer of research funding from open competitive arenas for fundamental research to more applied research.

Following EU and OECD initiatives aimed at facing big global challenges like climate and health, more of the Nordic funding went to large strategic programs. By 2025, however, the dichotomy "basic" vs. "applied" research is toned down. The strategic programmes include research of all types, and often in combination. Moreover, experts on research and innovation now argue that a sufficient amount of basic funding for researcher initiated research is needed for the development of strong competence environments within institutions. Again there is an increased focus on competence building as opposed to concrete research results. As one minister said it: "We need creative and independent minds that can help our companies and institutions think outside the box!"

In the period from the early 1990's to the late 2000's the main focus of innovation policy was on industrial innovation, research for industrial development and research and innovation in companies. Given the strong role of the public sector in the Nordic countries, competence policy makers started to discuss innovation in the public sector in the late 2000's. It was argued that one of the reasons for Nordic success was that they did have well developed competence based institutions providing public services, and that they also contributed to the profitability of industry.

However, there was also a need for more innovation in the public sector, not least because of the demographic changes and the increased demand for health and social services. This led to the establishment of several policy instruments aimed at (1) increasing these institutions in-house innovative capabilities and (2) strengthening research for innovation in the public sector. By 2025 there are several strategic R&D programs that combine the needs of industry and the public sector.

By 2025 competence based policy development also includes disciplines and competence areas that were once considered exclusively part of culture policies. The social sciences and the humanities increasingly support industrial development by providing "cultural contextualization" of marketing efforts, but also by providing input to the development of products and services. Entertainment, edutainment and tourist services employ people with competence in historical and cultural fields. Arts, crafts and aesthetics are now considered essential parts of both product and service design, and – because of that – of competence policies.

Competence policy becomes part of economic policies

Up until 2010 research and innovation policy were weakly integrated into economic policy in the Nordic countries (or the world at large, for that matter). Ministries of Finance focused on traditional macroeconomic instruments when developing policies. Although technological change was recognized as being important, these ministries and their supporting researchers did not include research and innovation policy initiatives in their proposals. Indeed, publicly funded research and education were considered expenses, not investments.

The crisis of 2008 showed that the models used at that time were not sophisticated enough to understand the complexity of economic, social and cultural systems. Moreover, given the increasing importance of global markets and international regulations, the national governments were deprived of many of the traditional tools of economic policy making, including the use of currency devaluation or customs barriers.

The criticism made by economist like Joseph Stiglitz and Paul Krugman in the 2010's led to new approaches in the 2020's. Economists increasingly tried to include more social and cultural dimensions into their models, and policy makers in the ministries of finance started looking at new tools for economic policy development. Given the importance of learning and innovation for economic growth, their interest turned to research, education and innovation policy.

By 2025 the Nordic competence policy learning initiative includes policy makers from the ministries of finance and related institutions, and there is strong collaboration between ministries of finance and ministries of knowledge along what has now become known as the economy-knowledge axis.

B.7 The new role of institutions for research and higher education

The university and college sector remains heterogeneous in 2025. There are institutions focusing on fundamental research, as well as colleges that can be considered mainly teaching institutions. The need to develop strong internationally competitive milieus for high quality research remains, but the ways that countries try to stimulate such research varies.

Some of the Nordic countries have established Universities of Excellence, institutions that are given ample funding for long term research, and that are allowed to recruit the best researchers and the best students only. In other countries the argument is that the need for democratic development, competition between different approaches to research topics and the need for broad based mass education require large institutions of higher education that combine excellence with

variety. These countries mainly use the competitive arenas of research council funding to stimulate research excellence.

In 2025 some institutions adhere to the so-called Second Best movement of 2020, which argues that innovation is not necessarily best furthered by institutions of academic excellence, but by researchers and experts who understand the needs of companies and institutions. “The strong focus on publications and citations has removed the best researchers from society,” the Finish Minister of Education said in 2024, “and they have become useless as generators of practical innovation.” The Principal of the University of Reykjavik argues that she would rather hire two of the “second best” researchers, provided they have work experience from institutions and companies outside the university, than one irrelevant Nobel Prize winner. Most of the “Second Best” universities and colleges, however, try to develop a mix of academically proficient and “excellent” scientist with research entrepreneurs with a deep understanding of societal needs.

This mix of university and college types and approaches is the result of a complex historical development:

The cuts in the budgets for research, innovation and higher education in the early 2010’s led to innovation in the sector for higher education. The cuts forced the universities and the colleges to think more strategically. For a while they were also forced to look for alternative sources of funding, and many of them developed new ties with the private and civil sector. This need for developing the capability of prioritizing was strengthened by following knowledge friendly policies, as policy makers demanded more bang for the buck. This led to a wide discussion regarding the balance between strategic research and free curiosity driven research, a conflict that has still not been resolved in 2025.

In the 2010’s there was also an intense debate in all the Nordic countries regarding the need for elite research institutions versus the need for expanding higher education to encompass even larger parts of society. Since the status and the money followed the research activities – publishing and citations included – colleges and universities felt pressure to focus even more on research rather than teaching. The need for mass education, however, required high quality education.

The drive towards research also led to the establishment of small research units at colleges and smaller universities which were competing with the ones at the larger universities, but without having the same resources.

In some cases this led to a fruitful heterogeneity where alternative research environments provided useful corrections to conservative university milieus. On the

other hand, the systems of higher education also saw the birth of many weak research units delivering mediocre research.

In the 1990's and the 2000's there had been attempts to solve this dilemma by merging institutions for higher education into larger organizations, often covering different geographic locations. In many cases this led to the kind of concentration of resources the policy makers were looking for, but it also led to bureaucracy and top heavy institutions without the flexibility needed to adapt to a changing environment.

A fairly successful experiment was the establishment of various kinds of centers of excellence, whereby existing institutions were encouraged to collaborate in time limited alliances. The system was criticized both for rewarding established researchers and for not taking the need for alternative points of view into consideration.

Another topic for discussion was the division of labour between RTOs (research and technology organizations or research institutes) and universities/colleges. Denmark tried to unite the two types of knowledge institutions into larger units. Sweden tried to establish new institutions of this type to help small and medium sized companies that needed more practical, short term assistance. Finland and Norway kept a fairly large number of RTOs outside the university sphere, but tried to strengthen market oriented research institutions by encouraging mergers, while at the same time funding more long term research at the same institutions.

The strong strategic focus of the national and European research and innovation policies, made policy makers demand strategic foresight from the institutions for higher education as well. This led to a lot of debate in the university sector as researchers, defending the independence of the individual researchers, clashed with researchers and administrators arguing for team building and a more strategic prioritization of funding within organizations. Many of them failed to develop such policy competences, which made the authorities channel more of the national research funding through the research councils.

The apparent confusion regarding the roles, functions and incentive structures of the different types of institutions: RTOs, colleges, targeted universities and broad based universities was discussed by a Nordic commission under the Nordic Council of Ministers in 2020. The different historical and cultural trajectories in the Nordic countries made it impossible for the commission to agree on one model for all countries. Instead it argued for the need for heterogeneity in all the countries, as well as the establishment of more cross-country centres of excellence, including knowledge institutions of all types. The commission also proposed the development of instruments for the "second best researchers", arguing that there would always be a limited supply of talent, and you needed ways of getting the best out of the people you have. This led to the development of a more nuanced academic incentive structure, where skills beyond publishing were rewarded (team and alliance building, teaching, popularization and media skills etc.)

B.8 The global market of education and research

The large Nordic companies are now international companies with branches all over the world. Some of them are owned by foreigners and some of them have even moved their headquarters elsewhere. The fact that their core competences are anchored in their respective national innovation systems, however, secures a continued presence in the country of origin. This applies to companies such as Nokia, Volvo, Statoil, Bang & Olufsen and 66º North. Policy makers understand that the only way of keeping them active at home is to provide them with access to a highly educated and motivated workforce as well as research institutions that foster an innovation eco-system. This has turned out to be more important than tax levels and regulatory frameworks.

In the 2010's the Nordic research institutions faced stiff competition from countries like India and China, and many Nordic companies outsourced parts of their commissioned research to institutions in these countries. This development was seen as a threat to Nordic universities and research institutes. As early as in 2010, however, the first American engineers moved to India in search of higher salaries and by 2025 gap in salaries between India and China on the one hand and Europe and North America on the other has narrowed significantly. The need for deep insight into local markets and local needs, means that in 2025 Nordic research institutions are able to compete in their areas of expertise, and thanks to large public and private investments in research and education the institutions have the skilled manpower they need.

The large research institutes, like VTT and Sintef, had been global since the previous century. Now they are increasingly turning their attention to non-Nordic markets, setting up branches in Europe and in countries like Brazil, India and Indonesia. This is partly an attempt to generate new revenue, but also an effort to gain access to the competence pool of these countries. The growth of South East Asia, Latin America and South Africa is no longer seen as a threat, but as an opportunity.

Many Nordic universities were losing students to institutions abroad. Young Scandinavians found their way to universities in Rio, Hydrabad, Shanghai, Cape Town and Kuala Lumpur. At the same time, however, the influx of immigrants and guest students has led to an overall increase in the number of students in the Nordic countries. Teaching practices have had to adapt to changing cultures. More and more courses are taught in English, which also strengthens the language skills of the native students. This helps them work in a global market. The weakening of local languages has led to a debate on the weakening of local cultures, though, and the Nordic countries have now established a common research program for new automatic translation technologies. The hope is that this will lead to a renaissance for local languages.

Harvard established its first Scandinavian branch in Stockholm in 2020, while MIT bought DTU in 2021, causing a lot of nervousness in Nordic university circles. Several universities and colleges have followed the traditional route and merged to face the competition. Others, however, have decided to explore “the long tail”, deciding that small is both beautiful and efficient. They have dug deep into their local communities, integrated with global networks of scholars and students, and provide bespoke and unique programs outside the large institutions.

A few Nordic universities have established branches abroad, especially in the Baltic countries. The Scandinavian Business Academy, an amalgamation of private business colleges in Denmark, Sweden and Norway now offer English language e-learning courses in India, Malaysia, Japan and Indonesia.

In 2025 the new academic publishing regime is firmly established. All nationally and EU funded research now requires open access publication, and all research reports and papers are published online for free. This has completely undermined the traditional market for printed peer review periodicals. The last printed version of a scholarly journal was a copy of Nanobiology from 2020. The publishers now require payment from the researchers for inclusion in their free online journals, and publishing support is an integrated part of all public funding of research.

Open access has had an effect on the public debate, as well, as the social web sees more and more direct links to original research reports. This has led to the identification of an audience for more popular and transparent modes of presentation linked to the still highly technical scholarly articles. As a result there is a new kind of video based market, modelled on the high successful TED talks (http://www.ted.com/talks) and that enables much greater involvement in research by people from around the world and a diversity of specializations. Several of the Nordic countries have also established semi-public bureaus for research dissemination, helping the institutions making their research known internationally, selling research results and forging ties with the public and other research institutions and companies.

B.9 The role of the EU

In 2025 the ERIA (the European Research and Innovation Area) is a dominant funder of research and innovation in Europe, and the national governments do their best to encourage researchers to apply for European funding. Given the increasing focus on the use and effects of research, members of the ERIA lobby hard to get their research needs covered by the ERIA. The Nordic research policy alliance has increased the Nordic influence on EU priorities. In general more of the EU funding goes to research targeting large global challenges, although the European Research Council remains an important funder of curiosity driven research in all disciplines.

The wide scope of EU funding, has led to a need for stronger involvement of ministries beyond the ministries of research, education and innovation. The ministers

of knowledge struggle to keep track of all the initiatives, leading to some fragmentation of knowledge policy strategies on the European and national levels.

ERIA has since the beginning of the century been an important learning arena for policy developers. Through the ERIA-nets policy makers have been able to learn from colleagues in other European countries, and they have been using these networks to find inspiration and information of relevance to their own policy innovation processes.

Due to the efforts of NordForsk and NICE, the Nordic policy makers have been able to make use of these learning arenas in a very efficient way. The Nordic networks help Nordic policy makers identify the most promising European groups and resources, as well as giving them access to relevant Nordic researchers and analysts.

Some of the Nordic countries experimented with cutting national R&D budgets in areas where there were strong ERIA initiatives in the late 2010's. It turned out, however, that weak national funding weakened the ability of institutions to win ERA competitions. By 2025 all the Nordic countries had adopted "the Complementarity Principle", meaning that they have intensified national funding of research areas of vital national interest (e.g. where the nation has competence based competitive advantages), partly in order to strengthen the role of their researchers in European networks.

In the late 2010's several Nordic policy makers raised concerns about the strong focus on European research collaboration. The argument was that European collaboration may weaken the countries' abilities to forge ties with the new growth economies – countries that are investing heavily in research and innovation. The Commission responded actively to meet these concerns, and in 2025 ERIA has become an important arena for collaboration with economic powers like India, Brazil, China and Malaysia.

B.10 Nopoli: Establishing the basis and the framework for a new Nordic knowledge policy

As the Nordic countries felt the impact of the global recession in the 2010's, demands for huge cuts in the budgets of public institutions for research and higher education became common in the early 2010's. For a while the knowledge ministers found it hard to defend their budgets and some cuts were made. As the crisis dragged on, however, policy makers and opinion makers turned to the "knowledge sector" for a solution.

The finance ministries and leading economists demanded clear and transparent strategies that showed how increased investments in research and higher education would lead to renewed growth.

At the same time environmentalists and critics of the existing system argued that the knowledge ministers had to prove that the new investments in knowledge did not lead to new technologies that would be used to continue old practices, leading to more pollution and more harm to the environment.

These activists argued that the current environmental and economic crises could be said to have been caused by research and technological development, and if you wanted to use research "to fix the world" you had better know what you were doing. In other words: The old argument about all research being good research, and that all research would ultimately lead to growth and prosperity did not play out.

The new consensus was that science as well as science policy could not be understood separately from society, and that knowledge policy development had to include both scientists, policy makers, stakeholders and the public at large. This consensus was strengthened by the so-called diaper scandal of 2013, where a big multinational company had to withdraw all their new baby napkins, as it turned out that its hyperabsorptive nano-core caused paralysis in some babies. The scandal activated the social web in a way that hadn't been seen since the Climategate scandal of 2009, and it became clear that there was now a highly educated group of opinion makers out there that did not accept the "truths" of scientists and companies without a debate. In order to regain the trust of the public in nanotechnology in particular and science in general, some kind of democratic oversight had to be established.

In the relevant Nordic ministries and in the public agencies for research, innovation and higher education it became clear that there was a need for more nuanced and sophisticated policy development, i.e. policies that took the possible future effects on the social, economic, natural and cultural surroundings into consideration – "to the best of their abilities". And in order to strengthen these abilities the Nordic Council of Ministers launched the Nordic Knowledge and Policy Learning Initiative (Nopoli) in 2015. Nopoli, which was run by NordForsk and NICE, developed a common learning arena for knowledge policy makers in the Nordic countries, as well as a Nordic network of economists and social researchers looking into innovation, knowledge and the role of research in society.

Nopoli was combined with a NordForsk/NICE initiative that conducted research into how to introduce the future more effectively into decision making and social

science. NordForsk and NICE also established a Nordic Centre of Excellence uniting some of the best experts in the fields of science and innovation research.

In 2018 Nopoli was expanded to include primary and secondary education, as well as kindergarten policy. It was argued that the innovative ability of the Nordic countries rests on having employees that know how to adapt to a changing environment and who know how to learn. It was therefore considered important to develop an independent, critical and creative mindset from day one.

Because of Nopoli the Nordic ministries were capable of developing plausible knowledge policy strategies in the 2010's, which convinced the public and the politicians that broad investments in industrial and social innovation, research and education were the way to go. The fact that the present crises had had a very long gestation time (some 150 years for the climate crisis) also convinced the politicians that there was a need for long term knowledge development in the sense of basic, curiosity driven, research in areas of great social, environmental and economic importance.

This new knowledge policy capability also increased the influence of the Nordic countries in Europe. Nordic researchers continued to do well in the ERIA. The Nordic policy makers also had the arguments to back up demands for shifts in the European research and innovation policies. Nopoli became an example of good policy practice and similar networks were developed elsewhere in Europe, under the aegis of the European Commission.

B.11 Research Councils and Societal Transformation: What is a "grand challenge" and how can collective efforts to encourage research make a difference?

Dr Riel Miller, xperidox. Global specialist in strategic foresights projects

First a story: Records have it that in 1898 the first international conference on urbanism was convened in New York City [Morris, 2007]. Given the scale of the agenda and the fact that many participants had traveled for a long time to get to the conference, the organizers set out a ten-day agenda. However, after three days the proceedings were brought to a halt and the conference disbanded. The consensus was that they had encountered an intractable problem to which there was no solution – the ever-mounting waste generated by urban horses.

Perhaps back in 1898 they were more modest or unimaginative since it is hard to see a group of intrepid conference goers in today's world ever giving up before the closing bell – no matter how daunting the problem. As for the case of urban horses, as we all know, it was the "horseless carriage" that brought the problem to an end. Of course this solution was not the outcome of a conference of eminent experts deciding that horse manure was a "grand" challenge and deciding to invest immense amounts of money in order to innovate a new less polluting horse. The solution was an amazing combination of unforeseeable emergent phenomenon like Henry Ford's much more efficient assembly line and the higher wages he offered the workers in light of their greater productivity.

Only hindsight tends to depict the solution to the problem of urban horses as a model for continued faith in the belief that we can find technological fixes for many of our current challenges – like climate change, water shortages, epidemics, illiteracy, and even 'so called' resource limits. To continue telling stories about cars, it is as if your car starts to break down and just at that moment, while you are pulling over to the side of the road, a mechanic arrives, fixes your car and allows you to continue merrily upon your journey. Such reassuring fantasies about the future and our ability to prepare on the basis of 'reasonably' good prescience are quite understandable. Indeed this is currently the burden laid on research councils, they will be clever and responsible, they will show great prescience by investing unerringly in the research needed to fix current and future problems. When breakdowns happen, science and technology comes to the rescue.

This story may be somewhat of a caricature, but in people's every-day scenarios of the future it is a role attributed and assumed by governments and the science-technology community. Of course this story is at the same time empowering and flattering for the research community as well as very easy to assimilate into our everyday imagining of the future, since we are so surrounded by the fruits of science and technology. Add to this that the 20th Century was above all else marked by the triumph of two beliefs – one is the human capacity to master the universe and the other is the power of planning to make it so. From trench warfare and the delusions of a "thousand year Reich" to the diffusion of the administrative organization, public and private, throughout the world, it is the engineering view of how to get things done that dominates. When the world is looked at from this paradigm all that is needed is a clear goal, good research and preparation, resolute and disciplined implementation, along with a pinch of innovation and a little bit of luck, and 'presto' you get what you want – less C02, less illiteracy, less poverty, less use of raw materials, etc.

The discussions sponsored by the Research Council of Norway around the future of research and the meaning of the Grand Challenges (Lund Declaration version) suggest that the danger is not that we will ignore humanity's "grand" challenges but that we will try to address them using the industrial era paradigms that got us into this mess. From this perspective there are two beliefs underpinning the basic concept of a "grand challenge" – one is the idea that challenges can be described as a "problem-solution" pair and the other is that technological breakthroughs are the solution. The danger of these beliefs arises from a fundamental misunderstanding of the nature and interactions of intra-, inter- and extra-systemic change. It is not that intra-systemic change, improvements and reforms are not good, nor that they have no chance of playing a role in both endogenous systemic transformation and exogenous, it is just that on the basis of this approach the attributes and distinctions that give shape to inter- and extra-systemic change are largely invisible.

As a result the dominance and defensiveness of entrenched systems prevail, unaware and unable to even consider systemically distinct aspects of what is currently actionable. This lack of systemic perspective reduces strategic choice to endogenous system reform, efforts at preservation – system immortality. The real question from a strategic perspective is to understand if current actions can be charac-

terized as a) neglect, benign or otherwise, if 'other' systems, b) active opposition to 'other' systems, or c) searching for ways to encourage experimentation and/or compositional change that encourage 'new' systems and new systemic configurations. If there is little or no capacity to ask non-endogenous questions then all that is left is to "solve the problem" through clever preparations that will fix what is broken, like the technological breakthrough that with hindsight appeared to solve the problem of horse manure. But as we know such associations are not causality. When we look more closely at the historical record we see that the tool was not the main catalyst or driver of change. We now know that without universal compulsory schooling, urban governments organizing water and waste systems, alternating elite power through electoral processes, open borders and enabled markets, it is unlikely that many of the scientific and technological advances of the 20th Century would have happened at all. And even if they had been "invented" the surrounding context, the economic, social and governance conditions, might have proved to be rather infertile ground for adoption and diffusion of the new tools.

Taking this more societal perspective to "grand" challenges suggests that the "problem" that was "solved" in the past might be better described not in mechanical or technological terms but in more systemic organizational and operational terms. The key changes were in such realms as: the rules and institutions that address illiteracy; the governance models that organize, finance and regulate the provision of clean and inexpensive drinking water and garbage collection; the values and rules for power sharing that attenuate the monopoly of monolithic elites; the lived experiences of diversity and the tangible results of the scientific method that reduced xenophobia and superstition.

From this perspective all of these "grand" changes were the outcome of largely unanticipated, willy-nilly organizational experiments inspired by shared as well as disputed hopes, social and political conflict and difference. It is worth remembering that the right to vote and universal schooling were both bullet points in Marx's Communist Manifesto. As things turned out, eventually, after many initiatives failed and a few new forms of organization proved their salt, what worked was emulated and adapted. Partly through intention, volition and action elements of new systems were built up. Gradually, in a process of iterative and compositional shifts the balance of systemic dominance, practical and symbolic, changed. There was no prior design, rather evolutionary emergence generated a collage that like an impressionists painting morphed from one image into another, a change of era, a change of systems.

During such periods of systemic change, as has been remarked by more than one historian (see D. McClosky), it is very difficult to discern the contours of the new order. Furthermore efforts to preserve the past often give rise to unintended consequences. Existing structures, methods and ways of making sense of the world serve as poor guides for action. In this transitional situation, as the mix and relationships of complex systems are transformed, there is even less direct causality and predictability in the relationships between research and societal outcomes, problems and tools, implemented solutions and actual outcomes. Does this mean that nothing can be done? That the only thing to do is to sit back and watch the

typically painful and anxiety-ridden decline of the old regime while waiting to see what will emerge from the ashes?

Such a passive response is, in my personal view, morally unacceptable. The ills of our current world, discerned on the basis of values that respect human dignity and Senian freedom, call for action. The question is what kind of action and, in the context of a discussion of the role of research councils, what is the role for collective efforts that mobilize intention and resources as a way to advance human knowledge? The first thing for Research Councils to do, as they attempt to take into account the "grand" challenges, is to avoid the trap of seeking solutions to the problem. Of course this is the most tempting and self-evident course.

"Grand" challenges are not like equations that can be "solved". It is not just a question of finding the right knowledge and applying it. Complex systemic change happens through the emergence of novel conditions – creative, inspired and spontaneous phenomena that change the conditions of change. As Buzz Hollings recently pointed out:

> *"Society is now at a stage in history in which one pulse is ending and another beginning. The immense destruction that a new pulse signals is both frightening and creative. It raises fundamental questions about transformation. The only way to approach such a period, in which uncertainty is very large and one cannot predict what the future holds, is not to predict, but to experiment and act inventively and exuberantly via diverse adventures in living."*
> C.S. "Buzz" Hollings, IIASA, Summer 2010

However, as reflected in some of the discussions hosted by the Research Council of Norway, at the moment, in light of the pervasive discourse of national competitiveness and the transition to a knowledge economy/society, there is evidence of a serious mis-understanding about the nature of today's "grand" challenges. Although the rhetoric does not always reach such proportions, it is often as if the Cold War rivalry of the 20th century has turned into a sort of race by already industrialized countries to stay on the summit of the industrial innovation mountain. Such efforts, like during the Cold War, get dressed up in the guise of assisting humanity, but more often than not are about helping "national" champions – or today how to keep Europe strong. As an alternative to this backward looking way of framing the "grand" challenges the discussions hosted by the Research Council of Norway point to two sets of conclusions – points 1 to 6 are about business-as-usual, point 7 sketches some alternative directions for "exuberant" experimentation.

Problems with the Grand Challenges

1. The GCs foster a problem-solution way of thinking about what needs to be done.
2. The GCs pose the problem in a way that encourages a technological fix approach.
3. The GCs, in the context of the competitive knowledge economy-society discourse, yoke research to playing a role in a global innovation race aimed at

preserving Europe's high rank a top an industrial pyramid that is shrinking in relative terms (due to successful efforts to enhance efficiency in research, innovation, production, delivery, etc.).

4. The high political stakes of 'winning' the GCs for the sake of 'saving' humanity's future and the anxiety about the future that is integral to the political meaning of the GCs make it extremely difficult to explore the idea that the GCs pose the wrong question and may be reinforcing the paradigms that created today's disappointments and fears.
5. Thus the GCs as guiding frames for current policy, often leveraging self-aggrandizing over-dramatization, reinforce existing approaches to both the role of science/technology in society and planning as problem-solving; even though such views have clearly played a central role in generating current hardships, fears and disappointed hopes.
6. This means that those who are attempting to set the research priorities and allocate resources accordingly run the risk of reinforcing exactly what they are hoping to overcome – disrespect through instrumentalization (mechanical problem solving) for the planet, the community and the self (body, mind, spirit).

Exuberant experimentation?

7. Is there an alternative to a GC approach? Discussions pointed to a number of useful directions.

a. *Research into more systemically open strategic futures thinking.* First much closer attention needs to be paid to the different attributes and opportunities for action presented by intra-, inter- and extra-systemic relationships. In practical terms this means more research on how to gain systemic and paradigmatic perspectives (distance from currently dominant anticipatory assumptions – Miller, 2010b), in particular by focusing on new ways to engage with discontinuity using experimentation and action research methods (Miller, 2011b).

b. *Greater use of non-predictive approaches to developing anticipatory assumptions.* Second that the images of the future being used to identify, motivate, justify and craft action today can be made more explicit in ways that help to identify implicit systemic assumptions – in particular anticipatory assumptions. In practical terms this calls for a resolutely non-predictive approach to anticipation because this opens up a whole range of new and more creative images of the non-existent, unforeseeable future. These images, in turn, facilitate identification and sense-making with respect to: system parameters, shifting system borders, system interactions and non-continuous system emergence.

c. *Embracing complexity: process-as-product, policies seek uniqueness not scalability or replicability.* Third that the vast majority of the images of the future currently being used to shape action not only fail to satisfy the criteria of today's more advanced understanding of the emergent nature of complex systems[11] but also stifle creativity and waste information by seeking replica-

[11] This is more than ignorance, modeling limitations or chance, it is the role of novelty in creating systemic discontinuity.

ble and scalable "preparatory" conclusions (generalizable pre-emptive solutions). Here again the practical steps involve moving away from treating the future as if it existed and only needs to be discovered towards engaging in local, real-time research that harnesses collective intelligence to welcome and makes sense of specificity and the continuous emergence of unforeseeable novelty. With greater capacity to make sense of change and emergence the task in the present, with a limited and modest role for planning, is to act in ways that are consistent with values, not on grandiose and dramatic undertakings meant to 'colonize' the future and impose legacies (even if of a different kind) on the future. It is such colonization and inevitably erroneous planning that produced the current unsatisfactory context. Imagine perfecting yesterday's approaches as a way to be "better prepared" for the future. Would the perfect school, the perfect national innovation system, the perfect hospital or factory, solve today's problems? Such immodest ambitions, both in terms of the potential effectiveness of a given model and the ability to 'perfect' it, betray a lack of confidence in future generations to take advantage of their novelty rich present as well as a paternalistic type responsibility to determine future outcomes.

d. *Everything is scientific:* experiment, hypothesis test, make failure as valuable as success throughout society (Mode 3 research as learning and learning as research). Fourth, following on the previous points, collective efforts to enhance the effectiveness of research in realizing public good (in both senses of non-appropriable value and collective well-being), need to experiment with new power/sense-making systems in order to facilitate research that produces both hierarchical and non-hierarchical (heterarchical – non-comparable) knowledge. Since there are no "winning" sectors or universal technical fixes the shift is towards fluid and constant research throughout society, including non-hierarchical knowledge, can embrace complexity by respecting all information and using continuous unforeseeable novelty. In practical terms this means focusing attention on the conditions for network fluidity (entry, exit, birth, death) – in other words trust, transparency and transaction systems, the sense making capacity of society as a constantly and everywhere. Here the tangible side, as discussed in the meetings, involves experimenting with new institutions, like evaluation and validation systems that would allow for human capital banking as well as peer to peer payment and copy-left tracking systems, etc.

Some references to articles with more complete bibliographies on the anticipatory systems approach to embracing complexity and the first urbanism conference in 1898 in NYC:

- Miller, Riel, (2011b), "Using the Future: A Practical Approach to Embracing Complexity", **Ethos** – Journal of the Singapore Civil Service, Singapore, November, forthcoming.
- Miller, Riel, (2011a), "Being Without Existing: The Futures Community at a Turning Point – A Comment on Jay Ogilvy's 'Facing the Fold'", **Foresight**, Emerald, Vol. 13, No. 4

- Miller, Riel, (2010b), “Which Anticipatory System for University Foresight? A Postscript”, in Blueprint for Organizing Foresight in Universities, Executive Agency for Higher Education and Research Funding, Romania.
- Miller, Riel (2010a)“Introduction to a Special Issue on Anticipatory Systems and the Philosophical Foundations of Future Studies”, co-edited with Roberto Poli, Foresight, Emerald, Vol. 12, No. 3, 2010
- Miller, Riel (2009), “To Experiment or Not to Experiment: That is the Question”, **Optimum Online**: The Journal of Public Sector Management, Volume 39, Issue 2, June, p. 21-25.
- Miller, Riel (2007), “Futures Literacy: A Hybrid Strategic Scenario Method”, **Futures**: the journal of policy, planning and future studies, 39, Elsevier, Pp. 341-362, May.
- Miller, Riel, (2006), “From Trends to Futures Literacy: Reclaiming the Future”, Centre for Strategic Education, Seminar Series Papers, No. 160, Melbourne, Australia, December.
- Morris, Eric, (2007) “From Horse Power to Horsepower”, **Access**, No. 30, Spring 2007.

C. The Helsinki Workshop 22 – 23 September 2011: Research Policies for Grand Challenges. Strategies and Tools

C.1 Approach of the Helsinki seminar
C.2 Highlights
C.3 Innovation and development in Brazil
Dr Glauco Arbix, Dept Sociology, Sao Paulo University
C.4 Research Centers in the Periphery – the Grand Challenges, the South, and Agency
Dr Michael Kahn, Centre for Research on Science and Technology of the University of Stellenbosch, South Africa
C.5 Value of Foresight and Flexibility in Research Policy for Grand Challenges
Dr David Croson, US National Science Foundation, USA
C.6 Grand Challenges in the European Context
Dr Anneli Pauli, European Commission, DG Research.

Background and context

Countries all over the world are facing grand challenges of a global scale and, in the future, science will play an emerging role in society’s response to them. Accordingly, the agenda-setting, coordination and conduct of science, and the ways in which scientific knowledge is used, are key issues.

Future research policies increasingly have to take into account that grand challenges entail complex, interactive systems. Accordingly, different stakeholders have to be involved, representing society at large, different sectors of society in addition to the research and innovation system. A flexible and more strategic approach is needed, based on interaction between all relevant actors, between national and EU efforts and between European and global efforts.

During the Swedish Presidency of the EU in 2009 a special *Lund Declaration* was issued: it demanded that European research and science policies "should focus on the grand challenges of our time". It listed as grand challenges sustainable solutions of global warming, energy, water, food, ageing societies, pandemics and security.

In 2011 a special Nordic Grand Challenges Working Group published its recommendations, which are intended both for Nordic and for EU policy makers. The recommendations focus on the concept of grand challenges, new ways of responding to them in research and innovation as well as processes and governance systems to identify and develop them.

C.1 Approach of the Helsinki seminar

The seminar focused on the role of research in grand challenges:

1. How are research policies for the Grand Challenges defined, prioritised, managed and evaluated in a sustainable way at national and regional levels?
2. How are relevant actors identified in different phases of the knowledge and innovation creating process?
3. How to identify the tools needed?
4. Nordic Added value – implications for the development of ERA?

The first day of the seminar was hosted by NIRPA and provided impressions from North and South America, Africa and Europe. Invited high level experts shed light on different strategies and tools of research policies in order to approach grand challenges in their regions.

The second day of the seminar, however hosted by NordForsk Agency, was based on experiences and lessons learnt from Nordic research cooperation.

C.2 Highlights

The presentations underlined that challenges are very different in different continents. Each region has its own historical background. Social challenges are closely linked in economy, innovation, education system and social safety networks. Therefore also the societal needs of different regions and their capacities to respond to grand challenges are very different emanating from diverse historical experiences economically, politically, culturally and socially. This is reflected in the policies, including strong emphasis on relevance-driven research and innovation policies for social engineering, in these regions.

The government of Brazil, for instance, has taken on a new active role, cooperating with industry and actively intervening strategically to support innovation by making state owned banks to cooperate actively in supportive investment when aiming for economic growth and the promotion of competitiveness, thus reducing poverty and inequality. The global economic crisis has stricken hard but society as a whole has gained strength from progress made in the political party-system and

the strengthened civil society by creating social trust. Funding for science and technology has been increasing. However, almost 60 % of researchers work at the universities, and a great deal are staffing the Institutes. There is scarcity in skilled labour and graduated engineers (6 % of researchers only). A more effective and inclusive integration with society and economy is needed.
South Africa is the higher education hub in Africa. In fact it has taken on the comparatively largest share in the world of foreign students to be educated there. There is also a different view of grand challenges generally in the South, characterized by eagerness to catch up scientifically and socially with the North in areas like for instance energy; health, social trust and social safety; demographics and societal and technological development. Open innovation systems are dynamic and transnational and moving to develop and connect to "mode 2" and user-driven innovation.

Generally, in the emerging research nations a paradoxical contradiction might appear with governments hoping for short-term economic returns when making policies often based on local interests: while science has long-term visions and often global interests. Identifying the right partners is one key issue.

One of the aims of science policy was to enable better decisions. Thus an example was given to illustrate the value of information from forecast and futures. An umbrella metaphor was presented as adequate when taking response action to a specific global challenge and then depending on efficient investments in foresight and flexibility. Without enough flexibility to use it, even the best foresight information is valueless.

In the European (ERA-) research-policy context, grand challenges have a future central role to play, especially in joint programming process, though current financial hurdles set by European economic crisis.

Key Note Presentations

The presentations and videos are available as pdf.files at the NIRPA web-page and at the ***web-page*** of the Academy of Finland.

C.3 Innovation and development in Brazil

Dr Glauco Arbix[12], Dept Sociology, Sao Paulo University

Brazil is as an emerging research-nation in science, technology and innovation. Currently the role of science is the underpinning of social engineering capacities for the reducing of poverty and inequality, and expanding innovative social safety networks. Its government is playing a more active role in the making of overall policies oriented towards investment, innovation and competitiveness. Brazil has

[12] Dr. Glauco Arbix is Professor of Sociology at the University of São Paulo. Since 2007, he is a member of the Brazilian National Council of Science and Technology, and heads the Observatory for Innovation, in the Institute of Advanced Studies at the University of São Paulo.

the unique combination of growth + job creation + social policies + minimum wage + low inflation. The new national strategy on science, technology and innovation was prepared in 2011. The key issue to be resolved is that innovation and technology have been conceived as byproducts of economic development rather than requirements for it.

Although affected by crisis, still the public funding of science and technology has been increasing, however, mostly oriented to basic research. An over-all current priority goal is to increase financial support to innovation, incentives to start-ups and strengthening of technology-intensive enterprises.

Brazil has several attractive R&D centers and Brazilian companies do go global. The main high-tech areas are aero-space, defense, energy, pharmaceuticals and equipment, green technologies and ICT.

Brazil still suffers socially and culturally from the consequences of being economically retarded in the past even if there are new policies and institutions dedicated to innovation. Companies are not clearly internationally attractive. There are too few innovative companies. Investment in technology is still low. Dialogue between universities and enterprises is difficult. Credit and financing are difficult, mainly for small businesses. Seed and venture capital market is poor. There is lack of human resources (engineering). The major challenges are education for a skilled work-force and business innovation.

C.4 Research Centers in the Periphery – the Grand Challenges, the South, and Agency

Professor Michael Kahn[13], Centre for Research on Science and Technology, University of Stellenbosch, South Africa

There are interesting times ahead. We shall live in multipolar world in 2050: 19 of the 30 largest economies will be the "emerging" economies such as BRIC countries. Traditionally leading research-nations such as countries such as Sweden, Belgium, Austria, Norway and Denmark might be to come replaced by new countries, such as Turkey, Egypt and South Africa and the like. "Energy availability need not hinder this path of global development (with) major investment in efficiency and low-carbon alternatives. Meeting food demand may prove more of a challenge, but improvements in yield and diet could fill the gap." World's fastest-growing economies are China and India and top-ten list has 7 African countries (Ethiopia, Mozambique, Tanzania, Congo, Ghana, Zambia, Nigeria) and Vietnam. South Africa is the higher education hub of Africa, in fact it is educating the largest amount of foreign students in the world thus tapping future skilled labour for knowledge production from riches hidden in the enormous reservoir of the continent.

[13] Professor Michael Kahn is Senior Research Fellow in the Centre for Research on Science and Technology of the University of Stellenbosch and is a board member of the Agriculture Research Council.

Approaching to grand challenges is very diverse in the South of the globe compared with the North. North is net importer of energy, population is aging and non-communicable diseases are predominant. South is net exporter of energy, population is young and main diseases are infectious diseases. The global food system is struggling to meet rising demands. Similar gaps will be seen in water supply, and increasing energy consumption will create huge strains on the system. Asia's share of energy consumption alone is projected to double over the next 20 years – to about 48 per cent for oil and 22 per cent for natural gas. Such significant challenges can only be addressed through innovative solutions in collaboration with research.

But addressing Grand Challenges by Governments in the South in order to promote a shift the imbalance of the North – South axis might even be contributed from a useful recipe recommending the complex blending comprehending a slice of theory from Prebisch-Singer scientific hypothesis, along with a dash of economics learnt from Joseph Schumpeter. Add to that absorptive capacity with strong migration policy together with a mix of public and private goods.
Put in season with levies on resource rents.
Serve this political blend with access to land and utilities.

That might be what it takes to create a fair, equal and good society for all citizens also in the South that are awaiting for economic progress and welfare to come from the tapping of riches from Science. That indeed does call for cooperation in research and building strategic partnerships for the creation of capacities for science. And, not to forget, exercise research funding agencies in strategic partnerships with MNCs - "the centre in the periphery".

And, there is neither any shortage of challenges. Take the example of India:

According to WHO: "India needs an innovation strategy geared towards creating an 'Indian model of development'. India needs more 'frugal, distributed, affordable, diverse, and malleable innovation' that produces more 'frugal cost' products and services that are affordable by people at low levels of incomes without compromising the safety, efficiency, and utility of the products." In 2004, 2 million deaths attributed to indoor air pollution (IAP) from use of open fires and primitive stoves.

Launching Research policies has to take into account the following tasks:

- The art and politics of governance, prioritization and agenda setting. Legislation, budgets, patronage.
- Mechanisms for specifying demand
- Framework conditions, institutional landscape and path dependence mitigate what is possible.
- Innovation systems are dynamic: trans-national; new modes - from R&D to 'connect and develop;' user-driven innovation
- Monitoring & evaluation, and synoptic studies for policy learning

Trade-offs to be considered could be categorized, such as:

Government:	Science:
Short-termism & local	Long-term and global
Social	Curiosity and self-interest
Economic	Altruism
Environment	Power of the invisible College
Political	

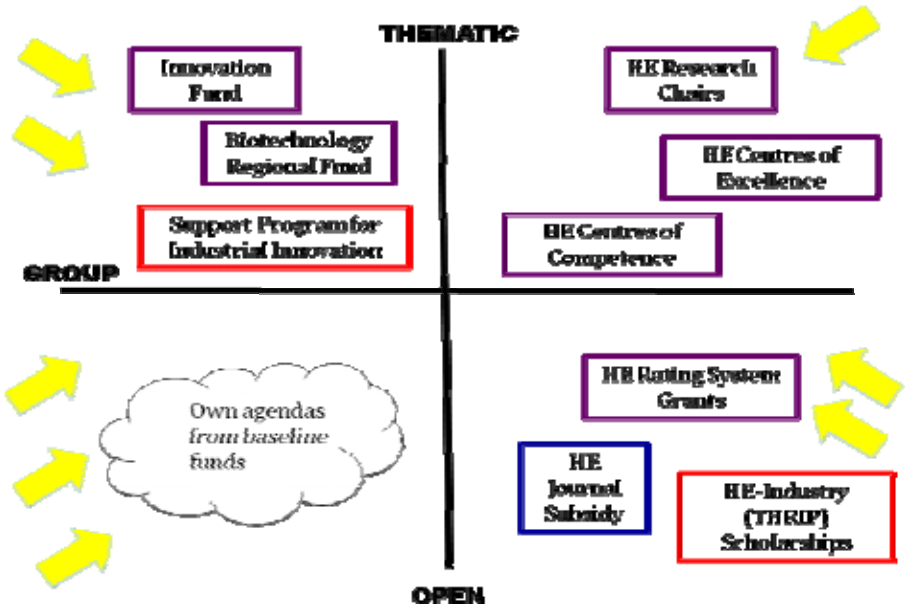
In South Africa crisis driven demand is reflected in the 12 targeted goals set by the government:

1. Improved quality of basic education.
2. A long and healthy life for all South Africans.
3. All people in South Africa shall feel freedom and safety.
4. Decent employment through inclusive growth.
5. A skilled and capable workforce
6. An efficient, economic infrastructure
7. Sustainable rural communities with food security
8. Sustainable human settlements
9. Effective local government
10. Environment and natural resources protection
11. Positive contributions to global relations
12. Public service reform with inclusive citizenship.

Selection process for priority-settings has been guided and under-pinned by:

Research and Technology Foresight (1999)
R&D Strategy (2002)
Learning from others
Kyoto; SADC cross-border pollution
Path dependence
Lobby groups and stakeholders

But a crucial question is how to cohere in a fragmented system to be steered and funded by a good funding-system? For major achievements then, we might need a good crisis. But the following modeling example could illustrate a good possibility: Steering by funding



There might be the following five Grand Challenges for South-Africa to take on, though its limited capacity for acting alone must be emphasized:

1. Energy (Hydrogen economy; renewables)
2. Farmer to Pharma (Biotechnology; Indigenous Knowledge)
3. Space Science and Technology (Astrophysics and satellites)
4. Global dynamics (Climate Change)
5. Human and Social Dynamics (Poverty; social exclusion and security)

However, leadership, priority-setting and decision- making call for a raise in status of R&D-policy- and strategy-making at the governmental top-level, together with change in perceptions from defining crisis and developing preparedness for cooperation, also internationally, for finding solutions to the following targeted areas of social crises stemming from Poverty; Low economic growth; Sustainability.

But to cope with these crisis South-Africa is focusing on

- "The New Growth Path:" toward Developmental State II
- National Planning Commission: a 20 year forward look
- Generating a national dialogue on research and innovation; demonstrate value
- Growth for expansion of the research and innovation system

To summarize: Open innovation systems are dynamic and transnational and changing by connecting to the developing of R&D- strategies based on so called mode 2; user-driven innovation. There is contradiction in government policies and science: governments tend to have more short-term and local interests, while science has long-term vision and often global interest. Identifying the right partners is one key issue.

C.5 Value of Foresight and Flexibility in Research Policy for Grand Challenges

Dr David Croson[14], US National Science Foundation, USA

Professor Croson presented a mathematical based model on rational choice in political decision-making from a foresight- approach in response to grand challenges and stressing value of relevant information and that science policy aims to inform policymakers and enable better decisions. Response to a specific challenge also depends on efficient investments in foresight and flexibility. Without enough flexibility to use it, even the best foresight information is valueless.
[Professor Croson can be followed at the ***web-page*** of the Academy of Finland].

C.6 Grand Challenges in the European Context

Dr Anneli Pauli[15], European Commission, DG Research and Innovation

Dr Anneli Pauli presented the grand challenges in the European and in the global context from an EU-perspective. In the European research policy, grand challenges have an increasing role. The Europe 2020 strategy, developed and advised by ERAB-expertise and adopted in 2010, aims at "Smart, sustainable and inclusive growth". The shared and agreed objectives are formulated to the 2020 headline indicators.

A significant part of the strategy is the Innovation Union flagship that has focus on societal challenges and is tackling under-investment, fragmentation and framework conditions for innovation. The innovation Union includes European Innovation Partnerships addressing major EU challenges, as well as new European Research Area framework, streamlined EU-programmes, new financial instruments, reform of standardization system, public procurement of innovation, social innovation pilot and stronger monitoring of developments.

In last few years grand challenges have been focused on within the European Research Area and especially in the Joint Programming process. The overall aim of Joint Programming is to pool national research efforts in order to make better use of Europe's public R&D resources and to tackle common European challenges more effectively in a few key areas. It will follow a structured strategic process whereby Member States agree common visions and strategic research agendas to address major societal challenges. It may involve collaboration between existing national programmes or the setting up of entirely new ones. The process is led by Member States in partnership with the Commission and requires new mindset where Member States also consider EU added value. The first four initiatives were launched in 2010 and six further themes were selected and will be launched by the end of 2011. Several of them include an international dimension.

The Innovation Union commitment also included a statement that the Commission will create a European Forum on Forward Looking Activities (EFFLA)

[14] Dr. David Croson is currently serving as Program Director of the Science of Science & Innovation Policy (SciSIP) program at the US National Science Foundation from 2010-2012.
[15] Since April 2008, Dr. Pauli is the Deputy Director-General on Innovation and ERA (European Research Area) of DG Research and Innovation at the European Commission.

bringing together existing studies and data and involving public and private stakeholders to improve the evidence base of policies. The mission of the EFFLA is to enhance collective forward looking intelligence, to help the EU in tackling upcoming societal challenges and to devise comprehensive and pro-active European research and innovation policies. The objective is to advise the Commission on the basis of the most outstanding outcomes and signals from Forward Looking Activities to facilitate the early identification of emerging grand societal challenges. It aims to debate these studies and results with policy and decision makers, the scientific community, European and international organizations, business and industry, think tanks and NGOs as well.

However, Grand challenges not only mean the dismantling of threats to society and solving problems globally, they are also an opportunity for scientific advancement. Global, European and Nordic actors need to cooperate, understand and respect the diverse roles and missions involved. Grand challenges also urge for holistic policy making and holistic policy-implementation as well.

And last but not least, there is need for the developing of science policy intelligence. But there is also urgent need for more daring foresight and techniques inspired by futures studies. These tools for planning and prioritizing directed research has not yet been taken very far by the European Commission.

Thus the future tool-box needed might, in the first place, even put pressure on the hegemonic claim from science, boosted by reliance on the so called linear model, when being challenged or even to be replaced by the circular innovation-model, letting stakeholders in to be actively involved in the intra-mural research processes. In the second place we might also have to reconsider a shift of balance-point between autonomy of science on the one hand, and societal demands for more immediate economic and social returns from society on the other. Finally, in the third place, faculty-intrusive pressure from the addressing of Grand Challenges could bring on in more substantial modeling features from the so called Mode 2 approach to the scientific production of knowledge, when hoping for research to follow the internationally over-arching laid down research policies to come.

Appendix D

Participants in the NIRPA project

Denmark
Grete M. Kladakis, Ministry of Science, Innovation & Higher Education
Ulla Høeberg Hansen, Ministry of Science, Innovation & Higher Education
Joakim Quistorff-Refn, Ministry of Science, Innovation & Higher Education

Finland
Paavo Löppönen, Academy of Finland
Annamaija Lehvo, Academy of Finland
Leena Treuthardt, Academy of Finland
Risto Alatarvas, Academy of Finland
Kaisa Vaahtera, Academy of Finland
Sirpa Nuotio, Academy of Finland

Iceland
Þorvaldur Finnbjörnsson, Rannis
Sóley Gréta Sveinsdóttir Morthens, Rannis

Norway
Per Koch, Research Council Norway
Jan Dietz, Research Council Norway
Kristin Oxley, Research Council Norway
Ellen Veie, Research Council Norway
Elisabeth Gulbrandsen, Research Council Norway

Sweden
Inger Jonsson, Swedish Council for Working life and Social Research
Marianne Wikgren, Swedish Research Council
Johan Fanger, Swedish Research Council
Jan Larsson, Swedish Research Council, Project coordinator
Lars M Nilsson, Swedish Research Council, Project leader

Providing valuable support to the project:
Professor James Wilsdon, SPRU, Sussex, UK
Dr Fredrik Melander, Nordic Council of Ministers, Copenhagen, Denmark