Governance of research and innovation: Globalisation and integration

Science, technology and innovation (STI) is still on of the most important area through which a region or a country may enhance its competitiveness and hence its welfare. However in order to respond the challenge of global economy we must optimize the interrelations between institutional and technological developments in innovation systems, with effective governance mechanisms integrating regional and upper-national aspects. Taking into account this arena, the author offers us the examples developments in the European Research Area (ERA), the Nordic cooperation, and the increasing cooperation in South-East Asia through ASEAN.

Zientzia, Teknologia eta Berrikuntzaren alorra (ZTB) eskualdeen eta herrialdeen lehiakortasuna eta, ondorioz, ongizatea hobetzeko funtsezkotzat jotzen da oraindik. Ekonomia globalaren erronkei aurre egiteko, dena den, Berrikuntza Sistemetako erakunde- eta teknologia-garapenen arteko erlazioak optimizatu behar dira, eskualde mailako eta herrialdetik gorako mailako integrazioa ahalbidetuko duten gobernantza-mekanismoen bitartez. Arlo horretan, zenbait kasu azaltzen dira: European Research Arean (ERA) izaniko garapen-kasuak, iparraldeko lankidetza eta ASEANen bidez Asiako Hego-ekialdean gertatzen ari den lankidetza gero eta handiagoa.

El área de Ciencia, tecnología e innovación (CTI) sigue considerándose crucial para la mejora de la competitividad de las regiones o países y por lo tanto, de su bienestar. Sin embargo, para responder a los retos de la economía global se exige optimizar las interrelaciones entre desarrollos institucionales y tecnológicos en Sistemas de Innovación, mediante mecanismos de gobernanza donde se dé la integración regional y supra-nacional. Dentro de este ámbito se exponen los casos de los desarrollos experimentados en la European Research Area (ERA), la cooperación nórdica y la creciente cooperación en el Sudeste Asiático a través de la ASEAN.

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1. **INTRODUCTION**

Improving competitiveness is an inherent part of any country's policy agenda. The same goes for regions as territorial entities on a sub-national level: Local or regional governments typically attempt to achieve economic development through supporting their industrial communities' innovativeness and competitiveness, e.g. through cluster development. This is seen as a key factor in improving welfare, quality of life and better material living conditions. The issue of welfare for citizens brings economic policy in a wide sense to the core of the policy framework in basically all countries, even to the point that it assumes the position of a dominant policy under which other policy areas have to be adapted.

Science, technology and innovation (STI) has over the past decades been seen as an ever more important area through which a region or a country may enhance its competiveness and hence its welfare. Innovation policy is the cross-cutting policy or vehicle through which STI is to be stimulated to play an economic role: Science and technology itself is becoming more integrated in economic life, and national innovation systems have become the accepted frame of reference for policy making in this area (OECD 1999, 2001).

Optimizing the interrelations between institutional and technological developments in National innovation systems (NIS) or its regional version, regional innovation systems (RIS), are seen as key instruments in achieving competitiveness. To be competitive implies being dynamic, being able to change and adapt to new circumstances, to adopt and develop new knowledge and technologies. It means not only to succeed in product markets, but also in competing for people, resources

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and investments, and skills. This dynamism is mostly addressed at the national level in the context of national policies for competitiveness, implying also that national innovation systems are competing which each other. Dynamism is improved through framework conditions, cluster policies, research policies, taxation policies and education policies, to name but a few, with the view to stimulate competitive capabilities at the national (or regional) level. At the same time, the world economy is integrating, a process mostly referred to as globalisation. The key challenge for national and regional governments is then to adapt their governance systems and processes to take this context into consideration.

This challenge may be seen as two-fold: Firstly there is a need to better understand the capabilities for dynamic adaptation of their own economies, often seen as knowledge economies as research and education play an increasing role in the processes of adaptation and competition. Secondly there is a need to develop sound governance systems to influence these capabilities. How do governments meet these challenges?

Nation-states and sub-national regions will have to take new trends in global economic integration into consideration in their policy development. I will argue in this article that in the area of science, technology and innovation supra-national, regional integration emerge to respond to the challenges of the global economy. This integration offers dedicated governance mechanisms, creating an additional layer of governance to which regions and nations must adapt and shape their own responses. I will place this development in the broader discussion of governance, using as examples developments in the European Research Area (ERA), the Nordic cooperation, and the increasing cooperation in South-East Asia through ASEAN.

2. **GOVERNANCE, INNOVATION AND INTEGRATION**

2.1. **Governance**

Governments are the formal agents of policy in a national context. However, complexity and dynamism have led to a search for more effective processes and mechanisms for investment decisions, planning and policy development. Governance refers to the very processes and mechanisms that allow partnerships, including governments, to engage and learn and to make effective decisions. Box 1 highlights some key features in a recent study in innovation governance by the OECD (2005).

Governance becomes a more relevant perspective also with the emerging global challenges and increasing cooperation in science and technology. In this context governance may refer to the cooperation processes, mechanisms, practices and institutions put in place to ensure collective action of nation states and other agents (Keohane and Nye 2000). A number of formal, global institutions have been established to help governments and others to govern, coordinate and steer collectively in the field of science and technology. These include the UN Commission of Science and Technology for Development (UNSTD), United nations Educational, Scientific and Cultural Organisation (UNESCO), World Intellectual Property Organisation (WIPO), Intergovernmental Panel on Climate Change (IPCC), as well as certain international projects such as Global Research Alliance

Box 1

Governance

Governance concerns the systems and practices that governments use to make priorities and set agendas, implement policies and derive knowledge about their impacts and effectiveness. The concept has received renewed attention in the context of the shifting patterns of governing and policy making. Governance implies a "change in the meaning of government, referring to new processes of governing; or a changed condition of ordered rule; or the new method by which society is governed" (Rhodes 1996: 652-3).

Stoker (1998) suggests that governance refers "to the development of governing styles in which boundaries between and within public and private sectors have become blurred". He further suggests five propositions related to governance:

1) Governance refers to a set of institutions and actors that are drawn from but also beyond government.
2) Governance identifies the blurring of boundaries and responsibilities for tackling social and economic issues.
3) Governance identifies the power dependence involved in the relationships between institutions involved in collective action.
4) Governance is about autonomous self-governing networks of actors.
5) Governance recognizes the capacity to get things done which does not rest on the power of government to command or use its authority. It sees government as able to use new tools and techniques to steer and guide.

Much like the focus on innovation as an interactive process is governance seen as an interactive process involving various forms of partnerships, collaboration, competition and negotiation. It implicitly addresses the issue of accountability as deficits may arise through lack of transparency and representation.

Source: Made by the author.

(GRA), UN Millennium Project Task Force on Science, Technology and Innovation at the United Nations University to name a few.

The increasing importance of global governance was recently addressed by an expert group on the global governance of science to the EU Commission.[1] The expert group states:

As countries and regions set their sights on becoming "knowledge economies" and mandated science is targeted particular objectives, there emerge new forms of "techno-nationalism". By contrast, scientists tend too look across national borders, creating a tension between science and national political economies. Yet links between scientists and mechanisms of global governance are typically much weaker than those with national governments. Where international organisations have the potential to govern globally, they do not have the weight, in terms of funding, steering and the use of science to complement their policies. The global governance of science thus calls for new global relations between

[1] See «Global Governance of Science», Report of the Expert Group on Global Governance of Science to the Science, Economy and Society Directorate, Directorate General for Research, European Commission, 2009.

> what might be called the society of science and the larger society in which science exists, treating each as active participants in new relationships. (p. 17)

Such governance structures have been put in place to solve joint problems, not to enhance competitiveness. In fact, the expert group points to the potential problem of excessive attention to governance might be detrimental to competitiveness in a global context if e.g. Europe should pursue higher standards in the production of knowledge than other countries or regions. Hence there is a need to distinguish between global governance of science, as an imperative for sound and common frameworks for science worldwide, from international governance of research and innovation which may be better suited to enhance competitiveness of knowledge economies.

For this purpose, regional (supra-national) solutions are emerging, providing institutions and mechanisms for coordination and steering to e.g. improve competitiveness. Examples are the EU (European Research Area and the EU framework Program), the African Ministerial Council on Science and Technology (AMCOST), the MERCOSUR of Latin America, the Nordic Council of Ministers, and the ASEAN in South-EAST Asia. Such governance solutions lie at the heart of this article and will be discussed below. In these cases, the key issue is integration leading to new governance mechanisms.

2.2. **Innovation and integration**

On the micro-level innovation is generally understood as the launch or adoption of new technologies, products or processes in economic life. Innovation systems are seen as the breakdown of a (national) system into those factors influencing innovation. Innovation policies may then be seen as those policy initiatives aimed at influencing these factors (OECD 2001).

Governance of innovation systems has become a new focus in recent years, as innovation policy expands from its core of research policy into a more horizontal approach bridging often several policy areas into policy portfolios. Governance hence relates to the processes of cooperation and coordination, including private actors, that influences the adaptability of innovation systems as well as the policy systems them selves. This adaptability has much to do with learning, and governance may be seen as learning and knowledge management for the timely transformation and adaptation of innovation systems. This was studied in detail in the MONIT project of the OECD (OECD 2005, Remøe 2008).

The MONIT project pointed to a number of issues influencing governance that had to do with integration. This included integration of policy areas into policy domains for innovation with greater coherence than before, integration of the policy cycle (agenda setting, priority setting, implementation) into systemic learning processes, as well as a number institutional factors that tended to inhibit the adaptability of governance systems. The countries studied in the project were quite different in their history, culture, political traditions and systems and economic specialisation, but were victims to common governance failures such as a deep sectoral division between ministries and great differences in cultures and modes of thinking across these ministries or agencies, inhibiting the capability for integration and learning.

In the present context, the issue of integration is key to enhancing effective governance for improved competitiveness and innovative capability. In other words, the systems approach should not be used to depict innovation and governance systems as a set of subsystems, but rather to see them as interactive learning systems where integration defines how institutions, practices and processes generates a certain performance. This can be illustrated with the two further examples of Norway and China. In the former case, Fagerberg et al (2009) shows how the Norwegian innovation system is a result of a path-dependent process in which industrial sectors, institutions and policies co-develop over time. The relationship between firms and research institutes is relatively intense, pointing to higher systemic integration than in many other countries. Further, structural changes such as the rise of the oil and gas industry have come about by integrating institutional practice from the hydro-electric industry with the presence of a long tradition in shipbuilding. Such re-combinations of knowledge demands integrated solutions in which knowledge and practice from one sector is accepted and adopted in other sectors. This also highlights the advantage of clusters and regional innovation systems as proximity (geographic or industrial) tend to ease knowledge flows. Hence, although the typical systems development is one of path dependency, shifts in trajectories may often take place when sufficient integration may ensure institutional recombinations and new knowledge flows.

China is another case where changes initiated since 1978 have implied a number of reforms aimed at reintegrating and upgrading a fragmented and defunct system in which science and technology was greatly separated from economic and other civic use. Great efforts have been put in place e.g. to reorganise the Chinese Academy of Sciences (CAS) and improve the integration with industry, the science community have been part and parcel in developing the long term science and technology plans, and the regional or provincial system, which has had a high level of autonomy, is to an increasing degree attempted to be integrated in a more concerted national approach to innovation (OECD 2008)[2].

A major challenge for national governments is thus to develop governance systems that allows integration and recombinations to take place. However, looking beyond national borders, it is clear that a national approach is not sufficient. Increasing globalisation leads to greater competitive pressures on national economies. This has in many cases led to supra-national integration in which new institutional solutions are meant to improve competitiveness in a given, supra-regional entity. The next section will examine some of these developments.

3. GOVERNANCE IN A GLOBAL PERSPECTIVE: THE CASE OF SUPRA-NATIONAL INTEGRATION

3.1. The European Union and the European Research Area

While the history of regional integration in Europe now spans several decades after the WWII, and the Framework Program for R&D has since the early 1980s been

[2] See also the contributions in the special issue on Innovation in China of the journal «Innovation: Management, Policy and Practice, vol. 8, 2006.

a visible example of governance of science and technology on a supra-national, regional level, it is in particular over the past decade that new forms of governance of research and innovation have developed. This has happened in the context of the launch of the Lisbon strategy and the European Research Area (ERA) in 2000, which focused on coordinating national programmes through framework programme instruments (ERA-NETs). This early stage proved to be less effective than expected. The recent reinforcement through the Ljubljana process since 2008 included the overarching framework for the ERA policy called the ERA 2020 Vision and frameworks for governance and priority setting. Today a number of mechanisms for governance on the European level exist, with different references to the legal framework for the European Union. Some of these were initiated before 2000, some later. But most of these initiatives and mechanisms stem from the conception of European research as one to enhance European competitiveness.

New ERA Initiatives and the Ljubljana process

The most recent development in governance at the regional level of the European Union has been the so called ERA initiatives. While the ERA developed only slowly until 2008, the Ljubljana processes gave a boost in launching five initiatives for creating an effective ERA including dedicated governance mechanisms based on a new concept of partnership between the EC and the Member States. These five initiatives are:

— *European Partnership for Researchers*, aimed at stimulating the framework conditions for human resources and mobility in science and technology. To enhance the Europe wide work in this area, a Steering group on human resources and mobility" (SGHRM) has been established. It exists already since 2003, but was revamped in 2008.

— *Joint programming in research* aims at making European research more focused and effective by aligning programmatic activities in research and integrating national programs between the Member States. A Joint Programming Group has been set up to initiate and coordinate the processes. The governance in this group is heavily based on the Member States and less on the Commission.

— *Community legal framework for European Research Infrastructures* is the third initiative, where the Commission is more in the lead. A European Research Infrastructure Consortium (ERIC) has been established to govern the cooperation between the Member States and the Commission. The complementarity needed for cost effective infrastructures leads to well founded regulation as well as voluntary participation.

— *Management of intellectual property in knowledge transfer* activities and code of practice for universities and public research organisations. CREST (European Union Scientific and Technical Research Committee) set up a Working Group on "Knowledge Transfer", paralleled by DG RTDs setting up an Expert Group on "International Issues affecting Knowledge Transfer".

— *Strategic European framework for international S/T cooperation* was initiated to enhance the opening up of the ERA to third countries and regions. A Strategic Forum for International S/T Cooperation (SFIC) was set up as a dedicated configuration of CREST.

Without going into detail in this development, it is fair to say that the Ljubljana process indeed led to a greater integration in Europe through the launch of these initiatives. However it is also evident that the governance becomes more fragmented, both in terms of adding governance mechanisms to those already present, as well as developing a set of different governance mechanisms for the ERA, thus reducing coherence.

Other instruments in ERA governance

While the European integration by now consists of a variety of mechanisms for governance of S&T, there are some that will be shortly discussed here as they are deliberately linked to objectives of competitiveness. This concerns in particular initiatives under Article 169 of the Treaty (185 in the new Lisbon Treaty) and Article 171 (187 in the new Lisbon Treaty). Hence, the emerging governance mechanisms for these initiatives are related to a formal or legal regulation and have hence an important function to play the ERA development.

Initiatives under the Article 169 concern the participation of EU Member States in integrating their national programs. In other words, the Article 169 enables the European Community to participate in programs undertaken by Member States. Thus, it is a key reference for building partnerships, and it is directly linked to the overall objective of integration of the European research and innovation landscape. Of the five initiatives that have been established so far, the EUROSTARS Joint Program is of specific relevance in the present context. It has been inspired by EUREKA and focuses on support to R&D and innovation projects in research intensive Small and Medium Sized Enterprises (SMEs). The European Community funds some 1/3 of the total resources, and as many as 31 countries in Europe participates. The EUROSTARS program addresses a gap in the funding for research and innovation as it provides a visible and simplified Europe wide funding arrangement for innovation and networking for a class of companies that may often have difficulties in operating within the EU Framework Program. The initiative is governed through three levels: A Eureka High Level Group to supervise the implementation of the EUROSTARS program, an Advisory Group, as well as a Eureka Secretariat which is tasked to implement the program through calls and related activities.

Initiatives under the Article 171 are different and give a legal basis for engaging in partnerships with the private sector. European Technology Platforms (ETP) are for a led by industry and have been established in areas where there is a need for stronger cooperation between research actors. There is a specific reference to the need for strengthening competitiveness and addressing social challenges. The ETPs have developed strategic research agendas in many areas, and the partnership also led to five Joint Technology Initiatives (JTIs). These are public-private partnerships between the European Community and the private sector and are the manifestation of priority strategic research agendas

developed by the ETPs. Currently six JTIs have been identified:

— Innovative Medicines Initiative (IMI)

— Embedded Computing Systems (ARTEMIS)

— Aeronautics and Air Transport (Clean Sky)

— Nanoelectronics Technologies 2020 (ENIAC)

— Hydrogen and Fuel Cells Initiative (FCH)

— Global Monitoring for Environment and Security (GMES)

These JTIs are being implemented as independent legal structures being able to manage integrated research projects in their domains. In fact, they will operate as semi-institutions and manage calls for proposals and contractual arrangements. They have governing boards as well as executive directors. In addition, they have a board of public authorities that represents member States. This also enhances linkages with national programs thereby increasing the overall integration on a European level in their specific areas.

Integration and fragmentation

The above examples are only a selection of initiatives having emerged over the past few years in the context of ERA. The picture arising from this discussion, supported by other initiatives such as the Strategic Energy Technologies (SET) plan, is one of highly interesting contradictions as has been well illustrated in a recent evaluation of the governance aspects of the ERA (European Parliament 2009). It is increasingly recognized that isolated solutions on regional or national levels are not sufficient to improve overall European competitiveness. The ERA initiatives can be seen as responses to this challenge. A key implication is that the European integration following from this pushes regions and Member States to reformulate their policies and strategies: The context in which their hitherto operational innovation policies have been developed and implemented is changing.

On the other hand, the ERA initiatives have shaken the stable landscape of the Framework Program as a European cooperative platform and governance pattern. Europe is now developing, through the ERA initiatives, a more fragmented and unstable landscape. The process is not guided by common rules for governance, and it may even be hypothesised that this development may jeopardize the ERA construction process (ibid).

A related issue that is emerging from this is the extent to which regions (sub- or super-national) adapts to this and how, and to what extent other regions of the world enter similar processes. The two cases of the Nordic region and the ASEAN in South-East Asia will be discussed in the next sections.

3.2. **The Nordic co-operation in research and innovation**

General institutional background

Nordic co-operation in R&D is part of a broader, long standing cooperation in the Nordic area. This area consists of Sweden, Denmark, Norway, Iceland, Finland, as well as the autonomous regions the Faroes, Greenland and Aaland. The

institutional set-up goes back to 1952 with the establishment of the Nordic Council, 87 elected members of the member countries' respective parliaments. In 1971, the Nordic Council of Ministers was set up, serving as the main institution for inter-governmental cooperation. Similar to the EU set-up, this council consists of several councils of ministers related to specific policy areas. The Nordic Council represents a broad political and institutional cooperation, including on the administrative level across sectors such as energy and labour market integration (the Nordic area has e.g. had an integrated labour market since long before the emergence of the same through the EU's internal market).

NORIA, the Nordic Research and Innovation Area[3], with the two pillars of research and innovation, serves as the overall framework for cooperation. The cooperation is comprehensive, although in financial terms on the Nordic level relatively modest. The overall objective is to promote research and innovation of relevance and the highest possible international quality. The co-operation adds up to some € 35 mill per year, distributed across the initiatives described below. There is additional participant funding, e.g. in industrial innovation projects.

The main components of NORIA today consist of three institutions co-located in Oslo:

— *NordForsk*[4] was established in 2005 with the aim to fund research co-operation, co-ordinate research in the Nordic area, and give policy advice to the Nordic governance bodies. The funds available are directed to cover co-ordination costs, while research activities themselves are mostly expected to come from national or other sources.

— *Nordic Innovation Centre (NIC)*[5] was built upon the earlier Nordic Industrial Fund. NIC belongs to a different set of governmental ministries and hence policy area, as it is linked to ministries of trade and industry. Within the development of NORIA since the white paper was launched, a key idea has been to create a better interface between the research and innovation components of the wider innovation system.

— *The Nordic Energy Research Cooperation*[6]*:* Co-operation in this field goes back to 1985. Contrary to the two-pillar concept of Nordforsk and NICe, Nordic Energy Research has an integrated research and innovation approach, where priorities are closely aligned with national energy research programmes defined by the needs of the energy sector. Research prioritisation at both national and also Nordic level reflects the societal needs of developing a sustainable, affordable and clean energy future.

Within the Nordic structure, these three institutions have different governance structures and are differently linked to principal institutions or ministries. NIC is governed by a board with representatives that have been nominated on a personal

[3] NORIA – White Paper on the Nordic Research and Innovation Area. Copenhagen, Nordic Council of Ministers, 2004.

[4] www.nordforsk.org

[5] www.nordicinnovation.net

[6] www.nordicenergy.net

basis, thus not representing any principal. Nordic Energy Research is governed by national energy authorities and board members are nominated by these. NordForsk is governed by a board with members nominated by the national research councils (5), Nordic universities (3) and industry (1). This situation highlights the fact that within a "variable geometry" there may be significant "variables" influencing the potential and processes of cooperation.

Selected research programmes

Nordic co-operation research involves a number of joint programmes that have partly been established through bottom-up processes. The management practice of these programmes, often aimed at opening national programmes or being long lasting activities of joint efforts (even with "common pots" as funding systems), represent a variety of sources for learning for future European development of collaborative solutions with and between Member States. Examples are:

— *NOVA – the Nordic Forestry, Veterinary and Agricultural University Network:* The network is aimed at develop tools for cooperation in selected scientific areas, enhance quality of research and otherwise help strengthen links to industry and other partners.

— *The Nordic Research and Education Area in Agriculture and Forestry:* It builds upon NOVA and represents a deepening of co-operation with a focus on opening programmes and reducing national duplication of efforts. However, the initiative did not get much attention in the White Book on NORIA.

— *The Nordic Centres of Excellence:* These were initiated in 2002 and consist now of 16 such centres. NordForsk facilitates the funding of five years programmes with a small amount of money (common pot) on top on the research centres' ordinary funding. The centres are selected by open competition.

— *Nordic Cancer Union:* This is a Nordic arrangement using a genuine common pot for funding, with a budget of some € 1 million per year. The funding sources are the national cancer research organisations.

The Nordic co-operation is focused on adding value. The most explicit joint solution in this context is NordForsk, with the mandate of match making and identifying joint priorities, as well as fostering co-operation with third countries. It may also more easily take part in global research infrastructures. In the field of energy research, Nordic Energy Research is an internationally acknowledged transnational energy cooperation institution. It is the Nordic representative in the International Energy Agency R&D prioritization and evaluation working group together with e.g. EU Commission (SET-plan secretariat).

Responding to Globalisation: the Top Research Initiative

To reinforce the implementation on NORIA, steps were taken to formulate a strategic, collaborative programme with a view to strengthen the NORIA, build critical mass, and enhance the attractiveness of the Nordic region as a research area. The programme, "Fraan Norden till Jorden" (From the Nordic to the Earth) was proposed in March 2008, and named the

"Top Research Initiative" (TRI). This is an ambitious proposal focusing on key issues at the interface between climate change, environment and energy.

The Top Research Initiative came as a part of a broader response among the Nordic governments to the increasing globalization. A reinforced approach to globalization was seen as necessary, and the Nordic region would gain in attractiveness with deeper investments in science and technology. This approach became evident in the Nordic Prime Ministers meeting in June 2007, where a knowledge-based approached to a Nordic Globalisation Initiative was taken, consisting of elements such as the Top Research Initiative, coordination of research and innovation programmes, cooperation in higher education, and Nordic innovation offices in Asia. Further, visibility was seen as important, giving the Nordic region a higher profile outside Europe.

The June meeting resulted in an agreement on "A new phase for Nordic partnership in particular on globalization. Synergy benefits with work carried out at the European and regional level". At the end of 2007 a programme group was set up with representatives from the three Nordic research funding institutions. In addition, a steering group was set up with representatives from national research and innovation councils to ensure consolidation on the national level.

The final decision in October 2008 contained key elements for implementation: Firstly, a programme board with three representatives from each of the Nordic countries will be set up. The three Nordic institutions will form the secretariat. Secondly, the programme board will set up three or more programme committees for the different areas with representatives from the public as well as from the private sector. Thirdly, the programme as such was left "underspecified" and flexible, with many aspects of the implementation such as instruments, involvement of industry and the relation to EU being left open. Hence, the initiative combined existing formal structures with informal and flexible links and structures.

The objectives of the programme are multiple, pointing to the high ambitions of the Nordic region. In particular, the program sets out to reinforce the Nordic region as an attractive research and innovation

Box 2

The Top Research Initiative

The best professional competencies in research and innovation will become involved in close partnership with industry and business. The Top-level Research Initiative is a Nordic initiative to solve the global energy and climate crisis, and strengthen research and innovation in the Nordic Region.

Source: www.nordforsk.org

region as well as enhancing the quality and competitiveness of Nordic research in Europe and globally. The funds have been foreseen from four sources: Nordic Council of Ministers (Education and Research), Nordic institutions (NordForsk, NIC, and Nordic Energy Research), national programmes, partner contributions, e.g. from industry. The programme is currently being implemented with calls issued on two of the subthemes. It is focused on the integrated topics of climate, energy and environment, with a budget of € 50 mill over the period 2009-2013.[7]

3.3. **ASEAN**

Background and mandate

ASEAN was established in 1967 with the 5 founding members Indonesia, Malaysia, Philippines, Singapore and Thailand. Later 4 additional countries became members: Brunei, Myanmar, Lao, Vietnam and Cambodia. The mission or purpose of ASEAN is two-fold: to generate and accelerate economic development and growth, and contribute to peace, stability and wellbeing. This mission will be implemented through three basic ASEAN Communities: the Security Community, the Economic Community, and the Socio-cultural Community. The Community most relevant in this context is the Economic Community, aiming at economic integration between the member countries, not unlike in the European Union. Hence, regional free trade, free movement of people as well as various mechanisms of financial integration, institutional development and infrastructure became important building blocks in this project. Co-operation in S/T has become ever more important on the ASEAN agenda.

The mandate for ASEAN cooperation in science and technology can be found in the ASEAN Declaration, which states that

> *ASEAN shall promote active collaboration and mutual assistance on matters of common interest in the economic, social, cultural, technical, scientific and administrative fields and provide assistance to each other in the form of training and research facilities in the educational, professional, technical and administrative spheres.*

The ASEAN Vision adopted by ASEAN Heads of State and Government during the Summit in Kuala Lumpur, 15 December 1997, sets out what ASEAN should be in Year 2020: "A Concert of Southeast Asian Nations, outward looking, living in peace, stability and prosperity, bonded together in dynamic development and in a community of caring societies". A major foundation of that vision is

> a technologically competitive ASEAN, competent in strategic and enabling technologies, with an adequate pool of technologically qualified and trained manpower, and strong networks of scientific and technological institutions and centres of excellence.

The ASEAN Secretariat is in Jakarta. The secretariat has currently about 120 staff, which is mostly considered vastly under-resourced for the task given to it.

Basic indicators: an overview

Taken as one community, the ASEAN countries represent a significant share of the world's population with some 565

[7] See Arnold, E. and Eriksson, M-l.: Experience from the first Toppforskningsinitiativ. Technopolis, 2009, for an assessment of the development of the TRI.

million people. This is larger than the EU, but as a group there is also a great diversity between the member countries. Indonesia is the world's largest Muslim country with some 222 million people, while Brunei and Singapore have 383 000 and 4.5 million respectively. The other member countries are of midsize, but in European terms large countries.

However, the recent economic development in the ASEAN area has been strong, with year on year growth rates between 11% and 5%. Most of the countries have acceptable levels of unemployment, with Indonesia and Philippines as the countries with the biggest problems. The inflows of foreign direct investment is in most cases meagre, with Singapore and to some extent Thailand as the two countries that are well endowed with foreign investments.

Two countries in ASEAN stand out for their economic performance (aside Brunei which due to its size is a special case): Singapore and Malaysia. With GDP pr capita on the level of well developed industrialised countries, their economic policies over the past 50 years have been more conducive to the increasing liberalisation and globalisation than the other ASEAN members. Singapore and Malaysia have both embarked upon liberal and open policies, with attention to inviting foreign direct investment as well as gearing their S&T policies to industrial development. This is in stark contrast to most of the other countries whose more socialist approach has turned out to be less effective. In sum, the difference in approach, as well as colonial and other influences, has led to a wide gap between the member countries of the ASEAN in terms of GDP and wealth.

There is in general a serious underinvestment in S&T, and in countries such as Viet Nam, Philippines, Lao, Cambodia and Indonesia, the investments are neglible. Indeed, this is according to Wattanapruttipaisan[8] a key component of the Achilles heel of ASEAN: the innovation capacity. The major part of the investments is on the public hand, while the private sector's investments are marginal. The exception again is Singapore. However, the attention to the role of knowledge is on the increase, a fact that is shown in acceptable levels of public expenditures on education as a share of GDP. On this indicator, Malaysia has an impressive score with more than 8%. Patents granted by residents, a key concern in the Achilles heel mentioned above, are few and far between with Singapore, Malaysia and Thailand with the best scores when taking into account population size.

The ASEAN composite indicator on S&T competiveness as extracted from their data (the site does not offer further insight into this and other such measurements), suggest that overall three countries have significantly higher scores than the rest of the ASEAN members: Singapore, Malaysia and Thailand. This reflects the investments and reforms over the past decades, making these three countries in particular standing out with (relatively) high S&T performance.

The policy framework for S/T

The ASEAN Committee on Science and Technology (hereafter ASEAN COST) was established in 1978 to strengthen and enhance the capability of ASEAN in science

[8] The Straits Times, 30 November, 2004

Table 1

Basic STI indicators for ASEAN[9]

	GERD as % of GDP 2004	BERD USD million 2004	Publ exp on education % GDP	Patents granted to residents 2004	ASEAN STI competitiveness indicator 2004
Brunei	0.03	0	3.14	0	38.57
Cambodia	0.05	0	2.13	0	38.34
Indonesia	0.01	10.92	1	72	38.24
Lao	0.04	0	3.2	0	25.32
Malaysia	0.71	443	8.03	27	69.87
Myanmar	0.2	NA	NA	NA	NA
Philippines	0.08	21	2.66	6	33.35
Singapore	2.15	1.168	4.21	110	94.85
Thailand	0.24	119.2	4.22	3.88	52.80
Viet Nam	0.19	12.23	3.38	17	32.85

Source: ASEAN statistics, UNESCO Institute for Statistics.

and technology so that it can promote economic development and help achieve a high quality of life for its people.

The ASEAN COST Sub-Committees are established in all the major programme areas of the ASEAN COST. They are responsible for the management, coordination, evaluation and implementation of regional programmes and projects. The Sub-Committees are also entrusted to review ongoing projects under their purview and assess the effectiveness and impact of their projects in strengthening the regional S&T capabilities. Currently, the ASEAN COST has the following nine Sub-Committees, illustrating key priorities in ASEAN S&T policy:

— Sub-Committee on Biotechnology (SCB)

— Sub-Committee on Food Science and Technology (SCFST)

— Sub-Committee on Science and Technology Infrastructure and Resources Development (SCIRD

— Sub-Committee on Meteorology and Geophysics (SCMG)

— Sub-Committee on Microelectronics and Information Technology (SCMIT)

— Sub-Committee on Marine Science and Technology (SCMSAT)

— Sub-Committee on Materials Science and Technology (SCMST)

— Sub-Committee on Non-conventional Energy Research (SCNCER)

— Sub-Committee on Space Technology and Applications (SCOSA)

[9] Reliable data on GERD is difficult to obtain. The ASEAN STI competitiveness indicator signals high rating towards 100. Source: http://www.aseansec.org/19230.htm

The key pillars of ASEAN policy evolution

While ASEAN was established in 1967, the functional co-operation in S&T was organised in 1978 with the setting up of the ASEAN COST. Since then, ASEAN COST has been the driving entity for enhanced co-operation and prioritisation in S&T. However, ASEAN COST has been directed and influenced by a number of events and decisions over the years, in particular

— The establishment of the ASEAN Free Trade Area in 1992, giving a boost to the development of an single market in ASEAN, not unlike the European one;

— The Vision 2020 was adopted by the heads of government in 1997, giving new mandates for ASEAN co-operation, including S&T. The vision directs S&T co-operation towards "a technologically competitive ASEAN, competent in strategic and enabling technologies, with adequate pool of technologically qualified and trained manpower, and strong networks of scientific and technological institutions and centres of excellence";

— The Hanoi Plan of Action (HPA) was the first in a series of action plans developed to implement the Vision 2020. The action plan covered the period of 1999-2004, and proposed a range of measures such as macro-economic and financial co-operation, greater economic integration, S&T development and ICT infrastructure, promote human resources and sustainable development. The action plan also specified areas of S&T, including networks and infrastructure;

— The ASEAN plan of action on S&T with the implementation framework for 2001-2004 was adopted to give priority to objectives like intensified co-operation and science-industry linkages, expanded regional programmes, human resources in S&T, improved incentives systems, and it contained strategic thrusts in key areas to mobilise and concentrate actions with more effectiveness. Commercialisation of public R&D was given leveraged attention. The action plan was implemented through the nine sub-committees of ASEAN COST;

— The Bali Concord II of 2003 built upon the Vision 2020, and developed further the approach taken earlier. In particular, the Bali Concord II elaborated strategic objectives and goals framed in the context of three "communities" for ASEAN: The security community, the economic community and the socio-cultural community;

— Following up on the Bali Concord II, the Vientiane Action Programme (VAP) was then developed for the period of 2004-2010. The action programme identified a number of priority areas to be addressed to reduce the development gaps between the ASEAN members. It included dedicated objectives and specification for S&T, and the ASEAN Development Fund was established to ensure a pool of ASEAN resources to support the implementation of the programme. A key mission of the fund was to ensure that activities across sectoral bodies seeking funding from ASEAN and its Dialogue Partners are in line with the action programme and its priorities;

— S&T ministerial meetings in 2003 and 2005 further reinforced S&T co-operation in ASEAN, including revamping the sub-committees of the COST. National plans and programmes were to be considered for improved co-ordination and cost sharing. Further policy developments in 2006 led up to the adoption of the ASEAN Plan of Action in Science and Technology (APAST) with an implementation period from 2007 to 2011.

The most recent step in the evolution of the ASEAN S&T policy is the adoption of the blueprint for the Socio-cultural Community in February 2009. The blueprint contains a significant chapter on S&T that provides a key basis for ASEAN capacity building and policy development in years to come, highlighted by a formulation of a strategic objective:

> Develop policies and mechanisms to support active cooperation in research, science and technology development, technology transfers and commercialisation and establishment of strong networks of scientific and technological institutions with the active participation of private sector and other relevant organisations.

The current S&T action plan

As mentioned, the current ASEAN Action Plan for Science and Technology (APAST) reflects recent political priorities as they have been defined in the Bali Concord II, the Vientiane Action Programme and other declarations. Its objectives include bringing S&T more into the core of the overall economic policy and efforts of integrating ASEAN as a region. In this, it clearly builds upon the experience of other, also neighbouring countries, in giving S&T a prominent position in the overall policy framework for the region.

The plan is framed in 6 strategic thrusts as key to the implementation of the plan:

— Intensifying R&D collaboration and promoting technology commercialisation, including strategic partnerships with the private sector, developing shared cost projects and stimulate technology transfer and spin-offs;

— Developing human resources, including enhancing the agreed ASEAN-help-ASEAN programme for collective support in human capital building, training programmes and scholarships;

— Networking of S&T centres of excellence and programmes, including networking of foresight practitioners and sharing of databases and information;

— Promoting S&T awareness and utilisation, to ensure a best possible take-up of new knowledge and technology, including dissemination and improvement of competitiveness of small and medium sized enterprises;

— Strengthening S&T infrastructure and support system, leveraging the ASEAN Science Fund and improving the indicator and information systems to guide policy, IPR, and innovation;

— Forging closer cooperation with dialogue partners and other relevant organisations on regional projects, including developing strategic partnerships with e.g. EU.

These strategic thrusts are then providing a basis for the development of priority thematic or scientific areas. This is done through the ASEAN COST and its Sub-Committees with reference to the PIS (Priority Integration Sectors under the ASEAN Economic Community pillar of the Vientiane Action Programme). Priority areas should also address or contribute to the other two pillars. This mechanism for priority setting on the ASEAN level has led to nine areas of priority: biotechnology, food science and technology, infrastructure and resources development, marine science and technology, materials science and technology, meteorology and geophysics, microelectronics and information technology, non-conventional energy research and space technology and applications.

These priority areas, and their sub-areas, in many ways correspond to the priority lines of the Framework Programme of the EU, with some differences such as the ASEAN priority for geophysics and geo-informatics. They are well grounded in ASEAN level policy through the Priority Integration Sectors mechanism. However, on top of these, the ASEAN Action Plan for Science and Technology has identified an approach that may serve as effective governance mechanisms: *Flagship programmes* are defined to ensure synergy and strategic impact across the ASEAN COST sub-committees, and will be co-ordinated with other bodies if deemed necessary. Based on extensive consultative processes, the following flagship programmes have been adopted for the period 2007-2011:

a) *Early warning system for disaster risk reduction*: The programme is designed to reduce the gaps in Early Warning Systems for various hazards among member countries, to provide an integrated, multidisciplinary approach to disaster risk management, and to broaden disaster preparedness and mitigation measures.

b) *Biofuels:* This programme is motivated by the need to reduce the dependence on fossil fuels. A network of R&D institutions has been formed to ensure momentum on the programme.

c) *Application and development of Open Source System:* This programme "seeks to provide a legal and more affordable software alternative and to accelerate the development of the ASEAN software industry.

d) *Functional food*: The programme is designed to provide a scientific basis for the sustainable development of the functional foods in ASEAN countries.

Recently two new flagship programmes have been endorsed:

e) *Health:* The programme is addressing key issues related to diseases and public health in the region.

f) *Climate change*: This programme is directed towards the global challenge of a changing climate, mitigation and adaptation.

The governance of these flagship programmes illustrate a key point in the way ASEAN is organised in general: Contrary to what one could expect, they are managed by different member states, and not by the ASEAN secretariat, which does not have the capacity to do so. The variable geometry of ASEAN governance is a dominating feature, and includes rotating COST Chairmen (alphabetically), rotating host countries for meetings, rotating responsibility for links

with EU (with reverse order of rotation), and distributed responsibility for flagship programme development.

Joint institutional structure

To help boost the S&T activities in ASEAN, the action plan provides for some infrastructural or support initiatives. The key idea is to nurture a joint institutional structure in ASEAN and develop a more effective network of institutions and people. Three such initiatives have been identified in the plan:

— The ASEAN Virtual Institute of Science and Technology (AVIST) was established in 2004. It comprises a learning network for learning and advanced studies in science and technology. It is still of limited scope and built up as dedicated courses in selected areas. Funds, although still limited, are provided for scholarships, and UNESCO participates in this funding.

— The ASEAN Science and Technology Network (ASTNET) is an ASEAN wide electronic information network and a gateway to ASEAN S&T information sources. It includes access to internal and industrial databases, and is aimed at improving the co-ordination between member countries through a more effective knowledge base for ASEAN COST. It will also support administration, monitoring and co-ordination of programmes initiated by ASEAN COST and its sub-committees.

— The ASEAN S&T Research and Education Network Alliance aims at developing a high speed broadband network and prepare the member states for connectivity to the second generation "Trans-Eurasia Information Network" (TEIN2). It will build upon existing networks (more than 10 research and education networks and grids in six ASEAN countries.

— An ASEAN S&T community for innovation, competitiveness and knowledge (ASTICK) has been initiated to ensure more effective use of existing S&T resources in ASEAN. It includes activities such as a move towards the adoption of a Visa free entry for scientists and S&T personnel in ASEAN, networking of testing facilities, networking of equipment facilities, identification and stimulation of centres of excellence in biotech, training and human resources development. Further, ASTICK will conduct a detailed study on the role of S/T in the 12 priority areas defined in the Vientiane Action Programme with a view to develop a vision for the ASEAN S&T community and to develop a framework programme.

Although not a new entity, ASEAN have developed greatly in recent years in its efforts to establish a framework for joint governance in the region. However, ASEAN suffers from some strong inhibiting factors, such as great diversity between the member states, low level of available resources, and a very small secretariat. On top of that, the governance mechanisms put in place for science and technology are complicated and include strong fragmenting elements, such as distributed responsibilities for flagship programs and complex rotational rules for chairmanship of committees and other activities. The development of ASEAN may still give important lessons concerning

how such governance may compensate for weaknesses in member states and spur a more competitive development of the region as a whole.

4. CONCLUSION: INTEGRATION IN GLOBALISATION

The three cases discussed here have developed in different contexts and with different rationales. Common to all is the fact that this level of governance systems develop on the basis of more general integration and governance processes. In other words, there are strong political visions and projects lying behind these developments, where economic and social development is the driving force. Further, all three supra-national regions lend increasing importance to science, technology and innovation as key components to economic development and greater material welfare. Mechanisms to support higher quality in research as the backbone of more general innovative capacities are ingredients in all these cases. Hence, competitiveness is being reinforced through attempts to create a more dynamic research and innovation system so that the regions may strengthen their roles and increase their specialisation in the global division of labour.

This layer of governance of science, technology and innovation increases the complexity of the overall system. But on the other hand it may lead to better structuring of available resources, as well as increase capabilities and cost-effectiveness. The three cases discussed in this article do not included good data or information on degrees of success, but it is fair to indicate that institutional capacity is key to the success or well-functioning of the respective governance systems. This is most evident in the case of ASEAN, where a very small secretariat and a great diversity between the countries involved lead to low real impact of the joint policies. Or in other words, success of such governance systems of science, technology and innovation rests on the success of the more general integration efforts. This would be evident both in the EU/ERA and the Nordic cases.

In the context of the innovation literature, there seems to be a contradictory development in play. Innovation systems are basically institutional frameworks for learning (Lundvall et al 1992), or in "the set of institutions that determine the innovative performance of national firms" (Nelson 1993:5). National innovation systems are characterised by trajectories of development influenced by economic specialisation and institutions adapted to this specialisation (Boyer 2009). This also includes regional innovation systems building upon structures such as clusters (OECD 2002). The supra-nation integration discussed above attempt essentially to improve scale and scope of knowledge related activities in order to enhance competitiveness (Vonortas 2009). In other words, scale and scope can be seen as the key mechanisms through with innovation systems gain effectiveness.

The deepening of globalisation has even reinforced the specificities of innovation systems among OECD countries (Amable et al 1997). However, as the globalisation process unfolds, open innovation becomes the mechanism through which innovators source knowledge without reference to national or regional borders. Policy is adapting to this by new processes of coordination (in Europe this is e.g. referred to as OMC, Open Method of Coordination), and research and innovation becomes

more policy driven with more programmes, infrastructures etc coordinated or even merged on a supra-national level. In all three cases discussed above the policy and governance processes aiming at integration and coordinated efforts are creating frameworks and incentives for research and innovation towards joint topics, joint institutions and big projects and budgets, while at the same time globalisation tends to underpin the case for economic specialisation across nations. On the other hand, there may be significant benefits to national systems from such supranational integration, e.g. in cases of lock-ins where exogenous impulses for change may be needed. Also in the case of weaker or less developed innovation systems (like ASEAN), there may be significant benefits. A key issue is therefore whether the regional level of integration like ERA, the Nordic NORIA and ASEAN is able to ensure an opening towards global knowledge structures, rather than become mid-level regional fortresses (see e.g. Soete 2008).

It is evident that this development may have significant impacts on lower-level nations and regions and their efforts to create effective governance systems to spur their economic development. For example, the emergence or a Nordic network of centres of excellence funded by Nordic level sources, impacts on the regional distribution of specialised competence in a country, to the benefit of some and the contrary for others. This should of course be seen in positive terms, as it is the nation-states themselves that have engaged the formation of supra-national governance, often with the aim to help allocate resources in a more effective way. Still, the overall impact on regions and nations in terms of structural change and competitiveness is still poorly understood, and invites more research: How should governance mechanisms and practices on a supra-national level be designed to ensure an effective and legitimate restructuring and specialisation of research and innovation activities? How could regions not benefiting from this development engage in compensating measures? How do such supra-national integration and governance efforts impact on competitive parameters and the global division of labour? For policy makers, the challenge is to develop these medium-level structures with a view to take full advantage of the deepening globalisation, including ensuring that smaller firms have easier access to global knowledge networks.

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