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tive democracy as the other decisions in academia, by including students and researchers.

2. *The link between higher education and research is the basis for innovation*
   Education should be linked to research, and this link should generate innovation. Research is a central part of education, but this is not reflected in many institutions at the moment. Concrete work on this issue is missing.

3. *Access to the knowledge triangle*
   We have to enable younger and older citizens to access higher education that is naturally connected to research. Support to doctoral students should be distributed equally, regardless of their employment status, discipline, country, background etc.

4. *Student-centred learning*
   Student-centred learning is important to achieving progress in most areas. We need to focus on curriculum reform and changes to teaching methods. The good practices that exist at institutional levels must be raised to the European policy-making level.

5. *Entrepreneurial skills vs. entrepreneurial universities in the context of academic values*
   The ESU sees a need for developing skills to tackle global challenges, such as entrepreneurship. The ESU argues that careful consideration of the governance model is needed to project the knowledge triangle into institutional realities, and stresses the importance of not losing sight of the identity and mission of higher education.

Annika Ström Melin asked Ms Deca to what extent students are part of the decision-making process. She answered that student representation has been reduced in decision-making bodies in recent years, especially for doctoral students.

Nikola Macharova asked herself how the links in the triangle are working. She said that the whole process of innovation is not flexible enough, adding that it is difficult to be flexible and act quickly. According to Ms Macharova, the main role for universities is to produce a future workforce that fits the current needs of the market. She contended that universities are not flexible and that there is an increasing need to meet the requirements of the labour market.

Doctoral candidates and researchers can help to strengthen the links in the knowledge triangle in close cooperation with companies and research centres. They can be the links between education, innovation and research, but these links could become even stronger with better recognition of doctoral candidates. Doctoral candidates are considered as students in some countries or institutions, and as employees in others.

Pam Fredman, Chairman of the Association of Swedish Higher Education, asked for the panel's view of ranking.

Ligia Deca argued that rankings do not serve the needs of students. Factors such as whether a programme is accredited, the skills of the faculty and the accessibility of the campus are of more interest to students. Ms Deca used the metaphor 'you do not make a child grow faster by measuring him more often'.

Nicola Macharova said that the ranking system is quite difficult, and it is hard to see whether it contributes to strengthening the links in the knowledge triangle.

Annika Ström Melin asked the panel about pressure from students and parents in terms of their expectation of suitable jobs after graduation. Where does the pressure occur?

Linnar Viik said that the pressure is substantial in countries where parents or students have to invest their own money in university studies. In countries where education is free, university studies are simply a natural continuation of childhood.

Mr Viik also described the worrying development in some European countries whereby educational fees must be paid back if a student graduates and does not work in the field for which he or she has been educated, or moves to another country.

Ligia Deca asked herself what makes a student employable. Her answer was that a student is employable if he or she can meet global challenges, is a good entrepreneur and can adapt to other work.

Is There a Need for National and European Strategies to Achieve the Knowledge Triangle?

Jose Manuel Silva Rodriguez, Director General, DG Research, European Commission

Marius Rubrialta, Secretary General for Universities, Ministry of Education, Spain

Adrian Smith, Director General of Science and Research, UK

Mauri Pekkarinen, Minister of Economic Affairs, Finland

Julia King, Vice-Chancellor of Aston University, UK

Anders Flodström, University Chancellor, Sweden

Annika Ström Melin started the second panel debate by asking if there really is a need for a knowledge triangle.

Jose Manuel Silva Rodriguez said that there was. He argued that we need sustained efforts for innovation, and that much can be gained from support and interaction between different fields of education. The European research area has to develop further, and Europe must become an excellent knowledge society and a strong partner to the USA, Japan and China.

Investment in innovation has an impact on the wellbeing of Europeans. Innovation is necessary in order to face big challenges such as health and security issues, as well as to remain competitive in a globalised world.

Universities have a key role to play. But they need autonomy and diversity to reach excellence in the triangle. There is a need for more specialisation based on the respective strengths of the universities, instead of imposing a single model. We also need pioneering in new fields.

Marius Rubiralta followed by stating her conviction that universities have a key role to play in the knowledge triangle. Investment in the knowledge-based economy and interaction with local and regional companies are necessary.

Mr Rubrialta talked about the importance of regional development to economic growth. Partnerships between universities, research centres and companies are necessary. There is also a need to improve and reform doctoral programmes. The current economic crisis has made us more aware of the importance of structural measures such as the promotion of talent in order to sustain economic growth. Mr Rubiralta is convinced that countries that invest in knowledge will have a better economy after the crisis compared with those that do not.

Adrian Smith emphasised the need to grow and expand European skills and to create new mechanisms that enable universities to interface with companies. He argued that funding should be linked to excellence, based on measured impact, and also stated the importance of stimulating mobility.

Mr Smith stressed the need for cultural change. Universities should integrate different disciplines to exploit interfaces; they must also negotiate new ways of measuring economic impact, such as creating new businesses. Therefore, research is crucial to creating highly skilled people and providing a flexible workforce.

Mr Smith argued that we must provide opportunities for people to conduct high-level research that interacts with industry. He described the **Technology Strategy Board**, which produces networks and partnerships. The Technology Strategy Board is a business-focused organisation dedicated to promoting technology-enabled innovation across the UK, bringing together various cultural groups.

Mr Smith went on to stress the importance of providing education for the new generation of researchers, and of moving more freely between government, companies and academia. He identified a need for a more long-term and strategic collaboration, via clear communication strategies, for example. The importance of communicating with the population, gaining a scientific understanding of the challenges that we face, cannot be underestimated.

Annika Ström Melin asked how the EU can contribute to this process.

Adrian Smith emphasised the need for an open dialogue, sharing of information and models of experience as a first step towards a functional European strategy.

Mauri Pekkarinen highlighted Finland's investment in research and development (more than five per cent of GDP). However, he admitted that the Finnish knowledge system does not produce as much innovation as it should. One of the key issues is improving universities' links to the business sector.

Mr Pekkarinen described the **university reform** and the **new innovation strategy** of Finland. Some of the key objectives of the university reform are to increase administrative and economic independence and to establish new universities with combined disciplines.

The new innovation strategy is focused on stronger, demand-based innovation. Innovation policy has so far been based on supply, but now Finland will try to create demand-based innovation. The demand is to be communicated to academia and new research results should be transferred to the business sector so that they can utilise it as quickly as possible. The new policy is much broader, covering not only technological innovation but improving the performance of innovation overall.

Julia King stated that the conference has agreed on the changes that are required and called for action.

Ms King gave a historical background to innovation. The UK moved from being an agricultural nation to a global industrial power in just two generations. This was achieved through interdisciplinary collaboration and the application not only of new science but of new manufacturing and managerial skills to societal and industrial problems.

In our time we must change from being dependent on fossil fuels to being an ultra-low carbon economy – in one generation (2010 – 2050). This requires rapid innovation and Europe-wide strategies. In addition, Europe is currently lagging behind the USA and Asia in the field of innovation.

Ms King asked herself why we need European cooperation to meet these challenges. She identified the following factors:

• together Europe is a significant market in global terms;
• European regulation and legislation can drive innovation and new solutions; and
• the mixture of cultures and experiences adds diversity and drives new ideas.

Ms King concluded with four requests:

1. For reform in universities: to recognise that we are special businesses that must be listened and responded to. Businesses must be able to move quickly in order to adapt to changing environments and opportunities.
2. For our legislators and policy-makers to focus on enabling the mobility of people between industry and academia. How many of our engineering academics have worked in an engineering company? How many of our business school professors have developed and delivered a company strategy?

3. For governments and funding bodies to focus more strongly, and value more highly, helping small companies to develop links with universities and research centres.

4. To do this with energy, speed and a sense of urgency.

Anders Flodström gave his impressions of the conference. He stated that he was convinced that the knowledge triangle would increase the status of higher education. It is of crucial importance that universities deliver people with the appropriate skills. We have to rethink higher education: students and universities have a joint responsibility for the quality of education.

Mr Flodström acknowledged that we need action, but stated that in order for the knowledge triangle to lead to action, we need cooperation and entrepreneurship. Entrepreneurship must be brought into teaching, learning and research.

One of the **questions from the audience** was about how universities can emerge from the current financial crisis with a functioning system.

Mauri Pekkarinen responded that universities know what is going on in the world and stated that many of them are ready to focus on innovation. Governments also have responsibilities to provide incentives for industry to work more closely with universities and help them meet their needs. In addition, universities must open up their administration to the outside world.

Adrian Smith added that universities need more cooperation between institutions in order to create innovation.

Annika Ström Melin asked the panel to identify the barriers to initiating university change.

Julia King responded that we do not have time to ask for permission to act. We must act now and be more confident about breaking the boundaries.

Conference Conclusion

Anders Flodström, University Chancellor, Sweden

Anders Flodström informed the audience of the conference conclusions, which included terms such as global challenges, entrepreneurship, interdisciplinary interaction (involving arts and humanities in the concept of innovation), diversity and autonomy.

Mr Flodström referred to the fruitful discussions on the autonomy and diversity of higher-education institutions, as well as to the ranking debates.

Finally, Mr Flodström stated that the conference would have an impact on the Swedish Presidency of the European Union. He summarised by stating that the right people had been discussing the right issues at the right time.

Seminar A – Putting Life Science to Use

Patrick Aaebischer, President, Ecole Polytechnique Fédérale de Lausanne, Switzerland

Anders Ekblom, Executive Vice President, AstraZeneca Development, Sweden

Paolo Macchiarini, Professor, University of Barcelona, Spain

Chair: **Harriet Wallberg-Henriksson**, Vice-Chancellor, Karolinska Institute, Sweden

Background

In Europe, as in most parts of the world, knowledge transfer has been identified as a crucial feature in a developing society. Within the life science sector there are systems for knowledge transfer, but these systems have to be developed further. How will research continue to advance if the training of students is inappropriate? One challenge for a sustainable future is to set up systems that attract today's students to move the knowledge triangle to the far edge and transfer what we can obtain within the life science sector over to society as a whole. Research must be translated into innovation (general public benefit), but at the same time research has to transfer knowledge back into education and into new research. This means an absolute dual focus for the research community: both to provide today's students with the latest knowledge and to translate the results into a benefit for society at large. The life science sector has an even greater social responsibility in the case of pharmaceuticals and medical innovation, which can offer a huge benefit but a rapidly increasing cost. Europe's ageing population requires more healthcare, both as direct care and as more optimised prevention methods, diagnostics and pharmaceuticals. How can we best exploit our resources within the knowledge triangle in order to obtain a cost-effective system in a sustainable society?

The workshop

Patrick Aebischer presented Ecole Polytechnique Fédérale de Lausanne (EPFL). EPFL has the advantage of being at the interface of science and technology, which is one reason why EPFL is ranked the second best university in engineering/technology in Europe (after Cambridge) and number 18 in the world (according to the Shanghai ranking list for 2008; high ranking counts). The EPFL School of Life Sciences started in 2002 and focuses on brain and mind, bioengineering, cancer research and global health.

Mr Aebischer illustrated the strength of having the combination of a polytechnic school and a school of life sciences, where they have a very attractive three-year bachelor programme in life sciences and technology with strong emphasis on mathematics, physics, chemistry and computer science. EPFL offers a further two Masters programmes [life sciences and technology (mole-

cular medicine, neurosciences, bioinformatics) and bioengineering and bio-technology (including biomedical engineering)] and finally three doctoral programmes (neuroscience, bioengineering and biotechnology, and cellular and molecular biology of cancer).

One of the prestigious projects at EPFL is the Blue gene project, which aims to build a simulation-based research facility capable of constructing software models of the brain. The strength of the project is the combination of engineering with neuroscience. EPFL has been very successful in technology transfer to start-ups over the years, with Logitech one of the most famous. The university has taken advantage of the Bologna process to train engineers in life science and medicine and to train medical doctors in science and engineering. This gives an opportunity to structure and develop innovative graduate and postgraduate education programmes across Europe.

Anders Ekblom explained the context of the pharmaceutical industry, saying that there is a huge medical need in society that cannot be fixed quickly. Mr Ekblom stressed the benefits of pharmaceutical industry successes and underlined that the sector is a key contributor to the European knowledge base:
- €26.0 billion invested in research and development;
- 5th largest industrial sector;
- 643,000 highly qualified jobs;
- trade surplus of €44.4 billion.

Furthermore, Mr Ekblom stressed that the EU needs a healthcare sector driven by innovation and clinical research of excellent quality. This is of utmost importance for patients and the pharmaceutical industry. Furthermore, good governance and efficient authorities are crucial. The 'cycle of pharmaceutical innovation' needs a transparent and rigorous ethical framework, strong intellectual property and data exclusivity protection with clear and predictable regulatory and an antitrust framework for the approval of medicines.

The pharmaceutical industry has a large impact on education (examination works, trainee posts, summer schools, theses, teachers from industry, science ambassadors and study visits), research [commitment to find solutions to unmet medical needs, triggering research in important areas, private–public partnerships (e.g. IMI), collaborations, grants, infrastructure, PhDs, postdocs and adjunct professors] and innovation (products and services, precompetitive knowledge, dissemination of knowledge and creative ideas).

Mr Ekblom summarised by saying that we need **politicians who are passionate** about education and research to solve the challenges of tomorrow. And we need **platforms for dialogues between stakeholders – including the pharmaceutical** industry – on how to improve the knowledge triangle and strengthen the interface between the European higher education area, the European research area and the European innovation area.

Paolo Macchiarini presented his impressive project within regenerative medicine and tissue engineering, which bioengineered a new trachea from transplanted stem cells. This was a pan-European project where different regulations almost stopped everything: for instance, passing cells from one country to another is more or less impossible within Europe.

Mr Macchiarini ended his presentation by saying that:

- education, research and innovation should be in patients' interest;
- more transversal information between health professionals is required;
- basic scientists should know about patients' suffering and clinicians about the potential of science – and administrative staff should understand that;
- innovative technology should be available for everyone and be much more cost-effective.

After the initial presentations, the Chair opened the session to the auditorium. It was stated that modernisation of universities is crucial for the future.

The Bologna process was discussed: some representatives in the auditorium from mid- and southern Europe claimed that it was a cosmetic exercise and that no changes will be performed according to the process. However, others saw the Bologna process as a challenge to modernise universities and stated that it can be used to improve the education system. The differences seemed to be between different countries. The selection of students was discussed (i.e. many universities are trying to attract the best candidates): one true challenge for the future and for Europe is to let everyone who wishes to be educated actually be educated, and for that education to be free.

Further points that were discussed were the need for an open and general funding system for universities and research and regulations (in view of the fact that some research can be moved to countries outside Europe), especially within the pharmaceutical sector, but regulations must be optimised for the relevant sector (including the needs of the patients). Long-term stability is requested.

The mission of universities was also discussed. Should universities run everything from education to innovation, or should there be a clear transfer to the industrial sector after basic research? No absolute answer was given.

Finally, questions and comments were raised about whether Knowledge and Innovation Communities (KICs) will change anything for universities.

As a closing statement, the chair requested the single most important issue from each speaker. **Anders Ekblom** restated his wish for a political passion for science; the other two speakers stressed that the different players within the field have to come together and communicate.

Seminar B – On the Entrepreneurial University

Martin Curley, Global Director of IT Innovation, Intel Corporation, Ireland

Mary Walshok, Vice President, UC San Diego, USA

Niclas Adler, Dean, Jönköping International Business School, Sweden

Chair: **Thomas Andersson**, Vice Chancellor, Jönköping University, Sweden

Background

Today's society is changing under the influence of technical progress, globalisation and organisational change, as well as remarkable challenges with regard to sustainable development. Universities carry high expectations in terms of resolving the issues and paving the way for a sustainable, knowledge-based society. Such hopes manifest themselves in an expansion of higher education and widespread interest in science and research, as well as in expectations of a dynamic interface between universities and society at large.

The workshop

The chair of the seminar, **Thomas Andersson**, started with a presentation on Jönköping University. Its ambition is to be entrepreneurial, integrating with local industry. He mentioned three factors that are important for the entrepreneurial climate: tradition and culture, economy, and knowledge diversity between countries.

Mr Andersson showed a slide representing research and development expenditure relative to GDP and share of researchers in 2005. He pointed out that Europe should aspire to reaching the level of Japan and the USA. What is needed is an open innovation model whereby internal ideas within the university flow out to companies and external ideas flow into the university sphere.

Mr Andersson went on to say that universities have to abandon their linear model and be more perceptive of the demand side. To put knowledge into something that can be commercialised requires integrating with other skills and relevant funding.

There is a need for public funding of research and there is an excess in demand for money. But it is also about the lack of an arena for people with entrepreneurial skills, which must be filled with the support of different kinds of funding bodies.

Martin Curley has worked with universities to help them achieve a digital Europe through Intel Labs. He identified joining education, research innovation and entrepreneurship together as the key issue. Mr Curley stated that the weak spots lie within innovation and research.

As a result of the current economic crisis, old tools and old schools are failing. Therefore, we have to meet new challenges. There is a need for a model of innovation because innovation can be taught.

Martin Curley also provided the audience with a definition of entrepreneurship: 'to shift resources out of an area of lower productivity into an area of higher productivity and greater yield'. Entrepreneurship is best provided for in experimental labs, through realistic experiments in which the product is tested before being released, through interdisciplinary work that rides on technology waves and is always open to innovation.

Mr Curley mentioned the example of Ryanair, whereby a bankrupt Irish company was turned into one of the most successful airlines in the world.

Mr Curley concluded by saying that innovation and invention are not the same thing. Innovation requires new research and adoption models; education is not the filling of a pail but rather the lighting of a fire.

Thomas Andersson asked what Mr Curley expects from a university wanting to integrate with the business world. Mr Curley answered without hesitation that the university should be interested in Europe and in advancing business.

The next speaker, **Mary Walshok**, noted that the US context is very different from the European context. Mrs Walshok talked about the historic role of universities in the economic development landscape. US higher education and research has a great role in the economy; this was reinforced after World War II, when federal dollars were put into basic research. The thinking was that science would keep democracy safe. America's competitiveness has always been linked to research in higher-education institutions. Research institutions also have a tradition of commercialising results.

Mrs Walshok talked about changes under the presidency of Barack Obama. President Obama has invested federal dollars in fundamental research that serves the national interest. There has been considerable renewable funding for strategic programmes. The 'field agents' have received funding to find ways to commercialise results. Mrs Walshok also stressed the importance of multiple funding.

In the USA, a variety of programmes support the commercialisation of results. This is achieved by integrating all the partners in the process: investors, industry, advertising agencies etc.

Mrs Walshok asked herself why some university communities have high rates of innovation and entrepreneurship while others do not. She answered that culture really matters. A large percentage of faculty wants to build fields, pushing the boundaries and introducing interdisciplinary topics. Mrs Walshok also stated that structure matters. It is all about building programmes around big ideas and leading scholars. Financing is, of course, an important aspect, particularly when it comes to rewarding risky ventures. There is also a question about providing the infrastructure of support.

Social dynamics play an important role in succeeding in innovation and entrepreneurship. Various gateways have to exist between the universities and the outside world in order for knowledge to flow in and out of the educational system, thus enabling platforms for interaction with users of knowledge. Mrs Walshok mentioned the 100 informal groups that have been set up to talk about, for example, nano technology in the USA. This is an indicator that the innovation ecosystem is starting to work.

Mrs Walshok identified the following needs:
- commitment to world-class research programmes;
- commitment to diverse knowledge;
- open innovation and multiple doorways; and
- participation in multiple networks.

Thomas Andersson asked Mrs Walshok to identify the main obstacle that universities must overcome. Mrs Walshok replied that the desire for control and self-organisation is a problem. We need enabling structures as opposed to controlling structures in academia.

Niclas Adler stated that despite all the opportunities, we have few examples of sustainable success. Universities have developed managing systems that control things. Research is acknowledged in most political agendas, but the problem is that we are trying to reproduce old ideas on how to make great plans using old assumptions.

Mr Adler identified the following challenges that universities must meet in order to be successful in research and innovation:
- Complex problems are best handled through hierarchical breakdown.
- Higher-education institutions are built for control and predictability rather than for experimentation.
- Universities are built on accumulated solutions to historic problems. They have built a defence system for these solutions that has been shown to work. Universities are stuck in historical successes and there are risks in doing things differently.
- There are distinct borders in universities; crossing of borders is difficult.
- Challenging the dominant approaches and established structures can be damaging to an individual's university career.

Mr Adler said that the prerequisites to establishing innovation activities in universities are success cases, convincing evaluation and formal legitimacy for alternative models for managing entrepreneurial activities.

After the seminar, there were several questions from the audience. One of them was about the role of the academic community. Is the development into a more entrepreneurial environment changing the academic community?

Niclas Adler said that the academic community will build the change and convince all of us that it is the way to go. **Mary Walshok** added that learning is not a one-way street: professors learn from their students as well.

Another question from the audience was about the differences between the USA and Europe regarding higher-education systems. **Mary Walshok** talked about the USA as a country of immigrants, where the universities have a socialising function as well as an educational function. There are also strong links between the universities and private funding. Research areas are attractive to students because they are well funded and more commercially oriented. The USA has a long history of application of research results. But the USA also has to learn from Europe, because the European higher-education system provides more quality in undergraduate studies.

The last question from the audience was about how universities can take steps in an entrepreneurial direction.

Niclas Adler said that there is a need for new types of universities and ways to help them with funding. There is also a need for helping existing universities to seize opportunities.

Mary Walshok added that institutional platforms and reforms are necessary to enable opportunities for entrepreneurs. Universities need zones in which to experiment.

The final question was about whether there can be a balance between chaos and order.

Martin Curley answered that creativity blooms in chaos. Research needs chaos, and order is necessary when commercialising results.

Seminar C – IT Security

Michael L. Sena, Consultant, Sena Consulting AB, Åsa, Sweden

Erland Jonsson, Professor, Chalmers University of Technology, Gothenburg, Sweden

Magnus Holmqvist, Managing Director, Commute Greener, Volvo IT Innovation Centre, Gothenburg, Sweden

Chair: **Karin Markides**, President and CEO, Chalmers University of Technology, Gothenburg, Sweden

Background

IT is becoming an ever more integral part of society as the information and knowledge society evolves. Reliable IT infrastructures and applications are gaining an even more important role in a sustainable society.

Addressing the issue of IT security is one of the knowledge triangle's greatest challenges. Society needs to be able to trust IT as it becomes more and more ambient. Business is demanding competent people to produce secure solutions and systems. Business and society need the solutions to rely on the latest research results in order to ensure the best conditions for sustainable growth. And research needs skilled and educated people to embark on a research career.

The workshop

The seminar explored how the domain of IT security (broadly defined) intersects the knowledge triangle concept. The Triple-Helix-based panel of three speakers was asked for its views on this topic.

Erland Jonsson pointed out that the knowledge triangle might benefit or strengthen if actors from industry, government and academia are all involved in shaping the collaboration and setting the goals for future university curriculum development strategies.

Triple Helix can be used to support the knowledge triangle, according to Mr Jonsson. The Triple Helix approach means achieving synergy through cooperation between industry, academia and society.

Magnus Holmqvist presented the so-called Commute Greener case. This case builds and launches 'a driving force for education, research and innovation with safety, quality and environmental care'. Mr Holmqvist discussed IT security aspects in interaction interfaces, business models, mobile services and green IT. Safety has been a core value at Volvo for a long time, but IT security is now gaining ground and becoming an integral aspect of every effort.

Michael L Sena, a telematics expert working in the transportation industry, spoke on the subject that 'road vehicles have gone from autonomous agents to communications nodes within the past fifteen years' and 'the vehicles of tomorrow will require advanced communications capabilities in order to deliver improvements demanded by society', emphasising that:

- IT security for transportation is a subject of growing significance;
- IT security for transportation is an important area of research and development for all companies working in the transportation sector;
- IT security for transportation is a worthy topic of focus for applied research by academic institutions; and
- the concept of the knowledge triangle, integrating education, research and innovation, is perfectly suited to this subject.

Mr Sena said that the line between activities performed inside and outside vehicles is being erased. Before it disappears, we need to make sure that it is secure.

The workshop also discussed cluster development. Awareness of IT security is crucial for the outcome of cluster development. The integration and interaction required between education, research and innovation partners, as described in the knowledge triangle, is a fairly new way of thinking for these partners. A redefinition of the role of each stakeholder, i.e. multinational companies, SMEs, institutes, universities, public sector (local, regional, national, EU) is needed.

The role of universities in cluster developments includes:

- incentives to integrate all stakeholders in dynamic collaborations;
- meeting places for open innovation (i.e. around research infrastructures and in centres of excellence);

- competence building;
- awareness of IT security for students, collaborators and the public;
- collaboration with all stakeholders in a global perspective; and
- medium- to long-term competitiveness for our collaborating businesses.

Both **Michael L. Sena** and **Magnus Holmquist** (both from the transportation industry) supported the notion that the sector of IT security, perhaps more than others, will have increased demands for educated professionals in the future – both experts in IT security and deep IT security understanding permeating every category of professionals in this industry. The entire vehicle transport system will increasingly see information flows and the potential for both hacks and cracks. A deep understanding of IT security issues is now required at the start of every project or effort.

Another conclusion was that the concept of IT security involves many more aspects than is widely known today; it is recommended that we try to define this more tightly in order for a fruitful development and discussion to be possible.

There was a clear recommendation for universities to offer education in IT security to all students, and possibly even make it compulsory. IT security, at least conceptual knowledge of possible attaching vectors etc, is essential for all citizens of the information society.

Other key conclusions from the seminar were that gained sharing is key to partnership, that government policies should provide opportunities for rewarding entrepreneurship and that entrepreneurship needs to be integrated in the education system and not – as in today's IT security education – be offered as optional courses afterwards.

Seminar D – Sustainable Artistic Intervention in the Urban Landscape

Sven-Olov Wallenstein, Philosopher, Södertörn University, Sweden

Esther Shalev-Gerz, Professor and Artist, Paris, France

Lene Crone Jensen, Director, Göteborgs Konsthall, Sweden

Johan Öberg, Head of R&D at the Faculty of Fine Applied and Performing Arts, Gothenburg University, Sweden

Chair: **Johannes Johansson**, Vice-Chancellor, Royal College of Music, Stockholm, Sweden

Background

Learning from the arts may be a key issue if European universities are to take up the challenge from their American colleagues and implement a knowledge triangle. European and Scandinavian art schools – inside or outside the Euro-

pean universities – are highly competitive institutions with an international perspective. They are small and selective, they grant a great deal of autonomy and freedom of action to their students – already artists – and support their development on an individualised basis.

The role of higher education in the arts may be formulated as 'design for design': we design environments and situations for innovation, research and education where creative individuals thrive and develop in their own spirit.

The workshop

The workshop started with an introduction to the role of the arts in the knowledge triangle. The arts are about creative freedom and constructive subjectivity. Or, as Aristotle put it, *metabasis eis allos genos* [a leap into another kind]. In this sense, society may learn a lot from the arts, and especially from their fearlessness when it comes to the reappropriation and reconfiguration of the given.

This highlights a paradox: the more we try to plan, control and evaluate creativity, the higher the risk that true originality and innovation will disappear into other fields where personalities capable of developing those qualities are given the required amounts of autonomy, trust and resources.

In fact, the experience of the arts shows that creativity and innovation have their own inner logics and must be granted resources, freedom and autonomy in order to flourish. True creativity grows out of diversity – of methods, languages and markets.

One main theme of the symposium was the project *The Place of Art* by Esther Shalev-Gerz. It is based on public participation and memory, creativity and sustainability. The project is, so to speak, the art school turned inside out; the art school as a social and artistic activist.

The Place of Art has initiated important processes for social change and gentrification based on a common imagination about where and what the place of art and creativity is in society and in the lives of each citizen. It has become an art-based sustainable intervention in the urban landscape.

Chair **Johannes Johansson** talked about the expanding of arts higher education from the individual knowledge to a more collective knowledge, from object orientation to process orientation. Mr Johansson said that it is important to understand that criticality is not against innovation. On the contrary, we need a critical aspect in the innovation process.

Sven-Olov Wallenstein talked about philosophy and the arts, and about how history is relevant to the present. He concluded by saying that:
- research in the arts is important;
- the environment of arts higher education exists in parallel with academia (humanities) and they need each other;
- art is upheaval of knowledge; unlike science, we do not start with rules;
- all things are commodities, even the arts;
- arts can never be predicted; if you can predict them, they already exist.

Johan Öberg said that there is a problem with a simplistic view; we need to encourage subjectivity, slow processes and resistance.

Esther Shalev-Gerz talked about her project *The Place of Art*. The subjects in the project are artists living in the suburbs of Paris. She asked the artists what art is for them. She spent a year producing five videos.

Lene Crone Jensen spoke about the exhibition of *The Place of Art*, which takes place in two separate but complementary venues, the Bergsjön Centrum (Rymdtorget's shopping centre) and Göteborgs Konsthall. In Bergsjön Centrum, the installation includes a silent movie that shows the artists and their art definitions, listening to their own descriptions in the intimacy of their homes. Between the sequences, quotations about art by artists from all over the world – both renowned and less well known – are inserted. The quotations are taken from the Parisian exhibition, *Magicians de la Terre*, which in 1989 sparked both praise and controversy for its postcolonial approach. In Göteborgs Konsthall, the installation comprises the participants' voices talking about their places of art and four visual propositions for those imagined spaces. The proposed models link their views to four different places: the kitchen, the studio, the culture house and the non-place.

Lene Crone Jensen summarised by saying that art could be an active mediator in communication between people.

Johannes Johansson returned to the importance of the knowledge triangle. What makes people and teams innovative? The key factors are practising 'investigation of trust' and creating a social environment in which innovation can take place. The investigation of art is a practice-based process (compared with science, which is more theoretical). *The Place of Art* is an example of such an innovative process.

Mr Johansson continued comparing science and the arts. In science we need to repeat things in the learning context, but art projects are not repeatable. **Ester Shalev-Gerz** added that students have to start with themselves: 'they cannot repeat my work. It is only from their experience that innovation could occur'.

Johannes Johansson asked how universities can learn from Mrs Shalev-Gerz's experience.

Esther Shalev-Gerz answered that the arts higher education has aspects that are important for the knowledge triangle. Students from different disciplines should meet and discuss issues on innovation.

Johannes Johansson concluded the seminar by saying that the sides of the knowledge triangle should be rounded with the cultural aspects of society.

Seminar E – The Role of Universities in Regional Growth

Silke Stahl-Rolf, Senior Consultant, European and International Affairs, Cluster Agency of the State of North Rhine Westphalia, Germany

Elvira Uyarra, Research Fellow, University of Manchester, UK

Henrik Runnemalm, Director, Volvo Aero, Sweden

Chair: **Per Eriksson**, Vice-Chancellor, Lund University, Sweden

Background

This session focused on universities' role in innovation and growth and particularly regional growth. The discussion highlighted questions regarding the ways in which universities are taking an active role in regional growth and how universities cooperate with industry. Other important questions are to what extent universities are taking part in processes in the region that aim to create renewal and innovation.

The workshop

Per Eriksson started by highlighting the situation for universities in terms of regional growth. Lund University was founded in 1666 and is one of Sweden's largest universities as well as a large research organisation. In order to make the university more innovative and outgoing, it is important to create new driving forces for the researchers to cooperate with the environment and industry of the region.

Silke Stahl-Rolf talked about universities being part of both external and internal growth. The vision is that the university should act both as a knowledge and an innovation node in the region. The university could contribute to being a node in many ways. For instance, it has a very important role to play in the visibility of the region, but also has a more operative role in terms of assisting start-ups and innovation. But making the university more operative requires cultural changes both within the university and in the region.

Successful instruments could include bringing together different actors in the region, to support universities in their new roles and to create a joint strategy.

Cluster policy can be an instrument to involve the university in regional issues and to encourage research and industry to cooperate. The state of North Rhine Westphalia has such a cluster strategy, working with 16 strong growth areas in the region – including healthcare, environmental technology and the media. The purpose of a cluster is to create economic growth through cooperation and co-work between different actors in the region. These actors could be companies related to the sector, the university, research institutes and the public sector.

Results include the following:
- cluster managements support dialogue along the innovation value chain (education, research, industry, intermediaries, politics);
- universities are involved in agenda-setting processes (key topics of the future, 'cross-innovation');
- clusters could stimulate projects with university participation beyond cluster competitions (federal, EU funding).

Henrik Runnemalm spoke about how Volvo Aero has cooperated with universities and also with the region. He talked about the importance of well-educated and competent persons but also of the involvement of SMEs in order to be internationally competitive. One main question is how large enterprises and SMEs can join efforts in research. For instance, several thousand SMEs in Europe join European research programmes, but Sweden has a very low contribution. The solution could be an arena for united actions, creating new technology.

Volvo Aero has composed strategies for the effective participation of both SMEs and researchers. One conclusion is that if you want involvement you have to work together, for example in a project creating new technology.

Elvira Uyarra talked about universities having different roles: one as a knowledge institution and another as a driver for regional growth. Links between university and industry are complicated and non-linear. The cooperation depends on the industry's ability and willingness to absorb knowledge from the university. There is a need for a shift from acknowledging the importance of linkages to actively and strategically promoting them. Adequate bridges need to be built between academic research and those who can effectively commercialise it.

Elvira Uyarra said that universities are nodes within a regional innovation system. The emphasis is on innovation as a collective process built on networks between firms, universities and innovation service providers and the government. The impact of universities depends on the alignment of actors in the system and the ability of universities to mobilise stakeholders effectively.

Some reflections and conclusions from the seminar were that increasing expectations are laid upon universities and that these multiple expectations can create tensions. A strong focus on commercialisation could neglect certain dimensions of impact. It is important to bear in mind that all regions and universities are different from each other. There is no 'one size fits all' model.

Seminar F – Higher Education and Regions

John Goddard, Deputy Vice Chancellor, Newcastle University, UK

Gülsün Saglamer, Professor and former Rector of Istanbul Technical University, Turkey

Britt Lööv, CEO, Inova, Sweden

Chair: **Kerstin Norén**, Vice-Chancellor, Karlstad University, Sweden

Background

Today's regions differ from the regions of yesterday in many respects. One difference is that trade and industry, which used to be local and national, have now shifted to being mostly local and international.

Another important difference between the regions of yesterday and today is that higher-education institutions have been established in almost every region. This is a consequence of the massification of higher education, which should provide Europe with the extremely well-educated population that will help it to compete with the rest of the world.

The workshop

John Goddard has recently performed a review for the OECD, Higher Educations and Regions. The study is about regions and universities discovering each other. Mr Goddard talked about universities as a pot of gold that had been hidden. The established city and regional partnerships are based on shared economic interest.

The success factors are:
- developing a common understanding of the mutual interests of universities and cities/regions:
  - the higher education drivers (education relevant to work, translation of knowledge into innovation, academic education and world-class academic research base);
  - the city/regional drivers;
  - the barriers;
- building conjoint capacity.

So why would universities be interested in regional partnerships? Mr Goddard provided the following reasons:
- declining national funding for higher education;
- search for local support to assist with global aspirations in research and student recruitment;
- increased local enrolment;
- additional income for services to local businesses through consultancy and CPD; and

- indirect benefits to the local environment of attracting and retaining creative academics and motivated students.

Mr Goddard added that in order to have success it is important that your region is doing well, which will also attract students.

The city and regional interests in higher education are the following:

- higher education as a major business;
- global gateways for marketing and attracting inward investment;
- generation of new business and sources of advice to established businesses;
- enhancing local human capital through graduate retention and professional updating;
- content and audience for cultural programmes.

According to Mr Goddard, the university is the key institution for connecting different actors. The connection takes place in locations such as science parks. Mr Goddard uses the term **the connected university**. This university recognises the importance of building networks, recruits people whose experience encompasses both public and private sectors, measures the benefits of university–business interaction more effectively and connects the university not only to business but to the wider milieu within which business operates.

However, there are barriers to regional partnerships, such as: the national higher education policy, which often does not take territorial issues into consideration; regional structures and governance; lack of financing; and universities not understanding the importance of cooperation.

Mr Goddard then talked about the wide range of universities. They can be autonomous or state-regulated, and have different sources of income. How this diversity is managed has an impact on cooperation with the region. Mr Goddard stressed the importance of university autonomy. Cities also differ from each other widely. They can be self-sufficient or dependent on the nation state, and they can be high or low in the national settlement system/hierarchy.

Mr Goddard believes that the way forward is:

- building capacity within universities and regional stakeholders;
- working in partnership with central government and the private sector;
- investment in the personal development of boundary-spanning people;
- the development of embedded conjoint planning capacity; and
- building sustainable bridges.

Gülsün Saglamer talked about the changing role of universities. **Globalisa**tion, knowledge economy, demographic changes and competition have contributed to producing a new conceptual framework for the university that pivots on cross-border networks. This is not a completely new feature. Over the centuries, universities have been at the centre of education–research and public service at national, regional and international levels. What is different

today is the intensity, complexity and global span of these concepts and roles, and the speed of change.

There are three important aspects of the system design challenge that we face:

1. *Designing an effective network of innovation:*
   the critical trade-off in this process is between creating commonalities across participants to achieve efficient and effective cooperation among the constituent parts; and preserving the cultural diversity and variety that drives innovation.

2. *Striking the right balance in university–industry cooperation:*
   We should design our networks of innovation so that they have the flexibility to adjust themselves as that balance evolves. Such flexibility is critical in thinking about systems such as science parks and technoparks.

3. *Training a pool of researchers who can be effective in focused problem-solving but who also have a holistic vision:*
   It should be noted that there is likely to be a trade-off between the two qualities. We should think carefully about how we train our researcher pool to provide the resources for society's changing needs and demands.

Britt Lööw presented **Inova,** an incubator in Värmland, **and how it cooperates** with higher-education institutions.

Today Swedish exporting is based mainly on big companies such as Ericsson and Volvo, and growth is generated mainly through higher efficiency. Ms Lööw asked herself for how long we can do that. The **big challenge is to establish** new companies and new industries.

Värmland has 273,000 inhabitants. There is a strong tradition in three areas (which have also become three strong clusters) – steel and engineering, pulp and paper and, more recently, IT. These clusters are three important pillars in Sweden. Karlstad University is the fourth pillar, with strong areas such as services research, chemistry and energy/environment.

New ideas are most important for Inova, especially from the university. In 1999, Drivhuset [Hot house] was started. Meeting with researchers inside the university started in 2006; this cooperation has contributed to an increased flow of ideas.

Inova lies off-campus and is an open incubator, receiving ideas from the university but also from others. Twenty-five per cent of the ideas come from the university. Inova looks at about 120 ideas each year. About 30 to 40 are developed in cooperation with the university. Inova supports researchers and gives them the facilities to develop their ideas.

Ms Lööw said that Inova is like a switchboard. Ideas come to Inova and the incubator connects the researchers with the right contacts. Entrepreneurial people who can move an idea forward and are willing to take risks are hard to find at the university. Talented researchers, on the other hand, are easier to find.

Seminar G – Increasing Valorisation of Research

Alice Frost, Head of Business and Community, Higher Education Funding Council for England (HEFCE), UK

Harry E. Fekkers, Policy Counsellor for Research and Innovation, Maastricht University, The Netherlands

Sven-Gunnar Edlund, Director, Vinnova, Sweden

Chair: **Pam Fredman**, Vice-Chancellor, Gothenburg University, Sweden

Background

Cooperation and teamwork between universities and the private sector, as well as with society at large, have great bearing on universities' ability to contribute to growth. Policy actions and initiatives are taken by governmental agencies in order to support universities in establishing professional infrastructure for collaboration with the business sector and society, as well as knowledge transfer.

This session explored the potential for universities to become more effective in transferring knowledge, commercialising research results and developing models for collaboration to ensure that the education and research carried out in universities meet the demands of industry and society.

The workshop

Alice Frost introduced the Higher Education Funding Council for England (HEFCE). It is a governmental, non-departmental public body (Department for Business, Innovation and Skills) that is responsible for funding teaching and research at universities, higher-education colleges and higher education in further education colleges. Every institution is funded, not only the strong research institutions.

Third-stream funding means funding from external non-government sources. HEFCE has performed an evaluation of the effectiveness and role of HEFCE/OSI third-stream funding.

The findings showed a very high degree of commitment to the third-stream mission by senior management across nearly all higher-education institutions, as reflected in the following results:

- explicit reference to third stream in higher-education institutions' mission statements and strategic aims, despite their diversity;
- organisational restructuring, with the development of new capabilities and capacity;
- integration of third stream with teaching and research, and recognition of synergies;
- in 2007, 62 per cent of higher-education institutions had a strategic plan for knowledge exchange, compared with 40 per cent in 2001.

After Ms Frost's presentation, there was a discussion on sustainable funding. The workshop concluded that there is always a need for public funding; third-stream funding is not enough and cannot stand on its own.

Harry Fekkers gave a historical background to innovation development in The Netherlands and also presented the history of Maastricht University.

Maastrich University has limited resources. Therefore, research is focused on a limited number of areas such as **cardiovascular, food and nutrition, primary healthcare, brain research, labour and organisation, innovation, Europe and governance**.

Mr Fekkers also talked about the regional involvement of the university:
- valorisation from the 1990s onwards;
- university holding: now some 30 subsidiaries
- patenting and licensing;
- student spin-offs: some 200 created;
- incubator, seed funding;
- Centre for Entrepreneurship;
- regional innovation schemes: product development, knowledge transfer, shared facilities. Mainly in life sciences and medical technology;
- connection to adjacent universities (Eindhoven, Aachen, Hasselt and Liege) and to international networks (FP 5, 6, 7);
- participation in policy development of the Province and cities. Member of many networks;
- largest employer of the Province (7000 employees, 14,000 students). Contributes some five per cent of regional product.

So why is there a successful cooperation between the university and the regional actors? Mr Fekkers highlighted the following reasons, among others:
- Mutual understanding of university and regional authorities: shared vision, intense communication, mutual use of expertise, joint projects of policy development.
- Support to the university is a long-term investment. Both parties understand: the Province has to show patience; the university has to understand societal needs and how to connect these with research and education policy.
- The Province and other authorities are willing to invest and can expect return on investment: i.e. the contract on support for life sciences obliges the university to deliver in between five and ten years' time: graduates, patents, spin-off companies, earning capacity for research.
- The crucial role of companies: they create the economic added value. That knowledge can be put to work by companies: from the region, imported ones and spin-offs. The university offers graduates with skills.

Sven Gunnar Edlund made a short presentation on Vinnova. Its mission is to promote sustainable growth by funding strategic research, addressing needs in industry and society and developing efficient innovation systems.

According to Mr Edlund, the knowledge triangle captures the key drivers in a knowledge-based society. Higher-education institutions must be given a central role in building a Europe where the impact of knowledge-building can be measured in terms of social and economic progress.

Member states should adapt policies and steering mechanisms with the objective of encouraging interaction between universities, research institutes, businesses and public institutions within the knowledge triangle. Higher-education institutions should focus their activities and develop their governance and management structures to better integrate the three sides of the knowledge triangle and use the triangle to its full potential.

Mr Edlund defined the characteristics of innovation processes:
- interactive;
- multi-disciplinary;
- combining demand-driven and user-driven, and enabling technology-driven;
- both science and technology (often codified) and experience-based (often tacit) knowledge;
- the result (innovation) – new and useful.

Sven Gunnar Edlund stated that valorisation is the creation of value. It is an established concept within the EU, including commercialisation and cooperation with society and business. Verification is the most important subprocess within valorisation. To aim for verification is to reduce uncertainty about the performance of a new research result and identify market possibilities and potential. Valorisation requires insight by researchers and higher-education management that the impact of valorisation starts when the research starts, and that professional competence, methods and key support processes are in place.

Mr Edlund's drew the following conclusions regarding the impact on higher-education institutions of the knowledge triangle:
- Understanding and fully embracing the knowledge triangle will certainly introduce real changes, which should be expressed clearly in the strategy of the institution.
- Adequate division of tasks and the different roles of the higher-education institution, research institutes, businesses and others should be well-defined and respected.
- Skills in innovation processes and valorisation should be adequately considered in the academic merit system.
- More developed forms for teaching: not only about innovation processes, valorisation and entrepreneurship, but encouraging students to be involved in innovation processes and valorisation.

Seminar H – The Regional Context of Entrepreneurial Development: The Importance of People

Artur Serra, Adjunct Director, i2Cat, Catalonia, Spain

Hannu Tenhunen, Professor, Turku University, Finland

Tina Lee Odinsky-Zec, Lecturer, Zagreb School of Economics and Management, Croatia

Margarete Rudzki, Policy Advisor, Education and Training/ Employment and Social Affairs, Eurochambres

Chair: **Agneta Bladh**, Vice-Chancellor, University of Kalmar, Sweden

Background

The development of a culture of entrepreneurship depends to a great extent on the 'soil' of the local ecosystem. At the same time, successful entrepreneurs become drivers for regional development. The regional context may range from the micro to the macro level. Similarly, the aspect of development may range from business to culture to social development. This seminar looked at different cases of innovation and entrepreneurial development, reflecting different levels of regional context as well as different aspects of development. The importance of people in this process, particularly the importance of unleashing the human potential, is addressed and discussed.

The workshop

Ramon Wyss argued that there is a need for a change in attitudes and mindset in order for Europe to become more innovative. There is huge diversity in Europe (in terms of regions and cultures) but we all want to achieve the same goal. Can we use the experience of the regions to reach the economic, societal and cultural impact that we are looking for?

    Artur Serra presented his experience from the Mediterranean region. He has worked with a project that looked into the possibility of connecting high technology to culture. His findings included the following:

1. *The regional locus: the regional dimension of the knowledge triangle.*
   The world can be divided into 40 mega-regions. One of these is the Barcelona–Lyon region, also called the Euroregion. The participating (smaller) regions share a vision of improving the infrastructure, enhancing innovation and a network of capacities in a polycentric space that moves towards greater economic integration.
2. *The i2CAT experience: the cultural dimension of the knowledge triangle.*
   The i2CAT project learned from the USA on connecting the internet with audiovisuals. i2CAT wanted to make a connection between culture and high tech and to export this connection globally.

Tuesday, 1 September 2009

16.30–17:45	**The changing role of universities in the Knowledge Triangle** *Lucienne Blessing*, Vice-Rector of Research, University of Luxemburg, Luxemburg *Günter Stock*, President of the Berlin-Brandenburg Academy of Science and Humanities, Germany *Helena Nazaré*, Rector, University of Aveiro, Portugal *Frans van Vught*, President of the European Centre for Strategic Management of Universities, Esmu, Netherlands *Odile Quintin*, Director General, DG Education and Culture, European Commission
19:00	**Dinner at Göteborg Concert Hall** Speech by *Leif Johansson*, CEO, Volvo

Wednesday, 2 September 2009

9:00	**The American Challenge** *Deborah L. Wince-Smith*, President, Council on Competitiveness, USA
9:40	**The Chinese Strategies** *Tao Zhan*, President, Jilin University, People´s Republic of China
10:20	Music: *Tamarind*, South Indian classical music with a jazz touch*
10:30	**How Universities can take on Increasing Societal Demands and Remain Powerhouses of Intellectual Freedom** *Sverker Sörlin*, Professor, Royal Institute of Technology, Sweden
11:00	Coffee
11:30	**We are the Future** *Linnar Viik*, Professor, Estonian IT College, Director, Skype Technologies Ltd, Estonia *Ligia Deca*, Chairperson, European Students Union, ESU *Nikola Macharová*, President, The European Council for Doctoral Candidates and Junior Researchers, EURODOC

Wednesday, 2 September 2009

12:15–13.30	**Is there a Need for National and European Strategies to Achieve the Knowledge Triangle?** *Jose Manuel Silva Rodriguez*, Director General, DG Research, European Commission *Marius Rubiralta*, Secretary General for Universities, Ministry of Education, Spain *Adrian Smith*, Director general of Science and Research, UK *Mauri Pekkarinen*, Minister of Economic Affairs, Finland *Julia King*, Vice-Chancellor of Aston University, UK *Anders Flodström*, University Chancellor, Sweden
13.30–13.45	**Conference conclusion** *Anders Flodström*, University Chancellor, Sweden *Peter Honeth*, State Secretary, Sweden
13:45	**Lunch**

* With students from the Academy of Music and Drama, Göteborg

The speakers´ CVs are found at www.se2009.eu/knowledgetriangle