SiSTER
Swedish Institute for Studies in Education and Research

KTH
VETENSKAP
OCH KONST
ROYAL INSTITUTE
OF TECHNOLOGY

COLLABORATION FOR COMPETITIVENESS

Appendices

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APPENDICES

APPENDIX I: LIST OF PARTICIPATING FIRMS

Respondents from the following firms agreed to be interviewed about rationales for research collaboration with Universities, effects from collaboration and attitudes different aspects of reform in Universities.

ABB Corporate Research
ACADIA Pharmaceuticals
Advancesis
Aerocrine
ÅF Infrastruktur
AFA
Arla Foods
AstraZeneca
Beltone
Biolipox
Biovitrum
Bombardier Transportation
Cenergie
Eka Chemicals
Fresenius Medical Care
GlaxoSmithKline
Grundfoss
IBM
KaroBio
Linde Gas Therapeutics
Länsförsäkringar
Lundbeck
Medtronic
Merck
Nokia Research Center
Nordic Managment of Clinical Trials
Novozymes
OJI Paper
Opcon
Organon
Osaka gas
Q-med
Pfizer
Rieter Automotive
SAAB Bofors Dynamics
SAAB Systems
SCA
Scania
Shell Research
Siemens Industrial Turbomachinery
Smerud Medical Research International
SUN Microsystems
TeliaSonera
UPM-Kymmene (United Paper Mills)
Volvo Aero
Volvo Technology
Wyeth

Respondents from the following MNE subsidiaries were also interviewed, using the same set of interviews, to confirm the findings from previous interviews and to allow the analysis of how proximity to a research university is a benefit to firms.

Zurich (CH)
Elan Microelectronics
IBM Zurich
Alcan
Google Engineering Centre
Millenium-Biologix

Cambridge (UK)
Kodak
Intel
Unilever
Microsoft
Hitachi

Hsinchu / Taipei (TW)
Wistron
ITE
Northern Telecom
QMI Taiwan

APPENDIX II: GUIDE FOR INTERVIEWS WITH FIRMS

1. Basic facts/information about the firm and its research.

(A1) Firm name: _____

(A2) Respondent name: _____

(A3) Respondent position (title): _____

(A4) Firm business sector: _____

Firm size, subsidiary and parent company:

(A51) Number of employees: _____

(A52) Economic size, yearly turnover: _____

(A6) Location of head quarters, firms and department:

_____

(A61) Is the connection to KTH / KI intra- or trans-national?

☐ Intra-national

☐ Trans-national

Respondent unit size /scope,

(A71) Number of researchers: _____

(A72) Budget: _____

(A73) Scientific scope of unit: _____

(A8) We are interested of what forms of university cooperation you been working with during the last five years. Please answer with a simple *"yes" or "no"* to the following forms of cooperation if you have been involved in any or not.

☐ Jointly owned centres, organisation (A81)

☐ Licensing/purchase of patents(A82a) **?** Consulting (on the same invention) (A82b)

☐ Other consulting, specific researcher (A83)

☐ Hiring equipment / renting facilities (A84)

☐ Joint staffing (e.g. industry financed PhD-students) (A85)

- ☐ Joint venture research (participation of both firm and university staff in research activities) * (A86)
- ☐ Commissioned research (pay for agreed work without own direct participation* (A87)
- ☐ Research sponsoring* (A88)

(A9) What university units have you been interacting with? Centres, institutes, departments, research groups? (Why?)

_____

_____

_____

(A10) Are you presently cooperating with any university on research?

- ☐ Yes
- ☐ No*

  (A101) Why not?

  - ☐ No current need.
  - ☐ Bad experience from earlier research.
  - ☐ No funding.

(A11) Are you planning to cooperate with any university in the near future?

- ☐ Yes*
- ☐ No

  (A111) Which one? _____

  (A112) What type of cooperation? _____

(A12) Could you possibly state when the first initiative was taken to cooperate with a university and by whom?

- ☐ Yes* _____

_____

_____

☐ No

(A13) Why did the cooperation not start earlier?

_____

_____

(A14) Have you cooperated with *more than one* university during the last five years?

☐ Yes*

☐ No

(A141) Around the same research issues/technical problem areas as with [KI/KTH]? What? Why?

☐ Yes

☐ No

_____

_____

(A142) Around the same business problem areas as with [KI/KTH]? What? Why?

☐ Yes

☐ No

_____

_____

(A15) Do you cooperate with *other firms* on research and innovation?

☐ Yes

☐ No

(A151) Around the same business problem areas as with [KI / KTH]?

☐ Yes

☐ No

_____

_____

(A16) Have you changed university as a cooperation partner, why/why not?

_____

_____

_____

(A17) Can you estimate what share of your total R&D budget that you spend on projects where you cooperate with universities?

_____

(A18) Is cooperation with Universities an efficient way of running R&D (or is it mainly a good complement to internal R&D)?

- ☐ Yes
- ☐ No

2. The decision to cooperate

(B1) If you were forced to motivate to your board why you spend precious time and resources collaborating with the university, what would be you foremost answer?

- ☐ Recruitment
- ☐ Promotion of technological and/or product development*
- ☐ Sharing / access to equipment and laboratories
- ☐ Affecting the university agenda

(B11) ***New technology*** →

(1) Do you demand concrete results that can be adopted by your internal R&D teams

or

(2) is it more important to promote learning and to become informed about technical development ?

if concrete → **what is most important…**

(1) access to concrete ideas for business opportunities (*what* to do)

or

(2) concrete assistance in developing opportunities already defined by your firm (*how* to do it) ?

(B112) Are Universities mainly partners to perform R&D in a cost/risc effective way, or is cooperation with Universities mainly a complementary activity to internal R&D, fulfilling other functions?

- ☐ Cost / risc dominates (1)
- ☐ Other factors dominate (2)

(B2) Why this university (KTH/KI)? Is there an alumni effect?

_____

_____

(B3) Describe a typical innovation cycle (from ideas via tests and development to product on the market). What parts of this process are facilitated by university cooperation?

- ☐ Innovation ideas (identifying the possibility / opportunity)
- ☐ Innovation development / supplementation (supporting technology etc)
- ☐ Innovation completion (supporting technology etc)

(B4) When assessing potential research partners, what personal characteristics are important? What is important to assess?

- ☐ Competence in basic research, as manifested in academic publications.
- ☐ Industry experience.
- ☐ Web of contacts.
- ☐ Other personal characteristics (“personal chemistry”).
- ☐ References

_____

_____

(B5) Do you work *continuously* with the university (on research and innovation issues)?*
Continuous: active relations resulting in monetary and/or personnel exchanges that has wider span than a specific research issue and that (are intended to) last more than one year.

- ☐ Yes (in X projects)
- ☐ No (in X projects)

_____

_____

Yes → (B51) Why? (i.e. what would you loose if you only cooperated temporary, in times when you have special needs)

- ☐ Because we have continuous need for consultation and/or equipment.
- ☐ Because we strive for branding effects.
- ☐ Because we seek access to *global* networks.
- ☐ Because we need access to *local* networks / ability to identify unique special competencies when needed.
- ☐ Because it enables us to make continuous recruitments.
- ☐ Because it enables us to affect the university research agenda and/or the education of doctoral students (who may later be available for recruitment).
- ☐ Because we want active relations, and relations need continuity
- ☐ The kind of work we do needs time to be useful

No → (B52) If not, how is a typical cooperation initiated?

_____

_____

(B6) Have the rationales for, and your attitude towards, university cooperation changed during the last five years? How?

_____

_____

_____

(B7) Could you describe how public interventions/support have affected your decision to cooperate? Has it increased the possibilities and/or removed some obstacles for cooperation? If possible, give examples!

_____

_____

3. Effects / evaluation of cooperation

(C1) We would like you to evaluate your cooperation with universities. Please grade to what extent you can agree with the following statements on different effects using a four point scale where:

1 – not at all, 2 – to some extent, 3 - beneficial effects, 4 – great effects.

(If 1-2: did you expect better results within the area?)

_ *Identifying* opportunities for innovation (C11) ?

_ *Realisation* of innovation opportunities and development (C12) ?

_ Enabling *further contacts* (C13) ?

_ Outside-in-view of our technology/*broadened perspectives* (C14) ?

_ Recruitment (C15) ?

_ Branding of product and/or firm, *scientific legitimacy*. (C16) ?

Other:

_____

(C3) If you seek a partner for R&D, where the expected results are of a sensitive nature, which partner do you prefer? (with which partner is it possible to protect intellectual property?)

- ☐ Other firms (competitors, customers, suppliers).
- ☐ Universities.
- ☐ Other public research organisations.
- ☐ Impossible to say (different from case to case).

(C31) In which cases?

_____

_____

_____

_____

4. Demands on the university

(D1) Please rate the following statements

1 - do not agree at all, 2 - to some extent, 3 - often, 4 - agree totally.

- _ It is *more effective* to have a corporate liaison office (university based) intermediating contacts with universities than to maintain contacts to researchers only. (D11)
- _ We are willing to build lasting relations *with the university*, not only with individual researchers. (D12)
- _ It is more effective to work with institute organisations within a university than with individual researchers in departments. (D13)
- _ Researchers who are used to collaborating with academics from other traditions than "their own" are better partners. (D14)
- _ Do you feel that the contacts you have enable you to draw on most interesting sources of knowledge in the university (all the most "relevant" professors, etc). (D15)

(D2) Which Universities do your unit cooperate with, worldwide? What general demands do you have on universities? Should they be world leading – in which way, general or in a specific area?

_____

_____

5. The decision to invest in R&D

(E1) Who/which body typically takes decision about collaboration in R&D?

_____

_____

(E2) Who/which body typically takes decision about (total) budgets for R&D? Is there another body/unit/person who has a strong influence on that decision?

_____

_____

(E3) Has collaboration with Universities been *critical* to the firm's success? Do you see it as *critical* for future success?

_____

_____

APPENDIX III: KUNGLIGA TEKNISKA HÖGSKOLAN

The Royal Institute of Technology, Sweden

Background and description

KTH, the Swedish abbreviation for the Royal Institute of Technology, won its name in 1877, as the institution previously named Technological Institute of Stockholm entered a phase of enhanced academic ambitions. In its fifty years of existence, the institute had struggled with the balance between industrial and academic demands, as manifested in its still prevalent motto "Science and art".

The University has a large campus area situated in the north of central Stockholm, where seven of the nine KTH schools have their main activities. A school for ICT is based in the telecom intensive suburb Kista and bachelor-level education is based on three campuses in southern Stockholm suburbs Haninge, Södertelge and Flemingsberg.

Increasing competition

As Sweden's oldest and largest University of technology, KTH has a natural leading place. But even if KTH celebrates many excellent research achievements and dominates the national scene of technical education (a third of Swedish engineering education is placed at KTH), the University has for at least two decades faced increased national competition. As a result of a long period of expansion of higher education, motivated by ambitions of widening participation and regional development, Sweden has a higher number of higher education institutions offering technical education than any comparable country. Resources for engineering research are also widely distributed. Sceptics ask whether there really is room for an excellent institution in a small country where nine universities and University colleges compete over national research funding.

The relations to industry go well beyond what is seen through official statistics, including personnel exchanges, cooperation financed by in-kind efforts, etc. It is however interesting to note that direct revenues from industry for research increased by some 20% nominally between 1999 and 2004. At the same time, official statistics for all Swedish Universities and University colleges show that the total industry direct investment in research cooperation increased by 60% nominally.[1] Is this an indication of KTH loosing out to national 'competitors' also in attractiveness as industry research partner?

Professional support

Similar to other well-established technical Universities, KTH researchers traditionally have strong connections to industry. However, KTH does not currently run any form of dedicated function or special programme for active industry liaison of the form often found at successful Anglo-Saxon Universities. It is a question for future thought to what extent such a function is demanded by KTH's industry partners or to what extent such a function would be able to win the University new ones.

[1] Source: the Swedish National Agency for Higher Education

Through the *External relations* office, KTH offers assistance in connecting industrial partners to researchers, either for short consultation or more ambitious relationships. The office does not currently work with active development of industry relations. A more active approach is used by the *Engineering institute*, situated in the school of Industrial Engineering. The institute, which specialises in contract research, presents itself as a gateway to KTH expertise for industrial partners. The *KTH Executive School* also upholds important contacts to industry, offering courses drawing on Faculty competencies and benefiting from as well as strengthening relations to Alumni. KTH also cooperates with two tech parks, none of them, however, directly controlled by or owned by the University.[2]

Vice rector dedicated to knowledge valorization

A sign of the increasing importance assigned to activities around the "cooperation mission" of universities is the appointment of KTH's first vice rector for cooperation in 2003. Under the present vice rector, a new integrated organisation for knowledge valorization is being constructed.

Manifesting an out-reach culture

In 2005, KTH introduced the magazine KTH&Co. The publication, which represents a significant investment on part of the University, is distributed for free to selected firms and KTH alumni. The office has identified a large number of firms in the Stockholm-Mälar region, to whom the magazine shall present KTH as a leading, dynamic technical University keen on cooperation. Examples of interesting projects where industry and University work together are presented and the University's central contact points for industry highlighted.

Alliances with other Universities

KTH's formal alliance with the second largest technical University in Sweden, Chalmers in Gothenburg, was launched in late 2004. KTH also has strong connections to its neighbouring Universities, formalised in a large number of projects. Academically, there are particularly strong ties to Karolinska institutet, Europe's top-ranked medical research institution, and Stockholm University. The Stockholm Academic Forum is a body where recruitment for basic education and establishment of university-industry relations are promoted by Stockholm Universities in cooperation. The SUSAM alliance is a forum for six Universities in the wider Stockholm-Uppsala region. KTH is also a member of the CLUSTER alliance – an example of pan-European cooperation.

The most recent alliances formed by KTH aim at establishing a presence in interesting Asian regions. Together with Chalmers and Karolinska institutet, the University has set up local offices at Beijing University in the Chinese capital and Fudan University in Shanghai. KTH has also announced the intention to launch an affiliated University college in Pakistan during 2007. These new networks can partly be understood as means to strengthen the University's ability to connect industry partners to local markets and local R&D resources, thereby increasing the University's attractiveness for industry. Through formalized research cooperation and participation in

[2] KTH is one of ten owners of the foundation Science city, which owns the tech park facility *Teknikhöjden*. The tech park facilities in Kista are part of the STING-scheme, in which KTH is an important partner.

engineering education, the University hopes to be able to offer access to interesting environments and to build local Alumni networks.

Organisation of research

Towards a more stream-lined organisation

The KTH organisation has transformed slowly over the last fifteen, slowly going from a very decentralized University with a large number of small institutions towards larger organizational units. Under its current Rector Anders Flodström, the transformation has continued to the current model featuring nine large schools. Many argue that the larger organizational bodies have enabled stronger research and produced synergies for research. It is still too early to evaluate the effect of the last reorganization, but one of the clear ambitions of the reorganization is that the schools will constitute stronger collaboration partners for industry, offering simplified interfaces and demonstrating improved abilities for dynamic out-reach.

Centres – where science meets business

At KTH, research centres with industry participation play an important part for the University's knowledge valorization efforts. Centres are typically focused around areas of application, and thus inter-disciplinary in scope. This set-up makes it natural for industry to participate and/or sponsor research, and centres normally have boards with strong industry presence.

A particular group of centres are the *competence centres* founded as a result of an initiative by the Swedish Agency for Innovation Systems (VINNOVA) and its precedents. Hosting a third of the 28 competence centres established in 1995, KTH has been a main benefactor from the programme. The competence centres are characterized by strong industry involvement, clear IPR rules and a research agenda shaped by industry needs.

In centre- and institute organizational forms, KTH has found important tools for building the bridges between technical science and industrial technology that are necessary both for breathing life into research agendas and for encouraging industry funding of universities.

Connections to independent research institutes

With their competences in application-oriented research, the large number or research institutes situated at KTH campuses constitute intermediaries between the University and industry and, for researchers, intermediaries between academic and commercial careers. KTH is continuously discussing how cooperation between the institutes and the University can be strengthened, and a joint analysis has identified a number of "strategic innovation milieus" where the potentials for productive cooperation are high.[3]

Co-location with industry

While the main campus in dedicated to KTH institutions and governmental research institutes, KTH has during the last ten years played an active part in creating new environments where industry and academic institutions from Stockholm Universities share facilities. The campi environments in Kista and at the *Novum* research park in Flemmingsberg are both seen as

[3] Eriksson, K., Ericsson, L., (2005), *Samarbete mellan KTH och kringliggande industriforskningsinstitut – nuläge och utvecklingsmöjligheter.*

prominent examples of milieus created in the hope of achieving positive dynamics for all partners. The most recent addition is the *Albanova University Center* located between KTH's main campus and Stockholm University. The two Universities have re-located their physics, astronomy and biotechnology institutions to this sub-campus in order to allow for interdisciplinary exchange. Currently, discussions are being held whether it would be possible to introduce industry presence at the campus to increase the potential for boundary crossing exchange further.

APPENDIX IV: KAROLINSKA INSTITUTET

Karolinska Institutet, Sweden

Background and description

The Karolinska Institute (KI) is the largest centre for medical education and research in Sweden with 30 percent of the education in medicine and 40 percent of the national medical research. More than 75 percent of the students at KI are studying within healthcare/medicine. In 2005 the university had about 5 300 full time students.

In an international perspective, KI is one of the largest medical Universities of Europe and ranked as the 45th university in the world and 7th in Europe[4]. Indeed, the university enjoys a reputation that should attract partners for research and development. This is certainly also very much the case for KI. Only five years from their 200 year anniversary in 2010 KI has put up the vision to become Europe's leading medical university. *"We aim to be the Nordic region's leading centre of innovation in the field of life science, and to help bring scientific discoveries to the benefit of society and human health. In so doing, we hope to be an important driving force for development in Sweden and the Stockholm region"*[5].

The Stockholm region, where KI is situated, is relatively strong within biomedicine. Several national and international, both small and large, companies in biomedicine are located in the near vicinity. KI, being the awarding institute for the Nobel Prize in Physiology or Medicine, has a rather unique network of contacts within the medical research society. The University has also been succesful in realising its research strengths into attractiveness for industry. Collaboration officers claim that the demand for collaboration is so large that the University can afford to be rather selective, and the company interviews performed in this study give no indications that this statement is exaggerated.

Historically already being an active cooperation partner in research, the future intention of KI is to become an even more attractive partner for other Universities, for the healthcare services and for industry. To further encourage and facilitate cooperation with these types of partners KI offers a multitude of services, contact organizations and entrances.

Karolinska Enterprise acts as an umbrella organization for different types of incoming contacts with KI. Under this heading, the following organizations are gathered:

Karolinska Institutet Strategy and Development Office (SDO) former Centre for Medical Innovations (CMI) which is a strategic research and development unit at KI. The role of SDO is to actively strengthen KI's development in the long term and also the interactions with the Swedish society.

Karolinska Development (KD) is an investment company, providing venture capital for life science companies in the start up process and early development.

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[4] *Academic Ranking of World Universities 2005* – Institute of Higher Education, Shanghai Jiao Tong University
[5] The Karolinska Institute webpage

Karolinska Education AB's (KEAB) business idea is to function as the bridge between the university's knowledge and the community.

Karolinska Innovations aims at to make sure that the biomedical research at KI is converted into practical applications.

Karolinska Institutet Holding's main function is to own, sell and manage shares and capital interest in wholly or partly owned projects and service companies.

Karolinska Research Services' role is to sell products and services produced or developed by KI to the business community.

Karolinska Science Park was founded in order to create opportunities for both mature and newly started companies to establish themselves in physical proximity to KI.

Karolinska Investment Fund is an independent venture capital fund for investments in companies specializing in pharmaceuticals, biotechnology and medical technology.

It is obvious that cooperation and contact with industry is very important at the Karolinska Institute – the motto *"A medical school not supporting its basic research results into applications is unethical"* [6] clearly supports this. In a more practical sense this is put into reality at Karolinska Innovations, Grants office, Karolinska Development and Karolinska Research Services. For established companies, SDO is the natural entrance to KI.

KI also has an agreement on cooperation with the leading biotechnology company in India, namely Biocon Ltd. Biocon is ranked as the 16th biotech company in the world with a market cap exceeding 1 billion USD. The cooperation with Biocon includes partnering in product development between KIHAB and biocon, joint PhD studies with KI, joint research programs between KI and Biocon, and scientific symposia in India sponsored by Biocon in association with KI.

Professional support

While much of the support structure around the University is focused on spinn-off and classical commercialisation activities, KI also has a central unit dedicated to the support of industry collaboration; the *Karolinska Institutet Strategy and Development Office* (SDO). As mentioned previously, SDO just recently changed its name from Centre for Medical Innovations. The office is currently restructuring its organization with a new director and a newly defined mission. SDO, at the time employing 14 people, is organized directly under the KI president (rector).

The history of SDO/CMI is relatively short, being established in 1996 by John Skår and Hans Wigzell with the overall ambition to explore the future of biomedicine, biotechnology and biosciences. SDO is financed both by KI and external partners. The characteristics of the projects are pre-commercial and/or strategic long term projects within the areas knowledge, competence and attitude and often in the context of the third task of the university.

[6] Karolinska Institutet Strategy and Development Office (SDO) 2006

The current vision for SDO is that it *"will as an objective resource contribute to an increased synergy and interactions between external partners, the society and units within KI – thereby adding value to the over all work and development of KI"*. While the strategy is stated as *"In collaboration with KI management and in the close interaction with the surrounding society SDO will as a "probe into the future", initiate and develop projects well anchored by customers and sponsors"*.[7]

More exactly, the mission of SDO is to

- Interact with the KI management, researchers and teachers.
- Develop and manage projects within identified key areas with the aim to strengthen the development of KI.
- Lay the foundation and generate opportunities for long term strategy.
- Improve mutual knowledge and technology transfer between researchers, healthcare and industry.
- Contribute to understanding of the impact and importance of life science in society by increasing awareness.
- Capitalize medical research within the context of translational medicine.

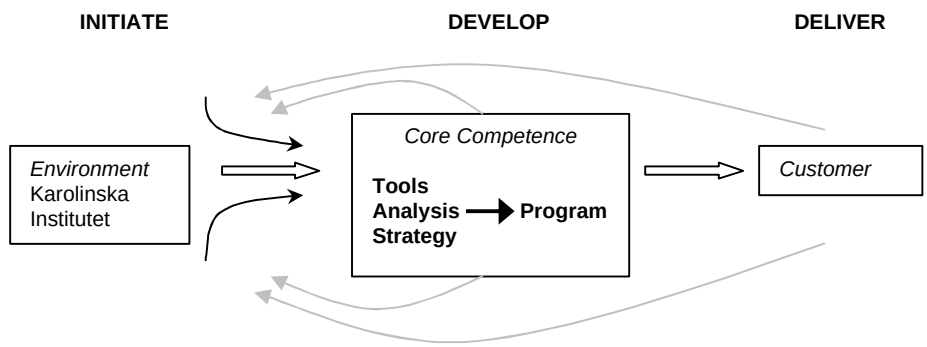
The core competence of SDO is:

- Perform knowledge building through Business Intelligence and Knowledge Management
- Provide analyses and investigations to lay the foundation for future informed strategic decisions
- Initiate and develop projects and activities beyond the ordinary work of individual researchers or departments

A recent example of a strategic collaboration established, KI signed an agreement with the leading biotechnology company in India, Biocon Ltd. Biocon is ranked as the 16th biotech company in the world with a market cap exceeding 1 billion USD. The cooperation with Biocon includes partnering in product development, joint PhD studies, joint research programmes and scientific symposia in India sponsored by Biocon in association with KI.

A new proactive approach

In general the contacts between the companies and the researcher is made by the researcher and/or the company as it is said that "the researcher, teacher or research group is initially responsible to cooperate and communicate their results with the business world, as a support for this KI provides special organizations". The SDO illustrates this with the following figure:



[7] ibid

However, the SDO recently announced ambitions to take a more proactive approach. The office will seek to improve its ability to identify KI research with high potential and to broker deals leveraging the commercial value of that research.

Facilities and library services

Besides the contact services offered by SDO and the help with development and funding of new innovations by Karolinska Development and Karolinska Investment Fund, the Karolinska Institute offers some services in facilities and library services.

The Karolinska Science Park (KSP) is managed by Karolinska Institutet Holding AB on the behalf of Karolinska Institutet. The Science Park is located at two sites, KSP North on KI's Solna campus and KSP South in the laboratory building near the KI grounds at Huddinge and Novum Research Park. Furthermore, Karolinska Science Park is planning to build three connected buildings at KSP North with a total floor space of 22 000 square meters. Rentable laboratory facilities will be available for companies. Today more than 30 companies are part of the Karolinska Science Park.

The University Library is the largest medical library in the Nordic countries, making it a valuable source of information for companies. Currently the library offers some customized contract services for companies within information in biomedicine. By becoming a customer the company gets access to scientific articles, database searches, boring of books, education in information search and other specific services described in the contract. Each customer is assigned a contact person at the library. Ordered articles and database questions are usually sent or dealt with the same day. Each company is also assigned a unique web page where the researchers at the company can order articles themselves. Information about the articles and who has ordered is protected and competitors can not access such information.

Manifesting an out-reach culture

The introduction of a robust structure for commercialisation has made commercialisation opportunities visible to KI Faculty, contributing to the University's strong reputation in the area. The issue of industry collaboration is perhaps more complicated for KI, as a large medical University. One the one hand, there is no doubt that collaboration can serve the mission of the University. This stance was elaborated in the often-quoted motto of the former rector: "It is unethical for a medical University to not actively promote the commercial application of our knowledge". On the other hand, dealings with industry risks undermining the esteem of the University as independent, which is a particularly delicate matter in the area of Life Science. Nonetheless, the present rector has continued to support Faculty who are willing and able to combine commercial and academic interests in their research.

Alliances with other Universities

During the years, KI has established a number of successful alliances with both firms and other Universities around the world. KI has signed agreements with around 50 Universities concerning research and postgraduate education, mainly in Europe, North America, the Middle East and

Southeast Asia. In Sweden, KI collaborates with other Universities as well as with the pharmaceutical industry in the STandUP region (Stockholm, Uppsala, Strängnäs and Södertälje)[8].

These alliances have different agendas and goals; however they do have an international aspect in common. At the present, KI has developed alliances both in basic education, PhD training and postdoctoral training with several universities abroad. Asia is becoming more and more important within research and the cooperation between KI and Universities in Asia is expanding. GoAsia gathers the alliances with Asian Universities, where KI focuses on large exchange programs with Singapore, India, China and Japan. For now, KI has the KI-NUS exchange program with Singapore, a program that has proved successful and which may be extended and enlarged in the future.

Chinese Universities are particularly attractive partners for research cooperation. KI has eight agreements on cooperation with Chinese universities, including one active joint PhD-programme involving 120 Chinese PhD students. KI also has five honorary professors at Chinese Universities. Furthermore, in March 2004 KI opened a joint research center together with Cancer Center, Sun Yat-sen University in Guangzhou. In October 2005, together with Kungliga Tekniska Högskolan (Royal Institute of Technology) and Chalmers University of Technology, KI opened two new offices; one at Beijing University and one at Fudan University in Shanghai. The offices are intended to serve as platforms for the marketing of the universities courses and research activities, and also to increase the commercialization of scientific data throughout the region.

The cooperation with India is becoming more and more enlarged and important for KI. In March 2006 KI announced a cooperation initiative with the Indian Institute of Science in Bangalore. The cooperation aims at research and PhD training within medicine and bio technology and runs over a time span of five years. The Indian Institute of Science is ranked as one of India's top research and education institutions within the natural sciences in India.

The Karolinska Institute is also part of the S* Star alliance[9] which has been formed to provide a unified bioinformatics learning environment with modular courses within the disciplines of genomics, bioinformatics and medical informatics. The aim of this alliance is to set up online courses for training in bioinformatics and genomics available and to develop an integrated modular learning environment.

Organisation of research

Currently KI is organizing several research centers for cooperation and proximity, both on and off campus. While centers are organized in different ways, a common characteristic is that they consist of research teams sharing equipment and premises. Some of the centers are organized as part of departments while others are run as foundations. The centers focus on a vast area within medicine. There are centers for cancer, allergy, bioethics, health care sciences, infectious medicine, medical innovations and molecular medicine and so on.

[8] Karolinska Institutet web page
[9] www.s-star.org

Each center gathers a number of staff members. For example, the Center for Molecular Medicine (CMM) has about 350 staff members with clinical experience from Karolinska University Hospital and research competence from KI for research on common diseases. Every year, more than 200 discoveries are published and about 30 medical or diagnostic methods are being developed at CMM. CMM was founded in 1997 after a number of large, private donations.[10] At the Cancer Center Karolinska (CCK) approximately 300 people work. They focus on tumor biology, radiation physics and biology, clinical trials, translational research, cancer epidemiology and forensic medicine. CCK is a private foundation which has built and holds CCK in trust, and its laboratory space is put at the disposal of the Karolinska Institute[11].

Co-location with industry

The Karolinska Institute Campus is divided into two main parts, one in Solna and one in Huddinge. In Solna, some companies are located on the campus. At the Huddinge campus, where 75 percent of the teaching and 40 percent of the research activities of the Karolinska Institute is located, co-location with industry has been taken a step further through the Novum Research Park concept.

Novum Research Park

The Novum Research Park offers a fairly unique bio technical milieu in Sweden where companies, academic researchers and students are gathered in one concentrated area. More than one tenth of the Swedish biotechnical research is located at Novum research park which is growing at a rapid pace. Today, around 15 medical companies are situated at Novum with between 10 and 130 employees. Both the Karolinska Institute and the Royal Institute of Technology have campuses at the Novum Research Park, which is also located in the vicinity of the Södertörn University College. According to Novum Research Park, more than 24 000 students, researchers and teachers are located in the area, within a radius of 500 meters. The Royal Institute of Technology has been active in the area since 2002-2003 and has rapidly expanded with two engineering educations within medical technology. The Södertörn University Collage has a strong emphasis on multidisciplinary education and research, with today about 12 000 students.

Ambitious plans for northern campus

Under the organisational caption *Stockholm Bio Science*, a joint cooperation between Karolinska Institutet, KTH – The Royal Institute of Technology and Stockholm University is developed, which is intended to create a new geographical new for bioscience research and biomedical companies in the region. The area is meant to be built on a railway area between the main KI campus in Solna and the city in a new city section. Here, an "urban science park" is to be created. So far, the infrastructure is only at the planning stage, albeit in an advanced phase. The project is a very interesting example of how ambitions to build new environments to create 'cluster' and co-location effects is the starting point for major regional infrastructure initiatives.

[10] www.cmm.ki.se
[11] www.cck.ki.se

APPENDIX V: UNIVERSITEIT TWENTE

University of Twente, the Netherlands

Background and description

Presenting itself as "an entrepreneurial research University", the University of Twente (UT) represents a new kind of young European research and education institutions. Since its' founding in 1961, UT has put scientific focus on interconnectedness between technical and social sciences, with exceptionally strong emphasis on innovation activities. Presenting its research agenda, the University states that "it is impossible to imagine research at the UT without […] focus on practical usage". The University performs internationally prominent research in areas such as telematics (combination of telecommunication and information technology), biomedicine, chemistry, microsystems, and laser technology.

Crisis and turnaround of the Twente region

The strong UT-management focus on fostering of entrepreneurship and knowledge valorisation has its' roots in the special context of the University and its' regional role. The University is situated in a, by Dutch conditions, relatively remote region on the German border. For many years the steel and textile industries provided the economic backbone of the Twente region. The rapid decline of these industries in the 60s and 70s lead to 25 % unemployment in the region. From the 80s and onwards, regional efforts have focused on fostering and attracting high technology businesses. From its' very start, expectations on the University to develop into a hub for technology and growing businesses has been strong.

The regional profile also shapes the knowledge valorization activities and cooperation patterns of the University. As opposed to the technical Universities in Delft and Eindhoven, there simply is no larger firms or strong industry clusters present in the region around University of Twente. To build strong industry-University relations, the University is forced to actively work with and if possible strengthen regional companies with growth potential and to encourage start-up activities among students and faculty.

Beside the University, the region hosts a second strong research organisation: the *Telematica Institute*. One of four Dutch Leading Technology Institutes, the independent institute is based nearby the University Twente campus, enabling research cooperation and staff-sharing with the University .[12]

Slow growth curve projected

With the smallest student counts of the three technical universities[13], the UT is something of a "little brother" in relation to Delft and Eindhoven. The University management has no conceptions about radical changes in this relation. The official goal is to expand research activities slowly through increased external financing beyond 50 % (46 % today). The road towards that goal goes through powerful concentration of research activities. University

[12] In 1997, four research institutes were created to support and perform research in four areas identified as critical to future competiveness of Dutch industry. They all have significant inputs and participation from universities and industry partners.

[13] The UT has a steady "market share" of about a fifth of the students in higher technical education..

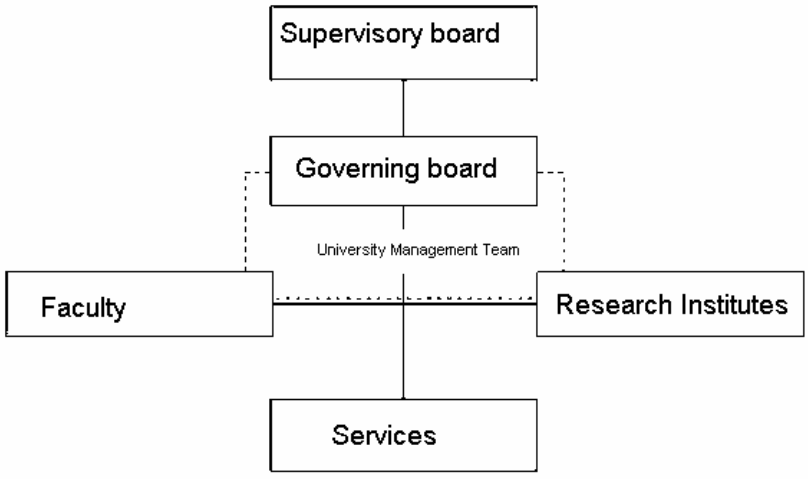
management anticipates a development where the University narrows it's disciplinary span "down to three disciplines". The UT argument is that in an increasingly competitive world, a small University can remain successful only through dedicated specialization.

The University calculates for a slow growth on the educational side too, student numbers are to increase by five percent per year. This expansion is in part aimed at attracting non-EU-students. As part of this strategy, UT has recently introduced a segmentation of tuition fees through a radical increase of fees for non-EU students: from € 1476 to at least € 8100 a year.

Organisation of research and education

Just as the other two technical universities, UT is organised in faculties and research institutes. Currently, UT has five faculties, where all academic staff are officially employed and where responsibility for teaching is laid. Research is organised in institute form. UT has six such institutes which are assessed as strong and broad, and therefore labelled "spearhead institutes". There are also ten smaller institutes/centres.

The University Management Team (UMT) consists of representatives from the governing board, the deans of the faculties and the scientific directors of the research institutes. In the UMT consultation takes place concerning all subjects of strategic importance.



Professional support

Central activities slowly emerging

The University has a recently developed a small central function for 'knowledge valorization'. Fully in line with the University's strategy, this function has a strong focus on supporting spin-off companies. Increasing attention is, however, also being paid to facilitating co-location possibilities for firms. Through such activities, the University seeks both to assist firms currently at the University and to reach out to firm's considering to establish a regional presence in the vicinity of the University campus. One part of this strategy is the intended launch of *High-tech facilities Twente*, a central contact point particularly meant to serve firms with an interest in accessing the research facilities of the UT.

UT furthermore runs a Holding Company, Holding Technopolis Twente, which is to be coordinated with efforts in the 3TU Innovation lab. Earlier, the University also had a liason group, but it was shut down as this approach to knowledge valorisation was considered too centralised. Large companies, it was believed, did not need a central unit to organize cooperation with the University, and for SMEs, the governmental organisation *Senter* was much more effective in establishing connections between firms and academic researchers than the UT itself.

The UT *Science Shop* is an attempt to organize small-scale knowledge diffusion. Students, or recently graduated students, perform research on behalf of individuals, groups, non-profit organisations and small companies, who otherwise do not have enough financial means to pay for scientific research. The UT states that the Science Shop yearly has about 80 customers.

Decentralised organisation of knowledge valorization support

The UT generally has a decentralised approach to third stream activities. Each research institute of the UT has a "commercial director", or the equivalent thereof, responsible for industry contracts, alliances etc for that area of research.[14] The *Institute for Nanotechnology* (MESA+) - the largest research institute of the University of Twente - has a special program for cooperation with Small and Medium-sized Enterprises.

On-campus knowledge park

Situated on a single campus – an almost unique arrangement for a Dutch University – UT and the on-campus business and science park constitute an important entity in local and national innovation systems. 4000 people employed by some 200 companies work in the facilities of the knowledge park. In August 2004 the Province of Overijssel, UT and the city of Enschede signed an agreement describing how the three parties will collaborate on the development of Knowledge Park Twente. The agreement aims at producing ten thousand jobs by 2010 - twice as many jobs as those believed to have been created through the UT over the past fifteen years.

Manifesting an out-reach culture

UT is a representative for a kind of young European Universities for which expectations on contributions to regional development have been built into the University from the very beginning. In Twente, these ambitions are still clearly embedded in the University culture. The University slogan,'De undernemende universiteit'[15], clearly points out how the UT sees itself as different from other Dutch Universities, especially in relation to the other two technical Universities in the Netherlands (TU Delft, and TU Eindhoven). The use of this slogan in it's Dutch logotype[16] is a way to constantly remind Faculty and stakeholders what the UT has set out to be.

A recent experience in Twente points to the problems associated with the active promotion of an out-reach culture. Plans to introduce compulsory workshops to promote a business-oriented mindset were met by fierce resistance in the Faculty and, as a consequence, in the regional cooperation partners of the University. After resolving this conflict, the University now proceeds

[14] The research institutes referred to here are large organisations with at least one hundred researchers and associated staff.
[15] 'undernemende' translates to 'entrepreneurial'.
[16] In the international version of the logotype, the text is exchanged for a geographical specification: 'Enschede – the Netherlands'.

by trying to build initiatives in the knowledge valorization area in cooperation with a group of leading academics who are recognized for their interest and relevant experience.

Alliances with other Universities

The three Dutch technical universities cooperate intensively, for example through the shared responsibility for a small number of Dutch "leading research institutes" in the field of technology created in the early nineties to support research in areas of particular importance to Dutch industry. In March 2004, plans to create a single Federatieve Technische Universiteit Nederland by 2010 were made official. A task force lead by former Dutch minister of Education, Culture and Science Loek Hermans where each of the three technical universities were represented by their chairman have discussed the future of technical education and research in the Netherlands, and come to the conclusion that strong coordination was in the common interest. Such coordination is at first to take the shape of a united "Virtual Technical University" (3TU), where joint plans for education, research and knowledge valorisation activities are made and a shared organisation for each of these three areas of activity is created.

UT has strongly championed the realization of the 3TU alliance. For the University, the coordination on the national level is well in line with its strategy of research focus. Coordination may remove some of the practical problems associated with concentration efforts (laying off staff, etc), and may at the same time reduce the risk of a research strategy leaning on but a few spearhead institutes in selected areas.

The 3TU alliance has ambitions to create coordination within all of the Universities' three missions: education, research and knowledge valorization. Activities in the latter are coordinated through the organisation called *3TU Innovation lab*. The Universities hope that they through the Innovation lab will be able to increase their attractiveness for foreign firms, as the alliance shall allow them to present common proposals and common terms of agreement as regards overheads and IP regulations to companies. It should be noted that such plans are in full agreement with the fact that a strong driving force behind the initiation of the alliance plans were demands from Dutch multinationals seeking a "one-stop-shop" for University contacts.

Alliance a tool to handle strategic risk

A University is traditionally thought of as an organisational entity where scholars of different disciplines and traditions work together and, at least occasionally, exchange views and ideas that enrich future research. For students, the University is often seen as a buffet of knowledge, where courses and disciplines of different nature can be found and combined in a way that suits interests and demands from employers. How, then, can UT imagine a future as a University with research (and therefore research-based education) only in selected areas? And even if concentration indeed does lead to research strength, what happens if the chosen research portfolio looses its' attractiveness in today's fast changing world of science and technology? For UT, the concentration strategy clearly conveys risks, which need to be managed. How can a University do that?

Part of the answer from Twente, as given by the University management, is the proposed changes to the Dutch system of technical universities. Since 2004, an alliance between the three universities is being constructed. The goal is "a single federative university" by 2010. As a part of

this alliance, research, education and knowledge valorization activities are being reviewed and coordinated. For UT, the alliance with the two larger and stronger universities is seen as a chance to manage concentration risks. As part of a greater, more integrated whole, the University sees itself more free to specialise and to develop a clear profile of its' own.

Loosely tied alliance

UT also takes part in a cooperation organisation created by European Consortium of Innovative Universities (ECIU). These universities are said to be "dedicated to the development of an innovative culture in its institutions, and to play a catalytic role for innovation in industry and for society at large". The ECIU Executive Board is the decision-making body of the association and meets twice a year. Chalmers was a founding partner of ECIU in 1997, but has since withdrawn from the cooperation. ECIU still consists of nine members, since Linköping University has joined the consortium. The ambitious goal of the of the cooperating universities stretches over education, recruitment of students, research applications to the EU and joint SME/University schemes for regional development. One example of cooperation is the master-level program "Innovative Entrepreneurship & Business development" offered in Twente. It is tied to ECIU, so that students of that program are encouraged to spend part of their time in education at another ECIU University.

Organisation of research

The Dutch organization of technical research is worth recognizing. All three universities have a matrix-organization, where responsibility for education and personnel is concentrated to faculties and research is organized in virtual organization called "research institutes". This organization is motivated by a strategic need to create scientific focus. However, the institute form also seemed to be beneficial for working with industry in several ways. First, the cross-disciplinary approach makes it possible to focus on application areas rather than academically delimited disciplines. Secondly, each institute is headed by executive officers, of whom several have industry experience. Thus, industry can find one-point contact partners who "speak the language of industry" and have a sufficient mandate to make commitments for the academic side. Thirdly, the institute organizations can be given enough inertia to allow for risk taking and strategic initiatives. An example is the ability of the Institute for Biomedical Technology to acquire a research division from a company. The deal provided the institute with 15 researchers with industrial experience as well as a long term relation with the company.

Co-location with industry

Facility sharing: a win-win situation if managed properly

The large nano technology research institute MESA+ is one of the most successful parts of the University of Twente. A central strength in the experiment-intensive world of nanotechnology is the lab facilities of the institute; the clean room and the Central Materials Analysis Laboratory. Lab milieus are as important for commercial development as for research, and since most of the equipment is expensive and rare, labs are also a strong connector between these worlds. Half of the 25 small companies currently situated in the incubator environment on the institute grounds have their roots outside UT. The facilities make out a large part of the attractiveness of the Twente location for these firms. In fact, the University is currently planning to expand the facilities to meet strong industry demand on co-location.

At MESA+, agreements on facility sharing are common and even though conflicts occur, all parts have realised the common benefits. For the academic researchers, the incomes from firm rents are recognised as vital to keeping the expensive labs running. For firms, access to specialised equipment is crucial.

APPENDIX VI: TECHNISCHE UNIVERSITEIT DELFT

Delft University of Technology, the Netherlands

Background and description

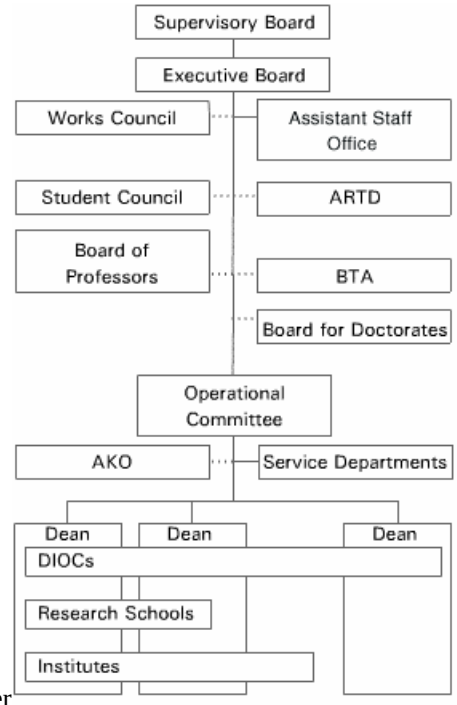
TU Delft is the largest, oldest and most prestigious of the three Dutch technical universities.[17] The second largest University, in student numbers, situated in Eindhoven seems to be steadily gaining on TU Delft in size, but the older University is still some 50% bigger than its closest national competitor. With a student body of more than 13,000 and almost 5,000 employees, TU Delft is also one of the largest universities in the Netherlands. Each year, the University's cumulative research results in an average of 185 PhD dissertations and over 4,000 publications in scientific journals.

The Polytechnic in Delft was set up in 1842 to meet the increasing demand for technically trained people, as it was felt that the Netherlands lagged behind its neighbouring countries from an industrial point of view. Today, the TU Delft is the largest employer in Delft and ten percent of the town's 100,000 inhabitants are students. The presence of the University has over the years attracted a number of technology-oriented companies to set up businesses in Delft.

The University is strongly concentrated to technical disciplines, where aerospace and landscape engineering are particular hallmarks of the University. Technology associated with the Dutch struggle against the Atlantic for land is the particular twist of the latter area. TU Delft also has a special emphasis on architecture; in fact the discipline is the single largest area of study of the University.

Organization

TU Delft has a traditional University organisation, which emphasizes the decentralised nature of academe. Undergraduate education is divided into eight faculties, each lead by a dean. Education of doctoral students are organised in eight research schools and research in twenty research institutes – across faculty borders. The research institutes are organised after problem areas, which makes them suitable for research motivated by technical problems and able to match the interests of industry within a single organisational entity. The faculties are closer to academic discipline organisation.



Strong connections to Dutch multinationals

TU Delft has strong established links to Dutch industry. Some Delft research institutes cooperate

[17] Technical higher education is in the Netherlands essentially per [illegible] s of professional education (Hoger Beroepsonderwijs) and by three academic, research-oriented universities situated in Eindhoven, Delft and Twente. A small part (1-2% of all students) of Dutch higher technical education is performed at Rijksuniversitet Groeningen.

intensively with Dutch multionationals Philips and Shell, particulary in areas such as semiconductor technology, nanoscience and chemistry.

The Philips Delft Design Center is an interesting example of how this cooperation sometimes takes very close forms. In the center, three permanent Philips employees dedicated to design work alongside three professors, two PhD students and two MSc students from the University.

One of seven Dutch Leading Technological Institutes, Netherlands Institute for Metals Research (NIMR), is based in Delft. The institute offers consulting services. NIMR is a public-private partnership between partners from the Dutch metals industry, the three technical universities and the Ministry of Economic Affairs.

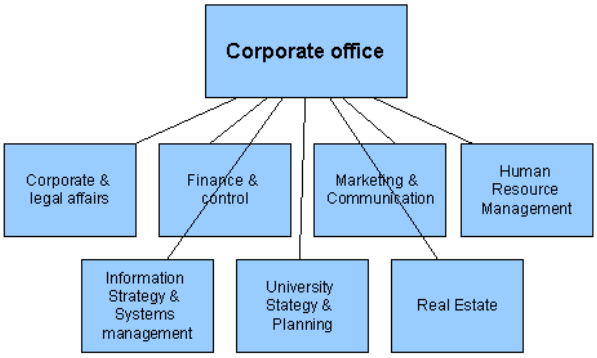
Strong lab environments attracts partners, researchers

The facilities of TU Delft are a source of University pride. Supported by substantial, direct funding from the Dutch state, TU Delft has been able to build a number of strong laboratory environments. These assets should be seen as investments that heighten the attractiveness of the University as cooperation partner, securing the University's role as a hub for demanding R&D in certain areas. These investments also produce concrete income streams, as firms place research contracts with the University or co-finance investments which are of mutual interest. The University accounts for some 1200 contracts with industry.[18]

Professional support

Non-managed third mission

Many of the third mission-related initiatives - technology parks, incubators, support of academic entrepreneurship - found at technical universities are missing, smaller/newer or less emphasized at TU Delft than at many other, more entrepreneurially oriented universities.



Situated in the densely populated western Holland between The Hague and Rotterdam, the actual hinterland for TU Delft is a huge urban area, in which the University is but one actor among many. The "regional role" of the University and associated pressure to act as economic hub has therefore so far not been as accentuated as in many other European universities. The strong funding from the state has also allowed TU Delft to stay relatively clear from some of the pressure that has caused other universities to undergo reorganisations and reorientations.[19]

Most central administration and monitoring of the University is handled by the University Corporate Office. Through intermediation of the Corporate Office, contract research is offered

[18] These contracts may not all be very substantial, but some 35 new contracts per year are worth more than € 250.000.

[19] In 2004, over 80% of the total funding for TUDelft was received directly from the state. Only a very small portion of those funds were distributed under competition.

within the areas ICT & Multimedia, Glass Treatment, Airport Development, Electronics & Mechanics, Ergnomics & Usability and Organisation & Process. Each of these areas is rather narrowly specified at the University webpage.

TU Delft, as so many other technical universities, offers special services, including recruitment, to Alumni and last year students, including a web-community and an alumni magazine with two issues per year. Non-profit recruitment services are offered by a separate University organisation called SUPAIR.

Deans adopt companies

TU Delft has not adopted the idea of corporate liason programmes as a way to establish stronger connections to industry. Instead, each of the faculty deans is called upon to 'adopt' two (large) companies. This model is clearly a representation of decentralised thinking and of the non-managed approach described above. An important part of the responsibility as "godfather" is to organize events based around the University's interaction with a particular firm. Through these events, connections to the firm in multiple faculties and research group as well as connections to TU Delft in multiple divisions and labs of the firm shall be made visible, and new links and projects encouraged. For the University, this is clearly a way to manifest commitment to cooperation with 'natural' cooperation partners such as Shell, Unilever, Phillips and Airbus.

Manifesting an out-reach culture

Reflecting upon ethics

In 2004, TU Delft launched an initiative aimed at creating a broad discussion of ethical aspects of research. The project made serious attempts to engage Faculty in discussions about the effects that the University's collaboration with society – both indirect and through direct cooperation projects – were likely to have.

Technology day

The yearly 'Technology day' is seen as an important way to promote all kinds of relations between TU Delft staff, alumni and industry partners. By presenting research from different faculties, the University management states that productive relations between researchers working on related problems in different institutes or faculties are facilitated.

Alliances with other Universities

In October 1999, four technical universities of considerable reputation entered a strategic alliance under the name IDEA League. These were TU Delft, Imperial College London, ETH Zürich (Eidgenössische Technische Hochschule Zürich), and RWTH Aachen (Rheinisch-Westfälische Technische Hochschule Aachen).

The alliance is meant as a tool to develop strong educational programmes on the master-level, following the development of the Bologna-process, and aims at strengthening the competitiveness of the four universities in terms of international student recruitment and international funding. Currently, the alliance runs two mobility programmes: *Vertical mobility* and *Horizontal mobility*.

Both of these programmes are meant for students who whish to study at more than one of the IDEA League universities. The first of these two programmes is for students who wish to switch universities between the bachelor and the master level, and the second for students who wish to spend part of their time as master level students as guest of another IDEA League University. The programmes ensure that students are treated equally in all cases.

During the current, fifth year of work in alliance, the partnering universities have started working together more closely on partnerships with industry. IDEA League is also setting up common master courses, drawing on the combined strength of the four partners. The alliance has lead to increased ambitions such as collaboration on international activities and coordination and common discussions of issues such as scholarships, media relations, alumni activities and education development.

Organisation of research

All research organized in institutes

A particular trait of TU Delft (and, to an even larger extent, Universiteit Twente) is that the research activities of the University are organised in institutes, or research centres. The University has 13 such organisations. A central idea behind this organisation is to promote multidisciplinary research work and influences. The organisation can thus be seen as meant to bring about increased relevance of TU Delft research for industry and for society as a whole.

Smaller, more focused research institutes

The University also hosts a number of smaller research institute organisations. One successful example is the aerospace software and technology institute *ASTI*. Behind the founding of ASTI lies the belief that cooperation with firms requires an organisational form able to act as a reliable partner, which can and is willing to make long term commitments. The Dutch government supplies the institute with € 2 Million for six years of operation, which currently constitutes approximately 30% of the institute's budget. Ambitions are that industry funding shall keep the initiative going after government funding is scheduled to run out in 2010.

Offering the right conditions for SMEs

With different sets of ambitions, traditions and cultures, University-firm relations are never uncomplicated. Establishing conditions for cooperation between universities and small and medium sized enterprises (SMEs) is recognized as a particularly tricky problem for public and academic policy makers. A small firm typically finds it impossible to invest in large research projects that last for several years – both due to financial and operational constraints. The successful ASTI institute is an interesting example of an attempt to organise academic activities in such a way that cooperation with SMEs is made possible. The institute offers royalty based contracts, in which the firm agrees to share future profits resulting from a research venture with the institute. The first royalty payment to ASTI is expected at the end of 2006, after two years of operations.

Co-location with industry

The TU Delft campus, situated just south of the Delft town center, hosts most of the University and its unique facilities, as well as the head quarters and research facilities of the large Dutch public research institute TNO. However, the area is virtually free of commercial firms. Ambitions to renew the campus area by introducing firm presence have been discussed for at least 20 years by the city of Delft and the University. A 70 hectare area just south of the campus has been assigned to the construction of office facilities and research labs, where firms who cooperate with TU Delft researchers will be encouraged to establish themselves.

APPENDIX VII: THE UNIVERSITY OF SURREY

University of Surrey, United Kingdom

Background and description

Surrey has frequently been described as the "rising star" of British academia. Founded in 1966, today over a third of Surrey's Faculty work in 5*-ranked departments, departments defined to work at a level of "international excellence".[20] With historical roots in a 19th century polytechnic school, Surrey is still expanding its disciplinary scope. Today, the University has eight Schools, of which the Medical School is the most recent. The University is particularly well known for its research in Electronics, Engineering, ICT and, increasingly, Medicine. In the British context, the University is a comparatively small player. As a consequence, a strategy to concentrate resources within each discipline has been developed. The British system for research funding (RAE-based funding) has strongly affected this strategy.

The University has employed a series of charismatic and strategic leaders, each of whom has had a clear entrepreneurial, as well as academic, profile. It is notable that the Rektor of Surrey also styles himself Chief Executive Officer, this business title relating to the actual powers he has and the University's culture, which can be described as strongly entrepreneurial.

Surrey collaborates with companies on campus and, notably, engages multinationals such as Nokia and Samsung in substantial research projects. Companies, and public agencies, appear to have input into curriculum development at Surrey as well, not surprising in a University that champions the "employability" of its graduates. This has produced strongly positive results with Surrey's students being the quickest to find full time employment in the UK.

Organisation

Surrey has a notably strong and *well resourced* management structure. The Vice Chancellor has a substantial Senior Staff of non-academics including a Director of Development and Director of Corporate Affairs, alongside more traditional posts such as Director of Finance and Director of External Relations. All Senior Staff report to the Rektor, as does the Director of Research and, though him or her, the Heads of Schools, illustrating a compact and highly centralised management structure with clear leadership.

The University is at pains to stress that, despite its strong management structure, its academics are free to research as they wish. Surrey argues that its strong management is there to support and enable its academic staff, not to guide their work.

Professional support

Surrey has a centralised approach to third mission activities. The Rektor is clearly active in initiatives and dedicated section head, a Director of Corporate Services (non academic), reports to him. Corporate Services has under it nine sets of activities, each of these run by a non-academic professional. To ensure that good links are kept with Faculty, many of these offices

[20] See http://www.hero.ac.uk/rae

have an advisory board from the faculty. It is not apparent that particular Schools have separate abilities; the centre provides.

A single office for industry interactions

The University has links with over 500 companies and a further 85 companies are based at the university-owned science park. Income from industry [21] in the year 2002-03 was £7M (94M Kr). Under the umbrella organisation of Corporate Services, the University manages an office known as UniSDirect. This office provides a gateway for industry to the University, as well as assisting the University to develop its third mission strategy with regard to industry.

Amongst services managed by UniSDirect are:

- Industry Research Collaboration facilitation
- Consultancy
- Support for Technology Transfer and New Businesses Start-ups
- SME support
- Continuing Executive and Technical Education

It is notable that this office also actively promotes government initiatives to industry such as Knowledge Transfer Partnerships (collaborations between universities and industry on strategic, high-level research projects. The projects can be variable in length, lasting between 12-36 months, and aim to provide benefits for all partners involved) and the R&D Tax Credit. UniSDirect has dedicated personnel assisting faculty and industry access these types of award.

Introducing key account methods into academe

The supportive approach of the University is continuously evolving. From previous emphasis on professionalism in contract support and handling of IPR, UnisDirect has started to experiment with a greater focus on professional management of relations and expectations. Drawing on industry experience, a "key account" approach to building and maintaining relations to important business partners is being discussed. The basic concept is to appoint an academic as responsible for the maintenance of the contact, while administrative support is provided by the employees of UniSDirect.

Manifesting an out-reach culture

Engaging with Society

Surrey's roots as a technical college charged with developing "*the industrial skill, general knowledge, health and well-being of young men and women belonging to the poorer classes"* greatly influences the culture of the University today which can be described as not only positive towards industry and society but rightly proud of the strong links it has made. The University lists amongst it strengths "Commercial Awareness", an "Effective and Responsive Management Structure" and an "Academic range well matched to the perceived economic needs of the UK and Europe" illustrating the influence that business-like thinking has had on both its structure and activities.

[21] Exact industry income will have to be further assessed, industry and "other" incomes are accounted for together in Surrey's Annual Report making the exact total unclear

Alliances with other Universities

The University is engaged in a national alliance including four Universities in southern English cities: Bath, Bristol, Southampton and Guildford (Surrey). This alliance, named the SETsquared partnership, started out as collaboration around spin-off support, but was widened to encompass the full range of business related activities as the partnership won a £13 million award from to British government in June 2004. Ambitions were expressed that coordinated out-reach efforts and the combined research strength of the Universities should bring about increased attractiveness for industry partners. The results in this area are, however, ambiguous. It remains to be seen to what extent true synergies can be found to emerge from the collaboration. On the whole, the alliance has, been seen as a something success story. In late 2005, the partnership was won further government funding (£1.5 million) for the development of collaboration with the University of California San Diego. The only other two Universities receiving this competitive funding were the University of Cambridge and the University of Manchester – an indication that the critical mass built through the SETsquared alliance may allow the Universities to offer competitive conditions. One of many challenges ahead for the involved Universities will be to realise similar effects working with large corporate partners.

Organisation of research

While research is organised in a traditional manner, within the organisational bodies of eight schools, recent developments meant to modernize the research organisation should be noted. The School of Engineering has recently completed a major re-structuring of its research activities in three school-wide, multi-disciplinary 'research centres'. This organisation is meant to create a forward-looking environment for multi-disciplinary research and to foster broader external relations. Ambitions to reach out more cohesively to "local SME's and larger UK based multi-national companies" are also expressed in relation to the reorganisation.

Also worth noting is an exceptionally clear example of a research centre; the interdisciplinary institute organisation called Advanced Technology Institute (ATI). The ATI was conceived in October 2002 to bring together electronic engineers, physicists, chemists and biologists within one integrated working environment, supported by laboratory and cleanroom facilities.

Co-location with industry

Spin-off activities and SME interactions are highly apparent on campus; Surrey owns Europe's most successful Satellite company, Surrey Satellite Technology. It works with sister universities in the south of England (Bristol, Southampton and Bath) to provide services for local SMEs, in particular in the form of continuing professional education.

APPENDIX VIII: THE UNIVERSITY OF CAMBRIDGE

University of Cambridge, United Kingdom

Background and description

Often described as Europe's leading research University, the University of Cambridge combines a commitment to fundamental research with an ever-keener interest in exploiting its knowledge. The University's strong academic heritage fosters an environment in which researchers are challenged to produce world-leading insights. Powerful in supporting this is the academic excellence Cambridge has achieved over all its disciplines; known increasingly for its Science and Technology, it should not be forgotten that Cambridge is a "full discipline" university, equally strong in the Arts, Social Sciences and Humanities. Trans-disciplinary research has long been a feature of Cambridge's working and is actively supported by its collegiate system. Today, Cambridge sees its role as that of a global University, with more than half of all graduate students and Faculty coming from abroad.

Engaging with Society

Against a background of funding cuts in recent decades, and changes in the structure of British industry, Cambridge has not always found it easy to engage with Britain's economy. The University has however, since its foundation in 1208, produced a long line of political thinkers, scientists and business leaders who have played critical roles in developing the fabric of British, and international, society.

Since the 1970's *some* members of the University have actively sought to play a more direct role in the UK's economy, in particular spinning-off research results in to new companies. Concerted activities in this area, combined with Cambridge's research reputation, mean the University is now surrounded by one of the strongest science park clusters in the world. Whilst how active the university as a corporate entity was in the establishment of this cluster is sometimes bought in to question, it now works to support the cluster through initiatives such as the Cambridge Network that link it with local companies. Through the Cambridge Centre for Entrepreneurial Learning and Cambridge Enterprise, the University also teaches innovation skills to both its students and researchers, and directly supports researchers in spinning-off companies.

More recently Cambridge also sought to formalise its relationships with Industry, and other key research partners. Again, members of the University have cooperated with industry for many years; Rolls Royce, for example, has based much of its jet engine research at the University since the 1950s. The University has not sought to hinder, or support, these alliances. Over the past decade however, it has become apparent to the University that it should value these links and provide professional support for forming relationships to its researchers. Cambridge's Wolfson Industrial Liaison Office, an embryonic office that formerly dealt with all innovation and industry issues, became the University's centralised Research Services Division (RSD) in 2000. A distinct Corporate Liaison Office was developed in 2001, this too merging with RSD in 2005. Today, 17% of the University's research income comes from companies. It is interesting to note that the majority of these companies are international with headquarters outside of the UK.

Organisation of research and education activities

With regard to University management, in line with University culture, Cambridge has a highly decentralised structure and, through the Senate, the academic staff of the University have the right to vote on most significant managerial decisions. Researchers were, for example, able to throw out proposals for IP reform put forward by the University. The University has no research strategy, other than to be the best in the world in the fields it engages in. The Vice Chancellor can *lead* the university but she has few powers, or resources, to manage it.

This structure has been seen as problematic as decentralisation makes it difficult for "the University" as a corporate entity to have a voice and for strategic decision e.g. investments in further research centres, to be taken. However, Cambridge academics would argue that their autonomy is at the heart of the University's success – both in research and commercial terms. Faculty can define their own working environment and *have to* develop entrepreneurial skills to succeed. In Cambridge the "Academic Entrepreneur", able to form trans-disciplinary alliances and sell his or her ideas to the funding councils or industry, flourishes. These types of skills, Cambridge argues, make its researchers successful in the commercial world too. It has also been felt however, that the University has not moved as quickly as others i.e. US Universities, to capitalise on its abilities. The development of a Clinical School to complement the Life Science research already undertaken at Cambridge has taken considerable time.

UK Innovation Policy

Though highly dependant on public funding, UK Universities have a tradition of autonomy and many have significant independent income from real estate and other investments. Relative financial and political independence means many UK universities have developed a capacity to act independently, both in terms of research and innovation activities. Several Universities took advantage of their independence to develop entrepreneurial activities well before the government actively promoted it e.g. the Universities of Surrey, Imperial, Manchester, Warwick.

In 1994 the UK government decided to fund a series of initiatives and programmes to support an entrepreneurial activities *within* Universities. The Higher Education Funding Council for England (HEFCE) increased its funding for these so-called "third stream" activities to over 100 million pounds in 2004. Funds managed by HEFCE, such as the Higher Education Innovation Fund (HEIF) describe their aims as "embedding" an innovation culture in research institutes, broadening their capacity and reach, improving university responsiveness to business and community needs, and catalysing the social and economic benefits of university research[22].

In complement to HEIF, the UK government has a number of national platforms for promoting various types of collaboration between business and universities. *LINK* research programmes match corporate funding for research projects with government monies[23]. *Faraday Partnerships* bring together a number of research institutions and companies to develop a certain technology or technology area[24]. *CASE* awards fund industry-partnered PhD projects[25]. It is interesting to note that, despite these initiatives, UK companies are amongst the worst investors in R&D. As a

[22] See HEFCE : Business & community
[23] See LINK
[24] See Faraday Partnerships Initiative in the UK
[25] See Industrial CASE

share of gross domestic product (GDP), overall corporate spending on R&D in the UK has declined steadily over the last 20 years, in marked contrast to the trend in most other developed countries[26].

Cambridge benefits from HEIF funding (over one million pounds a year) and also heads several Faraday Partnerships as well as taking advantage of *LINK* partnerships where possible.

Professional support

Cambridge Enterprise was established in 2003. It was created with the aim of bringing together spin-off and technology transfer activities. Cambridge Enterprise was established *within* the Reseach Services Division (RSD) as it was thought that closer association would bring about commercial synergies, as well as economies of scale.

The *Corporate Liaison Office* was founded in January 2000 in response to the university's need to provide a clear mechanism for interaction with external organisations. Whilst established within the University, the CLO was not a central initiative. The office focuses primarily on building research – and other – collaborations with industry. It also plays a role in coordinating community activities and Cambridge and has a Research Strategy Unit that assists academics develop research themes.

As the government, through the Higher Education Funding Council for England (HEFCE), introduced new forms of funding directed at support for third stream activities, the organization was adjusted. Cambridge Enterprise was "spun-off" from the University, becoming a for-profit organisation, and the CLO was merged with RSD so that it could provide the relationship management skills that the group was lacking and so that this increasingly important area could come under central management.

As a result, the University now has a central unit whose job it is to build relations to important funders of University research. A similar set of networking tools are offered to companies, charities and research councils. To reach industry, the office has established three focus areas: *Engineering, Electronics and ICT* and *Life Science and Chemicals*, respectively. It is believed that by combining contact facilitation to private and public sector funders, the unit may actually improve its attractiveness for firms. Working with public funders, the group can now help industry raise the matching funds sometimes needed to strike a new deal of research cooperation.

Cambridge Enterprise operates "down stream" focusing on spin-off, consultancy and licensing activities. Other, wholly commercial companies, will also be able to approach researchers to support the commercialisation of their work

Whilst centralisation is evident, it should be noted that several innovation functions still exist independently within the university. Several Departments have their own industry liaison officers, the Cambridge Programme for Industry runs educational courses for business leaders, as does the Judge Business School and the Institute for Manufacturing. University representatives also fosters links with local high tech industries through the Cambridge Network.

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[26] See the *Lambert Review* 2003 Lambert Review

Manifesting an out-reach culture

Management of Innovation Activates

Within the culture of Cambridge, centralised activities are always developed with great caution. As noted above, this has been the case with innovation support activities. Initiatives tend to develop around the periphery of the university, with support from interested parties, only being centralised when proved successful, or demand becomes such that they can no longer be left without support. There is a direct parallel here with the independence given to researchers and it can be posited that this approach has lead to Cambridge having an "Entrepreneurial Administration", as well as Faculty. It can also be argued that a lack of central commitment has meant that weaker than necessary support function have developed - and that much time has been wasted in chasing support and funding from within the University, as well as outside.

Seminar Series Supporting a Global Reputation

A particularly successful initiative undertaken by the CLO (now Partnership Group) at Cambridge is the "Horizon" seminar series. In the words of the series brochure, the seminars "bring together leading academics and industrialists to challenge disciplinary frontiers and explore novel application". The seminar series was launched in 2002. In 2005 seminar topics include:

- Technology: Interaction and Design
- Personalized Medicine
- Cities of the Future
- R&D – Beyond Einstein

These "early stage" seminars serve two purposes at the University. They of course allow the university to communicate the excellence of its research in certain areas to industry leaders, but perhaps more significantly, they provide an opportunity for a group of researchers to get together and explore ways to further research in this area. The seminars have become a surprisingly powerful bottom-up tool for seeding and developing trans-disciplinary research collaborations, as well as a marketing tool. It of course helps to have potential industry partners involved in early stage discussions.

Over 400 different companies have attended the seminars, with an average of approximately 100 attending each event. Whilst the University targets large multi nationals in key R&D sectors as (paying) guests, it also makes sure relevant SMEs from the Cambridge Cluster are invited. The seminars create, therefore, a unique networking environment bringing together leading researchers, industrialist and entrepreneurs.

Alliances with other Universities

Bilateral alliance with separate funding

The Chancellor of the Exchequer (UK Finance Minister) initiated the much-discussed Cambridge-MIT Institute (CMI) Alliance in July 2000 with an award of £65 million of government funding over 5 years. It is a collaborative alliance between the University of Cambridge and Massachusetts Institute of Technology established with the goal to develop joint

education and research initiatives that will improve entrepreneurship, productivity and competitiveness in the UK.

The alliance is set up as a separate entity with dedicated support and management staff, while researchers from both are engaged for the specific projects of the institute. The funded projects shall be performed in strategically important areas, preferably in cooperation with (British) industry partners. A special ambition is to reach out to sectors not traditionally working closely with Universities. CMI also runs its own partnership scheme and industry events.

The Alliance has had teething troubles but has dealt with these robustly. Research project funding at the start of the project was awarded to many, small projects. Whilst this raised levels of engagement, it was costly and inefficient over the substantial physical distances involved. From 2003, CMI supported fewer, lager projects, projects deemed strategic to the economies of both nations.

The renowned research University on the national arena

Often more comfortable with its global role, Cambridge has struggled to find significant advantages from national alliances. Nevertheless, the University is a member of the Russel Group, a network of large, research-led British universities and i10, the organisation through which Cambridge collaborates with Universities in the East of England region. The i10 alliance is funded by the Higher Education Funding Council of England. Through this funding, the alliance administration is able to support collaboration between local firms and the ten Universities and colleges residing in the East of England region. The i10 experience has helped Cambridge develop an interface with regional industries and the university has seen advantages from not responding alone to the needs of these diverse groups.

The decentralised structure of the University has made it difficult for it to champion alliances. It has been argued that Cambridge, in its position as a highly successful and renowned University, has little immediate need of this type of activity. However, there are signs that this attitude is weakening. The University is already a member of the international learning networks Coimbra Group and LERU (League of European Research Universities). Furthermore, the University recently announced its decision to join neighbouring Oxford to create a new partnership with eight other Universities in the US, Europe, East Asia and Australia.[27] The signed agreement expresses hopes that this latter collaboration shall enable funding of joint research projects by industry as well as by public organisations.

Organisation of research

In parallel to a typical School and Research Institute structure, Cambridge also has some 35 Colleges. As well as providing board and tuition to students, each College supports an academic community of Fellows. These Fellows are drawn from across all disciples at the university and are, in return for tutorial duties, given board and lodgings at the College. Colleges are seen as vital in promoting trans-disciplinary communication.

[27]The International Alliance of Research Universities (IARU) consists of Australian National University, ETH Zurich, National University of Singapore, Peking University, University of California, Berkeley, University of Cambridge, University of Copenhagen, University of Oxford, The University of Tokyo and Yale University.

Cambridge has six Schools, where most academic staff are also employed and where responsibility for teaching is laid. Trans-disciplinary research is increasingly carried out through problem-orientated Research Institutes such as the new Centre for Advanced Photonics and Electronics (CAPE); these Institutes tend to fall under the (indirect) management of Schools. Many informal trans-disciplinary groups e.g. the Cambridge Interdisciplinary Research Centre on Ageing (CIRCA) can also be found.

Co-location with industry

To persuade companies to establish a presence in the vicinity of the University is one of the articulated goals of Cambridge's partnership group. The University has a comprehensive set of guidelines, delineating how relations to "embedded" firms are to be managed.

A positive result of Cambridge's decentralised structure is the clear responsibility departments have taken for developing their own innovation and outreach activities. A strong example of this is the Cavendish, Cambridge's Department of Physics. The Cavendish laboratory has managed to combine a commitment to academic excellence with substantial achievements in innovation and outreach and is confident about working with industry on R&D projects. Both Hitachi and Toshiba have own-staffed labs in the Cavendish and close relationships with researchers. Whilst the Cavendish is careful to "ring fence" these companies so there is no loss of IP, it enjoys their presence valuing the market perspective, equipment and funding the companies bring. The companies have learnt from the University in other, non-research ways too, for example, Toshiba, have just spun out a company, Teraview, from research it conducted whilst at the Cavendish, preferring this "Cambridge Innovation" route to taking the technology back to Toshiba headquarters.

APPENDIX IX: EPF LAUSANNE

Swiss Federal Institute of Technology, Lausanne, Switzerland

Background and description

Technical education has been offered in Lausanne since 1853, for many years as part of the local university, run by the canton. In 1969, the technical faculty was given status of independent federal university under the name École Polytechnique Fédérale du Lausanne.

Transformation and growth

Recently, EPFL has undergone transformation processes dealing with both geographical and organizational issues. On January 1st 2002, the 12 departments were replaced by four schools and simultaneously, all activities were moved to the main campus. Since the beginning of 2004, the whole of the EPFL is situated on one single site in a Lausanne suburb. The number of schools has increased to seven. Volume indicators of the EPFL also show signs of rapid change. Student numbers are up 60 % since 1990 and the number of doctoral students is up 160 % for the same period.

Reputation on the rise

In the last few years, EPFL has acquired a reputation as something of a rising star of the Swiss university system. This position is partly related to the trend towards generally higher entrepreneurial activity in the French-speaking western part of Switzerland than in the German-speaking east, with the EPFL as an important hub for start-ups on a technological basis.[28] The seed-capital-activities and encouragement of entrepreneurship are by some experts considered to be best Swiss university practise. EPFL research quality is also increasingly distinguishing itself, e.g. through continuous climbs in popular University rankings.

In terms of education profile, EPFL is strongly oriented towards the engineering sciences and towards computer sciences in particular. However, in a Swiss ranking of higher education EPFL ranks lower than its sister University in Zürich (ETHZ) for most Architecture, Engineering and Computer Science educations, but higher in the areas Chemistry, Physics and Mathematics.

Organization

EPFL has four vice presidents, of whom one is responsible for academic affairs, one for knowledge valorization, one for international affairs and one for planning and logistics. All non-academic organisations of the university are organisationally tied to the respective vice president secretariats.

Professional support

Clearly structured support system

In 2005, EPFL created a position as vice rector for innovation and knowledge valorization. Formalised relations to industry is to an unusual high degree channelled through the organisation

[28] See www.swissup.com.

around the vice rector, who applies a very systematic approach for analyzing, coordinating and communicating university efforts within the field. It seems that a transparent interface can be a simple but effective measure to improve a University's ability to work with industry.

Two support units

There are two central university units belonging to the organisation of the vice rector for knowledge valorization. The industrial relations office (SRI) with seven employees has a supporting role for legal issues – both towards departments and start-up companies – and responsibility for IPR strategies. The unit also negotiate sponsored research and technology transfer agreements. In 2002, the office registered more than 200 research agreements and 27 license agreements. 40 patents were filed and 10 start-up companies created. The trend has since then been an increase on all fronts.

The unit CAST, consisting of eight people, runs the Industrial Liaison Programme of the EPFL, which has been going on since 1986. The APLE (Association pour la promotion des liaisons EPFL) was created at the same time in order to gather all the companies affiliated to the program. The Cast-EPFL's mission is to inform the APLE's members about EPFL's opportunities and assist them, whenever necessary, in order to maximize their interaction with EPFL laboratories. A discipline-specific liaison programme, presently involving eight companies, is run by the School of Computer and Communications Sciences. Recently, the unit and its Liaison programme was expanded to the be run at several Universities in western and southern Switzerland, lead by CAST team.

At the same time as these changes are being implemented, the office of the vice rector is changing some of its focus from negotiation of intellectual property rights to relationship building. New posts as 'science translator officers' are being introduced as a concrete result of this turnaround, and discussions are being held whether EPFL should establish a policy of always let collaborating firms take control of IPRs and as compensation demand higher overheads from collaboration partners.

Manifesting an out-reach culture

Attractive projects a possible catalyst

Some of the projects showcased at the EPFL did in themselves leave a strong impression on the delegation. The Alinghi project, where EPFL researchers teamed up with industrial partners to achieve a rather attractive goal (win America's cup) or the long-term EPFL effort to create a solar-driven aircraft are both examples of how large projects with a clear, exciting goal can serve as a catalyst for cooperation between academe and industry, and between different academic disciplines. Extraordinary challenges such as these projects, where scientific knowledge is applied to a clear, visionary task are, needless to say, also very useful for the communication efforts of all partners.

Internal funds made available for potentially interesting projects

In a rather unusual initiative, EPFL has set up a system for internal research funding run by the office of the vice rector for knowledge valorization. The projects funded by this programme shall address 'big issues' which are seen as important for contemporary society. The projects shall at

the same time have the potential to give glamour to the University, call for the combined efforts of several EPFL research milieus and have certain lustre for industry.

Alliances with other Universities

It is interesting to note that although EPFL is active in a number of alliances, most notable some recently set-up Swiss-Indian networks, none of this work is put in connection to ambitions to attract industry or to offer beneficiary conditions for industry partners.

Organisation of research

The institute that champions a new area

The newly created *Brain and Mind institute (BMI)* is an interesting example of how a University, despite all its management problems, can make strong commitment to a particular, commercially relevant initiative. A strategic overview showed that EPFL's lack of competence within the emerging field of life sciences could be overcome through bringing together existing research groups to form a basis for an initiative in a new and "hot" research area: the study of the brain and the human mind. To build the new institute, a leading researcher was recruited and substantial funds were made available to afford first-class laboratory equipment. The creation of the BMI was a substantial investment by the EPFL, made in an entrepreneurial spirit. Through building a strong position in an attractive area, the institute has attracted industry funding, some of which pours over on other departments. A very recent example is a prestigious deal with American software giant IBM, which gives EPFL access to the most advanced computer technology available as well as direct funding.

Co-location with industry

The EPFL Science Park on the campus currently hosts 102 companies. Companies who move into the park must be able to show strong synergies with the laboratories of EPFL, other universities or other business park companies. The companies have 12 months as of their establishment to show such synergies.

APPENDIX X: ETH ZÜRICH

Swiss Federal Institute of Technology, Zürich, Switzerland

Background and description

The history of ETH Zurich stretches back to 1855, a year that saw the opening of a technical school in Zurich called *Eidgenössische Polytechnische Schule*. This polytechnical college was intended to serve the needs of the entire Swiss federation, a much debated new way to organize educational matters in multilingual, strongly federal Switzerland. The present name of the university, *Eidgenössische Technische Hochschule* (ETH), dates back to the reorganization of 1909. Education at the ETH, which 'til then had been directed at scholastic learning, was shaped after academic traditions and the school was given the right to award doctoral titles.

Elite ambitions

ETH Zurich has an established reputation and is by many considered an elite university. This renown is in part due to the twenty Nobel Prize winners who, with a particular concentration to the 1930s, 40s and 50s, are associated with the academy. The stated ambition has for a long time been to compete with the best technical universities of the world. As many renowned universities, ETH tends to be comparatively concentrated towards research in the balance between research and educational activities, featuring comparably high numbers of Faculty and doctoral students in relation to its number of undergraduate students.

Breadth and internationality ETH hallmarks

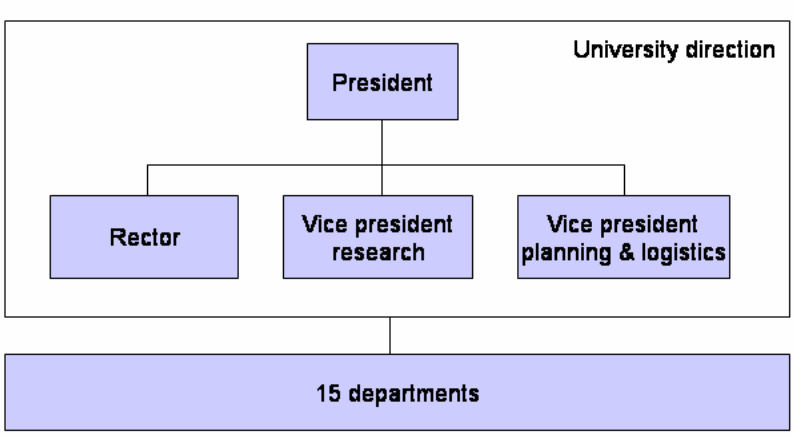
A relatively large share of foreign students has long been a hallmark of ETH. In 2003, 11 % of the undergraduate students and more than half of the doctoral students were foreign citizens. These high mobility rates are in part explained by the vicinity and non-existent language barrier to Southern Germany[29], but the attractiveness is surely also connected to the renown of ETH and to the central European location of Zurich.

For a European polytechnic, ETH has a comparably broad disciplinary scope. Besides engineering sciences, particular emphasis is placed on natural sciences. A characteristic of ETH is the activities in applied sciences such as earth, environmental, agriculture and food sciences.

Organisation of research and education

ETH Zurich is lead by a direction of four people. The executive power is that of the President. The Rector is responsible for education and has the overarching responsibility for academic affairs. There are also two vice presidents and three pro-rectors. The vice rector responsible for research is also responsible for cooperation with industry. Education and research at ETH is organized in 15 departments, each lead by a director.

[29] Although many Swiss accents are problematic for Germans, only traditional *Hochdeutsch* is traditionally spoken at ETH, as in most other Swiss universities.



Professional support

Organisation for technology transfer

The vice president for Research has a staff divided into four departments. The departments of *Research Coordination* and *Euresearch* both support and coordinate research projects and scientific infrastructure on the university and international level respectively. The other two departments, *ETH Transfer* and *Strategic Projects*, both to a certain degree support research projects where ETH staff cooperates with industry, governmental organisations and/or NGOs.

The department ETH Transfer acts as a contact central for faculty seeking support for industrial cooperation, inventions, patents and licenses or company foundation. ETH Transfer also reaches out to companies, offering intermediation services. The unit typically listens to firm's requests and suggests 10-50 research groups.

Internationally, ETH among other things participates in a cooperation network consisting of some 150 German research institutions with transfer functions. This network offers access to academic contacts for interested industry partners. ETH is also active in a national network; *Schweizerische Netzwerk für Innovation.*

The external transfer unit

The latest addition to the flora of support units is an initiative outside the walls of the University. The organisation *TEK* is since 2004 run by a group of entrepreneurs and enterprisers who seek to offer intermediation between ETH researchers and SME firms. The organisations claims approximately 30 ETH researchers representing four broad technological fields are available. In 2006, TEK is reorganized into a commercial firm.

Contacts students-industry

The student union, which is active both at the ETH and at the University of Zurich, organizes lectures, interviews and a yearly employment fair, where students and companies get the opportunity to make acquaintances. There are also similar contacts between the student organisations of the different educational programs and companies with an interest in the respective field.

Recently, ETH has added another initiative to list. The alumni department has introduced career service for students and alumni alike. This function is based on familiar patterns, with a mentor program, counselling and intermediation of jobs and apprenticeships.

Manifesting an out-reach culture

The three-campi analogy

ETH Zurich's proud history and strong standing is an asset carefully cultivated and built on. In a number of contexts, University representatives emphasize the role that ETH Zurich sees itself as having for the Zurich region, the Swiss nation and for the European mainland. A clear example of how this attitude is fostered is the way the University presents its three campuses in official presentations: City (the main campus), Hönggerberg (suburban campus area), the World.

Strong communication a necessity for the entrepreneurial university

Communication efforts at ETH Zurich are clearly impressive in terms of scale and professionalism. With 36 employees, the Corporate Communications office is able to act as strongly as a multinational company, offering 24h press service, large science fairs, etc. The office also runs a daily electronic newspaper. Since the launch of *ETH Life in* 2001, the editorial office of seven journalists have published news, portraits, debates, articles and so forth, all with clear focus on current activities at the ETH Zurich. ETH Life is also available in an international, English edition. In all its efforts, the office has a central message that it seeks to communicate: that ETH Zurich is "a leading research institute working for "the world for tomorrow". The penetrating power of this message is seen as vital for ensuring beneficial relations to firms, potential students and employees and, not least important, the Swiss taxpayers who finance the university through federal taxes.

The work of the corporate communication office can be said to have impact both the way the ETH Zurich is perceived by stakeholders, including potential industry partners, and the University culture. Also worth noting is that the Universities main support unit for promotion of commercialisation, ETH Transfer, recently added a function for 'communication and marketing' to market collaboration and commercialisation opportunities as well as the existing support functions inside the University.

Alliances with other Universities

Together with three other technical universities of some reputation (Imperial College, TU Delft, RTW Aachen), ETH formed the IDEA League alliance in 1999. The league has stated stimulation of mobility and cooperation on master-level education as a primary objective, but the hope to attract funding from both the EU and from industry was part of the original idea behind the alliance. So far, the main results are however exchange of views and cooperation at university management level, as well as possible branding benefits.

In 2006, ETH Zurich is forming the 'International Alliance of Research Universites' with nine other well known universities. This group consists of universities from the US (Yale, Berkely) and the Far East (Universities of Beijing, Tokyo, Singapore) as well as three further European institutions (Universities of Cambridge, Oxford, Copenhagen). Again, encouragement of mobility

for Faculty and students are mentioned as main short term goals. Common applications for funding from e.g. industry is, however, mentioned as a long-term objective for the Universities.

Organisation of research

Giving collaboration an organizational form

US corporate giant IBM has a large research facility in Zurich and is a key partner for the ETH Zurich. There are many examples of co-funded research in the form of consortia, research centres or co-financed conferences. IBM also hosts ETH students for special projects. Such funding has been known to include financing doctoral students as well as sponsorship through access to advanced IBM equipment.

One example of IBM / ETH collaboration is the Zurich Information Security Center (ZISC). Originating from discussions and prior collaboration between ETH and IBM researchers and formed in late 2003, ZISC is run by an ETH-led industry consortium comprised of Swiss banking giant Credit Suisse, IBM's Zurich Research Laboratory, and Sun Microsystems Laboratories. More recently, the Swiss federal department of defence has joined the consortium.

The construction of a separate entity such as ZISC can be understood as a way for university researchers to manifest commitment to a particular research area and to industrial partners, and as a way to get industry to commit attention and financial resources over a longer period of time than otherwise possible. Centers of this kind are not uncommon. What is uncommon, however, is that no public actor had either intermediary or funding roles to play in the creation of ZISC. ZISC is an interesting example of 'spontaneous' organization.

Co-location with industry

The main campus of ETH Zürich is very centrally located in the city, which has made arrangements for co-location less of a priority for the University. However, the relatively modern campus at suburban Hönggerberg dedicated to natural sciences and architecture is currently in focus for an ambitious initiative through which industry presence shall be introduced at the sub-campus. In this endeavour, Regional authorities work together with the University under the project name *Science city*. The project visions the Hönggerberg as a modern campus milieu where housing, academic laboratories and firm presence shall form a thriving scientific community.

XI: SZEGEDI TUDOMÁNYEGYETEM

University of Szeged, Hungary

Background and description

The University of Szeged (USz) was founded in its present form in year 2000 when several institutions of higher education in Szeged was merged. It has its origin in the University founded in Kolozsvár in Transylvania in 1872, which moved to Szeged in 1921. US is a classical University organised in eleven schools and faculties. The University has a reputation of high quality research, and has been ranked 203-300th in the world University ranking by Shanghai Jiao Tong University in the last three years.

Szeged is the largest city in the mainly rural region named South Great Plain. Szeged is the centre of higher education in the region. Apart from USz there are also several other academic institutions such as the *Center for Biological Research* of the Hungarian Academy of Sciences, and the Bay Zoltán Applied Research Foundation Institute of Biotechnology, *BayBio*. The strong research environment in Szeged is a development asset for the region that is utilized in various regional development programs, in which USz often is a central actor. The activities of the University are often set up with a regional focus to support needs of industry and the citizens of the region.

An industry in transition

The political transformation since the late 1980s has dramatically changed the structure of the Hungarian economy. On the industry side, large socialist companies have been privatized, leading to a structure with many small and medium sized domestic firms and some large foreign based transnational firms. The domestic SMEs are crucial for the economic development and innovation, but their lack of economic resources limits the ability to engage in research and development. The Universities and research institutes are suffering from a lack of R&D resources. In international comparisons the share of the GDP spent on R&D of about 1 percent is far below the EU average and the objectives of the Lisbon strategy of 3 percent. Also, the share of the R&D investments coming from the private industry is less than 40 percent, to be compared to the OECD average of more than 67 percent.

Even though lagging behind most western European countries both as regards input and output of innovation, there is a strong commitment in Hungary to establish an advanced innovation driven economy by strengthening the basis for innovation and R&D. Since the fall of the socialist regime there has been an ambitious process of identifying what the problems in the innovation system are and finding best practices at other universities in Europe and in the US. Only in very recent years actual comprehensive policies and strategies have been set in place. There a still, however, some major obstacles in the process of catching up with western European counterparts.

Tax incentives for firms to invest in R&D are an important element in the innovation policy of the Hungarian government. The tax subsidies for R&D investments are high in international comparison. To support investments in R&D in the industry, the Hungarian government has introduced a special innovation tax for all firms with at least 50 employees. The innovation tax payments are placed in an innovation fund supporting R&D and innovation projects. However

innovation taxes are refundable if the same amount is invested in R&D at a public research institution. This scheme subsidises the firms to cooperate with the Universities.

The USz is working with about fifty private firms. Most of them are national or even regional. All of these provide resources to the University. There are also some larger international firms cooperating with the University. They are often partners in externally financed projects and do not directly provide money to the University. Almost twenty-five bout ten percent of the research funding is coming from private industry.

Professional Support

As a result of the long period under socialist regime where the industry was owned by the state and the research was centrally controlled, there is a lack of traditions in cooperating with the private industry in the way Western European and US Universities have. The need to make the research outcomes available to industry has required new ways to perform research and establishment of a new culture to enable and facilitate reaching firms. As the industry is young, at least in the present model of ownership, there is also a lack of traditions in working with University researchers. Therefore, it is seen as especially important that comprehensive professional support structures are set in to handle the transfer of technology and knowledge.

After a process of identifying problems and objectives of innovation and commercialization of research results, the USz support system is in a stage of establishment and also in use. Before, the University was a closed community with weak rules regarding for example intellectual property rights. University management was not strong enough to enforce the existing rules. When the present rector was elected in 2003, he initiated an innovation scheme within the University setting up an internal scheme for regulation of intellectual property. Within this program, an *Innovation Management* group and a *Research Administration and Project Coordination Office* was formed. This program created a completely new basis for innovation management at the University. There is now a rather centralised strategy to deal with innovation at USz.

Since the resources available for R&D are scarce both in Hungarian private firms and at the USz, third party (public) funding is very important to enable and facilitate research collaboration with the industry. The Research Administration and Project Coordination Office assists research groups in finding grant application openings and preparing proposals. The EU membership has opened for better access to European research funds. These funds have facilitated several innovation initiatives involving private firms and public actors at regional and national level.

In the office of the vice rector of research, there is a department of innovation management coordinating the work of exploiting research results and cooperation between University research and industry. The department of innovation management is a contact point for firms and a contact mediator between the industry and research groups at the university. In order to facilitate the exploitation of inventions developed at the University, an innovation fund has been established. The fund is meant to finance application and maintenance processes for academic patents.

Together with the two large research institutes in biotechnology, the *Center for Biological Research*, and the *BayBio* and the *Cereal Research Non Profit Company*, the University of Szeged has established

a joint technology transfer office named Biopolisz. The City of Szeged is also a founding partner of Biopolisz as a part of a regional strategy to strengthen the utilization of R&D activities in the local industry. The mission of Biopolisz is to facilitate the economic exploitation of academic intellectual property, mediate contacts between the academies and the industry and to prevent unauthorized use of the intellectual propert developed at the university. In the strategic regional innovation process they also coordinate projects for investments and development of infrastructure. Biopolisz favours local and regional firms as they see it as important for the region to have close relations between the research institutes and the local industry.

Inventions at the University is transferred to Biopolisz in order to make profits from selling these to the industry or establishing spin off companies. This is also meant to protect the intellectual property from use by unauthorized actors. In order to facilitate matching of research results with demands in the industry, Biopolisz has organized a searchable database where University researchers can enter their activities and firms can report interest for research collaboration. For researchers interested in establishing a spin-off firm, Biopolisz provides legal consultancy, entrepreneurial training, project management and assistance in recruitment of key personnel.

Manifesting an outreach culture

Since the fall of the socialist regime dates less than 20 years back, there is naturally a lack of traditions among University researchers to cooperate with private firms operating on a free market. This puts demands on the researchers to obtain a completely different culture of reaching the industry and making their research results available for industrial use. University management has worked hard to actively inform the researchers on how the set of regulations for IP-issues around collaboration works and how collaboration enables and facilitates the commercialization and transfer of technology to the private firms. The department of innovation management and Biopolisz is actively screening the research at the University to find opportunities for industrial collaboration. They can also present the research groups with contacts at firms interested in collaboration.

To create and enhance awareness of innovation opportunities, the University offers training courses in innovation and technology management and intellectual property management for undergraduate students, PhD students and the general public.

For the growing industry, the transformation into a market economy has led to a new and still developing environment where the private firms are encouraged to establish research collaborations with the Universities. The department of innovation management and Biopolisz is actively approaching industry to inform about research at the USz and how the individual firm can benefit from research collaboration.

Alliances with other Universities

The University of Szeged has about 25 official partner Universities with which they are engaged in several international networks related to research and education. Researchers and teachers visit other universities in exchange programs giving them opportunities to learn from scientific achievements and also share the benefits of the knowledge developed in SU with researchers abroad. These networks have been very helpful in providing advice and best practices.

US has good cooperation relationships with other research and higher education institutes in Szeged and also in other parts of Hungary. In Szeged, the *Centre for Biological Research*, and the *BayBio* are examples of important research partner also enriching the research performed within the faculties of the university. Together with these two and the *Cereal Research Non Profit Company*, the university has established a joint technology transfer office as described above.

Organisation of research

An important part of the Hungarian national innovation policy has been the financial support for establishing thematic cooperative research centers based at Universities. These research centers are run jointly with industrial partners.

The research at the University of Szeged is primarily conducted in the traditional faculties and in departments and institutes within them. Since a few years ago there are also research performed in two new knowledge centres and a collaborative research centre designed to facilitate close cooperation between university researchers and private firms. These R&D centres are set up with a cross disciplinary approach bringing different fields of studies together. Already in the establishment of these knowledge and research centres they have industrial partners contributing with a substantial part of the initial investment. These centres are also the most important forms of research cooperation with the industry and an important force in the ambitions to achieve structural changes in the region.

Szeged Neurobiological Knowledge Center (DNT), was established in 2004, in collaboration with the Hungarian Academy of Science by its *Biological Research Center* and other supported research groups. Founding members are also 8 private firms providing 24 percent of the financial resources in equity and 4 percent of the total resources by government subsidies. The remaining 71 percent is provided by USz and the HAS research groups through government subsidies. The centre conducts research in five different sub-programmes within the field of Neurobiology and separate programmes for students. In order to encourage businesses to collaborate and to bring 'business thinking' into the research, DNT also arranges lectures for their employees, researchers at the university and the general public. The strategic objective of DNT is to establish a basis for a life science cluster in the South Great Plain region. In 2006 the knowledge centre will move into a newly established building, where also the partner companies may base laboratories. DNT is also establishing research cooperation with universities and companies abroad.

The Regional Cooperation Research Centre of Life Science and Material Sciences (DEAK) has only been in operation for less than a year. The research of the centre is organised in five different programs, but also wishes to expand to new areas where needs and opportunities arise. The centre is founded together with ten industrial partners contributing with about half of the budget. The European Union is providing about 40 percent of the financing and the Hungarian government the remaining 10 percent. The mission of DEAK is to promote the development of the regional industry by providing applied research results corresponding to the needs of the industry. The partners are, however, not limited to regional firms. There are also companies from other parts of Hungary and abroad. DEAK is also looking for opportunities of expanding its activities with more partners cooperation on shorter or longer terms. The objective is also to become self sufficient.

A new research centre, "The regional environment and nanotechnology knowledge centre" is currently in the process of establishment. In addition to the university, the research institute *BayBio* and eight private firms are founding partners of the centre. The University is a central actor in several regional innovation initiatives, such as three regional innovation centres where knowledge and technologies can be utilized and transferred to small and medium sized firms in the region. These centres address areas identified as specific needs of the regional industry.

Co-location with industry

In the Traditional set-up of the university the private industry has not shared facilities with the university research groups. Influenced by experiences at other Universities abroad, such co-location has been adopted as a tool to bring the two worlds of academia and industry together in formal as well as informal ways. The *Szeged Neurobiology Knowledge Center* (DNT) is one example of such an initiative.

DNT is located in a new multifunctional building where the industrial partners and spin off firms can rent office and laboratory space. This is the first initiative in USz to create a micro level co-location with the industry in a physical building. The co-location is intended to deepen the interaction between actors and thereby strengthen the Neurobiological cluster in Szeged.

XII: TARTU ÜLIKOOL

University of Tartu, Estonia

Background and description

The University of Tartu (UT) is the oldest and largest university of Estonia and one of the best-known in Northern and Eastern Europe. Its history dates back to 1632 when it was founded by the Swedish king Gustav II Adolf. It is a classical university organized in eleven faculties and three specialized research institutions: the Institute of Physics, the Estonian Marine Institute and the Institute of Technology. Five colleges are also located in other cities in the region. Six centres of excellence have been set up for research in specific areas: The Centre of Molecular and Clinical Medicine, the Centre of Excellence of Chemistry and Materials Science, the Centre of Basic and Applied Ecology, the Centre of Excellence of Gene and Environmental Technology, the Centre of Behaviour and Health Sciences and the Institute of Physics. Together with the Institute of Chemical Physics and Biophysics, the University of Tartu has established the Estonian Biocentre. In 1992, UT formed Tartu Science Park together with the City of Tartu and the Estonian government. The main goal of Tartu Science park (TSP), is to provide services to support commercialization of R&D. the science park also mediate contacts between firms and research institutes through an extensive network within Estonia and abroad.

The University of Tartu is the by far the largest academy in the city, but there are also ten other institutions of higher education, such as the Estonian Agricultural University. These institutions host about 40 percent of all students in Estonia.

Estonian industry structures changing

The period from the singing revolution in 1991, when the Republic of Estonia gained independence from the Soviet Union, has been marked by massive transformation processes in the society. The academic system has gone through a fundamental change in order to face the challenges of a liberal society with a market economy and increased internationalization. Starting from scratch it has taken long time to shape a structure enabling and facilitating collaboration between with the private industry in Estonia and abroad.

The small size of the country and the industrial structure of Estonia imply that the UT hardly has an abundance of potential collaboration partners to with whom collaborative research agreements can be made. Most Estonian firms are small and have scarce resources to spend on research collaboration with Universities. Many of the companies are also operating in low tech sectors with few incentives for research collaboration. However, as the Estonian economy is growing rapidly, the number of firms able to exploit research results is increasing. Estonia also provides opportunities for transnational firms leading to foreign investments. This development contributes to the Estonian economy and also increases the availability of potential industrial partners for the Universities.

The level of research and development expenditures in Estonia is low in comparison with western European countries. While the EU average R&D expenditure is 1.9 percent of the GDP, the Corresponding figure in Estonia is 0.8 percent. Also the share of the expenditure on R&D coming from the industry is low, 29 percent of the total R&D expenditure compared to the EU average of 55 percent. This also gives fewer opportunities for the universities to provide research for the industry.

The structure for technology transfer and research collaboration is to a large extent still in a development process at UT as in most other universities in the newest EU member states. UT is putting great efforts in making studies of best practices at other universities in Europe and in the US. Lagging behind many universities in Western Europe and in the US may sometimes also become an advantage in finding best practices that can be adjusted to the national and regional conditions.

Since the liberation from the Soviet Union the Estonian government has made ambitious efforts to identifying weaknesses of the innovation system and finding solutions by studying best practices in other European countries and in the US. Innovation is still not playing the role of en engine for competitiveness in the Tartu region, but there is a strategy launched at a regional level launched to establish an innovative region. In the regional innovation strategy public authorities such as the county and City governments as well as the various academic institutions. The University of Tartu takes an active role providing service to the society as well as implementing innovation policies and advancing knowledge-based Estonia. The Institute of Technology has been established to facilitate collaboration with entrepreneurs and support for setting up spin-off companies for high-tech innovation.

Professional support

The private industry in Estonia after the wave of privatization of state owned firms consisted primarily of smaller firms lacking resources to spend on R&D. The industrial structure has led Estonian innovation strategies to focus more on start ups from university research rather than cooperating with existing firms that are few in number. The private industry has gone through a immense growth, giving more firms and greater resources for investment. The influx of foreign investments has also provided the economy with more capital. The Estonian industry is, however, still lagging behind those in western European countries in terms of ability to spend money on R&D

The department for research and organizational development at UT is a support structure to promote the main functions of the university. The main goal of the department is to provide well-functioning support services for increasing the efficiency of the R&D activities at the university. The work of the department includes coordination of the R&D activities at the university, assisting in seeking research funding opportunities and participation in the technology transfer support system.

The main organisational unit for professional support is the Institute of Technology (TUIT), which is an organisation set up to coordinate the transfer of the university's research results into practical use in the industry. TUIT also has four development centres performing applied research with good potential to be absorbed by the industry.

TUIT helps matching needs in the industry with the technology and knowledge available in the university research. For the researchers at the university they provide advice and support related to for example patenting, property rights and commercialisation and finding external partners and funding for research projects. The services are provided to research groups free of charge which is possible by funding from the European commission and the state agency 'Enterprise Estonia'.

For firms looking for research collaboration opportunities TUIT is a contact point at the university providing advice and support. For firms lacking financial resources, TUIT can assist in applying for external funding for research projects.

Manifesting an outreach culture

As a result of the period under socialist regime, when the industry was owned by the state and the research was centrally controlled, there is a lack of tradition in cooperating with the private industry. New ambitions to make academic research more available to industry have required the adoption of new ways to perform research and establishment of a new culture to enable and facilitate industrial contacts. The most structured example is run by the TUIT, which actively contacts private firms in order to establish contacts and find opportunities for partnerships and research collaboration with industry.

To increase the awareness of commercial potential of research results, the University of Tartu has established a centre for entrepreneurship (CFE). The main objective of the centre is to promote spin-offs from Univesity research, but also to transfer the results to already existing firms. By raising entrepreneurial awareness, researchers will also better understand the processes through which academic knowledge and results may be made available to external actors. A major tool for CFE is a programme for researchers held at the Zernike Group in Groningen, the Netherlands. In a two months training visit, the researchers learn how to make their innovations and research results available to the industry.

The University is through different units such as the CFE, TUIT and Tartu Science Park connected to several national and international networks and development projects. This provides the researchers at the University with access to valuable networks through which University activities can be shown externally. UT is and has been involved in, and often coordinated, several EU-funded research projects aiming at developing regional strategies for research collaboration with industry. Tartu Science Park has been represented in many of these projects as an organization jointly founded by the University and the public authorities.

Alliances with other Universities

The University of Tartu is member of two European university networks, Coimbra group uniting European traditional research universities, and the European University Association. UT has also become associated with the Magna Charta of world Universities. Furthermore, there are three Baltic networks in which the University is a member: The Baltic Sea Region University Network, Baltic University Programme and the Conference of Baltic University Rectors. In addition to this, the University has bilateral partner agreements with nearly 40 Universities in Europe, North America and in Asia. The membership in the European networks provides experiences and opportunities to learn from the practices of others.

Even within Estonia and in the Tartu region the university has been involved in alliances with other academic institutions and public agencies. UT plays an important part in the strategies to improve the Tartu regional innovation system. The national agency Enterprise Estonia launched in 2001 a program called SPINNO with the original aim to improve the academic attitudes towards cooperation with the industry and to promote the transfer of technology between the industry and research institutes. There were two regional SPINNO programs of which one was aiming at the Tartu region. This program was coordinated by TUIT. In addition to this there was also a programme focusing on the biotech sector. Several institutes in and related to UT participated in this project.

Organisation of research

The Institute of Technology at Tartu University (TUIT) is the main institution organising the technology transfer of the University's research. TUIT has two main functions, supporting transfer of technology and secondly also run four development centres. TUIT was organized

based on advice from international contacts to gather more of applied research in an institute in order to make it more accessible for the industry. The Institute of Technology has from the beginning had a special mission to focus on technology transfer of their R&D activities.

The research at University of Tartu is mainly performed in various institutes within the eleven faculties. As a part of the strategy to make the research at the university more easily applicable and accessible to the industry, different fields of research has been brought together in research institutes. There are three specialized research institutions: the Institute of Physics, the Estonian Marine Institute and the Institute of Technology, and five additional centres of excellence: The Centre of Molecular and Clinical Medicine, the Centre of Excellence of Chemistry and Materials Science, the Centre of Basic and Applied Ecology, the Centre of Excellence of Gene and Environmental Technology, the Centre of Behaviour and Health Sciences and the Institute of Physics. Together with the Institute of Chemical Physics and Biophysics, the University of Tartu has established the Estonian Biocentre.

Co-location with industry

There are no immediate collocation of university research groups and private firms in strategically organized facilities at a micro level. At a meso level, the Tartu Science park provides office space for firms either spinning off from university research or wishing to enter networks stretching inside the academic world. The science park is organised with this purpose and fills these tasks as a part of a regional, but also national strategy to bring research results out to practical use in the industry.

APPENDIX XIII - INSTITUTIONAL METRICS

As a complement to the in-depth case studies of university activities, we have found it valuable to undertake a limited benchmarking exercise. This exercise aims at providing a deepened understanding of conditions at the studied European universities, though systematized and comparable metrics.

Ranking lists

Ranking universities is an area of great controversy. Can places of science be ranked at all? Does it make any sense to compare achievements in totally different disciplines? Are the included measurements really covering the most central aspects of university research? Still, rankings are more important than ever for a University which seeks to present itself as attractive for industry – in particular for multinational firms.

Below are results from two of the most frequently quoted global ranking lists. A first validation of these rankings is that universities that we view as prominent, such as Harvard, Cambridge, Stanford, Berkeley and MIT, appear on top positions. Looking at previous rankings, results are rather stabile for all Universities included in our study but EPFL, which has improved significantly.

Rankings of Universities

	Shanghai index top 500 (2005)	**TIMES top 200 (2005)**
Cambridge	3	3
ETHZ	27	21
Karolinska	45	-
EPFL	153-201	34
Delft	203-300	53
KTH	203-300	196
Szeged	203-300	-
Twente	301-400	-
Surrey	401-500	-
Tartu	-	-

Source: www.thes.co.uk/worldrankings, ed.sjtu.edu.cn/ranking.htm

Educational profiles

An important criticism of University rankings is that they try to compare the incomparable: different fields of education and different disciplines of scientific research. In a parallel way, we believe that findings on innovation and outreach activities must be related to the academic profile of a university. A Faculty of technology can for instance be expected to have better premises for attracting industry financing than a faculty devoted to humanitarian sciences. Table II below describes the differing disciplinary breadth and scope of the ten universities that we have studied.

As research profiles are more difficult to asses, we have limited the elaboration to profiles in terms of education. The universities are ordered from Universities with strong technical foundations, via broader universities with particular emphasis on humanitarian subjects and/or natural sciences to the concentrated medical profile of Karolinska institutet.

ETHZ has a broad education profile, where applied sciences such as forest science, agricultural science etc are particular characteristics. Engineering sciences are particularly known for high quality.
TU Delft emphasizes the technical nature and purpose of education in natural sciences and economic subjects. There is a strong concentration on architecture, and among engineering disciplines, aerospace and landscape engineering are hallmarks of the university.
EPFL has a strong concentration to traditional engineering sciences, including computer sciences and applied natural sciences. The natural sciences are smaller in absolute numbers, but are rated higher than ETHZ by a national ranking (ETHZ ranks higher for most other disciplines).
KTH has, just as Delft, Surrey and ETHZ, a long history as a polytechnic. Traditional engineering sciences and (applied) natural sciences dominate the education agenda.
Universiteit Twente has an emphasis on engineering education, but is also active within business administration and some social science / humanitarian fields, such as cognitive science and philosophy. More precise data is missing in the table below.
Surrey has its roots, and its most prominent research, in the engineering traditions. However, the university has actively sought to broaden its disciplinary scope. Today, the university has a large education activity in basic courses in business and economic subjects.
Cambridge is a full-scale university with a strong dedication to arts and humanitarian sciences.
Szeged, has over a fourth of students are enrolled at the Teaching College. The most particular characteristic of the University is its research and education in Food Engineering and other Life sciences.
Tartu is modelled on a classical university prototype and has a broad education agenda.
Karolinska institutet has its roots within medicine and chemistry. Restructuring during the 1990s has brought educations in the healthcare area into the University.

University disciplinary profiles

	Architecture	Civil and Environmental Engineering, geomatics	Other applied sciences	Engineering sciences*	Computer sciences	Basic (natural) science	Business studies / Economics + law	Other social sciences	Arts & Humanitairies	Medicine	Healthcare	Odontology
ETHZ												
TUDelft												
EPFL												
KTH												
UTwente												
Surrey												
Cambridge												
Szeged												

Tartu												
Karolinska												

Source: Own elaboration based on data from annual reports and websites of the Universities

Interpretation Guide:

	= 25 %
	25 % > = 15%
	15% > = 5%
	< 5%

of the number of total students.

Basic (natural) science: Mathematics, Chemistry, Physics, Biology / Life sciences

Engineering sciences: Mechanical engineering, materials science, electrical engineering, industrial design

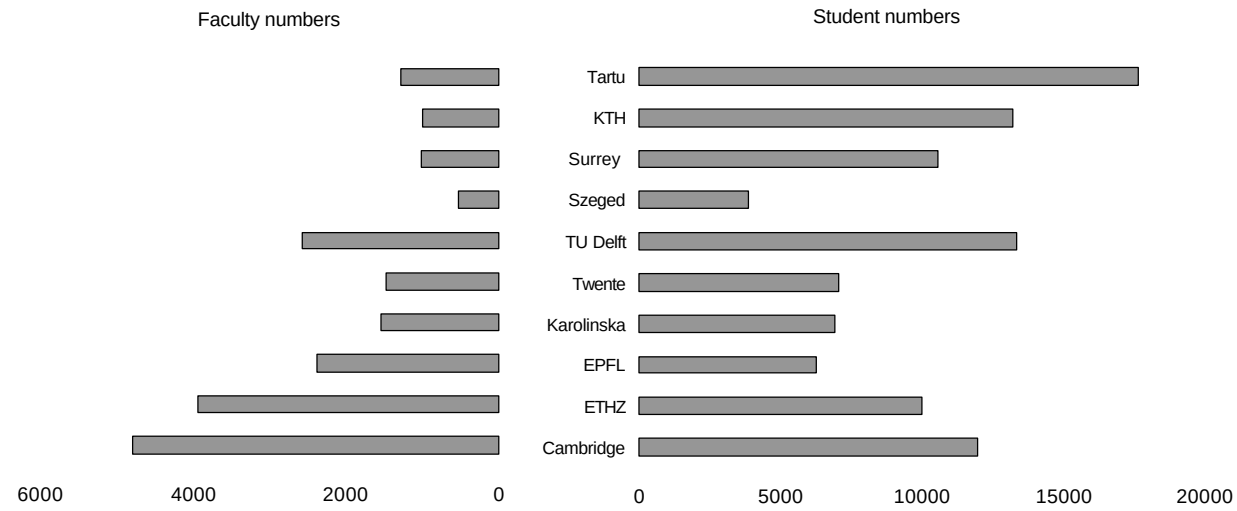
Other applied sciences: Agronomy, Forest science, Geology, Agricultural science

Other social sciences: Sociology, Education, etc

Student and Faculty counts

The scale of the different institutions is the key to interpretation of the above data on educational profiles. It is also useful to reflect over how different the institutions are in terms of their faculty counts. The greater the number of students per member of faculty, the less room can be expected for any other activity than teaching in the agenda of researchers (research, collaboration and other exchange activities). The potential for research collaboration with industry can therefore be expected to decrease with increasing student/faculty ration (from top to bottom in Figure I).

Figure I: Faculty and student numbers



Source: Annual reports of the respective universities, 2002-2004

National frameworks for higher education institutions

Traditionally closely linked to the state, each European University is still in many ways strongly influenced by differing national systems. Some of these frameworks should be reviewed, as they give the studied Universities a separate set of possible actions. For example: many Universities have the right to own property and charge student fees (at least for non-EU students), while others lack such rights. Some of the Universities studied here have a very strong balance account, which may be used for strategic investments.

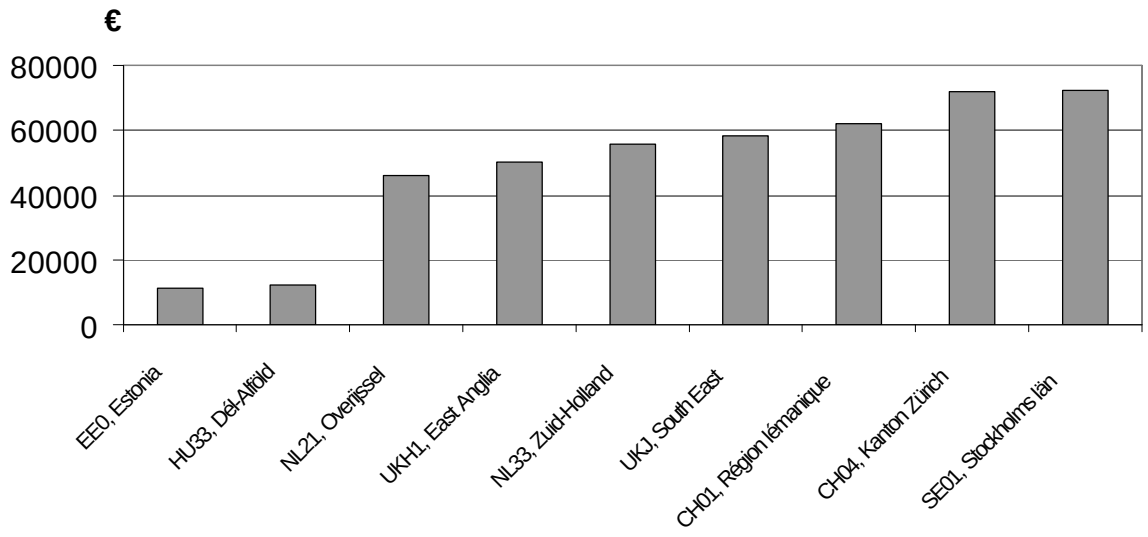
Also worth noting, the concentration of Universities, in particular of Universities of technology, differs significantly. In Holland, with its population of 14 million, only three Universities have the right to award the highest technical degree. In Switzerland, only two Universities have this privilege. It is hardly a coincidence that these Universities have stronger financial support from the national government than either one of the seven Swedish technical Universities / technical faculties with the rights to award the highest technical degree. Other examples of national priorities are the special legal status of the two Swiss technical universities and recognition of special status for Cambridge and Oxford in the UK.[30]

[30] See recommendations on special recognition for Oxford and Cambridge in the influential Lambert review: *Lambert Review of Business-University Collaboration* (2003).

APPENDIX XIV - REGIONAL METRICS

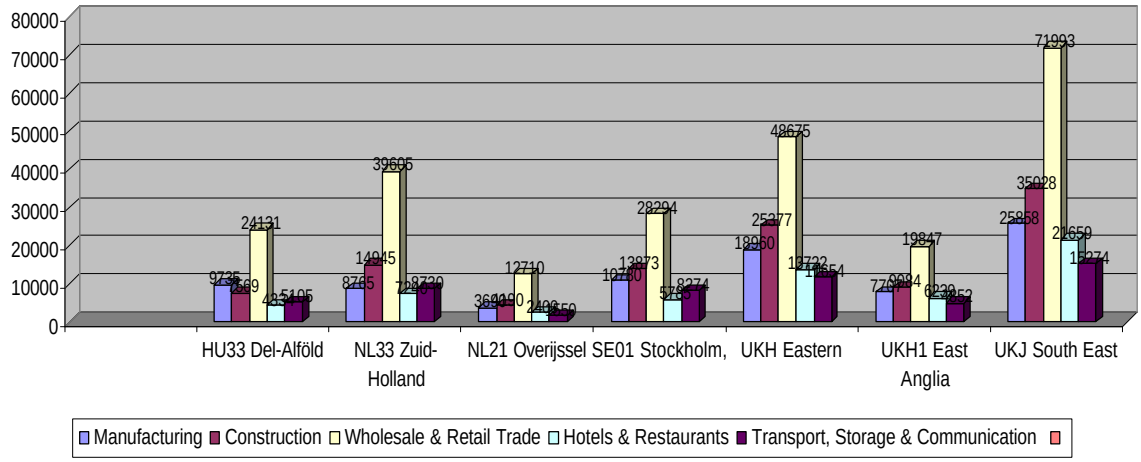
General note: The figures in this Appendix are based on the EU's Nomenclature of Units for Territorial Statistics (NUTS). Where possible, we have used the NUTS2-nomenclature. However, for the UK regions, data on business expenditure on R&D is missing. Following the practise of the Regional Innovation Scoreboard, we have therefore used the corresponding NUTS1-regions for UK in Figure III.[31] We have not been able to identify proper data on business sector R&D expenditure for Switzerland.

GRP / Labour force



Source: Eurostat, Swiss Federal Statistical Office

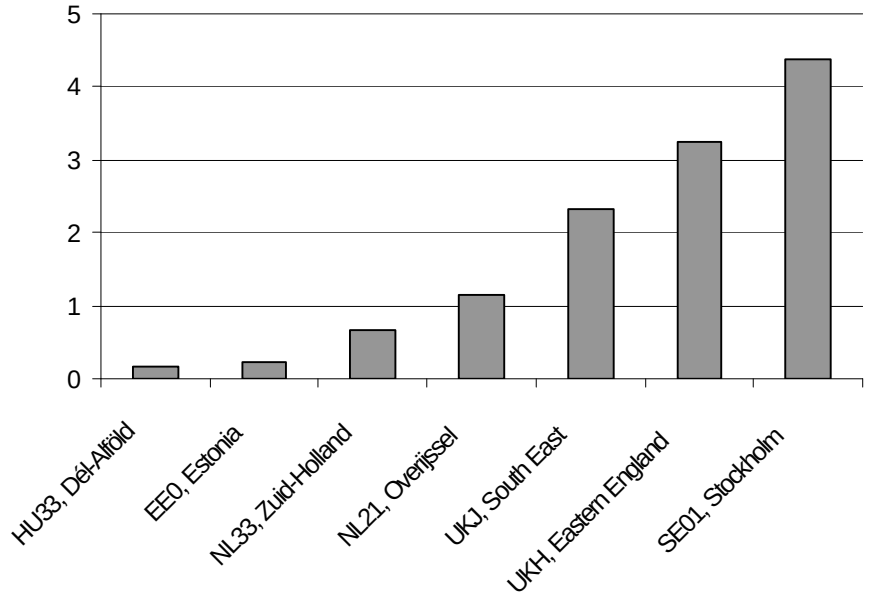
Industry structure



Source: Eurostat

[31] European Innovation Scoreboard 2003 – Technical Paper No 3: Regional innovation performances.

Business expenditure on R&D, % of GDP



Source: Eurostat