Research at Universities of Applied Sciences in Europe

Conditions, Achievements and Perspectives

On the initiative of the European Network for Universities of Applied Sciences

European Project: Educating the New European Professional in the Knowledge Society (EDUPROF)

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Overview of contents

On behalf of the European Network for Universities of Applied Sciences I have the pleasure to present to you the results of a first exploratory study on applied research at European UAS.

It is our aim that this report will function as starting point for discussion with UAS, stakeholders and government representatives about the role of applied research within the Lisbon and Bologna agenda. As such, the first copies will be distributed to participants to the international conference 'Putting the Pieces together. UAS as linking pin in the knowledge society'. The conference will take place in The Hague, February 2009.

The report and the conference are part of activities within the Eduprof Project: 'Educating the New European Professional in the Knowledge Society'. This project is supported by the European Commission under the Lifelong Learning Programme, the Dutch Ministry of Education, Culture and Science and the Network partners from Ireland, Denmark, Finland, Estonia, Lithuania, Germany, Switzerland, Austria, France, Portugal and the Netherlands. It is the follow-up of the BaLaMa Project: 'Bachelor for the Labour Market', in which the Network Partners undertook an investigation into the shared characteristics of professionally oriented higher education in their respective countries.

The participants of the Berlin Conference in March 2007, as the closing event of the BaLaMa Project, expressed the wish to focus on the research function as part of the mission of UAS in Europe. Under influence of the knowledge society research becomes an ever more important focus for the UAS to educate professionals in line with the skills needed in fast-changing professional practice. The image of a highly educated professional with a standard repertoire of knowledge and skills is outdated. Society expects a professional who continuously produces new and interdisciplinary knowledge on the basis of his or her creativity and innovative talent, which can be directly applicable in practice.

Therefore the Network Partners thought it necessary and useful to start mapping the current state of affairs on applied research at European UAS. This report is a first exploration to this end, which we would like to share with you. We hope that such a dialogue will bring us to new conceptions and initiatives.

To conclude, I would like to thank DG Education and Culture of the European Commission and the Dutch Ministry of Education, Culture and Science for their support, the Network Partners and the respective UAS for their efforts in filling out the questionnaires, and the researchers from CHEPS for bringing all the results together in the overview here presented.
I hope this study will bring you inspiring thoughts.

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1 Introduction

In the last few decades we have witnessed a rapid change in professional practice throughout Europe under influence of the development of the knowledge society. The image of a highly educated professional with a standard repertoire of knowledge and skills is shifting. Society increasingly expects a professional who continuously produces new and interdisciplinary knowledge on the basis of his or her creativity and innovative talent that is employable in various professional practices.

Universities of Applied Sciences (UAS) have a special role in responding to these changes by tuning their educational provision to the requirements and needs of the world of work. Compared to traditional universities the education offered by UAS is more interdisciplinary and more oriented to the solution of practical problems. Rather than instruction in merely scientific and academic subjects, UAS emphasise knowledge and skills oriented to professional practice. The development of problem-solving capabilities of a more general character has become a central dimension of professional education. This is particularly important since the dynamics of the knowledge society imply a need for continuing updating and retraining of all knowledge workers. Major actions in this area are knowledge transfer and application of knowledge through education and research.

In order to meet these demands, research is playing an increasingly important role for the UAS alongside their teaching obligations. In many countries across Europe the Universities of Applied Sciences see it as their professional education mission to accommodate the societal demands by linking professional practice and education through innovative research. Many institutions have developed a variety of research activities with the aim to contribute to regional innovation and to improve professional practice.

In view of these developments, it is timely for the UAS sector to examine their research framework for the years ahead and to offer a European dimension to the research being conducted at UAS. The European Network for Universities of Applied Sciences (UASNET) has initiated a three-year European project 'EDUPROF' (Educating the New European Professional in the Knowledge Society). With the Netherlands Association of Universities of Applied Sciences as project leader, the Network brings together 11 Associations of UAS in the front line of the European agenda. The partners represent a variety of higher education institutes from Ireland, Denmark, Finland, Estonia, Lithuania, Germany, Austria, Switzerland, France, Portugal and the Netherlands. All of them educate students in line with the demands from the world of work and keep in close contact with professionals in order to bring about regional innovation and meet life long learning requests.

This European Network is an extension of the previous network joined together in the so-called BaLaMa project ("the Bachelor for the Labour Market"). This network consisted of eight member states of the European Union and organised conferences and produced reports about several aspects of professionally oriented higher education in Europe.

As the start of the present European project, the network decided to carry out an international study to explore how the research function is evolving in the 11 participating countries. In particular it intends to investigate what kind of research activities are undertaken by UAS, whether a common profile can be detected as well as various conditions under which this research function has to be performed.

The current report contains the results of this study. The material explored will be used as information for the international conference in The Hague, in February 2009, as well as for follow-up activities of the Network. This will also be an important moment to look ahead with UAS and their stakeholders to the Bologna Ministerial Conference in Leuven, April 2009.

Aims and method of the study

The study which will be reported here focuses on the research function of Universities of Applied Sciences in the eleven countries in Europe. The main objective is to understand the nature and profile of research activities to deliver high level professional education and to prepare graduates for professional work.
This study has the following aims:

- To obtain an up-to-date picture of the nature and profile of research by UAS in Europe
- To identify good practices of research activities and issues relevant for professional development
- To map the ways UAS in Europe take up the challenge of integrating research in the curricula of the new European professional
- To function as a source of information shared by all partners and to be used in the follow-up activities of the network (such as expert meetings, study visits and a detailed benchmark).

In order to collect information from the countries two separate questionnaires were designed, one to be answered by the national (partner) associations and another one by individual affiliated higher education institutions. The reason why two questionnaires were used is that some information is available on the national level, but that more specific and detailed information can only be acquired from individual institutions. The questionnaire for the national associations concern mainly policies on the national level, whereas the other questionnaire focuses on institutional policies and practices.

The two questionnaires, however, are not completely independent and both address a number of common themes. These are:

- General information about the sector: national contexts and policies, types of degrees provided, statements of research missions and research strategies
- Funding of research: core funding as well as other types of funding for research, including third-stream contract funding
- Nature and scope of research: its organisation within the institution, research strategies, quality assurance and evaluation of research
- The output and impact of research on innovation and utilisation
- The link between education, training and research
- Human resources regarding the teaching and research staff.

On each of these themes, both questionnaires contain a combination of quantitative and qualitative (open) questions. Respondents were invited to provide additional documentation which could be used for this study as well, such as reports on the (national) position and policies regarding research in the UAS sector, institutional plans and future perspectives.

Because of the exploratory character of this study it was decided that the questionnaire for the individual institutions should be limited to about three institutions per country. These should be selected by each national association on the basis of their own judgement.

In addition to the 11 national associations there were altogether 36 institutions that filled in the questionnaire. Such a number would not allow to make cross-country comparisons, but altogether they may give a rather fair cross section of the kind of research activities institutions are undertaking. The statistics presented in this report are based on the data obtained from these institutions (cf 36 cases).
In addition to these two questionnaires we asked some institutions, after consultation with the respective national association, to identify and describe a case as example of research practice. Through these cases institutions could describe in more detail how research is practiced at the institutional or faculty level.

Structure of the report

Most of the information collected will be presented in a rather generalised way. Referencing to particular countries will be done throughout the report, but with the perspective of presenting the information as much as possible in a comparative way. Although there is a chance that some country-specific information is taken out of context, or may be left out because of a necessary condensation of information provided, the comparative approach will increase the readability and will provide a better opportunity to trace a common ground for the nature and profile of research across Europe.

In order to overcome a bias of neglecting the national contexts chapter 2 presents a short characteristic of the national contexts of UAS. It includes an overview of some comparative data across the countries regarding the size of the sector, subject fields, and particularly the degree structure in the respective countries. This is followed by an overview of some general policy developments regarding research at UAS. Apart from information as collected in this survey, other sources were used, such as OECD reviews on higher education, reports published by the network partners in the context of the previous BaLaMa project, as well as information on national systems as monitored by CHEPS.

Chapter 3 digs deeper into the research mission of UAS: how is this defined, what are the drivers of research, and whether a research profile is emerging.

The following chapters discuss the various themes as structured in the questionnaires. Subsequently attention will be paid to funding sources for research (chapter 4), the organisation of research within institutions, research capacity, quality assessments (chapter 5), output and impact of research (chapter 6), links between education, teaching and research (chapter 7), and human resources (chapter 8).

In the concluding chapter 9 major findings of the study will be placed in the context of European dimensions and an overarching conception of research at UAS. It concludes with a number of critical issues that can be considered in the context of follow-up project activities by the EDUPROF network.

The appendix contains 20 examples of research practices as described by different institutions across Europe. They illustrate the output and impact of their research and the way research and teaching/education have been combined. These cases together with the views presented in the different chapters show a kaleidoscopic picture of the shape of research at UAS.

To conclude this introduction two remarks should be made. First, the term Universities of Applied Sciences (UAS) is used for institutions that belong to the higher education system alongside the traditional universities and have organised themselves through their national association in the European project. On the national level various names are used, mostly in local language. In some countries the international term UAS has been recognised by national governments, in other countries this is not the case. Nevertheless, the designation UAS will be used throughout this text to denote all these institutions, without denying the variety of types of institutions that are covered by this term. The institutions are (affiliated) member of the national associations participating in the EDUPROF project. We realise, however, that the associations do not cover the full range of HE institutions that exist in a country. The survey concerns only those UAS that are members of the national partner association.

Secondly, this report deals with the research function of UAS and its connection in the knowledge economy. It is often assumed that the knowledge economy is largely related to technological issues and technology transfer. This assumption is not at the basis of this report. Although much attention will be paid to technology and engineering subjects – being an important subject area of many UAS. It is important to note that research in the social and economic sciences and humanities make an important contribution to innovation systems and also have the potential to generate profitable commercial activity. This includes a field like the creative arts such as design, film and video, interactive leisure software, and performing arts. Much innovation is taking place here and the sector as a whole account for 5-10% of national economies (OECD figures).

Moreover, commercialisation is limited in itself. Many subject fields in UAS focus on the collective sector, such as health, social work, and education, all aiming at a much broader goal to find solutions to societal problems and needs. Social innovation is a more encompassing term which applies to a broad spectrum of societal issues. Some case descriptions in the appendix illustrate the crucial value of research in these fields.

2 Overview of national contexts and characteristics

In the countries included in this survey the UAS sector shows a varied pattern. The sector differs in several aspects and also within countries the variation between the institutions can be quite considerable. It would go beyond the purpose of this study to give a complete account of these variations, but a few elements will be touched upon in this chapter which are important in understanding the research function within the sector as a whole and the major policy trends in the different countries. This is followed with a discussion on the degree structure in the context of the Bologna process. Finally major national trends and legislation regarding the research function of UAS will schematically be presented.

2.1 General features

In academic literature the sector as a whole has most often been subsumed under the term 'Non-University Higher Education', in order to give the sector a place in higher education systems with a binary structure[1]. Other more dated terms have been used such as the 'alternative' or 'the other' institutions. All of these terms are totally obsolete and do not do justice to the important place these institutions take in the national systems of higher education. In this report we concur with the term UAS which is becoming increasingly common across Europe. The following overview gives the full national names and their international designation as formally recognised by national governments. In order to distinguish them from the universities as such, for the latter the term traditional universities will be used[2].

Table 2.1 National terms and their English designation

	National term	International designation
Austria	Fachhochschulen (FH)	Universities of Applied Sciences
Denmark	University Colleges	University Colleges
Estonia	Kõrgkool	College, Academy, University of Applied Sciences*
Finland	Ammattikorkeakoulu (AMK)	Universities of Applied Sciences
France	Instituts Universitaire de Technologie (IUT)	Instituts Universitaire de Technologie (IUT)
Germany	Fachhochschulen (FH)	Universities of Applied Sciences
Ireland	Institutes of Technology (IOT)	Institutes of Technology (IOT)
Lithuania	Colleges of Higher Education	Colleges of Higher Education
Netherlands	Hogescholen (HBO)	Universities of Applied Sciences
Portugal	Instituto Politecnico	Polytechnics
Switzerland	Fachhochschulen (FH)	Universities of Applied Sciences

* For Estonia the international designation differs per institution

Although there are many commonalities across the countries, there are also important structural differences. A brief indication of some of them will suffice. First, the history of UAS. Some have a longer history and originated from various vocational streams and mergers between smaller institutions, whereas in other countries the sector has been established more recently. The Finnish AMKs, for example were launched in the 1990s but received permanent status in 1995. Also the Swiss UAS programme started in 1997. In Lithuania the colleges are a very recent structural element and the first ones were established by law in 2000. Despite being so late, the UAS in these countries have undergone a rapid development and have become firmly established in the national system in a very short time. In some countries the sector is still in process of reform (merging institutions, establishing new ones etc.).
Second, the share of UAS sector in the higher education system. One highly developed model of binary system (according to the OECD[3]) is that of the Netherlands where 65% of all students are enrolled in the UAS sector against 35% in traditional universities. Austria on the other hand has a relatively small UAS sector, only 12% of the total HE student population.

Related to the size of the sector is the provision of subject areas and the variety of study programmes. In most countries the sector includes engineering and technology, economics, management, health, education (teacher training), social welfare, and arts. In some countries these fields are more or less equally distributed, whereas in others there is quite a concentration on particular fields. In some countries some fields are not represented at all such as teacher training which either belongs to the university sector or is in separate universities of teacher education. In Switzerland, for example, the universities of teacher education form part of a UAS in two regions, in the others they exist as separate entities or as part of a university.

[1] See for example the compilation of national studies in Taylor, J.S., J.B. Ferreira, M. De Lourdes Machado, R. Santiago (eds.) (2008) Non-University Higher Education in Europe. Dordrecht: Springer.

[2] To refer to universities as being 'traditional' is perhaps also biased as this does not acknowledge the many changes these institutions are facing over the years.

[3] OECD (2008) Tertiary Education in the Knowledge Society, Vol. 2, p.219.

Some countries show a high concentration of engineering/technology subjects and economics/ management (as in France, Austria and Germany). In Denmark health and education/ teacher training are predominant. In other countries subject areas are more equally distributed (Netherlands, Finland, Estonia, Lithuania). Although in the Irish IoTs - as the name suggests - engineering is the largest area (22%), many other fields are well represented like health (14%), social sciences, economics and law (30%), humanities and arts (21%).

Third, the size of the institutions varies considerably. Some are large comprehensive institutions, encompassing a broad range of subjects and multidisciplinary approaches. Others are quite small and focus on particular occupational areas (e.g. teachers, health professions). Some have less than 100 students, whereas the largest have over 30,000 students.

Fourth, the entrance requirements are quite varied. In some countries entrance requirements are equal for both UAS and traditional universities whereas in other countries these requirements are more diverse. Some countries have rather open admission systems with varying access routes from secondary (also vocational) streams and focus on maximal participation in higher education. In other countries the entrance is quite selective with quite high entrance levels. This keeps the number of students quite small whereby the traditional universities have to accommodate the mass of students. In these countries the study conditions– good students, student/ faculty ratios, small study groups - are quite favourable. In other countries much emphasis is laid upon the important task in training a more diverse group of students in order to promote maximum participation, and to contribute to life long learning for those in the workplace or otherwise. Special provisions have been created to enable a larger group to pursue a higher education degree. This includes recognising and giving credit for prior learning achieved through study and in the workplace.

These structural factors are important variables in understanding the nature and the shape of the research function of the UAS sector. It would go beyond the purpose of this study to discuss these factors in detail. Table 2.2 provides an overview of some basic figures on number of institutions and students.

Table 2.2 Institutions and students in UAS (latest available data 2007/08)

	Number of institutions (UAS)	Number of students	Students in BA programmes	Students in (professional) Master programmes	% of total higher education	% part-time/ evening/ sandwich higher education
Austria	20	31,063*	17,184	2,754	12%	32%
Denmark	10	68,512	68,512	0	34%	0
Estonia	21	21,224	21,131	93	32%	10%
Finland	28	134,400	131,000	3,400	46%	2.4%
France	116	122,000	122,000	0	5%	n.a.
Germany	126	545,000*	242,000	22,500	29%	n.a.
Ireland	13**	52,295	51,360	595	44%	38%
Lithuania	27	60,096	60,096	0	29%	55%
Netherlands	39	378,585	365,882	12,637	65%	19%
Portugal	20	96,391	12,383	81,843 licent 2,165 master	40%	n.a.
Switzerland	9	60,800*	47,900	2,100	34%	28%

* These total numbers of students include Diploma students: 11,126 (in Austria), 280,500 (Germany) and 10,800 (in Switzerland).

** This is exclusive the Dublin Institute of Technology (DIT) which is not represented by IoTI. The number of PhD students in IoT programmes amounts to 340.

2.2 Degree structure in the context of the Bologna process

The degree structure shows a rather varied picture. Most countries in this review have changed the traditional degree structure by one which corresponds to the Bachelor degree, being the first degree which prepares for professional work. Some countries restructured the degree structure in compliance with the Bologna process by introducing a tiered-system which gradually replaces the old system. This is the case in Germany and Austria where the two-tiered-system co-exists besides the traditional (undivided) one-phase Diploma course (but will decrease in terms of student numbers overtime). These countries recognise three different types of degree programmes:

- Bachelor degree programmes (6 semesters)
- Master degree programme (2-4 semesters)
- Diploma programme (8-10 semesters)

All three types of degree programmes are expected to be complete in themselves and each level leads to a degree that qualifies the student for a profession. In the BaMA structure courses for the bachelor degree are designed to lead to a first degree qualifying for entry into a profession.

In other countries the professional bachelors degrees were established basically following the principles of the Bologna process. The first-cycle professional degrees are mostly 3-4 years (180-240 ECTS). In Finland, Ireland and Switzerland the length of study is mostly three years, whereas in other countries this is four years (Germany, the Netherlands). In the latter countries this length of bachelor courses is often chosen because it allows UAS to integrate a work placement without loosing time for basic education. Consequently, a large proportion (37%) of master courses in Fachhochschulen takes three semesters instead of four semesters as the regular master courses do.

In some countries graduates of UAS (bachelors and masters) are awarded a degree indicating the field of study in question, e.g. Bachelor of engineering (B.Eng.), Master of Social Work (MSW), whereas in other countries such an indication between degrees from traditional universities and UAS do not exist[4].

In addition advanced professional degrees are offered in various countries. They can be part of masters programmes, but also stand on their own.

The question whether the UAS should provide master programmes have not crystallised out in all countries. The following overview shows the countries with a bachelor-master structure and those with only bachelor programmes.

Table 2.3 Bachelor and master programmes

Countries with bachelor and master programmes	Germany, Ireland, Portugal Austria, Switzerland, Finland, the Netherlands
Countries with only bachelor programmes	Denmark, Estonia, France, Lithuania

Of those countries where only bachelor programmes are provided, France and Denmark are quite unique in the sector since they have traditionally short and medium-term higher education diplomas. In Denmark short-cycle programmes are offered at business academics, while the university colleges changed to the standard three years of study. In France the IUT is two-years aimed to train middle-level engineers and managers, but the system has been adapted to the European Higher Education area in the sense that Diploma holders (DUT) can transfer into a university bachelor's programme ("Licence Professionnelle" LP) which lasts one year after the DUT[5].

In other countries shorter vocational programmes exist as well. For example, in the Netherlands the two-years Association Degree is a new programme, still in pilot phase, mainly designed for those already in the workforce who want to update their knowledge and skills. This programme, though, has been incorporated in the Bologna structure in the sense that the associate can progress to the bachelor degree.

Lithuanian colleges in higher education only provide professional bachelor programmes, consisting of at least 180 ECTS credits and last at least three years. At present graduate level studies cannot be directly pursued after completion of the bachelor degree. There are two types of studies: sequential studies and selective studies. The main forms of sequential studies of the first stage are full-time, evening, part-time (or extramural) studies. The volume of these programmes in terms of credits has to be the same for all modes of studies, but the duration may vary.

In the other countries where masters are provided, the number of programmes is quite restricted and limited to particular subject fields. In most countries governments decide which master programmes will be eligible for public funding (for example in health sciences and teacher training).

A relevant issue concerns the nature of the second-cycle up to the masters degrees and the role masters programmes play in the context of the research function of UAS. A clear vision on this issue may contribute to the positioning the UAS in the European Higher Education Area. A few references may suffice to illustrate the views and dilemmas.

[4] This is the situation in The Netherlands. Similarly the German Diplomgrad indicates the field of study and that it was awarded by a Fachhochschule. Graduates of a Diplom course in engineering, for example, obtain a title 'Diplomingenieur (Fachhochschule)' or abbreviated Dipl.-ing. (FH). In the BaMa structure, the distinction in name of the degree is no longer made and German UAS may deliver BSc degrees.

[5] Livre blanc sur the système IUT après 40 ans d'existence: Histoire, Bilan et Perspectives. ADIUT/ UNPIUT.

In the Austrian view Bachelor's and Master's programmes are both degree programmes that are complete in themselves. The challenge is to divide in a meaningful way the traditional degree programmes (Diplom courses) into two tiers which have their own goals qualifying students for a profession and at the same time are related to each other as far as content and structure of the curriculum is concerned.

Portuguese polytechnics traditionally award the two degrees of Bachelor and Licenciado. The Bachelor was awarded after 3 years of studies and the Licenciado (which was organised in two-cycles) after 4 to 6 years of studies. The 2005 amendment of the Educational Act grants the polytechnics the authority to offer a professional master degree as well as the (new) Licenciado. University Licenciado degrees are 180-240 ECTS while those in polytechnics are predominantly 180 ECTS[6]. Although the regulation of the Bologna Process made a clear distinction between universities and polytechnics, some polytechnics distinguish a professional master and a research master, each with their distinctive features regarding research.

A similar situation exists in Switzerland where UAS have the right to offer a limited number of masters degree courses which requires accreditation in order to be eligible for a grant by the Confederation. The CUAS advocates a harmonisation of tiered study programmes ('gestufte Studiengänge'). The BA degree (fulltime) lasts three years, the masters 1.5 – 2 years, each with a professional and academic qualification.

Regarding the issue of professional versus academic masters the German situation is a case in point. Fachhochschulen provide bachelor and master degree programmes (in addition to Diplom degrees divided up in two periods of four semesters each which will gradually be absorbed in the BaMA system). The standard period of study in bachelor programmes is at least three years and no more than four years; Master programmes are at least one year and no more than two years. Where bachelor and master programmes are co-ordinated and taken consecutively, the total duration of studies is normally expected not to exceed a five-year standard period of study. The German UAS sector does not make a distinction between professional and research masters. There only exists a distinction between four different types of profiles: stronger research-oriented, stronger applied-oriented, artistic and education-oriented. The two internationally adopted types of orientation towards research or applied are not principally demarcated and are considered equally scientific. They concern various accents and the differences are relative between them. Both profiles are equally valued.

In other countries the professional masters is the most dominant type and the way this has been shaped betrays a clear difference in the degree structure between universities and universities of applied sciences. The Finish situation is a clear case in point. At Finnish UAS, students cannot automatically proceed to the second-cycle programme, but have first to acquire the minimum of three years of work experience. Another clear difference is that while university bachelors can more or less automatically continue with a masters programme, masters programmes in UAS are not meant for everyone graduating with the first-cycle (bachelor) degree. The objective is that 20 percent of the bachelor graduates would take the masters professional degree[7].

Finally the Irish IoTs make a distinction between taught masters and research masters. Both are masters at level 9 with a generic set of learning outcomes, irrespective of the institution which awards the degree.

The perspective on masters reflects the development of the knowledge society and the growing awareness that this type of professional masters will increasingly be attractive in the context of lifelong learning. This is an important reason to invest in the development of second-cycle degrees provided by UAS.

It would be beyond the purposes of this study to enter at length into the shifts in second-cycle study with mapping the movements of students. For Germany it is known that 40 percent of the bachelor's graduates from UAS continued their study in second cycle programmes[8]. This percentage which includes those moving to traditional university programmes, indicates that a substantial number of students were not confident that the new bachelor's degree would be sufficient to see them through whatever path in life they chose. In their perception a second cycle degree would enhance their employment chances. Also in other countries the movement of UAS bachelors' recipients to second-cycle students grows, with or without bridge programmes (as far as traditional university masters are concerned).

[6] Ferreira, J.B., M. De Lourdes Machado, R. Santiago (2008) The Polytechnic Higher Education Sector in Portugal. In: J.S. Taylor, J.B. Ferreira, M. De Lourdes Machado, R. Santiago (eds.) Non-University Higher Education in Europe. Dordrecht; Springer, pp. 191 ff.

[7] The Bologna Process and Finnish Universities of Applied Sciences ARENE, Helsinki 2007, p. 12..

[8] Minks, K-H & K. Briedis (2005) Der Bachelor als Sprungbreit? HIS: Hannover

A tiered system with different qualification levels is seen as an important step towards the internationalisation of the courses offered and the integration of the entire UAS sector into the European system of higher education. This is the more so when there is progress towards the PhD-degree. Ireland is the only country where the IoTs have the right to also provide doctoral programmes thereby completing the complete three-cycle, although this differs per institution. For instance, DIT (Dublin) has the right to make awards across all its faculties up to and including the PhD (level 10), Cork IoT has the right at level 9 (masters) and for specific areas at level 10 (PhD), while Carlow's delegated authority rests at level 8 (Honours).

In other countries, provisions have been created to facilitate the movement of students from one type of institution to another, including to doctoral programmes. In Germany and Austria UAS Diploma and master degree holders are legally entitled to enrol in all relevant doctoral programmes (PhD) at traditional universities. The HRK (Rectors Conference) recommends universities in all federal states to admit graduates (masters) from UAS to their doctoral programmes under the same conditions and regulations as university masters. Some States contain regulations that permit Fachhochschule professors to participate in guiding doctoral studies and in administering relevant examinations.

What is the importance of a debate on the Bologna process and particularly the relevance of masters programmes provided by UAS in the context of their evolving research function? One obvious reason is that if UAS have to develop their research capabilities, the establishment of higher degrees is crucial. The creation of a 'research mindedness' within the institutions and their units or faculties requires research being carried out on higher educational levels. Professional master programmes have a significant role in developing the research function which is rooted in professional practice and is focused on concrete developments in the professional field. This is not to say that research at UAS should be concentrated in the master phase – and most institutions do not take this position – but masters programmes which contain a clear research component have a positive impact on the level of research that is expected from UAS. As will be shown below, research activities undertaken by UAS constitute increasingly the programmatic basis of a masters programme.

There is another reason why master programmes are important for the research function of UAS, irrespective of whether these are professional or research masters. This relates to the issue of human resources which will be discussed in chapter 8. Here it is suffice to say that if UAS are seriously engaged in research activities, the conditions of employment and career structures should be taken into consideration. This point was strongly brought forward by the Irish partner who states that
the availability of research opportunities, as an important attractant in recruiting highly qualified staff, cannot be underestimated. By providing research and development opportunities, highly motivated and qualified staff can be attracted to these institutions

Favourable research facilities and challenging opportunities which can be offered when there is also provision on the master level, increases the chance of recruiting and keeping research capacity, the intellectual capital of which is needed to stimulate innovation and economic development. The provision of master programmes, for the development of research in the context of professional practice, is also important to keep all courses up to date and will undoubtedly contribute to the quality of education in the bachelor phase as well.

2.3 The research function: policy views and instruments

In the national contexts UAS are assigned with special tasks regarding their role in the overall higher education system. An important component of this role, which has been shared in most countries, is their educational function which is strongly oriented to the requirements and needs of professional occupations. Through this they contribute to the social, economic and cultural environment and provide flexible and innovative industry and society-responsive programmes of study. Several countries also see an important task to promote equality of access and seamless transfer through programmes of study, particularly in the vocational streams of the national educational systems. The research function is a relatively new component in this list of tasks which is not seen as a separate activity, but as an integral part of the overall tasks assigned to the sector. In some countries the research task of UAS has been explicitly formalised in current legislation, whereas in other countries the research function is an emerging phenomenon. National policies show a diverse pattern regarding approaches, views, and policy instruments.

Rather than giving a very extensive account of this pattern for each country separately, table 2.4 summarises in a nutshell current main policy views and policy instruments adopted.

Table 2.4 National policy issues and policy instruments regarding research

	Policy views regarding research	Policy instruments
Austria	UAS should promote innovation and entrepreneurial courses in collaboration with a wide range of providers. The UAS have a legal mandate to conduct R&D and to integrate this in their curricula.	Special funding programmes for the UAS sector
Denmark	UAS have no research mandate, but are obliged to conduct development activities in partnerships with individual university colleges and universities or research institutes, joined in knowledge centres.	Knowledge centres may apply for funding from national research programmes, mostly in cooperation with universities.
Estonia	Research role not explicitly stated, main priority is teaching	UAS that want to undertake R&D have to compete for funding under the same conditions as traditional universities
Finland	Polytechnics are assigned to conduct R&D geared to the needs of business and industry and usually linked to the structure and development of the regional economy.	Establishment of International Strategic Centres of Excellence in STI in key competence areas with regards to future needs of the business sector and society
France	As IUTs are part of the university system, they consequently have the same missions, including doing research	The larger part of staff (two-third) are teachers-researchers and belong at the same time to a qualified laboratory which is eligible for funding from research programmes
Germany	Since 1985 research is legally adopted as an explicit task of UAS. In later amendments R&D has become an official mission at UAS in all federal states.	Since 1992, the “applied R&D at Fachhochschulen” programme of the Federal Ministry of Education and Research (BMBF) plays an important role to improve the capability of third-party funding for applied research and development projects
Ireland	Under the Regional Technical Colleges Acts 1992, research was explicitly identified as an appropriate activity. Since 2000 the role of IoTs in research is strongly endorsed by the Government in subsequent legislation and in The Strategy for Science, Technology and Innovation (SSTI 2006-2013).	Research has been supported through the Technological Sector Research Programme and through initiatives from Enterprise Ireland.
Lithuania	According to the Law on Higher Education, Colleges in HE have to develop applied R&D necessary for the region. Courses should be based on results of applied research, and the role of the knowledge transfer is considered as important.	There is no clear structure how colleges should carry out applied research.
Netherlands	Development of the ‘knowledge function’ of UAS which encompasses “practice-oriented research and design activities” for the benefit of professional practice. Strengthening of the professional culture among teaching staff	Introduction of professorships as a new staff category in 2001 charged to boost the further development of research and research groups within UAS. Specific funding programmes (RAAK regulation) to stimulate applied research for private and public organisations.
Portugal	According to the law, polytechnics have (also) the task to orient themselves towards the “creation, transfer and diffusion of culture and professional know how through (...) research and experimental development”.	There is lack of a national policy for UAS research. Polytechnics are eligible for research funds, but the funding is not especially for them.
Switzerland	UAS have a mandate to carry out application-oriented research and to foster knowledge and technology transfer	Financial programmes are available provided both by the federal and the cantonal agencies, including some core funding.

A few points are notable from this table.

First, in some countries the role of research is strongly endorsed whereas in other countries national policies are exploring ways to define a distinctive research role. Among the latter group are Lithuania, Portugal and Estonia. In Portugal research as such is for polytechnics not a required activity, and it is left to the institutions themselves whether they want to be engaged and how they wish to shape their research. In these countries few provisions exist on the central level to enable UAS to undertake research. However, several research activities are currently undertaken by institutions in these countries. Increasingly research commissioned by the industrial/commercial sector is being carried out.

Denmark and France take a special position given their collaboration and affiliation with universities. The French IUTs are public institutions inside the universities. The research agenda is mainly determined by the affiliated laboratories or research teams who work at the same time in the IUTs. In Denmark the University Colleges function as regional application-focused knowledge centres supported by research agreements with the universities. The Danish Ministry of Education may place targeted research and development tasks in the knowledge centres in connection with different political strategies. In other instances, knowledge centres may apply for funding from national research programmes, mostly in cooperation with universities.

UAS in other countries experience relatively more favourable conditions, both legally and financially. These conditions, however, are not always parallel as the Austrian case shows. Austrian UAS have a legal mandate to undertake research, but since they enjoy a large degree of institutional autonomy and local decision-making powers, the sector experiences a consequent lack of legal obligation on the government level to fund research.

Second, countries differ in the extent to which national policies consider the role of UAS as distinctive, combined with specific policy instruments on the one hand, and national policies that emphasise a more general strategy on the other.

Examples of the latter are Finland and Ireland. Although in both countries the UAS sector has a specific task to conduct research geared to the needs of business and industry and usually linked to the structure and development of the regional economy, their role is strongly endorsed by the government in the context of national objectives and prioritisations. In Ireland the role of IoTs is strongly endorsed by the government and in the Strategy for Science, Technology and Innovation (SSTI 2006-2013). They should promote a research ethos aligned with the development of a national innovation system and the promotion of entrepreneurship that meets the needs of both the individual and society.

In Finland, the Science and Technology Policy Council states that
The national strategy of Finland is based, to a great extent, on research, innovation and success in key policy areas: education, science, technology and innovation. (...) the main principles in this development are prioritisation of operations, national and international profile-building and selective decision-making based on foresight[9].

In this context the Government resolution in 2005 concerning the structural development of the public research system required a national strategy to create and consolidate internationally competitive centres of excellence in science, technology and innovation (STI). These centres will be drawn up under the supervision of the Science and Technology Policy Council of Finland. These Strategic Centres of Excellence in STI in key competence areas will be oriented to future needs of the business sector and society. UAS will take part in these centres, although it remains to be seen what their place will be.

In other countries a more decentralised approach is taken – with policies on the federal state or cantonal level (Germany, Austria, Switzerland) or regional and local level. Several funding programmes have been tuned specially to the UAS, enabling them to undertake research activities.

In the Netherlands research at UAS has been placed in the general policy context of enhancing the professional culture among the teaching staff. The developing knowledge function of UAS encompasses a new staff category of professorships which are leading a group of staff members organised in a ‘knowledge centre’ or research group. In combination with a special programme for funding research (RAAK regulation, see chapter 5) this works both ways. Research is particularly geared towards questions originating from regional companies and (public) organisations with the aim to solve practical problems. At the same time teaching staff will enhance their knowledge and skills by doing research[10].

To conclude this chapter, it can be stated that the UAS sector in Europe is a varied one, due to different national contexts, history and diversity in policy approaches, but that there are also common trends. These will be elaborated on in subsequent sections of this report. One of the central issues concerns the views about the research function especially in relation to traditional university research. On the basis of all the material available for this study it is fair to say that in virtually all countries there is a conviction to preserve the differentiation of research missions between the UAS and the traditional universities, thereby enhancing their roles to their existing strengths[11]. The next chapter focuses on whether a distinctive profile for the research function of UAS can be delineated.

[9] (24.8.2007) (www.minedu.fi/reseach/Science and Technology Council/Reports)

[10] Ministry of Education, Science and Culture (2007) Strategische agenda voor het hoger onderwijs-, onderzoek- en wetenschapsbeleid. Den Haag.

[11] On the national level by governments and various advisory boards. See also several recent OECD reviews on national higher education systems in the respective countries. These views are predominantly shared by the UAS sector itself.

3 Towards a framework for the development of a research profile

3. 1 Drivers for research growth

In virtually all countries it was stressed that the sector of UAS consists of institutions that are by their very definitions primarily concerned with teaching and education. At the same time it is widely acknowledged that the role as educators is evolving. Changing conditions require increased professional education at the highest level, further training of professionals in the workforce and greater enterprise-academic collaboration. The function of research and development must be aligned with this.

In the various documents collected in this study a number of forces can be found which have fuelled the research function of UAS across Europe. Although the emphasis among countries varies, a number of drivers can be denoted that are common in most documents.

① Meeting the needs in the knowledge based economy

Most countries place the research mission in the context of the 'Lisbon' agenda to make the European Union the most dynamic and competitive knowledge-based economy in the world by 2010, with more and better jobs and greater social inclusion. Increasing international competition is creating pressure for improvements in quality and productivity, and a growing need for innovation. A national system of innovation policy has become a major strand of government policy in several countries.

Part of the development of a knowledge economy is the increase of public investment in R&D and the creation of mechanisms to ensure that the investment in research is turned into commercial value to the greatest extent possible. The university sector shows, according to policy makers, important shortcomings when it comes to the application of research results. The term often coined in this context is the 'knowledge paradox', referring to the incapability to translate research results into knowledge utilisation and valorisation. By taking part in the innovation agenda, UAS will have an important role to unlock untapped potential.

In this sense UAS are seen as the answer to the perceived difficulties in knowledge transfer to the economy. By its mission and nature the UAS sector works closely with industry and can conduct R&D geared to the needs of business and industry. Because of these ties they can contribute to transform scientific knowledge into new products and services. This potential of UAS research has been envisaged with increased research capacity with a view to contribute to innovative environments. In this sense they are seen as a strong partner of the overall national innovation system.

② Boosting regional innovation

Traditionally innovation policy has been concentrated on high tech manufacturing and national priority areas, but awareness grows that innovation strategies must build on each region's distinctiveness. Most countries are witnessing a policy shift from giving state aid to disadvantaged regions to supporting indigenous development through skills, promotion of entrepreneurship and innovation, for example through the involvement and commitment of higher education institutions. The location of UAS throughout the country, their connection with local business and communities and their openness to working life with the private and public sectors provide a basis upon which real progress can be built.

UAS are expected to be regionally engaged and to contribute to regional innovation. The policy of establishing new institutions is subject of regional policy (strongly emphasised in Ireland, Finland, France and Portugal) to be responsive to regional needs. This concerns the provision of courses, student internships, meeting training needs of the local workforce through special programmes, and supporting regional entrepreneurs. Many UAS have also regional representatives in their governing boards.

The development of the research function of UAS fits into this regional strategy. The political request of the UAS sector's development was to strengthen the regional environment. Regional engagement is often explicitly mentioned in legislation and governments see a future target to further strengthen and enhance the R&D co-operations of local companies with regionally oriented UAS. It is expected that their practical relevant R&D activities will ensure a sustainable transfer of know-how.[12] In a broader sense research can be used to cultivate networking between UAS and their environment, thereby contributing to the technological, scientific, commercial, social and cultural development. New partnerships will drive innovation by bringing together public, private and third sector organisations to come up with innovative solutions to local or regional challenges.

[12] See for example the Austrian paper „Strategie 2010", Research Council (RFTE), p.21.

③ Focus on SME's

In line with the first two drivers, the UAS have a special task to focus their research activities on the needs of regional small and medium sized enterprises (SMEs). It was pointed out in several national reports that the majority of small businesses is unlikely to have the scale or the resources to engage in in-house research. The research mission of UAS will bring a specific small business orientation to the issue of innovation. This view is well expressed in the Danish questionnaire when it states:
There is a political demand for applied research from universities, but delivery to regional and local communities and SMEs suffers from a mental and technical distance between the world of academics and the world of practice. (UAS...) may reduce this gap between theory and practice, if they can balance the distance in a right way.

Likewise most other countries see an important target of UAS research activities in the innovation and technology transfer to the SMEs. UAS want to be their main research connection. Such a transfer requires intensive quality and quantitative connections with the overall knowledge market. The articulation of enterprise requirements and their input to institute activity is essential to ensure that the needs of the industrial base are reflected in the evolving offering of the institutions. The exploitation of research is encouraging a culture of interaction between researchers and users.

④ Relevance for professional education

The primary task of universities of applied sciences is to prepare their students for professional practice. By staying in close contact with the changing professional demands, institutions can keep their curriculum up-to-date and adapt this to the changing professional needs. Research is seen as an important instrument to translate the outcomes into new knowledge, new teaching contents and to innovative curricula.
In contemporary work settings professionals are in a permanent process of learning and innovation. Rather than applying a fixed set of knowledge and skills, professionals have to be adaptive to a continuous change. Graduates from UAS are increasingly confronted with more and more complex tasks found in the industrial and service sector. For them, problem solving skills, analytical skills, and the ability to communicate about various challenges also in a multidisciplinary environment, are becoming increasingly important. As an international committee on the Dutch degree structure put it: Practical and professional experience of students, by preference from the start of their study and in combination with applied research, will allow these competencies to develop[13].

⑤ Relevance for professional practice

The role of research in professional practice implies a growing need of professional curricula to pay attention to research-related subjects and to enhance the abilities to translate knowledge to application. Basic research competencies of graduates are felt to be necessary to support evidence based practice.

At the same time, as one respondent phrased:
the new professional will increasingly choose to follow non-traditional learning paths to master the necessary skills. The main task for a successful development of the European knowledge society therefore lies in providing an adequate answer to the needs from employers and employees.

These needs concern the updating of skilled knowledge workers, to improve professional practice and to take non-traditional learners in education. In this sense research is seen as bringing together the preparation of future professionals and the improvement and renewal of professional practice. The overused phrase 'reflective practitioners' is applicable in this context as it refers to the process of a continuous reflection about individual actions, approaches and methods adopted, and solutions taken. If professionals have developed such an 'enquiring capacity', they do not take these prevailing methods and approaches for granted and fixed. Research informed by and linked with such a reflective attitude will in its varying methods plays an important role in developing such an attitude, thereby improving and renewing professional work on a continuous basis.

[13] Committee Review Degrees (2005) Bridging the Gap between Theory and Practice. Possible degrees from the binary system. Den Haag: NVO. Compare in this context also a vision from Germany as expressed by M. Stawicki, The Quintessence of Higher Education at Universities of Applied Sciences (Final Conference in Berlin of the Balama project March 2007).

3.2 Research framework rationales

These five drivers in their combination constitute the basis for a further conceptualisation of the research function at UAS. The question arises what the nature of this research is like. Is there a particular profile underlying all the research activities by UAS? What are the commonalities and where do they diverge?
The most common term is applied research which is used in a rather broad sense and includes a variety of activities in the sphere of R&D - research and development. According to the OECD manual for R&D statistics - the Frascati manual[14] - applied research is understood as
original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective, or the objective is to search for practical applications of knowledge.

This description is distinguished from basic research by traditional universities described as experimental or theoretical work undertaken primarily to acquire new knowledge, without any particular application or use in view. The other types also referred to in the questionnaire are:

- Experimental development: systematic work, drawing on knowledge gained from research and practical experience, which is directed to producing new materials, products and devices; to install new processes, systems and services; or to improving substantially those already produced or installed.
- Consultancy work: a residual category of all work mostly on an individual basis to provide services to industry, commerce, public organisations, professional bodies, community and cultural partners.

It is important to note that the Frascati manual acknowledges that there are conceptual problems with these categories because they seem to imply a sequence and a separation which rarely exist in reality. The three types of R&D may be carried out in the same institution and there may be movements in both directions. The linear model of basic research leading to applied research, that supports development followed by market application, is no longer an accurate reflection of what is happening, in the face of growing (scientific, technical, and business) complexity and the requirements for rapid speed to market innovations in the face of global competition. A more strategic approach to collaboration of knowledge exchange is seen as being integral to the effectiveness of these R&D activities.

Nevertheless there have been various attempts to distinguish the type of research envisaged for the UAs from university research. Several documents refer to the distinction between Mode 1 and Mode 2 type of knowledge production, stating that mode 2 type of research should be the domain of the UAS (emphasis on interdisciplinary knowledge, focus on applicability) in contrast to curiosity-driven disciplinary research by traditional universities. Another typology often referred to is Stokes's classification of four types of research known as 'Pasteurs quadrant' with two superimposed axes: the quest for fundamental understanding and considerations for use. Research at UAS is typified as 'Edison research' (pure applied) as opposite to 'Bohr research' (pure basic research)[15]. These types are not mutually exclusive and there is overlap between them.

In order to get a better understanding how the profile of research at UAS can be drawn, some exemplary models will be presented as these are becoming common in successively Ireland, Germany, Switzerland, and the Netherlands.

Ireland: the integrated research continuum

After detailed discussions, the IoT Ireland (IoTI) selected its preferred research framework which has been designed to encourage individual IoTs to pursue their own priorities within its parameters. This attempts to accommodate an industry research focus with the practical realities of the current IoT, key government policies, and the funding available. The selected focus is an integrated research continuum, consisting of a mixture of industry-oriented and academic research.

This framework allows for the diversity of research competencies and experiences within the IOTs. The scope of research for most IoTs is an integrated research continuum embracing both basic research and applied research. This framework as illustrated in figure 3.1 aspires to enable a continuum of research from basic through to industrially-applied research.[16]

[14] OECD (2002) The measurement of scientific and technological activities Frascati manual: Proposed standard practice for surveys on research and experimental development. Paris: OECD.

[15] Stokes, D.E (1997) Pasteur's Quadrant – Basic Science and Technological Innovation. Washington: Brookings Institution Press.

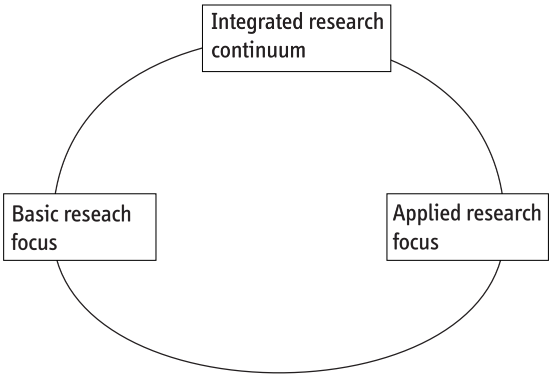
[16] Institutes of Technology Ireland (IOTI) Framework for the Development of Research in the Institutes of Technology 2008-2013.

To achieve the appropriate profile of research by 2013 in the IOT sector, the current annual research programme should break down as follows:

- 15% of research should be industry related research, i.e. supported by research funding from industry and industry schemes (e.g. Enterprise Ireland);
- 55% of research should be cutting edge applied and strategic industry related research;
- 30% of research should be basic research. This research provides the understanding for future cutting edge applied and strategic research.

To avoid any misunderstandings, it is noteworthy to add that although the majority of IOT priority research areas are in science and technology, they do also have clear relevance to other areas of socio-economic activity and need, including health, tourism, various aspects of business and social support, and also design and the creative arts.

Figure 3.1 Research Framework Rationale for Irish IoTs



Germany: applied-oriented research

In Germany the term application-oriented research and development is mostly used. The German Rector's Conference states that application-oriented research and transfer of knowledge and technology are recognised as central tasks of the UAS. A core element is the transfer of results of basic research into innovative solutions of practical problems up to product development.[17] A later decision-paper by the Fachhochschulen in the HRK (2007) endorses the strategy to connect fundamental and applied research and product research as a way to foster innovations and impulses for new developing markets.

The core competences of this innovation chain have been assigned clearly whereby universities, UAS and enterprises all concentrate on parts of this chain. The core competence of UAS is situated in applied-oriented research described as follows[18]:

- It is oriented towards utilisation and transformation of knowledge into operation,
- It is situated close to the market, is application-oriented and not in the last place focuses on a speedy transformation of research results into innovations,
- It is theory-oriented in the sense of construction of theories, but as a rule with a view to practical soluble problems in economy and society. This means responding to concrete requests from enterprises and other societal organisations with "product and customer-oriented" research for the short and medium term.

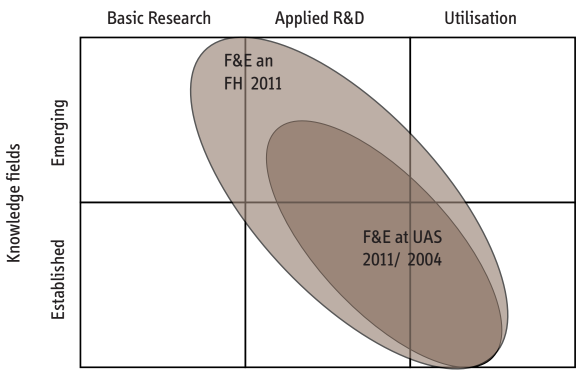
In the innovation chain the applied oriented research needs to be strengthened. This emphasis is quite explicit in the 7th Framework of the European Commission. The German case can be illustrative to connect fundamental research and applied-oriented research by creating joint research endeavours across institutional borders. For this purpose various network structures between UAS and traditional universities have been built.

Switzerland: extension to more basic research

In the Swiss model applied research and development subsumes all activities that have as a main purpose to generate new knowledge and to combine existing knowledge in new ways. This presupposes knowledge in its scientific and artistic context. The research problem formulations are based on problems that are connected with practice. The newly acquired knowledge flows back to education and practice which in its turn will directly or indirectly benefit a concrete circle of users and society.[19]

In this view as expressed by the Swiss Rectors' Conference of FH (KFH) there is continuous interaction between basic and applied research and a fundamental demarcation between them can hardly be made. Research at UAS is not merely limited to the established sciences, but

Figure 3.2 Perspective of research at Swiss UAS



[17] Profilelemente von Universitaten und Fachhochschulen, HRK 1997.

[18] HRK-Mitgliedergruppe Fachhochschulen vom 26.11.2007. Forschungspotentiale ausschöpfen für das High-Tech-Land Deutschland.

[19] Rektorenkonferenz der Fachhochschulen der Schweiz (2008) Forschung & Entwicklung an Fachhochschulen. Grundsatzpapier.

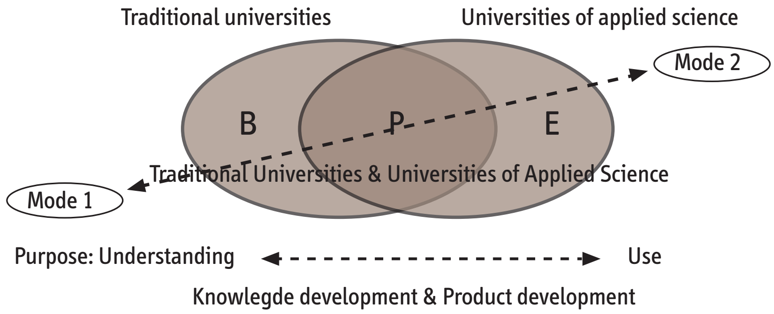
increasingly seeks and discloses emerging fields of science as well. They undertake basic research in the extent to which this is necessary to attain applied-oriented research objectives. In the following figure the KFH illustrates the direction in which R&D at UAS should move in 2011.

The Netherlands: practice-oriented research

In the Dutch view research at UAS should - contrary to basic research by traditional universities - contribute to the maintenance and development of professional practice in society. As this practice is increasingly evidence based and thus knowledge-intensive, innovative research and knowledge transfer play an ever growing part in this. Several policy documents from advisory councils considered 'design and development' an appropriate term and particularly 'practice-oriented research'[20]. The latter term is preferred above 'applied research' as this term does more justice to the professionally-oriented character of research as it encompasses a diversity of research practices.

On the basis of the previously discussed Mode 1 and 2 distinctions and Pasteur's quadrant the figure 3.3 represents how the UAS sector itself considers the identity of traditional universities and the UAS and their respective position within the knowledge infrastructure[21].

Figure 3.3 The position of traditional universities and UAS in the knowledge infrastructure



In this figure the left section B stands for basic, disciplinary academic research (mainly Mode 1, Bohr's quadrant) which is predominantly carried out by traditional universities. The UAS are localized in the P and E area which stand for:

P = Practice-oriented research (more and more Mode 2; Stokes: Pasteur's quadrant)
E = Experimental development of new products and services (Mode 2; Stokes: Edison's quadrant).

Research in Pasteur's quadrant is driven by a desire to achieve a better understanding of what is being studied and at the same time by the desire to develop new products and services. The emphasis may lie sometimes on the one and sometimes on the other. Such a description of research subsumes a diversity of research activities which are all rooted in professional practice. It is practice driven and at the same time is directed towards long-term strategic issues.

What can be said of all these models presented here? First, that research at UAS embraces a continuum of activities that are not clearly delineated from each other. Rather than seeing research as simply a duality between two types of research, there are overlapping areas between them. Much applied research will be based on basic research finding and methods and it increasingly covers emerging aspects of science as well. In this sense there is no clear demarcation of research by UAS and traditional universities. However, the practical dimensions and orientations constitute the major directive for research action.

Secondly, research at UAS is seen as constituting a vital link between various knowledge domains and various actors in the field. Knowledge circulation seems an appropriate term to indicate that there is no linear process from knowledge to application, but a continuous interplay between the development of new knowledge and insights and products by practitioners in the various professional fields.

In the concluding chapter this view is taken up and included in a more comprehensive model of what research at UAS encompasses, including its significance for education. First, we turn to the way UAS are shaping their research activities within their institutions.

[20] See for example Adviesraad voor het Wetenschaps- en Technologiebeleid (AWT) (2005) Ontwerp en Ontwikkeling. De functie en plaats van onderzoeksactiviteiten in hogescholen. Den Haag.

[21] Adopted from Borgdorff, H, A. Van Staa, Joh. Van der Vos (2007) Kennis in Context. Onderzoek aan hogescholen. TH&MA, 5, p 10-17.

4 Funding of research

As shown in the previous section, the research role of the UAS sector has been more recognized in many countries and consequently discussions are taking place about adequate funding of the sector. Several countries have also implemented specific programmes to build up capacity and infrastructure in the sector and to support UAS research activities. The principles how research in the UAS sector is funded vary somewhat across the 11 countries, but the general scheme and main challenges are quite similar. As the questionnaires show, the funding system is currently under discussion and many countries are in the process of finding an appropriate funding model for the sector.

In broad terms, the UAS research is funded through three main funding sources. First, research can be funded through the regular core funding to UAS. In most countries, a core funding for research is a part of the budget to (research) universities, but the UAS are traditionally seen as teaching institutions and the core funding for research is either missing or very limited. The other group of funds are research and development grants, often by research councils or other public agencies. These grants are usually competitive and fund specific research projects. In some cases UAS need to compete for these funds along with traditional universities, in other cases there are targeted programmes designed for the UAS sector. Third stream of funds comes from contract research, either from private companies or public partners. The importance of this funding source seems to be growing in most countries. The relative importance of each of the three sources varies considerably across countries. All these funding sources with their advantages and disadvantages will be discussed in greater detail in this chapter.

4.1 Core funding

The core funding of UAS rarely includes funds for research. From the 11 countries taking part in this study none has a specifically allocated core funding for research activities, with the exception of Switzerland where UAS have a core funding from the federal government. In some countries the UAS staff is expected to do also research and the core funding is supposed to include some research funds, but the budget is not separated for teaching and research funds[22]. This is the case in Germany where basic funding includes money for research, but the proportion of research funds for the UAS is considerably smaller than for traditional universities. A small core funding component was recently introduced in Lithuania – about 0.003% of total funds to UAS. These funds are allocated to UAS based on their performance, depending on their success in attracting contract funds from other sources. The UAS sector in France is quite unique as UAS function in close cooperation with traditional universities. Research-active UAS staff has access to publicly funded university laboratories and their research activities are thereby indirectly subsidised. Also Denmark is a special case where the application-focused knowledge centres conduct R&D in collaboration with the universities.
In Finland UAS do not have a regular core funding for research but the funding of all UAS has been based on performance contracts and some contracts include allocations for R&D activities.

The lack of stable core funding for research is in many cases mentioned as a major problem. The representatives of national associations see this funding source as essential to build up research capacity in UAS:
... [core funding is] most useful to strengthen the research function of UAS in a sustainable way. The development and the preservation of competent, full-time research staff need reliable basic funding. In the moment there is only R&D funding based on contracts for specific projects, thus leading to bonding of resources and to research staff being kept in "stand-by position". Research can not be provided only by teaching staff besides their teaching and administrative obligations. (Austria)

The problem of relying only on project funds in UAS has received attention also at the national level in Austria. The head of the Austrian Research Council has publicly recommended a basic funding for R&D in the UAS sector. A national evaluation of the FH plus programme (see below) pointed out the difficulties of being able to keep research staff without stable core funding where it says, that the ability to keep qualified staff for the entire project duration is a major challenge. Especially in the end phase of a project staff mobility and job search of those on temporary contracts cause serious difficulties for other project members.[23]

The Ministry of Science and Research is reserved and tends to enhance the already implemented programmes in the area of targeted and contract funding, despite the fact that a survey instructed by the Ministry recommended an increasing of the federal budget for a basic funding of the scientific activities of UAS[24].

[22] From the questionnaires it is not always clear whether the UAS sector receives core funding for research or not. Some 30% of the institutions report that they get no core funding for research. About half report that the core funds for research are between 0 and 10% and another 20% report that the core funding is over 10%. These results should be interpreted critically. Some respondents may have presented the data on total core funding, not only that of research; the others may have had difficulties with interpreting what to count as core funding.

[23] KMU Forschung Austria, Endbericht zur Zwischenevaluierung des Impulsprogrammes FH plus, p. 4.

[24] "Auftragsforschung an österreichischen Fachhochschulen" AMC, Hanisch and Turnheim, April 2008, 12.

Similar issues are indicated in Germany. Stable research funding is needed in order to build up a stable research infrastructure:
... Professors at UAS have to teach 18 hours a week, they have not enough time to do good research and the UAS don't have young scientists below the professorial level. The UAS need money from research programmes to get staff etc. to support the professors in doing research. (Germany)

Also in Switzerland it is pointed out that
... core funding is very important for building up stable R&D capacities (human resources, infrastructure. (Switzerland)

Similar discussions are taking place in Finland where concrete efforts are made to include research funds (ca 20m Euros) as a part of UAS core budget but until now the plan has not materialized yet.

4.2 Research grants and targeted programmes

In most countries the majority of public research funds are distributed by national science/ research councils, based on competitive grant proposals. In some countries (e.g. in Finland and Denmark) UAS are not eligible for such research grants and only traditional universities can apply. In other countries UAS can compete along with them on equal terms. Such research grants are for example the only public funding source for research in Estonian UAS. Such competition, however, often puts UAS in a weak position. The selection criteria in national research agencies tend to prefer basic research and are thus not favourable to the type of research conducted in the UAS. Research capacity and infrastructure in UAS is usually not comparable to traditional universities and this makes successful competing very difficult. The problems with applying for research funding through national agencies are repeatedly pointed out in questionnaires:
... The national research funding system is tailored for Universities and not for UAS [...]. The budget and the criteria for research funding are based on basic research and less on applied and experimental development. (Portugal)
... lack of success in [national research programmes] points to deficiencies in research capacity and a lack of historical research funding.
... Hence, any programme designed to grow research in the sector must first address these core issues by a dedicated funding programme. (Ireland)
... It's difficult for a Lithuanian UAS to participate in 7FP, Eureka programmes because of lack of scientific potential. Lithuanian colleges started just 6-8 years ago.

It is therefore evident that equal access to competitive research funds is not sufficient for developing research activities in the UAS. Some stable funding either through core funding or special programmes tailor-made for UAS is needed in order to develop research capacity in the sector and to fund the research that is conducted in UAS. Such targeted programmes are increasingly implemented in countries. Two types of programmes seem to benefit the UAS sector: some programmes are accessible only for the UAS, the others are open both to traditional universities and UAS but they target applied and regionally relevant research that fits better the profile of the UAS research.

Ireland is a good example of the challenges of public funding for UAS research. Institutes of Technology have no core funding and must compete for the funding next to universities. In recent years the total funding for research has considerably increased. The "World -Class Research" sub-programme has a budget of 3.5bn Euros and it includes various initiatives, such as Science Foundation Ireland (SFI), the Programme for Research in Third Level Institutions (PRTLI), the Research Councils, and Technological Sector Research initiative (TSR). The competition for these research funds is not favourable to the UAS. PRTLI is the most important source for capital funding for research in the country but the UAS sector has been able to secure only 1.5-2.5% of the total funding. The capital investments in UAS remain a problem as the facilities are designed for teaching purposes only and do not support research or consultancy activities. From SFI funds only 1.5% reached the UAS sector. TSR is designed better to meet the needs of the UAS sector. The programme is administered by IOTI (the association of IOTs) on behalf of the Higher Education Authority. 55 TSR Core Research Strengths Enhancement projects have been funded in 9 UAS since 2000. 488 master's research projects were funded in all thirteen Institutes of Technology over the period. The "Enterprise Ireland" (total budget of 1.3bn) is another sub-programme to promote research. The programme includes funding for the Applied Research Enhancement initiative dedicated to IOTs for technology transfer support. The programme also includes an innovation vouchers scheme aimed at SME engagement with higher education institutions.
Similar developments can be found also elsewhere. National science councils manage special programs that are either entirely dedicated or at least more favourable to UAS. In Switzerland, the National Science Foundation has DORE program that supports applied research with practical relevance. An innovation agency CTI in Switzerland supports technology transfer in general and is an important source for UAS.

In Austria the Fachhochschul - Forschungsförderungsprogramm 'FH-plus', developed by the Ministry of Education and the Ministry of Transport, Innovation and Technology. The programme, with a budget of 18,1bn Euros, aims to enhance R&D capacity in UAS and to develop structures to better cooperate with industry. This enables UAS to position themselves as competent development partners for the economy.
In Estonia the so-called SPINNO Programme has been developed and co-financed from EU structural funds. Managed by Enterprise Estonia, the programme aimed to create a favourable entrepreneurial environment within the R&D institutions and UAS in Estonia. It also advocated the potential for effective co-operation between enterprises and UAS in order to increase the benefits from R&D activities.

Germany has implemented a series of programs, all with a unique focus, that are designed to suit and develop the UAS sector: "Application oriented R&D at Universities of Applied Sciences (aFuE) , "Applied Research at Universities of Applied Sciences in co-operation with Business (FH) and R&D at Universities of Applied Sciences in Cooperation with Business (FHprofUnd). All these programs were designed to develop research capacity in UAS and they are administered by the Federal Ministry of Education and Research. In Germany there are also research project grants that are open both to traditional universities and the UAS sector but that suite better the UAS profile than traditional research grants. These programmes target collaboration of firms and universities, UAS and research institutions (e.g. PRO INNO II). Current policies are oriented to strengthen applied oriented research at UAS by a consequent further extension of the current federal promotion programme for research[25].

The Netherlands has two main initiatives that support research in UAS. The professorship (Lectoraat) programme was established in 2001. The professor[26] is a newly established senior staff position in UAS that heads a so-called knowledge circle. This is a research group within the university of applied sciences that links together education, professional practice and practice-oriented research in socially relevant fields. These applied research groups have approximately 10 lecturer-researchers and external experts. Students will often be involved in applied research projects too, as part of their studies. Research groups share knowledge with companies and institutions, carry out applied research and develop new knowledge. The public funding for professors is augmented by funds raised from industry, non-profits and public sector organisations. Approximately, the government pays for 70% of the lector positions and the rest is funded by external partners[27]. About 400 professorships have been funded by the government. The RAAK programme (Regional Attention and Action for Knowledge circulation) is another government funding program targeting UAS research. RAAK aims to improve knowledge exchange between SMEs and Universities of Applied Sciences. Subsidies can be awarded to regional innovation programmes that are aimed at the exchange of knowledge, and are executed by a consortium of one or more education institutes and one or more businesses. In addition to these two, several other programs exist in the Netherlands that are open both to traditional universities and UAS but fit well with the UAS type of research. For example, the government provides innovation vouchers to SMEs (Đ2500 for the smaller and Đ5000 for the larger vouchers supplemented with Đ2500 co-financing) and this programme subsidises knowledge transfer between the industry and higher education institutions (similar to Ireland).

In a comparable way legislation exists in France of an R&D Tax credit system which is a government support for companies that want to invest in R&D activities. The Finnish Funding Agency for Technology and Innovation (TEKES) also supports cooperation projects between researchers and business enterprises. This source is open both for UAS and traditional universities; however, UAS can get only partial funding from TEKES while universities can get full funding. As discussed below, Finnish UAS rely much more on European funds than national funds in their research activities.

In Portugal a major programme QREN (National Strategic Reference Framework) was implemented to improve the competitiveness of the country, to develop knowledge, science and technology, and for other economic and social goals, using European structural and cohesion funds. PRODEP (Education Development Programme for Portugal) especially has been used to fund staff accreditation in UAS. In sum, research grants and targeted funds to the UAS sector can take a very different shape. Competitive research grants available equally to traditional universities and UAS tend to put UAS on a weaker position, unless they specifically target the type of research conducted in UAS. Some countries have implemented specific programs to systematically improve research capacity in the UAS sector (Austria, Germany, Netherlands). Some countries have special programs to fund applied research in the UAS research (e.g. RAAK in the Netherlands, FHprofUnd in Germany). In many cases research in the UAS sector is funded through more general programmes that support university-industry partnerships and regional innovation. Sometimes a budget matching of these programmes (national, regional, municipal) with third-party funds is mandatory, sometimes it is optional.

[25] HRK-Mitgliedergruppe Fachhochschulen vom 26.11.2007. Forschungspotentiale ausschöpfen für das High-Tech-Land Deutschland.

[26] In the Netherlands there is a distinction between these professors at UAS and professors at traditional universities. The formal title of professor at UAS in Dutch is 'lector'.

[27] Until 2008 the professorships were allocated by a special agency that assessed the applications from institutions. Since then the allocation is allocated directly to the institutions.

4.3 Contract funding

Besides the governmental core funding and public research programmes, contracts from private business, non-governmental sector or public agencies is another important funding source for UAS research. The importance of contract funding in the general budget of UAS and the type of most common partners vary considerably across countries. Table 4.1 summarizes the proportion of funds coming from different partners to the UAS sector as identified by the representatives of the national associations of the UAS. The first column shows the proportion of contract funds from the total budget of the institutions and the subsequent columns show how these contract funds are divided by source. For all the countries that have provided the data, income from contracts varies between 5% and 27%. It should be noted though that grants from research council and targeted programs are also included here as contract funds. The highest proportion of contract funds is presented in Austria, almost half of which comes from research council/targeted programs. The lowest proportion of contract funds is reported in Lithuania (2%). The funds from the industry reach the highest proportion in Switzerland – 50% from all contract funds. The European Union is most strongly represented in Finland – 26%. In Lithuania the contract funds come from various private activities, such as consulting, publishing and offering short courses.

Table 4.1 Proportion of contract funds from the total university budget and the proportion of different funding sources for the contract funds (latest available year)*

	Proportion of contract funds from total UAS budget	Research council or targeted programs	Industry	Public bodies or non-profit organization	European Union and other international sources	Other
Austria	27%	48%	11%	36%	5%	
Denmark	7.5%	11%	6%	3%	2%	77% (multi-year agreements)
Estonia	n.a.					
Finland	12.5%	7%	8%	8%	26%	52% (from Ministries)
France	n.a.					
Germany	7.5%	14%	33%	30%	12%	10 % (foundations, donations)
Ireland	5%	86%	11%		3%	
Lithuania	2%	10%	7%		2%	80 % (consulting, publishing, conferences, short courses)
Netherlands	13.5%	12%	55%	21%	6%	6%
Portugal	n.a.					
Switzerland	8%	40%	50%	8%	3%	

* figures as estimated by the representatives of national associations of UAS

In general, representatives from many countries have mentioned that the proportion of short-term contracts with a specific client (business or public agencies) has increased in recent years and expect this trend to continue. This is particularly assigned to improving research capacity in the UAS.

4.4 Trends in the present funding model

Although funding sources vary considerably across countries, some common trends and changes in UAS funding can be identified. As already mentioned, it seems that in many countries short-term client-oriented contracts have become more important in UAS' budgets. This is probably related to the improved research capacity in the sector as well as public pressures to attract more external funding. Since the role of UAS in providing applied research for local partners is increasingly recognized, many countries expect to see the increase in research with local partners and accordingly also more funds from these partners. There are also some signs that UAS may have become more successful in attracting public research funds next to universities. Here is a selection of statements about future trends that the representatives of national associations have observed:

... the funding from [contracts] is increasing [2002: 21.144[m Euros]; 2004 28.151; 2006: 43.493) (Austria)

...we expect an increase in regional and local community/private sector funding and a decline in government funding. [...] it is very difficult to get sufficient governmental funding for development activities, and university colleges are therefore also forced to search for other funding sources. (Denmark)

...There might be difficulties to get so much new EU-projects to the new funding season that our UAS's had in the last season. (Finland)

...from these [government strategies and plans] we can conclude that the role of UAS's R&D would strengthen in the regional innovations and together with the industry and local bodies. Of course we hope more funding for UAS's R&D in national and international level as well. (Finland)

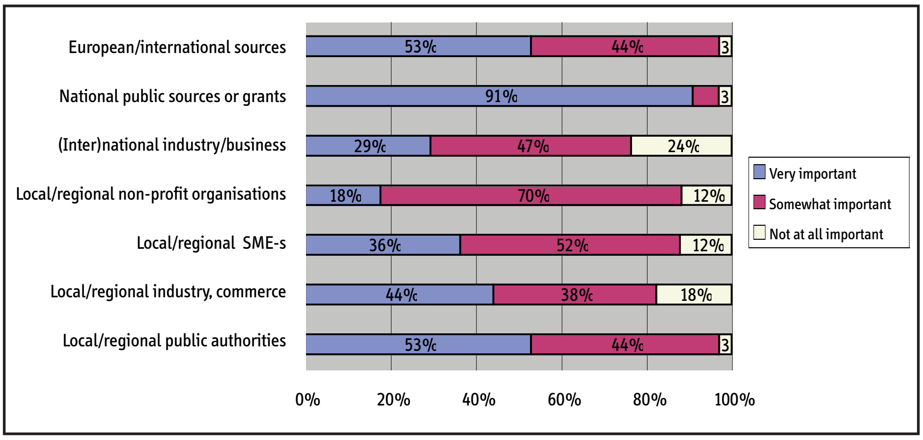
... [the contract funds have increased] due to a) improving the R&D competences; b) development the R&D capacities by the UAS (Switzerland)

In many countries the government has made more money available for research. This is often linked to programs that encourage innovation, knowledge transfer and applied research. From these resources also research funding in the UAS sector has improved. Targeted programs for the UAS have become more common. Countries where such targeted programmes do not exist (e.g. Lithuania) seem to miss such programmes and point out that a systematic funding through such programs would be most useful to strengthen research in the sector. In Denmark funding for R&D in the UAS sector is determined by political agreements which result in varying and not necessarily stable allocations for such activities.

4.5 The importance of different funding sources

Figure 4.1 indicates how the UAS representatives evaluate the importance of different funding sources for their research activities. Public sources of funding are clearly the most important sources for UAS. 90% of all respondents think that national public sources and grants are a very important funding source and additional 6% thinks that it is an important source. Local and/or regional public authorities are the second most important source – 53% considering this as a very important and 43% as somewhat important source. European sources are also relatively important: over half of the respondents (53%) consider this source as very important and 43% as somewhat important. Funds from industry seem to have a somewhat lower importance. For 25% of UAS inter/national industry is not at all important; for 19% and 13% local/regional industry and local/regional SMEs, respectively, are not an important funding sources.

Figure 4.1. The importance of different sources for the funding of research activities



Question: Indicate how important [are] the following sources for the funding of research activities for your institution.

When university representatives were asked to indicate what kind of funding sources (grants, contracts, programmes) are mostly preferred given the research policy of your institution, two main sources appeared: (1) funding from national and European research agencies and (2) funding from industry.

Institutions prefer funding from national and international research agencies primarily because the funds support bigger and longer-term projects which allow long-term planning and enable to build up research infrastructure. Such funds are also an indication of research quality:

... these projects usually have a larger volume, they allow for a medium to longer term planning of R&D (Austria)

... they strengthen the competitiveness of our research and are a quality indicator (Switzerland)

In case of international research funds, the funds are a further indication of quality and provide opportunities for establishing contacts with colleagues abroad:

... international quality assurance and networking (Austria)

If targeted programmes from research agencies exist in the country then these sources tend to be the priority for institutions, such as FH-plus in Austria, FHprofUnd in Germany, RAAK and Lector programme in the Netherlands, CTI and SNF DORE programs in Switzerland, etc. They are highly valued because institutions have a relatively high chance to secure such a grant, the grants provide a stable funding and they are relatively large-scale:

... provides a considerable and contact inflow of external funds (Austria)

... there are the best chances to get a funding [...] with reasonable probability (around 30%) (Austria)

... [most preferred are subsidies from the targeted government programs that have] longer periods and build the focus and mass (The Netherlands)

EU funding seems to be very important in some countries but not so much in other countries. EU structural funds have been particularly important in Finland and to a lesser extent also in Lithuania:
... external, extra resource for regional development (Finland)
... easiest funding source (Finland)
... the terms of funding are reasonable (Finland)

However, as mentioned earlier, institutions are sceptical whether the present high level of European funds in the UAS sector can be continued. Next to the EU structural funds also other EU funds, such as 7th framework programs contribute to research funds in UAS. Framework programs are oriented directly to research rather than social and regional development. In Switzerland, for example, the Framework programme seems to be quite an important source for UAS funding. Also in some other countries such EU funding is increasing in importance:
... international programmes (tenders, FP7) are gradually becoming more important (The Netherlands)

The funding from the industry is highly valued by institutions. It is mostly interpreted as an indication of the relevance of the research, but it is also seen as an opportunity to be in touch with the practitioners in the field and to contribute to society:
... [most preferred are] contracts for short activities and programmes for long research activities, but always on industrial problems (France)
... indicates practical relevance of our research (Austria)
... contribution to strengthening the competitiveness of the regional/national economy (Austria)

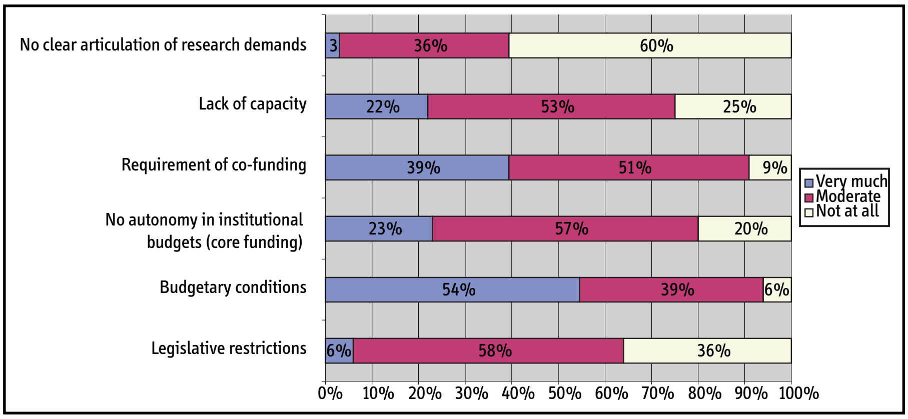
In some cases, a combination of funds is most preferred. For example, a Danish UAS found that most preferred are:
... national grants combined with private industry funds for a period that is longer than 2 years. We find this gives the projects a sufficient length and volume, which allow teachers to participate along side teaching. There is the motivating factor attribution to business development and being involved in developing state of the art technology or business process. (Denmark)

Small research and training contracts from either private or public agencies are particularly valued in countries like Estonia and Lithuania, where probably access to bigger grants and other sources is relatively limited. Such contracts are the most feasible external funding source and they also provide an opportunity to work together with the practitioners in the field:
... pedagogical staff members are in close cooperation with these institutions as their social partners (Lithuania)
... As our history as an higher education institutions is very short (from 2006), we try to teach the teaching staff together with the representatives of the field to get common understanding and work out common projects. (Estonia)

Technical and administrative aspects may also be important when choosing a project partner, for example preferred projects are:
... research projects that do not involve matching [...], do not require excessive administrative accounting (Netherlands)

Two other issues deserve attention. One is the extent to which funding is an inhibitor to research. Funding-related issues are perceived clearly as the most important inhibitor of research activities in the UAS sector. 54% of university representatives find that budgetary conditions are very important and 39% as moderately important inhibitors to research (Figure 4.2). The requirement of co-funding is also seen as a major obstacle (39% and 51%, respectively) because of a lack of structural funds to match with. These proportions by far exceed other potential inhibitors, such as legislative restrictions or lack of clear articulation of research demands. Lack of research capacity in UAS is perceived as a moderate inhibitor to research.

Figure 4.2 The importance of potential inhibitors to research activities



Question: What conditions currently exist that inhibit research at UAS?

Another issue is the internal allocation of research funds in higher education institutions. An effective allocation mechanism may help to create incentives for academic sub-units and individual academics to improve their research activities. Secondly, an effective allocation mechanism may help to channel scarce research funds to these departments and individuals that can make a maximum use out of the funds. However, many respondents left the question unanswered which may be explained by the fact that UAS do not have much "free" core funding for research activities that can be allocated to departments and individuals according to some general allocation principles. If structural funds are lacking or limited institutions do not get down to internal allocation mechanisms at all. If most of the research is conducted with the funds from earmarked projects and grants then the issue of internal allocation mechanisms is of course irrelevant. Table 4.2 demonstrates how research budgets at central institutional level are allocated to departments or individual faculties. It is difficult to draw any generalisations or cross-country comparisons. Some form of formula funding seems to be the most common principle and negotiations with individual faculty members seem to be also used in many occasions.

Table 4.2 Internal research allocation mechanisms

	Strongly	Somewhat	Not at all
Formula funding	46%	19%	35%
Negotiation with departments	37%	44%	19%
Negotiation with individual faculty	23%	55%	23%
Historically-based procedures	21%	42%	38%

Question: How are research budgets at central institutional level allocated to departments or individual faculty?

4.6 Concluding remarks

Several important issues come out of the analyses of the UAS funding system in these eleven countries. The lack of research funds is perceived as a main inhibitor of UAS research. What is particularly missing is a stable core funding for research activities for UAS, which forces them to rely on short-term project funds. Stable core funding is however essential in order to build up research capacity and research infrastructure in UAS. It is also essential to recruit qualified research staff, which is not possible with unstable funds of short-term projects. Further, longer-term (multi-year) and larger projects from national agencies allow better planning of research activities.

Another point is related to the competition for research funds. It is nowadays widely accepted that a significant proportion of research funds should be allocated to projects competitively. Yet a competition between traditional universities and UAS tends to put UAS on an unequal position. Such research grants tend to be designed for the type and level of research conducted in universities. As a result, UAS are rarely successful in securing the grants and considering that writing the proposal is already a time-consuming process, the funding source is not appealing for UAS. UAS are in a better position if national research agencies have special programs targeting applied research and/or university-industry cooperation as these programs usually meet more effectively the needs and capacity of UAS.

Regarding core funding: the problem which is inherent to the nature of projects is especially urgent for the UAS sector compared to universities, because of the lack of a basis funding for their research infrastructure. Basic funding will be essential to ensure a sustainable innovation-performance and technology-transfer to SMEs and their research connection.

5 Nature and scope of research at institutional level

In this section we turn to the institutional level and consider how institutions shape their research within their organisation. Generally speaking they comply with national policies, conditions and legislative statements. These are important frames of reference which enable institutions to develop their own research policies. Most national associations stress that within these boundary conditions, the organisational parameters are mainly left to the individual institutions themselves.

Subsequently we will discuss how the research function has become part of the mission of institutions, what they see as important aspects of research, how research is initiated and organised in the institution, what research strategies are pursued, and finally whether and how the quality of research is assessed.

5.1 Research as part of the mission of the institution

Asked about the extent to which research is an explicit part of the mission or strategic objectives of the institution, 74 % of the institutions in the survey indicate that research is an explicit part of their mission. 40% of them indicate that their institution has a strategic plan developed and accepted across the whole institution. Such a plan is used to set targets and monitor achievements.

Another 17% indicates that a plan has been developed and only partially implemented, or restricted to some departments only, and 9% of the institutions indicate that there is no plan and that research is mainly an ad hoc activity. In this latter group, a few institutions refer to a recently established unit which is in charge of developing a research plan. In referring to these plans, institutions give a variety of motivations which generally are in tune with the objectives of research and development as stated on the national level, both by national authorities and current legislation. Regularly reference was made to views and recommendations prevailing at the national association of UAS.

In Finland for example, the National Innovation Strategy affects strongly the R&D agenda of Finnish UAS. Moreover, Finnish UAS take into consideration the periods of the Development Plan for Education and Research, the triennial performance agreement periods of the Ministry of Education, as well as the EU programme periods.

In France and Denmark, the respective institutions follow their research mission in accordance with the specific institutional context in which they are to operate. In France the research policy is defined by the laboratories of the IUTs according to the quadrennial planning of the ministry. In Denmark the research mission takes place in the context of the research institutions with which UAS have to collaborate.

Considering the various statements of UAS across Europe two rationales for research appear to dominate the research mission of institutions.

- the relationship with and benefit for professional education
- transfer of knowledge, innovation and regional development

Both aspects can be found across countries, most of the time in combination whereby both aspects are equally stressed.
... to acquire new knowledge within a practical and applied context, to enhance professional and technological development and to improve academic curricula.. (Portugal)
... to improve the quality of teaching and serve the needs of working life ... through research is an active player in the regional innovation environment (Finland).

Some institutions seem to accentuate the one or the other position. Examples of mission statements to take the contribution to education as a point of departure are:
... applied research is a precondition for research oriented teaching...(Austria),
... to educate / train students to become fully competent professionals in a globalised knowledge society. Applied research and embedding of applied research in curricula are both essential for this objective ... (Netherlands).

Other institutions stress that R&D are practically oriented, aiming to support the development of business, and creating new business in the region. These institutions see themselves as active players in regional innovation environment as a developer and implementer of the regional innovation strategies. Some UAS in Finland, Switzerland and Ireland are stressing this view. As an Irish IoT puts it:
We highlight the increase in commercialisation activity at the Institute, growing links with companies in the region and enhancements of the Institute's expertise base to support innovation and technology transfer (Ireland).

The views which range on a continuum from knowledge transfer to the market and commercialisation of knowledge products on the one end and relevance for the curriculum on the other can be seen as different accentuations but not necessarily as contradictory missions. They can go together and be mutually supportive. The education preparing students for their professional work is based on the needs of working life and its development.

However, there can be different accents depending on the rationale of undertaking R&D. If the aim of research is to benefit education, the curricula provided will be the point of departure for determining the research agenda. If knowledge transfer and contribution to the regional innovation agenda is the point of departure, curricula tend to be more following. The position on the continuum diverges when responding to demands from industry becomes an activity of its own without hardly any repercussions for education. This tendency is stronger in the extent to which institutions are in their research depending on external demands combined with contract funding. If relevance for the curriculum is the major purpose, this may not necessarily mesh with practical needs.

Another kind of subdivision of the research mission is the scale and the focus on regional development. One of the main drivers for research growth at UAS is, as indicated before, its relevance for regional innovation. For this purpose collaboration with the local industry should be stimulated. Some UAS interpret their mission in a rather narrow sense, partly also because they were established quite recently or because their research function is in the beginning stage of development.

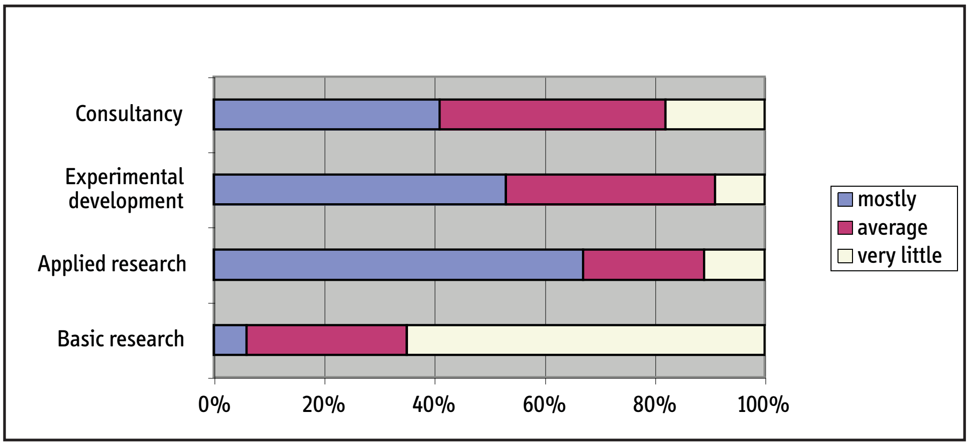
Other institutions consider this regional orientation in a broader perspective. They tend to link the regional significance with their national and international ambitions. These UAS - proclaiming themselves as ' leading UAS' - strive at scientific excellence in selected topics on an international level which enables them in turn to perform technology transfer functions in the region. Their ambition is to take part in strong international collaborative networks.

Some of these institutions can be found in for example Austria, Ireland, Switzerland, and Finland. They emphasise the internationally competitive character of their research. The choice of topics should be related to regional, national and international trends. The institution is deploying its R&D in key areas of regional expertise, in cross-border interaction and strong international collaborative networks. It would be too simple to wave aside these international missions of UAS as being too ambitious. The inclusion of international components can well complement the regional tasks. As one Finnish UAS puts it, the R&D activities promote the competences and competitiveness of central Finland's economic and working life both nationally and internationally. In its R&D strategy plan for the coming three years this UAS has formulated as its missions to be
a recognised and sought-after development partner which is perceived as a significant actor in the innovation system of Central Finland.

In other words, regional innovation is not based solely on regional research as such. Several UAS also focus on particular areas as well as economic sectors to achieve critical mass and thus one UAS may contribute regional inputs across a country. Or as another UAS put it: "we are locally engaged, internationally oriented".

Various strategic plans which have been accepted by the management of institutions contain targets for the institution as a whole: the monitoring of achievements, staff development, quality of research, contribution to education and to professional practice. These issues will be discussed in later sections.
How do institutions consider the main types of research as distinguished in the previous chapter? Figure 5.1 shows how institutions divide the different types of research activities they undertake.

Figure 5.1 Type of research activities



Question: What types of research activities are undertaken?

It appears that applied research is by far the dominant type of activity, 63% of all institutions say that this is mostly the case, and over 20% on average. Altogether 35% of institutions say that they are mostly or on average involved in basic research, which in a way may suggest that in more than a third of the institutions applied research and basic research cannot too straightforward be delineated from each other.

Several institutions point out that the distinction between basic and applied research should not be conceived as whether or not new knowledge is being produced. In their view applied science does not exclude original investigation in order to acquire new knowledge. It is, however, directed primarily towards a specific practical purpose. This research effort adopts a multi-disciplinary knowledge base, by linking different areas of knowledge or combining existing knowledge. This view corresponds with some national profiles as indicated before[28].

France is a special case where IUTs are closely connected with their respective universities and the importance of basic or applied research depends on the label of the affiliated laboratory (as assigned by the French qualification institution -AERES). Although the missions of those laboratories both encompass basic and applied research, IUTs are relatively stronger involved in the activities of technological research (ERT) and the technological platforms (PFT).

Other institutions emphasise that applied research as understood by the Frascati Manual also needs a thorough approach and should comply with methodological requirements. If research does not meet current standards of scientific rigour, it is not useful as practice-oriented research since it produces no valid and reliable knowledge[29]. In this view the standards are not basically different from basic research, or as one institution puts it
Research is the development of knowledge. The collection, analysis and presentation of information is carried out in a systematic way. Use is made of scientific models and current scientific criteria. Research focuses on the development of general valid knowledge or knowledge that applies to several situations (The Netherlands).

Another reason frequently mentioned to require methodological rigour in UAS research refers to the need to generate new knowledge that is transferable to other contexts as well as the emphasis on the public character of research. This enables to utilise the outcomes for educational purposes as well as for professional practice. Research becomes part of a knowledge circulation process with movements back and forth. Several institutions consistently use the term R&D indicating that research is part of a chain focusing on the knowledge utilisation in order to create new products, services, production processes or new methods, to develop new treatment concepts (e.g. in health care, social work) or to essentially improve existing ones. Research is then understood as knowledge production which contributes to the development of an 'evidence based professional practice' and research questions emanate from the cooperation with professionals. Examples of this process of knowledge circulation are presented in the appendix.

5.2 Organisation of research

The way research within the institution has been organised, carried out and evaluated relates to the level on which research is localised. There are various possibilities:

- Research as an activity of individual staff member
- Research as a feature of a subject field or institute
- Research as a feature of a whole institution which has adopted a particular profile

Research activities at UAS have very different forms and levels which are dependent on how research activities are initiated and find their place in the institution. From a list of possible ways to initiate a project, respondents were asked to indicate the three principal ways in a priority order. Table 5.1 shows the priorities as the weighted calculations (first priority three times, second two times and third one time) in descending order of priority.

[28] The UAS rector's conference in Switzerland adds some flexibility, since some development of basic knowledge is foreseen where needed for practical application, while it is excluded that UAS engage in basic research for itself. See B. Lepori, Research in non-university higher education institutions. The case of the Swiss Universities of Applied Sciences. Higher Education, 2007.

[29] See Leijnse, F., J. van Hulst, L. Vroomans (2007) Passie en Precisie. Over de veranderende functie van de hogescholen. Hogeschool Utrecht: 01 Kennis voor Kennis.

Table 5.1 Initiation of research activities

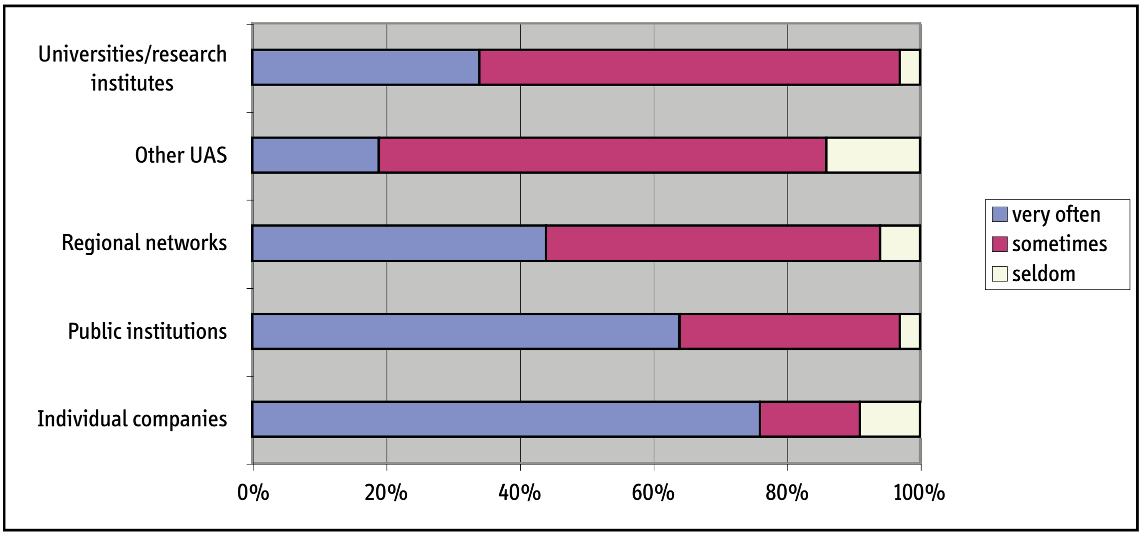
Response to demand from companies	44
My institution is focused on sector-specific areas	44
It has the best fit with my institution's strategy	32
Initiatives by individual staff members	24
We identified important business clusters in its region	24
Response to demand from professional organisations	20
We focused on a gap in the market left by other HE institutions	7

Question: Generally speaking how are research activities initiated?

Response to demand from companies and the focusing on sector-specific areas show the highest scores. Research requests emerge 'bottom up' as a response to external demand. But other elements also occur showing that institutions pursue a certain research strategy or identify particular needs. Professional organisations play to a lesser degree a role, but generally speaking the table shows a rather diverse pattern.

The question was also asked about the frequency of organisations participating in a research project (figure 5.2).

Figure 5. 2 Frequency of participating organisations



Question: Give an indication of the frequency of participating organisations in a research project

This picture shows that the larger majority of participating organisations concern individual companies, namely in 76% of all cases. Public institutions are also more than average mentioned as a vey regular partner. The other possibilities are less common across all the countries involved. Participating in regional networks occurs relatively more in Finland, Austria and Switzerland. Collaboration with universities / research institutes takes more place in France, due to the specific position of IUTs, and occasionally in other countries. Overall the picture is quite diverse and it shows how UAS are positioned in a varied network of participating organisations, the individual companies being the larger group.

The question was asked how UAS organise their research activities, for example regarding the major decision-making structures and services available. The way UAS can organise their research activities can vary between a centralised or top-down approach, a decentralised bottom-up approach and some combination of both. Most institutions indicate that the organisational centre of research lies at the decentralised level, mostly at the individual department level and even further down to sub-groups and individual staff members. The latter are strongly depending on whether they are capable to obtain research contracts on their own initiatives. This decentralised policy by UAS is seen as a way to assure the value of research for their educational programmes without any organisational separation between education and research.

A few institutions have established separate research centres with own stated objectives, budgets and research staff. These centres are more the exception and are only possible when they are in a position to cover to some extent the current operative costs. They operate – connected with various networks with renowned partners – on a high level and they increase the reputation of the institution and have a high potentiality to attract research funds. These centres are more loosely coupled within the overall organisational structure of the UAS and enjoy a relatively high degree of autonomy.

A variant of the separate research centres exists in Denmark where university colleges engage in partnerships with traditional universities. This cooperation mainly takes place through knowledge centres that carry out interdisciplinary development activities.

Most institutions, however, emphasise the benefits of central dedicated units which provide a number of services. Some institutions are growing in their research activities and they feel a need to restructure their current research units in larger ones. Many institutions maintain a central unit which has coordinating functions to support individual departments. They provide the following services (in order of occurrence):

- A central contracting system required for all research activities of staff
- Assistance to SMEs in specifying their needs
- An enquiry point for SMEs/ portals
- Entrepreneurship Centre
- Technology Transfer Offices (TTO) for big or smaller companies (liaison officer, business managers)

There are still a number of institutions (9 out of 36) that indicate that this is all determined decentrally by departments, by separate units or by faculty members (individual or in teams), although in some cases it was brought forward that some restructuring in the near future is needed.
In a few cases reference was made to the development of Enterprise Development Centres which are managed as separate legal entities or holding companies. The research strategy is defined by a separate body of representatives from management, heads of degree programmes and R&D experts. This structuring and management of R&D is more the exception and takes place mainly in the area of technology transfer.

A recurrent issue that institutions in many countries are facing in organising their research concerns its rather fragile organisational character. Being dependent on contract funding without a sustainable funding base for a longer period accounts for this. A few references may illustrate some national contexts.

The lack of core funding was stressed by the Austrian partner (see the funding chapter). Also in Lithuania it was mentioned that colleges have developed strong relationships with local industry, social partners, but that the services delivered are short-term and that a systematic funding base for the development of R&D activities is lacking. Portugal refers to the predominant attitude in Portuguese civil society where higher education institutions - because of their public character - should bear all the costs of their research but should share the results obtained. It is evident that in such an environment companies are less prepared to pay for research.

In other countries where national or state funding programmes exist for the UAS sector, the prevailing dependency on external funding is also important as these programmes often require co-financing by industry.

In Germany research has a strong 'bottom-up approach'[30] whereby research is often an activity of individual staff members, i.e. professors. They differ in the extent to which they can attract external funding for their research. The number of professors doing active research varies extremely and ranges from only a few percent to 100 percent. This dependency on individual staff, combined with a high teaching load of professors as well as a limited number of middle level research staff to support research, gives research a rather fragile character.

The dependency from individual staff may be overcome by constituting larger research groups (and not necessarily research centres as discussed before). This can be illustrated in the Dutch case where research has been organised in the professorships (lectorensystem), consisting of a professor who on average has a mean appointment of 0,6 for a four-year period, and as a rule has a research group in which about 10 teaching staff members are participating with a total of 3.3 fte. This small scale of the professorship has led to the concern - also observed by the OECD's thematic review on the Netherlands - that the system is at present 'scarcely more than a drop in the ocean'[31]. The process by which professors are allocated broadly disperses the available resources. This limits the capacity to build a critical mass of sufficient depth and expertise for UAS to function more effectively as innovation partners for companies.

One Dutch UAS considers in its strategic plan the risks professors encounter in terms of the scope and the fragmented character of research.
Because of the limited scope, professors have less influence on the research projects they can carry out and to maintain and develop their external relations (...). This also leads to a multiplicity of themes and research domains. These are sometimes so small that these are not recognised by the professionals in the world of work, neither by the regional environment. Those professors that aim a larger

[30] Cf. Bundesministerium für Bildung und Forschung (2006) Forschung an Fachhochschulen

[31] OECD (2007) Thematic Review of Tertiary Education: The Netherlands. Paris: OECD.

scope are depending on the market. The demand from the market for consultancy and other services may be at odds with the development of in depth programmatic lines in which the professorship wants to focus on in particular (Netherlands).

This kind of duality as expressed here is inherent in the position in which UAS across Europe have to operate. Because of the dependency on third-party funds, institutions are confronted with a diversity of research requests from various clients in the regional market. Many of these requests have a quite messy character and as the German report states, "a central problem is the short date of many projects, and with this, the lack of continuity in the relevant fields". Also in other countries the lack of resources limits to build a sustainable research basis which is more than a collection of short-term activities.
This situation makes it difficult for institutions to develop clear research policies. It is therefore not surprising that several institutions in the questionnaires expressed a need for a structural re-organisation of research at their institution which would increase the scope and reduce the fragmentation of their R&D activities. In the following a few directions will be highlighted in what UAS themselves see as desirable options.

5.3 Research strategies and prioritisation

A general direction to overcome these problems is to better organise and integrate research within the general objectives and profile of the institution. Especially the concentration on particular knowledge domains can be found across some countries. The Dutch UAS referred to above agreed on a number of priority areas within the institution. These priority areas will not be determined centrally, but developed in consultation between faculties, their professors and the external constituencies. Investments will be made in these areas, in order to strengthen the electorates regarding content, personnel and funding. This strategy aims to arrive at some 'condensation' of research around particular thematic areas.

Similar approaches have been taken elsewhere, such as in Germany, where a UAS defines particular profile lines and organises research work predominantly in cross subject institutes, as well as some UAS in Switzerland and in Finland. These initiatives appear to create more focus and mass in their research which is a guarantee for more accumulation and enhancement of research expertise and competences. Reference was made to semi-autonomous research centres and centres of excellence, sometimes in collaboration with traditional universities.

Some Austrian UAS mentioned the establishment of research centres that are in a position to cover the current costs for a substantial part themselves. These centres operate on a high level and due to their connection in various networks with renowned partners increase the reputation of the institutions and consequently the chances to acquire funding.
Ireland seems quite ahead in the direction of supporting a vibrant research culture that values both individual and team-based research. One IoT for example facilitates the creation of integrated multi-disciplinary teams that span School and Theme boundaries and has the capacity to generate competitive and effective responses to new research opportunities. The Higher Education Authority in Ireland supports this development very strongly when it states that a prioritisation of research areas is essential to move towards a critical mass of activity taking place.[32] The HEA adds that
from an enterprise perspective, in order to be able to access relevant R&D expertise, it would be beneficial to have a greater awareness of what level of expertise resides where. Greater promotion of Institutes' expertise/ core competencies, along the areas in which researchers are willing and able to work with industry, would help companies identify relevant expertise.

Worth noting in this Irish context is that the identification of research priorities is not solely left to the institutions themselves, but finds support on the national level and is closely linked to national research strategies. For example, Enterprise Ireland piloted an initiative to establish centres in those IoTs that would grow their applied research competence in areas identified as important for future regional economic growth. This was based on an analysis of regional industry needs. The report by the national partner organisation (IoTI) refers to the work of the Expert Group on Future Skills Needs which identified growth and employment opportunities in six key sectors in three regions over the next decade. These key sectors could also provide a focus for the IoTs and enhance their contribution to development in their regions. According to the expert group, the IoTs are ideally located to respond to the identified needs on a regional and national basis.[33]

The alignment of research prioritisation by the UAS and the external needs is an important aspect to ascertain their research function in the knowledge society. It would be too simple to suggest that UAS have to respond to external demands, how messy and diverse or short-term they may be. As indicated before, the UAS are in an important role to contribute to innovation and knowledge

[32] The role of the Institutes of Technology in Enterprise Development, profiles and emerging findings Forfas (Higher Education Authority), 2007; 184.

[33] This identification with priority areas is more pronounced in the national Strategy for Science, Technology and Innovation 2006-2013 in Ireland which advocates to monitor and prioritise research in line with its strategy. "The IoT sector must focus its research in line with these needs if it is to continue to grow at the appropriate rate" p. 27.

circulation. This is not a one-directed way, but a kind of dialogue and initiatives from both sides. Companies (and especially SMEs) tend to avoid projects that have a high risk in terms of financial or human costs, the outcomes of which are very uncertain. However, precisely in those situations the kernel can be found for exploring new directions. One institution expressed the specific role of UAS in these situations as follows:
Precisely in those situations lies the challenge – and the mission of UAS - to explore and investigate questions that are lying beyond what the entrepreneurs can handle given their time and success pressure. In this sense innovation refers also to the prioritisation of generating the demand by research before meeting the demand. What matters is a weighted balance between generating and meeting the demand – [phrased in German as "Bedarfsweckung" and "Bedarfsdeckung"](Austria).

Such a view gives a perspective on the research mission of UAS which is not merely restricted to responding to the demands from the market. This includes a proactive approach from the UAS themselves if they take their role in the innovation strategy seriously, both nationally and regionally. In this process of knowledge circulation the push and pull factors are continuously shifting from two directions. This perspective may have considerations in the context of a view on the research infrastructure at UAS including the prevailing funding mechanisms as well as the quality and evaluation of research.

5.4 Quality assessment and evaluation of research

Altogether 30 UAS (from a total of 34) indicated that research activities are evaluated on a regular basis. Most of the time this is done by the institutions themselves for each research project separately. Formal criteria seem to dominate, such as execution of work packages, overall goal achievements, available resources, time slots, and project management. 21 UAS mentioned that they get feedback by clients on these issues. Quite often is was stated that when a client comes back for a new project, this is seen as a sign of client satisfaction with the quality of the previous project.
In countries with targeted research programmes for the UAS sector, it is quite standard that the funding agencies conduct reviews of the outputs and effectiveness of its programmes, for example the Austrian "FHplus"[34] programme under auspices of the FH Council, which is responsible for Evaluation and Accreditation.

Another practice is the evaluation by an independent organisation, such as an accreditation agency as part of the overall accreditation of the institution which encompasses some research components. Or like in Finland in the context of the bilateral negotiations with the ministry. In France, the IUTs are subject to national evaluations by the evaluation body on higher education and research - AERES).
Several UAS brought forward the need for a more systematic and a more comprehensive system of quality assurance in R&D and corresponding structures for auditing research evaluation. Although this in its infancy, some initiatives in this direction have been taken. A few references may be indicative.
On the micro level research activities of staff have become a constituent part of the overall teaching plan. A Lithuanian institution refers to the practice that at the end of each academic year teachers have to give presentations about their research activities over the last year. This relates to a specific contract between the individual teacher and the institution. Criteria of this assessment were not mentioned. Other institutions refer to mostly quantitative criteria such as number of publications and other scholarly outcomes, number of contractual relations with companies, and income generated.

In Ireland the government has established a working group to determine and monitor appropriate indicators for the higher education sector as it works towards the objectives of the national strategy for science, technology and innovation. A range of key indicators and targets for the strategy will be monitored regarding degrees delivered, citations, internationalisation (funding from foreign sources) and research commercialisation (such as number of patents, licenses, spin-offs). Also other institutions refer to similar indicators which are currently in use and which focus on recognised scientific production.

Generally the question can be raised whether indicators which are current in research assessments of universities would equally apply to the UAS or whether more specific indicators should be brought in. One Portuguese polytechnic emphasises that the importance of published work must be replaced by other criteria concerning the practical input and solutions obtained. In a similar vein, an Austrian FH states that these (scientific) indicators are important but should be balanced with indicators which are specific for the sector and relate to the mission of the UAS (such as professional field, significance for education, knowledge circulation), indicators which seem less quantitatively to be determined.
In Finland the strategic processes related to the quality management of R&D include the performance agreements concluded between the rector and the units on an annual basis. The quality management of R&D is based on process descriptions and the project evaluation tools are utilised in R&D quality management (recognition, design, implementation and evaluation stages). Self evaluations and the details about R&D work in the Balanced Score Board which includes a large variety of aims and indicators belong to important internally reported data. These will be part of the triennial performance agreement periods between the ministry of education and the UAS.

[34] See http://www.ffg.at/content.php?cid=773

In Austria the evaluation of applied R&D by UAS will take place in view of the following criteria[35]:

- The determination of the research strategies and goals is clearly in line with the strategic orientation of the institution. The structures created or planned for realising and organising the research activities correspond to the requirements.
- The resources for applied research and development are used in an effective and efficient manner, taking the research strategies and goals into consideration.
- Applied research and development activities ensure know-how and technology transfer to relevant industries and business communities or non-profit organisations (NPOs). It is ensured that research methods and results are integrated in the curricula.

The evaluation takes place both on the level of the institution and on the level of the degree programmes. On the institutional level indicators are for example collaboration with R&D and scientific institutions at home and abroad as well as with enterprises (SMEs in particular), examples of results of applied R&D (documentation in the form of patents, publications and reports, information about implementation in the business world, if applicable)."[36] For evaluation on the degree level see chapter 7 on the link between teaching and research.

Finally, in the Netherlands a quality assurance system is in development for the entire UAS sector. Basic idea is that each UAS is responsible for an internal selfevaluation of research per research unit. The Dutch UAS agreed with a branche protocol for the entire sector that regulates quality assessment of research on a six-year basis. Basic idea is that research will be evaluated and validated by a special committee to be appointed by the HBO-raad in cooperation with the Dutch Ministry of Education. This committee will be formed by experts in research, education, business and the public sector. This external evaluation has to be preceded by an internal self evaluation by UAS themselves for each research unit. This self evaluation should encompass the mission and profile of the unit, positioning within the institution regarding organisation, strategy and human resources. Other aspects include for example the quality of researchers (their qualifications and experiences), collaboration with other units internally and externally, and output and impact of research (e.g. publications, and other products and impacts).

The external evaluation focuses on these issues and considers whether outputs are satisfactory regarding knowledge development within the domains, valorisation to professional practice and relevance for education and training. Finally a validation committee will assess for a six-year period the overall quality assurance system corresponding to the requirements as set in the branche protocol and certify the audit systems of the UAS. Some Dutch UAS started an internal audit systems to assess their professorships anticipating the national system (see box).
The existence of a quality assurance system which includes the research activities of UAS as well as the development of evaluation indicators for research is by most institutions seen as an important factor in developing the research function of the UAS sector as a whole. This corresponds with earlier findings from a study by the OECD that identified evaluation criteria the most important factor (after funding) that impacted on the process to grow research capacity in so-called newcomers[37]. The active use of performance indicators should help institutions to match internal evaluation processes with external processes to ensure that research is meeting international standards. Institutions can use the results to help shape priorities, funding mechanisms, staff recruitment etc. In this

> Utrecht UAS (NL) developed an internal evaluation system which focuses on the intrinsic performances of the research group in the domains professional practice, education, science/research, and the management and research policy of the group. Evaluations both assess the achievements so far and intend to give directions to the development of the knowledge and research function of the research group. Starting point of this so-called sci-Quest method is that research and knowledge production occur in diverse contexts and domains. Within these domains the criteria for, say, relevance, validation, usefulness, reputation and funding can vary substantially. Since quality is seen as a multifaceted concept, centres can develop their own profile of activities.
> The research group draws up a self evaluation which describes how the group has carried out its mission (management and organisation) and how this has affected the three domains of professional practice (external orientation and knowledge circulation), education/curriculum innovation and science/ research. Additionally stakeholders are invited to give their view about the functioning of the research group and assess the activities. Finally the group reflects both on the achievements and the outcomes of the stakeholders' review.

context the Austrian Research Council takes the view that, in order to optimally fulfil the innovation- and technology transfer to the SMEs, international benchmarking in the UAS sector is essential[38].

35 Evaluation-regulation of the FH-Council, 2005, Page 6f.

36 Guidelines of the Austrian FH Council for the Accreditation of Bachelor's, Master's and diploma degree programmes, 2006, Page 19f.

37 Ellen Hazelkorn (2004) Growing Research: Challenges for Late developers and Newcomers. Higher Education Management and Policy Vol. 16, no.1, OECD, p.133.

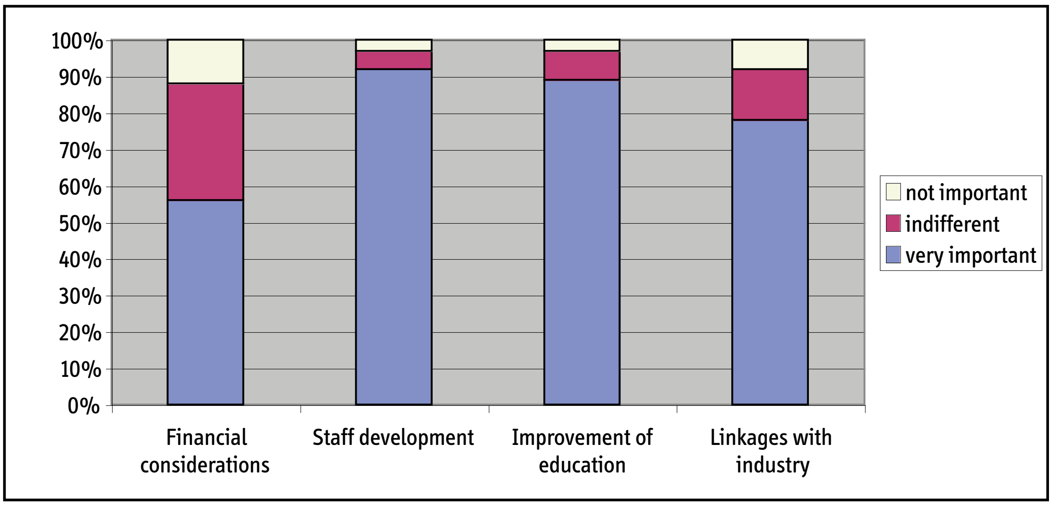
38 "Strategie 2010" Research Council (RFTE), pp. 15 and 29ff.

6 Impact of research on (regional) innovation

6.1 Research contributions

As indicated in the previous chapters, research at UAS has several functions, both for the internal process in terms of attracting extra funding and improving education, as well as propelling the links with professional practice. Figure 6.1 shows how the institutions assess the different benefits of research.

Figure 6.1 Benefits of research for the institution



Question: How do you consider the benefits of research by your institution?

The development of staff is seen as the highest benefit for the institutions. Many institutions have at one point appointed their staff on the basis of their teaching qualifications and research is an important vehicle to develop competencies of staff that are important from the institutional perspective. Linkages with industry are relatively less seen as very beneficial to the institution, but this is still 78%. Financial considerations are the lowest, indicating that attracting funds as such is not the major aim and is always placed in the context of the other benefits for the organisation.

A general problem expressed in many countries is the incapacity to formulate and articulate industry-led research needs. This articulation is essential to ensure that the needs of the industrial base are reflected in the evolving offering of the UAS. In parallel with this, as was indicated by several institutions, many companies are unsure as to how to identify and access expertise which is potentially available in UAS. An improved system for the identification and communication of this expertise is needed to assist companies in knowing who to contact for their requests. UAS in their turn have to find potential clients to work with and connect the needs from the working field with their own possibilities. Personal contacts are seen as essential in this field, but more structuring of these contacts are felt necessary. Table 6.1 presents an overview of the kind of areas in which UAS in their research activities make an important contribution.

Table 6.1 Contribution of research (in absolute numbers)

	Top three	**Appropriate**
Graduate employability in region	19	32
Research collaboration with local/regional industry	19	29
Spin-off activity/ start-up companies	18	21
Supporting (SMEs)	14	28
Management development	14	17
Technology transfer	13	30
Developing local partnerships	11	33
Support for community development	7	33
Research collaboration with (inter) national industry	5	27
Strategic analysis of regional economy	4	18

Question: In which areas do you see your institution in its research activities as a whole making an important contribution (please tick all those appropriate and the top three which make the greatest contribution)

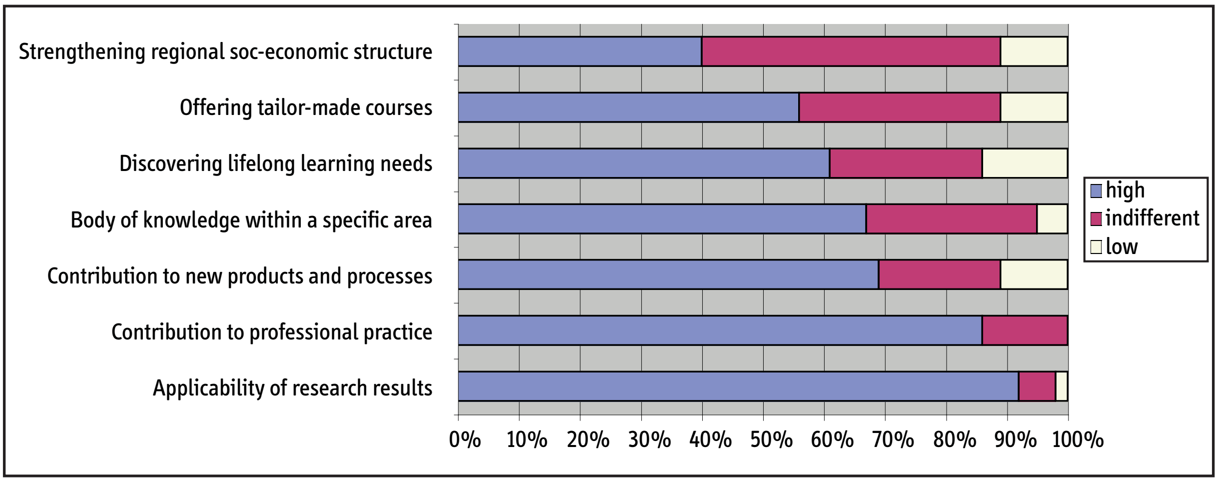
This table shows that the graduate employability overall is seen as making the most important contribution. Through the channel of preparing well-trained professionals an important goal of knowledge transfer can be achieved. As a UAS puts it:
Well-trained workers are able to develop further research inside the enterprises, making these enterprises more innovative and competitive. Research helps to improve the qualification of employees of enterprises as well as the teachers/ lectors (Lithuania).

Another area of making an important contribution is the research collaboration with local/regional industry. This can take many forms, often depending on the subject area. In engineering subjects, for example, high regard is given to the development of problem-solving activities or designing a new type of technology that is innovative or part of a whole production chain, and diffusion of technological knowledge. Several UAS work directly with companies to develop their expertise.
In social work and education (teacher training) research has more the character of a process of taking back and forth ideas within communities of practice. For example, a project based on research on the impact of learning environments on schoolchildren's social and mental development yields pedagogical analyses which aim to give
teachers, educational managers, social workers tools to analyse and cope with factors that provoke, influence and maintain barriers for development of learning and social behaviour (Denmark).

This type of research contributes significantly to lifting standards in professional practice and action learning. Such a connection between research and professional practice moves away from a linear model of knowledge transfer towards a reciprocal one in which research and practice are in a continuous dialogue. This view is well expressed by a UAS that has adopted "Social Innovation" as its research priority area when it states that
... in close cooperation with the practice new concepts will be formulated which enable professionals to tackle traditional social problems with new problem solving approaches or elaborate on emerging problem statements... The impact and utilisation of research is judged by the professional community since the transfer of results in the professional community is an integral component of development (Switzerland).

A remarkable finding from table 6.1 is that the development of local partnerships scores relatively low, as well as the item 'strategic analysis of regional economy'. Hardly half of all respondents consider these areas as appropriate and only four institutions see this item as belonging to the top three. This figure is contrary to what might be expected given the regional focus of the institutions quite low. This finding is supported in table 6.2 which presents how institutions assess the impact of research on a number of objectives.

Figure 6.2 Impact of research activities



Question: How do you assess the impact of research activities on ...

The strengthening of the regional socio-economic structure received the lowest impact. Only 40% of the institutions considered the impact as high, while half of them assessed this as indifferent and another 10% as low. The contribution to professional practice and the applicability of research results have the most favourable scores.

6.2 Emergence of regional networks

The awareness grows that in order to develop the research function of UAS to boost regional innovation and to strengthen the socio-economic structure in regional areas collaborative networks are key enabling factors. These networks are instrumental in developing a closer relationship between UAS and regionally based enterprises focusing on applied research. This is particularly important in regional areas with a high number of SMEs. Although initiatives in this direction are taken in several countries, a few references will suffice here.

In Austria several regional networks have been established, some of them originally set up by UAS themselves. UAS generally play a keyrole within these networks which operate mainly as a platform for exchange between UAS and enterprises. The R&D-staff at UAS usually maintain excellent relations with these companies since they have acquired work experience in these enterprises and industry in general as well as in UAS. This fact is seen as a keyasset of UAS not only with relation to their R&D activities but also to their curriculum. There is a strong incentive to involve external experts both in teaching and in research and external stakeholders in decision-making processes in UAS. Governing boards, in which business members are involved, serve as a platform for the articulation of external demands. This should ensure that curriculum development takes place in interaction with the socioeconomic environment.

Ireland is another example where initiatives have been taken to develop stronger partnerships with society around them, including local communities and the business world. In this way these partnerships contribute to overcome insularity and support less advanced regions in order to build a high quality in specific areas of activity. Enterprise Ireland has a specific role in developing a closer relationship between IoTs and regionally based enterprises by enhancing the networking across the IoTs through the mechanism of TecNet, which is a vehicle used by the Institutes to manage cross college collaboration.

TecNet is a company jointly owned by all the IoTs and it is co-sponsored by the Institutes themselves and Enterprise Ireland. Individually, the Institutes can make a marked impact on the region. In concert, they can draw on a significant pool of talent and facilities across a wide range of topics. Enterprise Ireland has supported TecNet on the basis that there are worthwhile gains to industry in the regions in facilitating the co-ordinated delivery of services across IOTs. Within the IoT system TecNet functions as a facilitator and central resource, especially in the field of research.

To ensure that the links between the expertise in the IoTs and local industry occur as a flexible process, Enterprise Ireland will work with each institution at a local level to agree common agendas setting out how the two organisations will work together to address local industry needs and to see where the commercialisation of research can bring benefit to the economy.

Another example is the RAAK programme in the Netherlands (Regional Attention and Action for Knowledge Circulation). This programmes aims to establish regional networks in which UAS, enterprises, representatives of regional authorities, and mediating bodies collaborate and initiate joint research projects.

Competence centres have also a networking function, similar to the example of the Irish TecNet. They aim to more closely couple research expertise with industrial needs and to build an infrastructural base in the research system that is closely linked with the expressed needs of enterprises. There are several international examples of these centres which aim to build critical mass in relevant technologies and technology programmes to exploit critical mass. Examples were reported from Finland and Germany.

In conclusion, regional networks and competence centres may well contribute to strengthen the collaboration with local and regional industry and the regional social and economic structure in general. In some countries evaluations of the effects of these networks are underway. But there is evidence that these networks and centres help to identify relevant expertise within UAS as well as to facilitate the articulation of enterprise areas of interests. This would help to ascertain that the research priorities of UAS are aligned with the industrial base. This may crystallise more as the industry-driven research networks progress and the competence centre initiatives gets underway.

7 Links between education, teaching and research

A general and uncontested view is that the research function at UAS is motivated by its relevance for education and teaching. Research should contribute to the actuality and the quality of education as well as the anchoring of education in professional practice. National policies take the position that it should be left to the institutions how their research can support education and involve students in research and development projects.

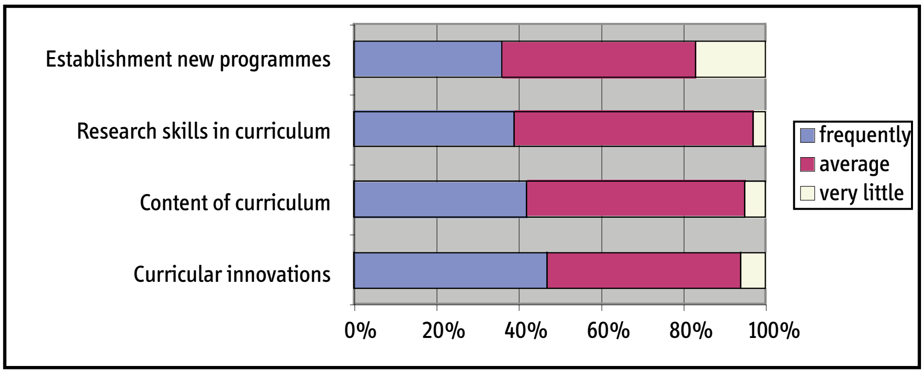
7.1 Contribution to curriculum development

In order to assure such a link, a few national governments have made this part of the quality assurance and accreditation of study programmes at UAS. Institutions are then obliged to show how research and education are connected. Some accreditation agencies require a specification of how each programme and the members of the teaching and research staff are involved in the research activities, and how the research methods and research results are integrated in the teaching process. The Austrian council, for example, requires for the masters programmes a description of how students are involved in the organisation of R&D activities under the teachers supervision and how this has been realised through project work, placements and diploma theses."[39] A few countries use a quantitative measure, such as the number of students involved in research. This occurs in, for example, Austria and Finland where the respective ministries require statistics on how many ECTS students have earned in R&D projects.

Most institutions state that the research at their institution is aligned with the educational goals of the institution. More than 50% of all UAS underline the statement that a link is the explicit aim and that without it research looses its function. Another 50% tend to support this statement as well but they indicate that this link is not a necessary condition in all cases. They tend not to interpret the link as being too strict and allow some variations.

There are various ways in which education and research can and should benefit from each other. For example, by including research skills in the curriculum, innovating course content, or establishing new study programmes. Some institutions in their strategic plans express the view that research clusters or research groups should translate appropriate aspects of their research into programmes of study both at bachelor and masters levels. Reference was made to the development of a number of unique programmes and courses. In the questionnaire representatives of UAS were asked to what extent research would contribute to curriculum development (figure 7.1).

Figure 7.1 Contribution of research to curriculum development



Question: To what extent does research contribute to curriculum development?

As this figure shows all these aspects occur with a slight majority of the frequency of curricular innovations. But the differences are quite small and they seem more or less evenly distributed with no major differences between them. Given this outcome, there is an overall awareness that it is undesirable to divorce 'learning' from 'researching'.
Part of the curriculum is whether students are involved in research activities and whether this is a mandatory element or takes place on a voluntary basis. 50% of all UAS stated that all students somehow have to participate in research as part of their training. The other 50% indicated that this is optional for students who are interested or depends on whether there are sufficient research projects available for students. Not any institution stated that students are not at all involved.

An interesting way of involving and stimulating students in doing research is by nominating thesis work whereby the practical application of results is an important criterion. The organisation of conferences where students have the opportunity to present the results of

[39] Guidelines of the FH Council for the Accreditation of Bachelor's, Master's and diploma degree programmes, 2006, Page 19f.

their work was mentioned in various countries. Another notable practice was mentioned by a Lithuanian college to form students' research groups that unite the most motivated and capable students to undertake research.

7.2 A typology of approaches

In order to get a better understanding of the research-teaching nexus in curricula different ways of linking research and teaching can be distinguished. For our purposes we used a fourfold typology[40] which was presented to institutions with the question in what ways they construct the link between research and education. The numbers behind each of them are the times these were ticked (where appropriate)

- Research-tutored (emphasis on writing papers and essays) (19x ticked)
- Research-based (students learn by doing research: research as part of project work, assistants in research projects, thesis work) (32x ticked)
- Research-oriented (focused on knowledge construction) (14x ticked)
- Research-led (teaching and learning is structured around actual themes of the discipline or subject area (18x ticked)

The research-based type was mostly mentioned, almost all of the UAS in the sample. This is probably not very surprising as many institutions refer to the important role research has in the period in which students do their internships and do their thesis work. Professional education by its nature focuses its teaching on practice or problem-based learning in which the applied setting is crucial. As a Lithuanian UAS states, "students' papers are based on the application of results of research that they perform". Students may gain experience of applied research and development through practice-oriented learning.

This type is even stronger in postgraduate programmes. Countries with a developed masters programme state how these programmes are accompanied by research projects and that students are required to do real research work applied in an industrial setting. Most often graduate students are involved in R&D projects and their theses have a strong link with current research projects undertaken by their institution. Additional practical and research experience is regarded as an enrichment for their education. As an Austrian UAS puts it:

Projects in the field of industrial management were development projects where graduate students and project engineers are working on industrial topics. Educational aspects of project management as well as interdisciplinary industrial approaches could be developed. The established direct link between education and R&D has also a positive effect on the SMEs in the region that benefit from the innovative approach of the students that sometimes implement their concepts during their internship or thesis (Austria).

The four types distinguished here can be combined in the extent to which they are more student-focused or more teacher-focused and whether the emphasis is on research content or research processes and problems. According to Healy, the research-based approach emphasises the student-focused approach whereby students are seen as participants in the research process[41]. The curriculum is largely designed around inquiry-based activities and the division of roles between teacher and student is minimised. This is contrary to the research-led and research-oriented approach where students are more treated as the audience.

Although the research-based learning is the most characteristic type, this by no means does diminish the value of the other types mentioned which are more teacher-focused. The research-led and research-oriented approaches were mentioned in 53% and 41% of all the cases (34 UAS). The need to provide students with systematic research methods for all students in all stages of the curriculum is considered as a prerequisite by many UAS.

In the research-led approach students learn about research findings. The curriculum content is dominated by staff research interests and information transmission is the main teaching mode. In this context it is seen as important that staff are involved in research: this provides practical experience with working life and ensures that staff remain in contact with partners from the professional field. This has beneficial effects on their teaching and education.

Some institutions point out that the research depth and the actual kind of integration of teaching and learning differs between departments. There are different ways of learning in different subject areas. For example, in engineering high relevance is given to the development of problem-solving skills whereas in social and teaching subjects, social action paradigms are prevalent.

[40] Healy, M. (2005) Linking Research and Teaching: Exploring Disciplinary Spaces and the Role of Inquiry-based Learning. In: Barnett, R. (ed.) Reshaping the University. SRHE & Open University Press. P. 67-78.

[41] Healy, ibid, p.70.

Another issue is what role research plays at the degree level. Some institutions tend to concentrate research skills in the masters programmes whereas others take the position that research skills ought to be taught in the undergraduate curriculum to get students acquainted with them.

In the research-oriented approach the processes by which knowledge is produced is as important as the achievements a such. The view of as Dutch UAS on arts is illustrative here:
The practice of creative design, like in any other practical domain, is to a great extent informed by tacit knowledge. The work of our research groups focuses around research into design, design processes and methods. This research aims to make the tacit knowledge used in creative design practice explicit. (...) Since design problems in the field of art, media & technology are becoming more complex and 'mission critical', designers themselves are obliged to inform their design using research methods (research for design), reflecting on their design methods and processes in order to adapt to new and changing situations (research into design). (...) Design research methods need to be developed in close relation with the design practice itself. ... Design and research need to be integrated on the level of the designer/researcher (Netherlands).

This quote illustrates how the research-oriented perspective is a continuous process of reflection. It is context-specific and oriented towards problem solving rather than towards completing a purely deductive research process. This comes close to the issue of how the link between research and teaching may benefit professional practice.

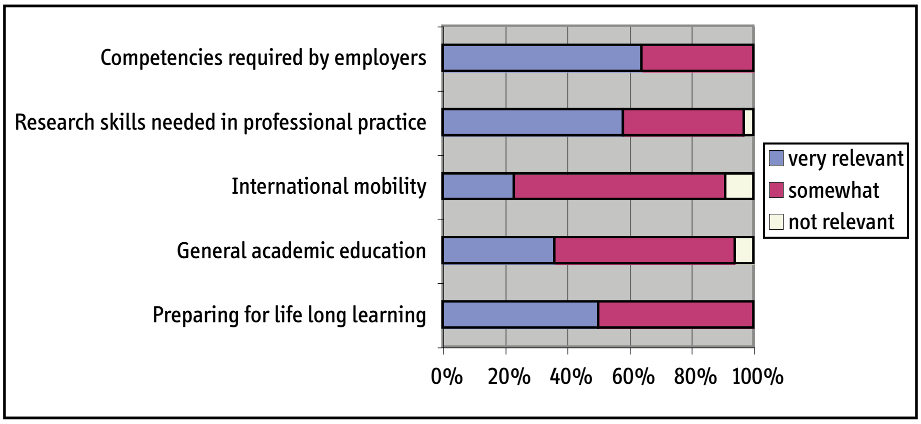
7.3 Relevance of research for (future) professional practice

The relevance of research for graduate employment was mentioned before as one of the drivers for the research mission of the UAS sector. Students may gain experience of applied research and experimental development through which they may enhance their competencies in the world of work. High regard is given to the development of problem-solving skills in which students have to formulate a problem, to choose a particular approach, and be able to assess whether their solutions and conclusions make sense.

There is some evidence to support the view that students who participated in research projects or were exposed to enquiry-based learning enhanced their competencies regarding problem statement, analytical thinking, and taking a more independent perspective – all qualifications highly rewarded by employers. Referring to the Mode 1 and Mode 2 debate (see section 3.2 above), the applied inquiry character is mostly associated with modes 2 type of knowledge production where the boundaries between research and application are not clearly delineated and consequently research is context specific and multidisciplinary. This view corresponds with the fact that students during their placements or internships are most frequently involved in applied research. Less frequently are students involved in experimental development. They are rarely involved in basic research and consultancy activities.

Institutions were asked how relevant research activities undertaken by students during their studies are for their future employment. The following figure shows that most emphasis is laid on competencies required by employers, closely followed by research skills needed in professional practice. General academic education and international mobility are not considered 'very relevant' and score higher on 'somewhat relevant'.

Figure 7.2 Relevance of research by students for their future employment



Question: How relevant are research activities undertaken by students during their study for their future employment?

This figure shows that research is very relevant in the context of acquiring competencies which are high in demand by employers as well as the research skills needed in professional practice and the preparation for lifelong learning. These findings support the earlier thesis about the relevance of research for the curriculum and the development of competencies. Acquiring research skills during the courses may enhance the ability of students to develop their competences further and improve their employability. Especially the research-based approach whereby students are regarded as participants rather than as audiences may positively affect their learning abilities in future employment.

But for those already in working life the research function of UAS is an important dimension in enhancing key competencies. This can be reached through work-based programmes which adopt an inquiry-based learning approach. A few institutions made reference to the employment of part-time master students in research projects by UAS. These students carry out real research work applied in an industrial setting. This enriches their education by providing additional practical and research experience. This is beneficial both for the UAS and for the employment organisation concerned.

The importance of all four types of research distinguished should not be underestimated. In contemporary knowledge societies it is impossible to separate 'learning' from 'researching'. Especially the UAS sector has as its major goal to educate (future) professionals who are more than graduates with expert knowledge who merely apply those professional skills they learned before. They increasingly need an active 'enquiry capacity' to reflect on existing practices whereby the process of "how knowledge is managed, synthesised and adapted become as important as knowledge itself"[42].

In the appendix several institutions present examples of how they connect research and teaching and how this can benefit the learning process of students as well as professional practice (especially in the examples numbered 12-20).

[42] Jenkins and Zetter , quoted in M. Healy, Ibid. p. 72

8 Human resources

As the role of research has become more important in UAS, the characteristics of academic careers and research qualifications of academic staff in the sector have become a more important policy issue. While the UAS traditionally have been seen as primarily teaching institutions, research capacity has not been emphasized in the sector. Investments into research capacity have often not been possible, and also the self-selection of staff has emphasized more the teaching than research activities. Although the survey of UAS representatives demonstrated that the research capacity of academic staff is not considered as important of an obstacle to research activities in the sector as the funding, it is an essential issue for the future development in the UAS research. With the new expectations to the UAS sector also the attention to human resources in the sector has substantially increased both at the national and institutional level.

8.1 Qualifications of academic staff in UAS

Formal research qualifications of the academic staff in the UAS sector is one issue that has come up in many countries in recent years. According to the questionnaire results, the educational level of academic staff varies considerably in the selected countries (see 8.1). While in Germany 90% of academic staff is reported to hold a PhD degree and in France the number reaches 57%, in Estonia the proportion is only 1-2% and in Denmark 3%.

Table 8.1 Educational level of UAS academic staff (in percentages)

	PhD	Masters	BA-university	BA-UAS	Other
Austria	31	54**	1,6	0.1	13
Denmark	3	80	2	15	
Estonia*	1-2	75-80	10	10	
Finland	7	68 + 11 (licentiate)	3	3	7
France	57	43			
Germany	90	10			
Ireland*					
Lithuania	15	85			
Netherlands	4	46	7	39	4
Portugal*	15	35	12	30	8
Switzerland	34	42	0	8	15

Question: What is the educational qualification level of academic staff on average (in percentages)?

Notes: * Figures of Estonia and Portugal are rough estimates, not based on actual data. For Ireland no figures are available.
** this includes 7% masters obtained from a UAS.

Most countries at some level regulate the minimum requirements for academic positions in the sector. The criteria usually have to do with three aspects: minimum educational degree, minimum years of work experience in the field, and in some cases also some pedagogical training. Some countries use the same academic positions and requirements for both the UAS and university sector. In Estonia, for example, academic staff both in traditional universities and UAS is divided into professors, docents and lecturers and the terms and qualifications for each position are by the legislation identical in the two sectors. The great majority of the academic staff in UAS is however lower level academic staff. A similar structure is in Lithuania where possible positions are professor, associate professor, lecturer, assistants, but 94% of the staff are lecturers and assistants. In Finland there exists three staff categories for the UAS staff: principal lecturer (about 16% of actual staff), lecturer (60% of actual staff), and other full time teachers. A principal lecturer must have a doctorate or licentiate degree, three years practical working experience and some training in pedagogy. A lecturer must also have three years working experience and pedagogical training, but Masters degree is sufficient. In Germany, the qualifications are specified for the professorial staff: finished higher education studies, pedagogical capability, capacity for scientific work (or art), and depending on the needs of the positions also demonstrated scientific, art achievements or 5-year working experience in the field (with 3 year minimum outside of the university).

Irish UAS have a full range of staff categories: Assistant lecturer, Lecturer 0-II, and Senior Lecturer I-III. About 67% of full-time equivalent staff are on Lecturer, Lecturer I or Lecturer II positions. Requirements are specified by the Ministry of Education: Assistant lecturer must have an appropriate honours degree and minimum three years relevant post-graduate experience; Lecturer must have a postgraduate qualification in addition to the appropriate honours degree and minimum five years experience. A national framework for research career paths is currently under development in Ireland.

In Portugal there are three categories of staff: coordinating professors (about 17%), adjunct professors (58%), and assistants (25%). A national decree from 2007 specifies the requirements for each staff category: an assistant must hold a licentiate degree; adjunct professors must have a master degree or pass a public exam; and coordinating professors must also pass a public exam. The PhD degree is however not a requirement on any level. In France about 9% are professors, 48% are maître de conferences, and 42% are teachers. The first two categories require a PhD degree, and teachers must have a Master degree.

The issue of low educational level of the UAS staff has come up in many countries in recent years. The issue has been raised for example in Portugal; also in the Netherlands it is recognized that the educational level (both PhD and Master degrees) of the UAS staff must increase. Recognizing the problem of low educational qualifications of the UAS staff, some countries have set specific targets. According to the Lithuanian Law of Higher Education, academic staff in UAS must have minimum a Master degree. The law also states that no less than 10% of staff should have a doctoral degree and no less than 50% should have at least 3 years of practical experience in relevant field. In Finland, the Ministry of Education has set some targets for every UAS over the 2007 and 2009 period: 80% of principal lecturers must be doctors or licentiates and 25% of full-time R&D work should be conducted by full-time teachers. According to the Estonian legislation, at least 75% from the academic staff should have a Master degree. The new legal framework of 2007 in Portugal sets a target both for universities and UAS in terms of staff qualifications: universities should have one PhD holder per 30 students while for UAS this can be either a PhD holder or a "specialist", a new position still to be defined but intended to recognize experts with relevant professional experience but not necessarily a PhD.

Another characteristic of the UAS staff is that a relatively high proportion of academic staff is hired either part-time or on the basis of temporary contracts. In Portugal temporary staff is about 54% of all academic staff in UAS and thus forms an essential part of human resources. Such a high number of contracted staff is due to the fact that the number of centrally approved placed is much below the level that is actually needed in practice. Also in Germany there is a considerable part of temporary staff, especially in research related position, reflecting the problem of short-term project-based funding of UAS research. In Lithuania about 43% of academic staff is classified as "to whom this job is secondary". In Austria it is reported that 80% of the staff are part-time.
In several countries it has been emphasised that the high proportion of part-time staff is due to the fact that staff are professionals drawn from working life. Ideally these staff members remain professionally engaged throughout their teaching careers, providing a bridge between working life and class room instruction.

8.2 National level policies

The survey of representatives of national UAS associations inquired about national efforts in the area of human resources, such as improving working conditions of staff to be actively involved in research, enhancing research skills of staff (research training, PhD trajectories), selecting new staff on the basis of research qualifications, developing new career perspectives, creating financial reward systems of research performance. Many representatives pointed out that these initiatives are taken at the institutional, not national level. Some representatives recognize national initiatives in all the listed areas: e.g. Austria, Estonia, France. In Austria the Act on Fachhochschulen states that staff members are to engage in applied research and development in order to ensure that the courses would be in compliance with their objectives. The research tasks of FH staff have been explicitly recognised by an amendment (2003) to the FH Act that replaced the words 'teaching staff' by 'teaching and research staff'. This is also expressed in the third "Plan on the development and funding of the FH sector" (2005-2010) which adopts the R&D concept as a criterion for government funding. In France the position of staff at IUTs is connected with the affiliated university and its research centres.

Other countries concentrate on some areas. In Ireland the selection of new staff on the basis of research qualifications and developing new career perspectives for staff is a priority. But most of the efforts in the area are still done at the institutional level in Ireland: e.g. providing seed funding for establishing research groups, recruitment of research active staff, funding teaching release through research contracts. Denmark focuses on improving working conditions of staff to be actively involved in research and on developing new career perspectives for staff. Lithuania focuses on enhancing research skills of the existing staff, selecting new staff on the basis of research qualifications, and developing new career perspectives for staff. In 2008 there was an increase in the number of government supported doctoral students in Lithuania after the national association of colleges articulated the demand. Similarly the Netherlands supports PhD trajectories for the UAS staff. A government supported voucher program enables the UAS faculty members to purse a PhD degree. Most UAS now add their own funds to these government vouchers in order to raise the number of staff with doctoral degrees.

Germany seems to be concentrating on financial reward system for research performance. Some countries have no national level policies to report.

Many countries currently feel the need to revise their human resource policies and academic careers in the UAS sector as the importance of research has increased the expectations to the UAS staff:
There is an urgent need to rethink the polytechnic academic career in Portugal. The law in place is 27 years old and out of touch with the 21st century. It needs to be altered. (Portugal)

A national framework for research career paths is currently under development in Ireland.
In the context of increasing the number of PhD holders various national fellowship programmes has been established to encourage staff from UAS to pursue a doctoral degree in collaboration with a university (e.g. Germany, Austria, Netherlands – promotion vouchers). Institutions themselves are proactive in supporting academic staff to complete advanced research based programmes (by reducing their teaching loads) and in achieving targets of proportions of staff qualified to doctoral level. A problem identified seems to be the focus of the PhD research of the UAS staff. Research by the UAS staff is often done in the form of their PhD dissertations. This research is however integrated with the research in the institutions that award the degree (i.e. universities), under general responsibility of a university professor. Increasingly this occurs in collaboration with UAS staff who takes part of the responsibilities. This may have implications for the format and nature of those dissertations.

8.3 Institutional policies in the area of human resources

As appears from the institutional surveys, institutions are developing policies to encourage research activities. There does not seem to be a clear model how staff time for research is determined. Only in a small minority of cases all staff is required to conduct research. It is more common that academic staff on a specific academic position or selected academic staff have certain time allocation for research (Estonia, Lithuania, Finland). In about half of the cases there are specific designated positions for research activities, for example in the Netherlands, Finland, Lithuania and Austria. While traditional universities have established often quite aggressive incentive structures to encourage research productivity in academic units and individual academic staff[43], UAS seem to be more modest in such policies. It appears from the survey that UAS are relatively reluctant to use strong external incentives and rely more on intrinsic rewards of research (8.2). Professionalisation of staff seems to be the dominant instrument: 64% strongly and 33% somewhat rely on this. Also other indirect motivational aspects are important, such as increase in prestige (47% and 53%), intrinsic rewards (44% and 44%), and having research as part of personal assessment (41% and 41%). Direct external incentives, such as financial rewards to academics or departments are least common in the sector.

Table 8.2 The incentives for academic staff to undertake research (%)

	Strongly	Somewhat	Seldom
Financial rewards for department/institution	9	44	47
Individual financial rewards	10	42	48
Part of personnel assessments	41	41	19
Professionalization of staff	64	33	3
Reduction of teaching load	34	41	25
Increase of prestige	47	53	0
Intrinsic (personnel) rewards	44	44	13

Question: What are the incentives for (teaching) staff to encourage them to undertake research activities?

Institutions also seem to be implementing various instruments to support and encourage research activities (8.3). The most common effort is improving working conditions of staff to be actively involved in research: 70% and 27% pursue or moderately pursue, respectively, this policy. Improving research skills of the current staff is another common way to improve research activities: with 64% and 36%, respectively, pursuing the policy. Selecting new staff on the basis of research qualifications and developing new career perspectives for staff is somewhat more moderately applied but still pursued in several institutions. Financial rewards are however considerably less used than other instruments. Only 16% have created financial reward systems and 44% have no financial reward system at all.

Table 8.3 Staff policies focused on the research function

	Yes	Moderate	Not at all
Improve working conditions of staff to be actively involved in research	70	27	3
Improve research skills of teaching staff (e.g. research training, PhD trajectories)	64	36	0
Select new staff on the basis of research qualifications	45	55	0
Develop new career perspectives for staff	47	44	9
Create financial reward systems of research performance	16	41	44

Question: Do you pursue staff policies focused on the research function of your institution?

Staff mobility between academic sector and external sector is often seen as a useful way to encourage public-private partnerships and by undertaking research staff can strengthen further this connection. 36% of institutions report that they do actively encourage personnel exchange with external organizations; 54% report that they encourage such exchange somewhat. Only 10% thus do not encourage staff mobility.

[43] See Connell, H.E. (2006) University Research Management: Meeting the Institutional Challenge. Paris: OECD.

9 Issues for the development of research at UAS

This study aims to map the various research activities that are undertaken by UAS across Europe. It investigates in the participating countries the current state of the art, with special attention to the conditions in which UAS have to perform their tasks and how UAS shape the link between education and research. It appears that there are quite some varieties across the 11 countries due to national contexts, history and diversity in research approaches and practices. Recognising this variety between countries, the material presented here can be useful to learn from each other, and to consider practices and approaches which may work in other contexts as well.

Given all these variances, there appear also clear commonalities on the research function in the UAS sector and the research profile. The analysis presented here can be seen as part of joint efforts across Europe to strengthen the research function in the UAS sector and to stimulate convergent decision-making within Europe in joint operation with its external stakeholders (SMEs, private and public organisations, as well as policymakers).

In this concluding chapter findings presented in this report will be placed in the context of European dimensions and an overarching conception of research at UAS. It concludes with a number of critical issues that can be considered in the context of follow-up project activities by the EDUPROF network.

9.1 European dimensions: education and research in the knowledge society

The research function of UAS in all countries is put in the context of the challenge to prepare European professionals for the knowledge society. According to the Lisbon Declaration the central task is to equip Europe's population – young and old – to play their part within the knowledge society, in which economic, social and cultural development depend primarily on the creation, application and dissemination of knowledge and skills. In this context the UAS sector faces a range of complex and historically novel challenges.

Across all the countries in this study, it has been recognised that the Universities of Applied Sciences, given their specific position and role in the knowledge infrastructure, have a pivotal role to play in meeting the innovation goals sets by the Lisbon Agenda and in particular to their commitment to the European Higher Education and Research Areas. In order to meet these demands, research is playing an increasingly important role for the UAS in direct combination with their teaching obligations. In many countries across Europe the Universities of Applied Sciences see it as their professional education mission to accommodate the societal demands by linking professional practice and education through innovative research. Through this the following aims can be achieved:

- To meet the needs in the knowledge based economy by focusing on applied research and knowledge transfer; to strengthen the knowledge chain between scientific results and their utilisation, thereby contributing to solve the knowledge paradox
- To boost regional innovation, especially in relation to SMEs
- To improve professional practice
- To prepare (future) professionals to function adequately in the knowledge society

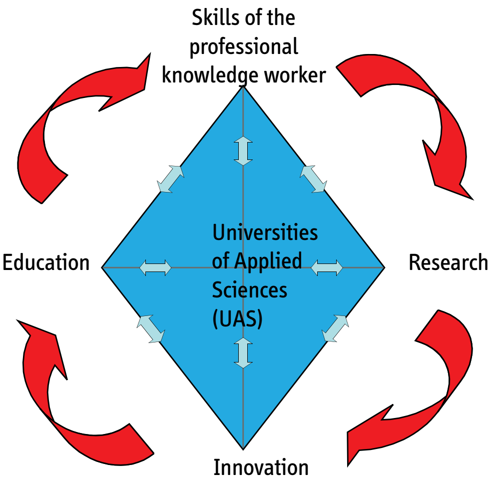
In all these areas UAS developed research activities and increasingly their value has been recognised by external stakeholders. This is apparent from the following:

- The recognition of a research mandate in virtually all countries, sometimes in legislation, sometimes in other official policy documents.
- The ability to attract external contract funding both from private and public organisations, indicating that there is a growing need for this type of research; UAS are also increasingly successful in attracting public research funds. These are mainly targeted funds while core funding is an exception.

9.2 Towards an overarching conception of research and education

Various terms of research at UAS across Europe have been used, applied R&D and practice-oriented research being most common. A clear distinction with basic research is not the aim, and much research at UAS actually seeks connection with this. Nevertheless the problem or practice-oriented focus is the most dominant feature and should be the point of departure for any kind of research by UAS. This kind of research, however, should meet normal high standards in terms of methodological rigour and quality. It is strongly embedded in the professional practice to which UAS are oriented and for which they prepare their students. As this practice is increasingly evidence based and thus knowledge-intensive, innovative research and knowledge transfer play an ever growing part in this. At the same time research should improve the quality of education and innovate curricula through the interface between education and professional practice. This can be visualised in figure 9.1.

Figure 9.1 Conception of research and education at UAS



This figure shows how research and education in their mutual relationship can contribute to innovation and improvement of professional practice.
First, conducting research and offering assistance with practical innovation to professionals - from SMEs, business and the public sector - enables UAS to integrate skills in the curriculum in relation to knowledge acquisition, application and research. This is in line with the findings that the vast majority of UAS strongly motivate their research by its relevance for education which enriches the learning processes of their students.

Secondly, by staying in close contact with innovative demands from the world of work, UAS can act as an important partner in the region for practical innovation and improvement of professional practice.

Thirdly, by cooperating directly with the professionals in the various companies, UAS are also able to detect lifelong learning needs. Thus, by linking professional practice and education through research, UAS have found a way to contribute to social and regional innovation and accomplish their professional education mission.

The coherence of these relationships in the figure is based on doing research which yields practical innovation on the basis of concrete demands which are submitted to UAS. UAS have strong ties with the actual issues in work practices and demands in the context of life long learning. Thus, students are prepared for work in line with the latest knowledge and up-to-date curriculum. Students in their turn will be optimally prepared to bring about innovation in their professional practice. In this view research at UAS is seen as the linking pin in the knowledge triangle.

This scheme is not meant to suggest that all the components should be accomplished at the same time. This may vary according to specific settings. Traditionally the UAS have primarily a teachers' culture whereby all activities have been valued in relation to their contribution to education. However, research at UAS oriented to practical demands from external stakeholders can be a very worthwhile activity in its own. Examples given in the appendix illustrate various ways in which the different links can be made.

9.3 Critical issues to consider for follow-up activities

Given the European challenges and the way UAS are taking up their research activities in order to meet the needs in contemporary knowledge societies, a number of issues can be distilled from the findings of this study which deserve further consideration for activities to be developed in the context of the European project (EDUPROF). These issues are subsumed under three major headings.

① Research as a structural element integrated in the organisation

Research strategies and priorities

The way research has been organised within UAS shows a varied pattern. When a bottom-up approach is chosen, research depends mostly on contracts attracted by individual staff. This dependency on individual staff, combined with a high teaching load and the absence of research positions as such, gives research a rather fragile character. This has the risk that research becomes a separate activity, drifting away from the primary process. Also smaller units where research takes place result in a multiplicity of themes and research fields which are not easily recognised by the professional world.
In order to overcome this problem a shift can be noted away from individual and ad hoc research activities towards research strategies

which focus on research priorities, creation of knowledge centres, and interdisciplinary themes and clusters. As such more critical mass can be achieved. A mix of top-down and bottom-up approaches is seen as an appropriate way, so institutions have established dedicated units which provide a number of services.
Some institutions have adopted a policy to concentrate their research by focusing on particular themes, or even one central theme covering all research activities of the institution. Some countries advocate such a development strongly, and consider a prioritisation of research areas crucial to move towards a critical mass of activity taking place. Such a prioritisation could be achieved in targeted areas against clear national or regional economic and social innovation strategies, as well as international key areas.

Need for a sustainable funding base

The lack of a stable core funding for research is perceived as a main inhibitor of UAS research, which forces institutions to rely on short-term project funds. Stable core funding is however a condition to secure a basis for building a research capacity and research infrastructure in UAS. Some structural funding will be essential to ensure a sustainable innovation-performance and technology-transfer to SMEs and their research connection as well as a programmatic continuation of research in the organisation. Moreover, it appears from the study that the requirement of co-funding is seen as a major obstacle because of a lack of structural funds to match with.

One option might be that UAS participate in competitive research programmes for universities. However, for this competition there is no level playing field so UAS are put in an unequal position. These research programmes tend to be designed for the type and level of research conducted in universities. As a result, UAS are rarely successful in securing the grants, apart from a few exceptions where UAS in some countries collaborate with relevant universities and research institutes in joint endeavours. Considering that writing the proposal is already a time-consuming process, the funding source is generally not appealing for UAS. UAS are in a better position if national research agencies have special programmes targeting applied research and/or university-industry cooperation as these programmes usually meet more effectively the needs and capacity of UAS.

The vitality of a two-cycle degree structure.

When the UAS sector develops its research capabilities, the establishment of masters programmes is vital. The creation of a 'research mindedness' within institutions and their units or faculties requires research carried out on a higher level. These master programmes have a significant role in developing research that is rooted in professional practice. Innovation of this practice aligned with the continuous updating of professional knowledge through lifelong learning is the aim.

In this context a two-cycle degree structure is important for two reasons. First, research groups and research clusters should translate appropriate aspects of their specialisms and research into programmes of study or individual courses both at masters and at bachelor taught levels, thereby contributing to curricular innovation. Secondly, master programmes guarantee the availability of research opportunities at a higher level which is an important attractant in recruiting highly qualified staff.

Human resources

Human resources is a major issue confronting UAS. UAS are traditionally teaching institutions which means that faculty at one point have been appointed on the basis of their teaching qualities as well as their professional practice. To date, human resources is not a well developed area in the sector and the research qualifications of current staff in several countries leave much to be desired.

If institutions want to develop their research activities, a high priority should be given to staff development issues and allocate resources accordingly. The importance of qualifications among faculty as an important driver of meeting future research needs should be recognised. This includes supporting current staff to update their research skills in completing advanced research based programmes.

Increasing research capacity of UAS implies the recruitment of new teaching staff whereby the research record is taken into account. On the other hand the availability of research opportunities as an important attractant in recruiting highly qualified staff cannot be underestimated. For research it is important to have sustainable research positions so that staff can build and expand their research expertise. By providing research and development opportunities, highly motivated and qualified staff can be attracted to UAS thereby increasing the intellectual capital available to stimulate innovation and economic development.

② Collaboration to strengthen the regional socioeconomic structure

Central role of UAS in meeting regional demands

One of the main drivers of research at UAS is the strong orientation towards regional development and innovation, especially SMEs. It appears from this study that the impact and output of research relate mostly to the employability of graduates in the region and the research collaboration with local/ regional industry. Financial considerations as such are seen as less important than the possibilities of staff development, improvement of education and linkages with industry.

Institutions consider their contribution to the strategic analysis of the regional economy and the impact of their research activities on strengthening the regional socio-economic structure not as high as compared to other kinds of contributions they make. The awareness grows, however, that in order to develop the research function of UAS to boost regional innovation collaborative networks are key enabling factors. UAS have to be firmly rooted in these regional networks with other UAS, SMEs, business, public sector and research performing institutions. This is particularly important in regional areas with a high number of SMEs.

Competence centres have been established aiming at building an infrastructural base in the research system that is closely linked with the expressed needs of enterprises. Because of their close ties with regional enterprises and public organisations, UAS have the potential to play a central role in developing these regional networks and competence centres in meeting the demands from the region.

Demand-led versus proactive

Institutions indicate that much research is demand-led whereby UAS have to respond to a variety of requests. Institutions are often requested to deal with sometimes poorly articulated and short-term problems. Moreover, demand-led research is not by definition the most appropriate way to achieve innovation. This demand-led approach should be accompanied with a more proactive approach by institutions. Especially SMEs tend to avoid projects that have a high risk in terms of financial costs. Precisely these situations offer a challenge to explore questions that are lying beyond what the entrepreneurs can handle given their time and success pressures. In this sense innovation refers to the prioritisation of generating the demand by research before meeting the demand. To realise a proactive outreaching role, UAS need a solid and sustainable research infrastructure.

③ International comparison and collaboration

Joint efforts across Europe to strengthen the research function of UAS

The diversity between countries in terms of the specific characteristics of institutions and the increasing possibilities to exchange views and practices provides an enormous potentiality to learn from each other and to consider whether national options could be applicable in other national contexts. In addition there is increasingly a need for joint efforts to stimulate further activities and convergent decision-making within Europe. One option could be to make priority research areas in research well-known across individual institutions and create a platform in which exchange could be facilitated. Some of these areas could well be developed and aligned with national and European prioritisation of research. This may increase the chances of UAS to participate in European research programmes.

The inclusion of international components can complement the regional tasks, since regional innovation is not solely based on regional research as such. Local engagement and international orientation may well go together and reinforce each other.

Quality assurance

Most institutions consider the development of quality assurance systems for research at UAS as highly important. There is a growing awareness among institutions that they should evaluate their research activities on a regular basis to make transparent to stakeholders what their research comprises. Some institutions have taken the initiative to develop such a system to operate and working groups have been established to determine and monitor appropriate indicators for the UAS sector.

The overall picture, however, shows that this is all in its infancy. There is much agreement that indicators which are current in research assessments of traditional universities would not equally apply to the UAS and should be balanced with quality indicators which do justice to the special characteristics and mission statements of the sector. In that sense UAS would review their internal allocation processes, with a view to ensuring that resources are allocated in line with established institutional strategic priorities and strategies. The active use of performance indicators should help institutions to match internal evaluation processes with external processes to ensure that research is meeting international standards. Institutions can use the results to help shape priorities, funding mechanisms, staff recruitment etc. in order to optimally fulfil the innovation and technology transfer to the SMEs. For this purpose international benchmarking in the UAS sector is essential. These benchmarks should reflect the specific nature of research as exemplified in this study.

Appendix: Examples of research practices

This appendix contains 20 examples of research practices as described by Universities of Applied Sciences in Europe.

They cover a wide range of topics and subject areas. Some focus more on the output and impact of research (cases 1-11) and others more on the link between education and research (12-20). However, the distinctions are not very sharp and several cases include both elements.

The examples are discussed by taking the following points into account:
- How the project was initiated
- How companies were associated
- How students were involved and the link with education has been achieved
- What problems were encountered and how solved
- How research has contributed to innovations (products, processes), curricular innovations
- How the case may benefit professional practice.

Altogether the descriptions provide a kaleidoscopic overview of how institutions are dealing with their task to undertake research. Through this information institutions may exchange their views, learn from each other and stimulate collaboration between them.

The cases display the professional expertise that is available within Universities of Applied Sciences across Europe. It shows their creativity in dealing with research, the research design, approaches and possible outcomes.

Contents

① FH Joanneum (Austria)

AREAmp3: Innovation Management and Regional Development in the Region of Easter Upper Styria

From 2005 to 2007 the University of Applied Sciences FH JOANNEUM with his Degree Programme "Industrial Management" cooperated with the AREA m styria GmbH in a Reg-plus project called AREAmp3. The entire scope of the project was more than Euro 600.000, thereof Euro 120.000 by Industrial Management. AREA m styria is a virtual impulse center and was founded on the basis of an intercommunity cooperation to provide sustainable support for the economic development of the region of eastern Upper Styria. The project aimed to strengthen the competitiveness of the region.

Several subprojects – especially in the fields of innovation management and regional development – were conducted during the project AREAmp3:

a) Benchmarking of the innovation system: This subproject covers an analysis of the current innovation potential in the region. The results were compared with other Austrian and European regions.
b) Supply chain analysis: The task of this project was to analyze the supply chain of the important companies in the region to find gaps in the fulfillment of demands (supply side, demand side, recycling).
c) Analysis of target groups: The target was the development of a procedure to appoint a target group of companies, which could have a reason for settling in eastern Upper Styria.
d) Establishment of continuous innovation activities in SME: The goal was to set up a continuous support (organization) for helping SME to realize innovations.
e) Strategy assessment: An analysis of the strategy of the region was accomplished. Suggestions for the future development and the strategy of the region were compiled and evaluated.
f) Logistics index: The logistics index consists of a detailed analysis of different means of transport (rail, plane and street transport). This should allow an evaluation of a region and a comparison with other regions.
g) Employee qualification: This subproject covers three parts: (1) an analysis of the reasons for migration from the region; (2) an analysis the current employee qualification structure in the region and proposals for future improvements; (3) the development of innovative approaches to sensitize children for technical studies.

Innovative approach

The innovative approach of the project was on the one hand the use of instruments of business administration in a regional context. For example, as shown above, a benchmarking of the region was carried out as well as the use of strategic instruments (portfolio analysis, SWOT analysis). Normally, these instruments are used for business purposes within companies.

On the other hand new approaches for innovation management and regional development were developed. For example a logistic index for evaluating the logistic capabilities of a region, or a methodology to analyze different countries and companies to be able to find out which companies (target groups) would possibly be interested in investing in the region.

Impact

The project had different impacts on the regional development:

- The results of the different subprojects helped to further develop the region as well as the services of the virtual impulse centre AREA m styria GmbH.
- The projects, especially the interviews with representatives of companies during some subprojects, helped to strengthen the retention of the need for further collaboration in the region.

② VIA University College (Denmark)

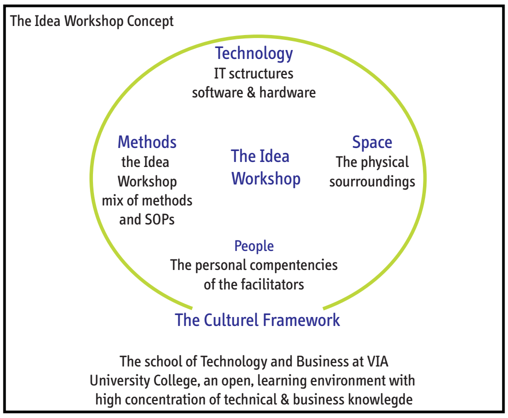
A case story of bridging education and commerce

The Idea Workshop was established in 2005, at the School of Technology and Business in Horsens, Denmark, as a physical workshop for innovative processes. Today the Idea Workshop is more than physical surrounding - it's a business concept and the Idea Workshop provides innovative processes for private companies, University Colleges, Universities, Regional and National Offices, NGOs and for VIA University College in particular.

Background

In 2005 the School of Technology and Business, VIA University College received a grant to establish a national Knowledge Centre of Innovative Processes and Business Development (KCIPBD). The Idea Workshop was established as an artefact that signalled an innovative agenda, as a vehicle for cultural change and as a business tool for KCIPBD – a tool that could be applied to strengthen and professionalize idea generation and innovation not only in the educational programmes but also in regional commerce and industry in order to strengthen the overall competitiveness of Denmark.

The idea of building a workshop grew out of two different development projects. At the time there was a development project about integrating innovative competencies more thoroughly in the education programmes and another development project about IT supported innovative processes. Both projects would benefit from some kind of laboratory - a special space where professors, students and external collaborators could experiment and develop innovative competencies – the optimal context for innovation.



KCIPBD received public funding over a period of 2 years. During that period the Idea Workshop grew into a viable business concept with its own set up of space, technology, methods and facilitators embedded in the cultural framework of the School of Technology and Business, at VIA University College (see the model of The Idea Workshop Concept).

In 2007 when the school of Technology and Business merged into VIA University College the Idea Workshop changed from being a unit under the Rector of Studies at the School of Technology and Business, to become an independent unit under the Division of Continuing and Further Education at VIA University College. The Idea Workshop is 100% self-financed with 4 full time employed facilitators.

The Workshop

The physical workshop remains one of the most important structures of the Idea Workshop concept. The workshop is a 180m2 room at VIA University College. Much thought was put in to the design process. Experts in spaces for creative processes and architects were consulted and the result was a room that looks a little like a movie set because everything is flexible. The furniture is for both standing up and sitting down. The IT equipment is wireless and portable or on wheels. The lightning can be moved around to create the right atmosphere. The only fixed elements are the fridge for water bottles and a table with the main dashboard – everything else is completely flexible in order to be able to "match the space to the case".

The Facilitators

The workshop was from the beginning meant to be used only in facilitated processes. The facilitators received training in facilitation, specific software tools, idea generation models and in Standing Operating Procedures for booking, preparation and wrapping up a session. The Idea Workshop has constructed its own templates - a guide of preliminary questions to design the right session, a script template to plan the actual session and a report template that document the outcome of the session. 10 lecturers were trained in facilitation and another 40 lecturers were trained in a "facilitation light" version for the students Innovation Week.

Two simpler versions of the workshop have also been established at the school - Workshops that can be used in non-facilitated processes both by students and lecturers.

The Output

The Idea Workshop has become a successful vehicle for innovativeness. It allows VIA University College to set the frame for fruitful collaboration between students, lecturers and external stakeholders in three different set ups: as a driver for student activities, as a subcontractor in development projects and as a business partner.

Firstly the Idea Workshop plays a key role in the students' Innovation Week. The Idea Workshop have developed the event, trained the facilitators and established the physical surroundings. Regional SMEs, big companies and public institutions propose challenges for the students. The students then team up in cross-disciplinary teams and work out solutions. Around 300 students and 40 professors participate each year.

Secondly the Idea Workshop is a sub-contractor in development projects. Both projects initiated by lectures from the School of Technology and Business and in external projects. For instance in the project "Newer and Better Assistive Technology via User Driven Innovation" conducted by a research institution in collaboration with NGOs, schools, regional bodies and regional commerce and industry funded both by regional government and national public funds. The Idea Workshop provided a user driven innovation session. In the session there were facilitators from the Idea Workshop, a group of disabled students from the Egmont school, a group of engineer students and a lecturer from VIA University College and two manufactures of assistive technology. At the end of the day some of the ideas to new assistive technology had been chosen from the big pool of ideas. The ideas had been further developed and visualised - made ready for the engineer students to bring into the technical workshop where they can develop prototypes. The two ideas were 1) a floor board remote that can be operated with feet or wheelchair for a Playstation or painting tools etc. and 2) a lift-board for helping users of wheelchairs if they fall out of their wheelchairs. The companies went away with many ideas to their products as well as a first experience in how to involve users in the innovation processes. The disabled students went away with improved innovative competencies.

Thirdly the Idea Workshop is a business partner and offers innovative processes for public and private costumers. The distribution of costumers in 2007 shows that The Idea Workshop is most successful in the educational sector and within VIA University College. The Idea Workshop has played an important role in the merger. The distribution in 2008 will show a greater part of external costumers. However, private companies still constitute a growth possibility.

The Idea Workshop is experienced in a wide range of sessions. Product development, project maturation and strategy development were the main work areas.
The feed back we get from costumers is that the sessions:

1) allow everyone to participate on equal terms regardless of normal hierarchies
2) professionalise the process, provide systematic work.
3) provide a helicopter view on their business or situation
4) lead to concrete and documented ideas to for instance new products, new markets for existing products, or new strategies that can easily be implemented.

The main purpose of the Idea Workshop has been achieved. Today the Idea Workshop frames mutual learning processes - each session or activity potentially lifts the knowledge of innovative processes in VIA University College as well as lifting the overall innovativeness in companies as well as public organisations on both a regional and a national basis.

The Challenge
The Idea Workshop has had good growth conditions in terms of dedicated facilitators, a long period of stabile funding and continuous support from top management. The biggest challenge is becoming visible outside our own field of education. It is both an advantage and a disadvantage that the Idea Workshop has been so successful in attracting consumers from education and local government. The advantage is clearly that the Idea Workshop has been able to grow into a self financed-unit and has become a very experienced unit.

The marketing mechanism has been that sessions make sessions - either because the people in the sessions order new sessions, because people that have been in sessions recommend session to others or because the press coverage of sessions attract new costumers.

Even though The Idea Workshop has attracted private companies through this mechanism the visibility outside the world of education is still poor. The advantage of being successful in one field is a disadvantage in another as the challenge of becoming a recognisable business partner for private companies still lies ahead – and it becomes even more important to overcome this challenge in the next years as the big change processes within VIA University College is completed. In order to meet this challenge the Idea Workshop is in the middle of working out a marketing strategy and has already started a "Road-show" where facilitators visit companies and demonstrate what the Idea Workshop has to offer.

③ Tallinna Technikakorgkool (TKTK) (Estonia)

Research and Implementation of Coatings technology and functional characteristics

Coating and welding technology used by the Faculty of Mechanics is innovative and is being used more often in advanced production technology. TTK has equipment that is unique and irreplaceable in strengthening or repair works. The number of contractual works has increased. Research and also students have been involved in this.

Initiation of the project

The necessity of coatings research was conditioned by the wear out and repair of different machines. It´s not always practical to buy a new detail, maybe only a small part of the surface of the whole detail is damaged. Restoration is concerned to be functionable when it forms up to 75% of the new detail price. It is possible to restore unique details with diggerent coatings methods, then the price is secondary. Diversity of coatings technology ables to get coatings with different virtues and thickness.

Companies were involved that need operatively restoring or /and strengthening some details operatively (corrosion proof AL coatings for Volovo(trucks) emission pipe flange- AS Argonic). The project, under T.Pihl´s direction, is dealing with four subthemes.

① Implementation of coating technology in racing technology

This consists of the following the main research themes:

- Strengthening and developing necessary technology for racing car semiaxis and transmission shafts. For example project in the faculty of Transport called „ Formula Student- strengthening semiaxis with gasflamespraycoatings and covering exhaust pipes with dividing fillet coatings.
- Developing and implementing of ceramic dividing fillet coating´s spray technology in order to strengthen explosion chamber.
- Using fluorpolymer coating in order to enhance durability and decreasing friction of internal- combustion engine´s pistons.
- Reestablishment and strengthening technology of outworn details nominal size´s.

We have participated in a conference: 6th International Conference of DAAAM Baltic Industrial Engineering, 24-26 april 2008, Tallinn. The Properties of Different Barrier Coatings.

About this theme an article has been published by T. Pihl in TTK´s Publications 2008 under the title 'Characteristic´s of dividing fillet coatings'.

② Plasmaspray and welding technology

Plasmaspray and welding technology´s usage has turned out to be one effective and important method when renovating various details. Plasma welding device for powder feeder has been improved. It makes it available to increase the nomenclature of usable coating materials.

③ Fluorpolymer,- selective plating,- spray- and fusion coatings structure research

This theme involves all coating methods. In the end of 2007 equipment for making pilot sample were purchased. In the beginning of 2008 also one microscope was purchased.

In addition to coating structure research, structure research has also been carried out for Tallinna Masinatehas AS.

Continuous contractual research work takes place with Limited Liability Company Argonic.

Selective plating coating research takes place in cooperation with Tallinn University of Technology: Diffusion welding detail coating with nickel.

④ Research of coatings internal voltages

Residualstresses and internal voltages that arise almost every time when coating. That can damage functional characteristics. Longstanding cooperation in this filed exists with the Estonian University of Life Sciences.

Almost all the coatings that are used have been researched.

Under this theme we have participated in XVI International Baltic Material Technics Conference- Balttrib, with following report: Measurement of residual Stresses in Brush Gold and Silver Coatings on Thin Cross- cut Rings Substrate.

Regarding the articulation of companies' needs it can be said that these needs are a step higher than TTK can complete. Coated details need mostly extra treatment, but unfortunately our benchpark doesn´t enable to treat big overal dimensional size or variable details. Therefore companies look for other options to resolve their problems. Also welding technology needs some supplementing e.g. lazerwelding and ultrasound welding.

Impact on innovation and professional practice

Generally speaking modern compenies need usually fast and operative solutions for their problems. This is not always possible with our existing equipment and coatings devices. Therefor applied research is primary oriented to solve real problems. Companies are less involved in coatings research e.g. structural and barrier coatings areas. Biggest part is individual subscribers, who deal with racing technology(barrier and fluorpolymer coatings), restore or repair cars, machines.

In the last few years coatings equipment has been supplemented due to the usage of different coating oportunities.Every year the amount of contract works has increased. In the present year (2008) the amount of contract works is over 200 000 EEK (approx. 12 782EUR). In a laboratory research has b een carried out concerning other and related subjects e.g. disc material structure and virtue for Tallinna Masinatehas.

④ Jyväskylä University of Applied Sciences (Finland)

Applied Research in the Bio-energy Sector

Objectives and partners

The need and demand for environmentally friendly, sustainable and effective energy solutions is increasing. The Central Finland Region intends to meet this demand with its own energy resources. The needs of the people living in rural areas should be combined with environmental responsibility. These are challenges for applied research in the bioenergy sector.

Central Finland is one of the strongest bioenergy clusters of expertise in Finland. The vision of Central Finland is to be one of the best developed bioenergy markets in the world by 2015. In the Jyväskylä University of Applied Sciences (JUA), bioenergy is one of the top areas of expertise. The focus is on wood and agro biomass energy, biogas, and bioenergy entrepreneurship. Bioenergy projects are centrally implemented at the Bioenergy Development Centre, which is an on-the-job learning environment and centre of expertise for bioenergy technology. The expertise group applies bioenergy research data to practice, produces new innovations, and develops these innovations further.

It is important that the region's major enterprises and development organizations are committed to supporting bioenergy research and development, as it forms a connecting link between the Jyväskylä Science Park, University research, JUA, VTT Technical Research Centre of Finland, network of the units of natural resources in the Finnish universities of applied sciences, private businesses, education and training, and local farmers. Many of the projects are implemented with international partners.

R&D promotes entrepreneurship in the bioenergy sector

Together with its partners, JUA has created new expertise and applications to enhance growth in the bioenergy sector. JUA has developed technology, knowledge and different kinds of business opportunities and thus promoted new businesses and helped entrepreneurs expand their businesses. Active local cooperation creates chances to commercialize expertise nationally and internationally. International cooperation increases possibilities to adopt the best practices from different countries and to transfer technology from one country to another. It has also improved the international contacts of the enterprises operating in the field. All in all, JUA´s applied research in the bioenergy sector has promoted the vitality of rural areas. At the same time, it has enhanced the region's self sufficiency in energy resources.

The following projects are examples of JUA's research and development work:

- BioHousing - Sustainable, comfortable and competitive biomass based heating of private houses. Project aims to remove the barriers for sustainable biomass based heating by designing standards and commercial technical systems, and by producing tools and information material. The project has been carried out in close cooperation with manufacturers and resellers of prefabricated one-family houses, equipment and fuel suppliers, and other actors in the field. The project has organized training for experts working in the field, produced information material packages, and developed maintenance service entrepreneurship. The international partners are from Italy, France and Spain.
- Decentralized biomass-based solutions of power production and their application in practice. Project promoted the distribution of knowledge and technology related to the use of biogas to farms and enterprises. Increased awareness of biogas production promoted entrepreneurship and reinforced self sufficiency in energy resources. One result was a biogas cooperation network of rural entrepreneurs.
- 5EURES/ Five European RES Heat Pilots. Pilots in five EU member states promoted the use of bioenergy. The project developed e.g. new business models and technology. The results were disseminated and utilized widely in other countries. JUA organized training in Finland and in Spain, and piloted new technology in Spain and in Lithuania.
- BTN-Bioenergy Technology Transfer Network. JUA promoted the use of bioenergy with its international partners. Another objective was to enhance the transfer of data and technology for the use of local businesses and educational institutions.

Results through cooperation

In the projects cooperation with companies has been versatile. For example, new products have been piloted abroad and introduced in international fairs. Companies have been able to use planning instructions produced in the projects in their own product development. Companies have also participated in planning a bioenergy strategy for Central Finland. Strategy planning processes are one way for finding out the needs of companies, but usually the needs are brought up in projects and through other, often unofficial interaction and cooperation, and this has led to new projects and cooperation. The challenge is to identify and determine the real needs and to develop ideas into projects. It is important that projects and other activities can be planned and started quickly enough while the needs are still current and companies are interested in cooperation.

JUA and its Institute of Natural Resources have played a key role in creating new expertise and new possibilities for small and medium-sized enterprises, especially in the northern part of the Central Finland Region. Entrepreneurs appreciate research and development where theoretical view is combined with practical experience. R&D is also a significant part of the education, and students participate exceptionally actively in it. Close cooperation allows interactive transfer of knowledge and expertise between JUA and trade and industry.

Through this cooperation, JUA has, for instance

- piloted Finnish heating and biomass harvesting technology in various European countries, which has facilitated the export of technology and the spread of efficient methods in Europe.
- founded and developed regional bioenergy development centres and created and compared regional bioenergy strategies.
- developed information services and training packages for national and international demand.
- implemented the HeatingTool Internet Service, which can be used to compare the heating costs and environmental impacts of different heating forms in single-family houses.
- developed a prefabricated boiler room for private houses in the BioHousing Project. A Finnish company has launched this product on the market.

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⑤ Jyväskylä University of Applied Sciences (Finland)

Wire Project: Empowering Social Networks

The Wire Project was prompted by increased unemployment and scattered employment management services in the early 1990's in Central Finland and the whole country. In four years, the number of employed fell radically, and the unemployment rate rose from 5.4 percent to 24.2 percent. If those employed through labour policy measures are included, the actual unemployment rate was higher than 28 percent.

The services and various guidance and counselling activities to support efforts to find employment have been developed in a wide network in the Jyväskylä Region for a long time. ESR Projects were implemented to find solutions to meet the challenges posed by the changes in the labour market and the ensuing prolonged structural unemployment that started in the early 1990´s. During the first programme period, several projects to stimulate employment were implemented in the Central Finland Region. The results and good practices were utilized in the Wire Project (2000-2007) administered by the Jyväskylä University of Applied Sciences. The aim of the project was to develop and harmonize the employment management services. The Project was initiated by the Central Finland Employment and Economic Development Centre.

Key actors of employment management and job creation and the evaluation of the development needs in the project
The key actors of employment management and job creation participated in the project, i.e. eight Central-Finnish municipalities, companies, entrepreneur organizations, employment offices, Central Finland Employment and Economic Development Centre, and unemployed people's associations. The project personnel conducted negotiations with each actor on the implementation of the project and drew up development partnership agreements. The development needs of the partners were evaluated in accordance with the EFQM Model and documented using Balance Scorecard.

Challenge: building and establishing a network-based action model for employment management and job creation
The challenge of the project was to build and establish a network-based action model for employment management and job creation in the basic service structures. To help the participants get used to the working methods required in building the action model, various learning events, e.g. municipality-wide networking seminars were arranged.

Various municipality or organization specific development projects were implemented to establish the action model. The projects aimed at developing the case management skills and multi-professional working attitude that employment management requires. Other development targets included cooperation with business and industry, and employment coaching. The employment work groups that operated in the municipalities under the Municipal Directors provided possibilities for the local actors to hear about each other's work and to develop new, shared work practices.

Action research in developing employment management services
The Wire Project was implemented as a development partnership project supported by action research. It produced information on both the current situation in practice and on the conceptual models that were based on previous research and experimental information. This information could be used to describe the starting situation of the development work and the relationships between the various measures. The research also produced feedback to the employment work groups of the municipalities and supported the development of solutions to promote employment in the public and private sectors, as well as in the third sector, which provides employment coaching.

In addition to the project personnel, also the teachers and students of the Jyväskylä University of Applied Sciences participated in the project by carrying out practice-based research and development work. The project provided a new, integrative learning environment for both the teachers and the students. Teacher and student participation helped disseminate the expertise developed in the project within the JUA organization, and the JUA graduates have applied their expertise in their work and thus harmonized the practices of the various actors in the field.

New service products and operating methods for employment management
During the first phase of the project, four new service products were developed: Wire Health Services, Wire Coaching, Wire Rehabilitation Planning, and Wire Sport Services. Another result was a customized employment path for unemployed job seekers, through which several people were rehabilitated and helped to return to the world or work. About 250 unemployed persons utilized the Wire Sport Services every year to maintain and improve their physical condition and working capacity.

During the second phase of the project, the good practices developed in the network for employment management were established in the basic municipal service structures, e.g. health checks and physical activity groups for the unemployed. In Jyväskylä and the surrounding municipalities, also a case management model was adopted in employment management. In addition, hundreds of company visits were made in cooperation with JYKES Ltd, Jyväskylä Regional Development Company. These visits resulted in services that helped employers lower the recruitment threshold, and in numerous development projects funded through various sources.

A total of 3806 people, 60% of whom were long-term unemployed, participated in the Wire Project. During the project, 500 people were employed in the open job market, and 546 in other ways. Eighty-four people opted for further education, and twenty-eight established businesses of their own.

The Wire Project created an action model for employment management and job creation which is especially suitable for helping people in a weak job market position to survive in today's job market. The model successfully implements employment promotion as a network-based cooperation process that allows the actors to learn new things, promotes innovations, and disseminates the action model.

⑥ IUT Bethune, Institut Polytechnique LaSalle Beauvais (France)

Programme Vectral

Le dossier étant confidentiel, on ne peux rentrer dans les détails scientifiques. Le plus important est la procédure pour accéder à ce type de programme. En premier lieu comme chacun sait, il faut du temps et de la patience lorsque l'on discute avec les industriels, mais il faut aussi de la réactivité lorsqu'ils disent OK. Mon équipe (chimistes) hébergée au sein de notre IUT et celle de nos collègues biologistes de l'Institut Polytechnique LaSalle Beauvais (IPLB) développe depuis 2001 des actions communes. L'une de ces actions à aboutit en 2004 à la synthèse (et tests) d'une nouvelle molécule pouvant apporter un bénéfice au niveau de la médecine vétérinaire.

Il nous est donc paru opportun d'essayer de développer cette molécule. En effet depuis le départ, nous avons tous travaillé sur fonds propres (avec aide du Directeur de l'IUT de l'époque Pierre Boulet, sans lui rien n'aurai été possible). Pour ce faire nous avons démarché nos antennes ANVAR (Agence Nationale pour la Valorisation de la Recherche, aujourd'hui elle s'appelle Oséo) respectives pour trouver quelques argents pour développer la molécule et l'améliorer. Nous pouvions avoir une aide financière ANVAR dans le cadre d'une étude de faisabilité, en trouvant bien évidemment un industriel intéressé. Nous sommes donc partis à la recherche d'un industriel par les listes de diffusion ANVAR.

Un industriel a alors répondu à notre annonce. Il était situé à 35 kilomètres de chez nous et on ne le connaissait pas (importance de la comm.). Pendant toute l'année 2005 nous avons discuté avec eux et avec un cabinet conseil dont j'avais eu connaissance par relation. L'année 2005 a été longue en réunion et discussion Industriel-Oséo-IUT-IPLB, et finalement l'industriel a dit non en octobre 2005. Il voulait partir directement en médecine humaine mais Oséo ne voulait pas aller aussi vite.

Donc nous avons pris un coup de bambou…..puis nous sommes repartis à la recherche d'un industriel. Et par hasard, nous sommes tombés sur une recherche de partenaire de la part de la société Techna SA (pour nutrition du poulet), après contact téléphonique avec eux, nous les avons rencontrés en janvier 2006 pour présenter notre projet. A l'issu de cette première rencontre ils ont dit : « on réfléchit et on vous informe en mars »…et ils ont répondu officiellement en avril. Et à partir de là tout est allé très vite, heureusement nous avions toujours avec nous le cabinet conseil.
Nous avons alors enchainé réunions sur réunions sur nos sites respectifs (Nantes, Beauvais, Béthune, Paris….). Et toujours sur fonds propres.

Le cabinet conseil qui a de l'expertise dans les dossiers Euréka, nous à conseiller à tous de monter un tel dossier. Et nous y sommes rentrés ; donc contact avec Bruxelles et Euréka Paris. Pour ce type de dossier, il faut des partenaires étrangers….donc nouvelle « chasse » à l'industriel. De là nous avons fait rentrer des industriels belges (Proviron et Novus) bien évidemment pas du premier coup. Et là encore il ya eu des réunions et des visites des sites.
Bref fin 2006 nous avions les « participants » et maintenant il fallait rédiger le cahier des charges et donc planifier les actions et l'aspect financier pour introduire le dossier auprès d'Euréka. Dossier (conséquent) que nous avons introduit en février 2007 et présenté oralement en mars 2007 devant la commission Euréka sur Paris. Commission composée de tous les financiers potentiels (ANR, Ministère, Oséo, INRA….) et nous avons reçu le label Euréka en avril 2007.

La commission nous a donc donné un avis favorable et cette même commission a décidé que l'ANR prendrait financièrement en charge l'IUT et l'IPLB. Mais il nous a fallu refaire un dossier, idem au premier mais présenté différemment de celui d'Euréka et oui l'ANR avait des exigences de présentation bien particulières et souhaitée que nous introduisions le dossier auprès de ses instances en juin 2007. Donc nouvelle course contre la montre. Et en juillet 2007 nous avions la réponse de l'ANR qui subventionne à 90% la participation de notre équipe IUT soit prés de 240kĐ.

En résumé entre début 2005 et juillet 2007 cela a été la course aux réunions et aux montages des dossiers, mais cela en vaut la chandelle. Nous sommes à présent dans la deuxième année du programme qui va de juillet 2007 à juillet 2010. Notre IUT est partenaire au même titre que les autres acteurs du programme et nous bénéficierons aussi des dividendes de la commercialisation du produit sur 10 ans. Travail lourd mais très intéressant. Et satisfaction personnelle vis-à-vis des chercheurs de notre université qui disent « pas de recherche en IUT ». Cette subvention ANR est jusqu'à maintenant encore la plus grosse allouée sur notre université, nous avons eu les félicitations de notre Président.

Autre point, pour la mise en place de ce programme nous avons créé au sein de notre IUT un centre technologique qui nous a ainsi évité de passer par toutes les instances universitaires et cela convenait parfaitement à l'ANR. Nous sommes à présent sur un autre dossier Euréka mais à visée médecine humaine avec des partenaires français et anglais.

⑦ Fachhochschule Aachen (Germany)

Novel spark plug

Prof. Dr.-Ing. H. Heuermann, Dept.of Electronics and Information Technology
(heuermnann@fh-aachen.de)

In a first step the FH Aachen filed a patent at the 7.2.2006 regarding a novel spark plug basing on the ideas and pre-development work of Prof. Heuermann. The second step was the verification phase. For this it was necessary to realize a first demonstrator and to buy a RF laboratory power amplifier with 50W (cost 5000Ð).

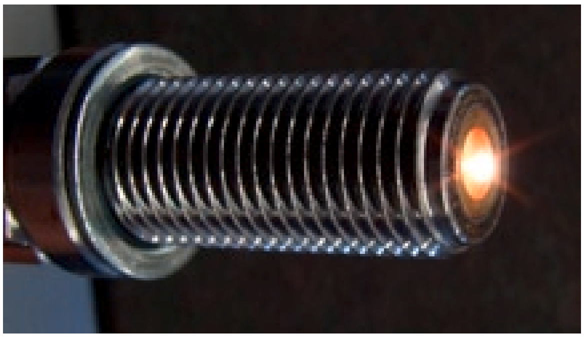
A diploma student and the workshop of the FH Aachen realized the first demonstrator. A co-operation with a company was necessary to buy the RF amplifier. Prof. Heuermann presented the ideas by Siemens VDO, Daimler, Bosch, and Beru. This new spark plug fits to the product lines from Bosch and Beru. Bosch has had a long-term research project regarding spark plugs with microwave signals with the University Stuttgart. However, for Beru is this novel spark plug the start for research work in this area. Beru was the company which supported the project study with 5000Ð for the amplifier.

Basing on the very good results of the first demonstrator, a research project with Beru was founded. Since 8.2006 the ex-diploma student R. Perkuhn is a member of the FH Aachen and works on this research project.
In parallel Beru becomes an owner of the patent. This process was supported from Provendis, the department for all Universities of Nordrhein-Westfalen (NRW) to manage the patent activities. There were no problems and bottlenecks encountered regarding the collaboration with Beru and Provendis.

The potential benefits of this new technology are:
- No wear
- Larger flame
- No ground electrode
- New possibilities to control spark flame (length, number of pulses, ...)
- More engine power, less petrol consumption, less emissions, etc.

The technology can use a low-cost magnetron (only 25€, used in microwave ovens) to support static fixed generators (e.g. bio-gas power plants) and get a very large flame.

But there are still a number of practical problems to come from the demonstrators to a product:
A large one is the implementation of an isolation area between internal spark plug and combustion chamber. Spark plugs with isolation element were developed:

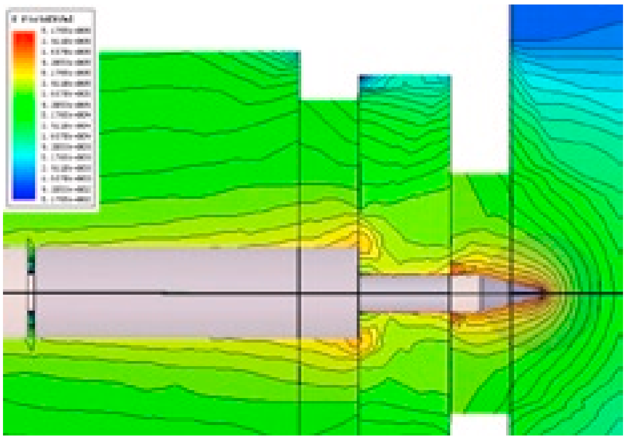


Second generation for car applications with 50W microwave power

However, all technology steps were not solved to have a good ceramic metal connection for high pressure. This is an internal research project by the industry partner Beru.
Another general problem is a cheap RF power amplifier for the car application. To overcome this problem a new research project with a lot of partners including Infineon is started with an application. Basing on the fact, that Prof. Heuermann was an employee of Infineon in the power amplifier field, it was no problem to start this co-operation. This research work is still ongoing.

Around to this project with other plasma-project were started at the FH Aachen, one concerning a novel lamp and the other one for material identification. With these projects the research activities of the spark plug contributed to regional innovation in companies in Aachen. Philips is supporting and monitoring the plasma lamp activities and the Fraunhofer Institut of Laser Technology started a research application regarding the material identification.

A lot of diploma and bachelor as well as future master works are (will be) included for the development and research work around this novel plasma generation projects with microwave energy.



3D finite element simulation of spark plug head with E-fields

⑧ Siauliai College (Lithuania)

The development of software for automatic calculation of recipes

This innovation helps to maintain the top quality famous not only in the region, but in whole Lithuania and abroad. The development of software for automatic calculation of recipes for a confectionery factory was carried out by one of Siauliai College's lecturers of Information Technology. The research was realised between November 2005 and November 2007. The contract was initiated and funded by the confectionery factory „Ruta“ located in Siauliai City. The company's demand was to develop software for automatic calculation of recipes. The calculation of materials budget and proportions of ingredients is very important both for the quality of sweets and the financial profit of the enterprise. This is very good example of how the knowledge triangle has been strengthened. The main research was done by the lecturer but development of the software proceeded together with College students of IT. They had possibility to do research and learn simultaneously and implement their work results. The innovation of the software was evaluated by the Centre for Quality Assessment in Higher Education (CQAHE) in Lithuania and recognized officially. Innovations developed and implemented by an UAS in Siauliai Region are quite rare due to no clear articulation of research demands from companies, but this is a successful case. This innovation helps to maintain the top quality of sweets famous not only in the region, but in whole Lithuania and abroad. Further details of this project are restricted according to the contract.

How/ why the project was initiated

Before this project was initiated the lecturer Mr. Saulius Milasauskas who leaded the research team was working for the confectionery factory and developing software. The company was planning to expand its product range. Company's plan required innovative software for automatic calculation of recipes. The company proposed him contract for the development of the software. At this time already Mr. Saulius Milasauskas was Head of Department of IT Studies of Siauliai College. He brought togehter the research team and the contract between confectionery factory Ruta and Siauliai College was signed. The research was realised between November 2005 and November 2007.

How companies were associated and any problems encountered

Company leaders were highly interested in the economic efficiency of this research, because the calculation of materials budget and proportions of ingredients is very important both for the quality of sweets and the financial profit of the enterprise. Company technologists participated actively and ambitious in the development process. The result was evaluated by the chief technologist and the economist. Company leaders and responsible employees had enough experience in common research projects. There was no significant problems or bottlenecks, small problems were solved together punctually. It helped to prevent bureaucracy and ensured to be on schedule.

How research activities have contributed to innovation in companies (products, processes)

Research results are implemented into the production process and used for development of new sweet products. This innovation helps to maintain the top quality of sweets. New products are now faster and more effectively brought to the market. This research project stimulates competition between confectionery factories in Lithuania. Only in Siauliai, quite small city with 130000 inhabitants are two big confectionery factories.

How the case may benefit professional practice

The research project was done together with second and third years students of IT. During the project they gained valuable practical and theoretical knowledge and experience of practival and creative work. They had possibility to do research and learn simultaneously and implement their work results. The students are now graduated and work successfully in Lithuanian companies.

⑨ Hogeschool Utrecht, UAS (The Netherlands)

Social innovation in Small and Middle sized Enterprises

By giving a positive impulse to innovation and entrepreneurship, the Dutch government intends to make The Netherlands one of the leaders in the international knowledge economy. Within this approach Small and Middle sized Enterprises (SMEs) deserve special attention since they form an important motor for our economy: excluding government, almost 60% of the Dutch work force is employed by SMEs and 60% of the total trade and industry revenue is generated by SMEs. Additionally, through the introduction of new product-market combinations, SMEs can be regarded as nurseries for innovation that force large enterprises to continue to remain focussed.

Social innovation, i.e. the systematic innovation of employee and organisational policies, is essential for the increase of the innovative power of SMEs. By starting the project 'Social innovation in SMEs', the Hogeschool Utrecht, UAS, wants to support the increase of innovative power of SMEs in the Utrecht region. Through this project, existing knowledge about social innovation is channelled to SME entrepreneurs who can apply this to their day-to-day business, and develop new knowledge. This can be achieved within enterprises or UAS themselves or, even better, through the interaction within the networks formed by these enterprises and UAS. This latter mechanism even strengthens the networks of SMEs to enable them to autonomously gather and apply knowledge. These networks consist of SMEs, consultant, training agencies, branch associations, business circles and teaching institutions.

Co-operations with external entities

In this project the research group "Organizational configurations and work relations" of the Hogeschool Utrecht, that focuses on social innovation in employments, co-operates with the consultants of firms, recruitment agency USG People, innovation network for entrepreneurs Syntens and the research institute TNO. This consortium is furthermore supported by a large set of initiatives that have been established in the Utrecht region, e.g., Task Force Innovation region Utrecht, the Science Park Utrecht, Chamber of Commerce Utrecht, employers' associations MKB-Nederland for SMEs and VNO-NCW for the larger companies.

Sharing and applying knowledge and skills

The project intends to emphasize and demonstrate the importance of social innovation for the innovation and growth of enterprises and to exchange and disseminate existing knowledge and skills. A 'basic innovation scan' will give entrepreneurs the opportunity to analyse their company. This scan consists of an analysis of the enterprise's ambition, its products, services and market innovations, multiple aspects of its social innovation and its knowledge infrastructure. In general, for separate lines of businesses the realisation of social innovation may differ significantly and even for different enterprises within the same line of business, the manifestation of social innovation may be completely different. No 'one size fits all' policy exists: each theme, each entrepreneur and each enterprise demands its own dedicated approach.

From this 'basic innovation scan', the important bottlenecks in the organisation are identified. This leads to a proposal that lists the most essential changes for the organisation, its employee policy and its management. Additionally, it may also become evident that there are bottlenecks in other areas than social innovation, e.g. in ICT or in product development. In the end, the objective is to provide the enterprise with means to independently implement organisational improvements.

Improvement and innovation of organisation and employee policy

On the basis of advice to individual enterprises, knowledge and skills have been upgraded, applied and disseminated. Several entrepreneurs are supported while further improving and innovating their organisation and employee policy. Additionally, collective activities, characterised by their small scale, their profound contact and their interactivity, are organised for entrepreneurs. Here one could think of dialogue meetings, master classes, knowledge groups etc. This approach of convergence, focus and divergence is repeated continuously in order to evaluate and disseminate progress, to update the approach and to develop new knowledge and skills at all times. In the meantime we assess whether our approach of sharing and applying knowledge is still effective and whether it actually leads to innovation and growth.

Strengthening the knowledge infrastructure

It is a requirement to strengthen the infrastructure for all activities and here lies the main task for our institution. To implement the project and to safeguard it in the long run it is necessary that the results of the study are added to the education of our students, so that knowledge and skills on social innovation in SMEs become part of the curriculum. In order to continue to supply SMEs with competent entrepreneurs and employees, the Hogeschool Utrecht intends to co-operate in this project with the Utrecht University, the Research University of the city and the secondary vocational education in the region Utrecht.

Benefits

In the end this project yields two concrete deliverables. First of all, SMEs will have obtained useful and accessible social innovation knowledge and skills, such as self-help instruments, methods, guides and roadmaps. To develop, implement and apply these instruments, an infrastructure of skilful advisors will be constructed to. Moreover, a network of enterprises, universities and consultants arises that guards the level of innovation knowledge and skills and that facilitates the continuous exchange and maintenance of this knowledge and these skills.

⑩ Polytechnic Institute of Leiria (Portugal)

The functioning of the Technology transfer Information Center (OTIC)

How and why the project was initiated?

The OTIC (Technology Transfer Information Centre) was the IPL's (Polytechnic Institute of Leiria) structure created to manage R&D output valorisation and promote a fully dedicated partnership channel between Enterprises and the Academy. The OTIC manages and promotes technology transfer projects, focusing on the valorisation of its teaching staff experience, knowledge and R&D, according to IPL's strategy. It was a 3 year project funded by AdI (Government's Innovation Agency).

How companies were associated and under what conditions?

Enterprises have been increasingly recognising the value of new information, knowledge and technology as a useful output of R&D activities. Its application on commercial purposes led to a constant product and methodology innovation, and therefore the enterprises constant adaptation to real market needs.

As an effort to stimulate enterprises to develop their projects in a close cooperation with the IPL, it was maintained a narrow relationship throughout several protocols and partnerships established. This comprises 3 main relation types: IPL's consultancy/applied services, bi-lateral consortiums and technical cooperation.

If and how companies articulated their needs?

Enterprises often have the need to solve particular issues regarding their internal activities and projects. In order to do so, the OTIC was asked for help on trying to promote the viability of the solution for a specific problem presented. If the OTIC intends that the IPL has got the means to comply with the request, is started its usual procedure of a briefing meeting between the enterprise and the OTIC projects management team, in order to understand the global issue and then internal contacts are established to answer the initial request, and then defined the best type of collaboration possible.

As the OTIC is responsible for the management of all the projects it runs, enterprises articulate every necessary step with the specific internal OTIC project manager. This allows the project development to be fully controlled in what comes to its management, an issue previously done by the researchers involved on these activities, limiting the time they actually spend in the project technical issues. Also the evolution of the development side of a project is monitored, easing up the contacts between the enterprise project partner and its output results.

Any problems and bottlenecks encountered and how solved?

The predictable difficulty about the hard way through the objective of getting the awareness of the enterprises to the OTIC's mission and advantages it comprehends, led to its operational plan definition based on the creation of promotional material about the research fields at the IPL, brainstorming sections with researchers and business/industry actors in order to identify potential and emergent areas of knowledge and research, creation of an internet portal for the OTIC, visits to enterprises, support and promotion of research results transfer for the industry, development of technological benchmarking studies between enterprises of the same activity sector (specially with foreign enterprises), participation in information nets and national and international events, promotion and negotiation of R&D+i contracts, promotion of consortiums, support appliances for national and international funding programs, offering of consultancy services for the enterprises, among others.

The OTIC has a double responsibility as it is the structure that does project development and its management. The difficulty to comply with bureaucratic procedures inherent to a Higher Education Institution legislation, and the effort to make it compatible with the timing of the projects did put some constraints on these processes. In addition, there were several different operational/administrative departments of the IPL which OTIC must attend to. As a consequence, it was crucial for the parts involved to know the common procedures needed in several situations in order to create a productive process flow dynamic.

The implementation of a new active methodology of the initial approach to project management and follow-up did promote time economy and therefore efficiency improvement. This methodology was based on the definition of a common flowchart that comprises all the steps needed to be taken and the internal departments involved. As time was a determinant factor, limits were defined for each step and department intervention duration and field of actuation. This way the project could be more predictable in what comes to its time management and therefore its efficiency.

As a significant part of the R&D outputs were eligible for patenting or other intellectual property protection systems, therefore some restrictions on their previous use were created. This was mainly because of the time it takes to implement the protection process and the internal agreements to be established. To minimize these effects, the IPL implemented an Intellectual Property Management System in order to allow all the actors involved in these processes to follow the same guidelines and obtain a common and well known workflow.

As some collaborations were based on technology transfer, there was noticed some reluctance from the enterprises to this process. It was clearly a new methodology that needed to be simplified in order to have a better level of acceptance. That way the IPL tried to overcome this by establishing specific and well limited technology transfer contracts with the enterprises.

Besides the existence of some constraints in the cooperation between enterprises and the IPL, these difficulties have been a learning element in the cooperation process. The IPL made the option to look at the identified opportunities with an active attitude in order to reach a successful cooperation.

How research activities have contributed to innovation in companies?
The cooperation between Higher Education and enterprises is a very important instrument so that a Higher Education institution could be seen as a learning place with an effective position to contribute to the regional and national development, participating actively in innovating processes through the valorisation of R&D outputs.

The growing consciousness of the enterprises about the need of constant innovation and development mainly through R&D applied results, and the Higher Education Institutions awareness of the need of knowledge valorisation created throughout technological research, allows to narrow the difference between knowledge itself and knowledge influence applied on industry. This clearly stimulated enterprises to base their activities on scientific results and thereafter implementing an entrepreneurial innovative culture.

How the case may benefit professional practice?
Innovation gets its maximum extent when it creates economical or technical effective value. The effort of the IPL to do so was clearly determined by the creation of the CTC (Knowledge Transfer and Valorisation Centre), which is an evolution of the former government funded OTIC project. It has similar objectives and mission as its previous structure. However as it is now an organic structure of the IPL, it must be economically viable and sustainable, therefore constantly acting as an enterprise itself, doing efforts for economic inputs of its activities, but also evolution through the valorisation of innovation it generates on R&D. As a structure that manages projects and partnerships between a Higher Education R&D outputs and the enterprises, it can be understood as a fundamental resource to promote economy development, either by a direct or bilateral cooperation on R&D based innovation.

⑪ FH Vorarlberg (Austria):

Optimisation of waste disposal infrastructure

The aim of this project is to develop a software-tool for simulation and optimization of the waste disposal system in Vorarlberg. The work focused on two parts:

1. Data Collection: The waste collection vehicles have been accompanied on all collection tours in Vorarlberg so that the GPS-positions of more than 80'000 waste collection points were recorded along with other date, like GPS-positions of the waste depots, restrictions in the road network, such as one-ways, or streets which have to be collected separately on the left and on the right street side.
2. Simulation and Optimization Software: On the one hand the software enables the user to simulate the effects of possible changes of parameters in the existing waste disposal infrastructure, like collection frequency, waste fraction or collection technology (multiple compartment collection vehicles). On the other hand it's possible to optimize the vehicle routing when the parameters of the disposal infrastructure and the collection-area are given. Here optimization means to minimize the total length of the routes.

The outputs which are computed by the simulation/optimization are distance, time, costs and emissions (CO_2, NO_x, PM_{10}).

Project initiation

In March 2007 "Umweltverband Vorarlberg" (UV Vorarlberg), an association of all communes in Vorarlberg, organizing the waste disposal infrastructure in the province, assigned the development of the simulation and optimization software described above, to FH Vorarlberg. The decision was caused by the experience of FHV in the field of optimization and simulation and by the proximity to the location of interest so that a high flexibility was anticipated. By and by the relation between FH Vorarlberg and UV Vorarlberg deepened and the project is now characterized by a close collaboration between the two partners. This enables UV Vorarlberg to update the requirements whenever new experience makes this necessary, and FH Vorarlberg has the guarantee that their research is directly applicable in practice. The project described here started in April 2007 and ends in December 2008. It is fully financed by UV Vorarlberg. Subsequently the work on this research area will be continued as a part of the new governmentally funded Josef Ressel Research Center for Optimization under Uncertainty.

Difficulties and solutions

For data recording we used standard hardware (PDAs with GPS receiver) and self developed software on these mobile devices. It turned out, that it was impossible to develop this system to a really satisfactory degree of reliability. Especially the cold start of the GPS receiver caused problems. These troubles were circumvented by working together only with students of FH Vorarlberg who were highly motivated and interested in informatics or even students of informatics who were able to restart the system in the case of failure.

Data handling and graph generation posed and poses a great challenge. Computing shortest paths between two vertices has to be done extremely often as a sub-routine in route optimizing. Hence saving shortest path, which have been already computed, saves computational time and makes the optimization of large areas possible. But large areas imply graphs with a lot of edges and vertices so that the computers run out of memory when saving all shortest paths. Until now our tradeoff between runtime and memory usage allows optimizations on graphs with about 2500 edges. For the subsequent project we plan to optimize data storage so that optimization on even hugher graphs is possible. Furthermore we plan to implement more flexible data structures, in order that the system can represent real world events, like barrier because of road works (cancellation of an edge) or completion of a new apartment building (new waste collection location).
Only few optimization algorithms which consider at least some of the restrictions of the given real world situation can be found. The class of optimization problems we deal with are mixed rural postman problems with capacity restrictions and time windows. The algorithm which we use (VNS algorithm) is one of the fastest and most accurate which is known until now and finds satisfactory results at least for the more urban areas of the country. Unfortunately the solutions for rural areas are poor. We will develop algorithms which overcome these problems in the subsequent project.

Benefits

Umweltverband Vorarlberg uses the software permanently to analyze the possibilities of an improvement of the waste disposal infrastructure. The possible reductions of costs reach up to 30% in some areas. To achieve these reductions major changes in the system are necessary, and the reliability of the results can help in the decision process. For FH Vorarlberg this project led to a major increase of know how in the areas of optimization on graphs and handling geo-referenced data. Furthermore research at FH Vorarlberg got better known in the province since the majors of all cities got in touch with it. The connections to education at FH are manifold. First of all master students of informatics are an important part of the developing team. Furthermore bachelor and master theses are written on topics related with this research area. Finally topics for a semester projects in Bachelor and Master programmes emerged from this project. The project is a beautiful example of how the involvement of students can enhance research projects for third parties, and how third party research projects can enrich education.

⑫ University College of Northern Denmark:

Research Light in Rehabilitation Practice

Lecturer Jette Bangshaab, Project Manager at Center of Knowledge for Rehabilitation and Physical Activities.

Background and purposes
The background for this educational sequence is a wish to develop a closer cooperation with practice, and get a better connection between educational activities and the practice for rehabilitation. In parallel, we have a desire to have this project, because we want to associate learning about rehabilitation closer to the professional practice in cooperation with practice.

Purposes of this project are:
- The students acquire knowledge on rehabilitation.
- Practice may have studied a relevant problem in rehabilitation
- The students test a method – Research Light - for use in practical research
- The students are able to go to "real" practice and try out this method on an existing problem in rehabilitation formulated by health professionals.

Structure and content
Students - from the study of physiotherapy on the fifth semester and students from the study of occupational therapy on the fourth semester of training - are together in a cross-disciplinary sequence for 3 weeks. The pivotal point is rehabilitation, and to work with problems in this area, the students are introduced to a scientific method called "Research Light".
The Research Light method can be implemented relatively quickly, and the results come in a form that can create good dialogue between students and between students and health professionals in practice.
Research Light is a road to work with evidence based practice in practice. The method is a researched inspired activity, which defines clear questions, a clear analyse and methodology suited to the issue.

Training course
The training course consists of the following elements:
In the first week the students are introduced to key concepts of rehabilitation. This point is not involving practice. Students visit a professional practice site and will be introduced to the place of working in connection with rehabilitation efforts. This is done by a brief meeting in preparation for the course. The purpose of this introduction is, that students can make some thoughts on a possible focus of the investigation. The introduction may also be through websites or telephone contact with practice.

In the second and third week students develop in small groups of 2-3 students a classical research protocol for the subject area, a clear analysis unit and a plan for data collection.
Data collection: The students carry out their research in a professional practice. The research is based on the questions, that were formulated in the first day and the research that was planned on the second day.
Data processing: The students present relevant data and results to practice and other relevant persons. The students get response from their advisers. The data from the research are disseminated to other students from the study of physiotherapy and occupational therapy.

Outcomes and benefit for professional practice
In professional practice they say, that this research get "new eyes" on their practice, and that is a base for developing their professional practice to a more evidence based and reflected practice. Furthermore they stress, that it gives them an opportunity to research an area, which they did not have time to investigate themselves. The students say that it was very good for their learning to formulate the problem area on the base of a theme formulated by practice, and this makes the research very relevant to the students.
Furthermore the students get knowledge, insight and a relevant method on how to develop professional practice in cooperation with practice, and Research Light makes it possible to link between education and practice through research.

Problems and perspectives
We only have had this training course one time, so we have not much experience yet. But the main problem just now is to get practitioners involved in this program, because they have not enough time and resources for activities like this.
We now try to establish a network of professionals in rehabilitation practice, and they shall support the process for a higher degree of cooperation between practice and education and pave the way for practice to join the training program with Research Light.

⑬ Tallinna Tervishoiu Kõrgkool (Tallinn Health Care College) Estonia

Impact on regional development and innovation process through research and development

During the Community Action Program of Leonardo da Vinci project "Senior Citizen participate in Creating their Future – SAGE" an overview was prepared about the possibilities of elderly, their needs and expectations to be active citizens in Estonia. (Tiina Juhansoo, Anne Ehasalu, Merike Kravets, Eve Epner, Mai Kull, Tallinn, 2006).

For the development of activities in the field a new consortium between SA EELK Tallinn Deacon Hospital, Tallinn Health College (Anne Ehasalu, Merike Kravets), Geriatrics and Gerontology Association, Alzheimer Network, Estonia and Schleswig - Holstein Deaconie, Germany, was created.
To introduce planned activities to the members of society, an international conference for all interested parties "Aging of the Society and dementia – whose problem?" was held in Tallinn in 21.09.2007.

The Consortium elaborated a plan of activities for development of the quality of offered services by the care workers. Special modules for the education under the headline " Dementia - challenge to the society and to an individual" with the modules:

1. Medical meaning of dementia, evaluation of the living management, work with the case, documentation;
2. different aspects of the care of people with dementia, validation, application of the environment to the needs of the patients/clients group, facilities for the client;
3. nursing care, resources for the activation;
4. terminal care, fatigue of the care worker, work with family members;
5. Consultations.

At the same time, a research (under the supervision of Tallinn Health Care College together with students as a part of learning process) was carried out in care units. Course works and diploma thesis on the topic will be prepared and presented by the students.
Future development plans will be elaborated together with the members of the consortium on the basis of ongoing research.
The project members are consulting about actual issues in field.

⑭ North Karelia University of Applied Sciences, Joensuu (Finland)

D'ART Design Resource Center and Innovations for Independent Living ISAK – user-driven development projects

NKUAS has carried out several user-driven development projects for local and national companies such as Tulikivi Oy (leading fireplace manufacturer), Abloy Oy (door environments and security), Rakennusliike A. Taskinen (buildings, residential area planning), Respecta (assistive devices for disabled people) and Koistinen Kantele/ Jamkids (childrens' kantele string instrument learning). Collaborative user development has also been carried out with associations, institutions and the city of Joensuu. The diversity of students by age, profession and nationality and collaboration with schools and nurseries has also offered user involvement opportunities. NKUAS has currently two active development centres applying user-driven development processes. The first is D'ART Design Resource Centre which has organised user involvement in the product development processes in the Joensuu region with the diverse consumer user segments both through participatory innovation camps, interviews/ observations in the consumer homes and usability testing. Centre for Innovations for Independent Living ISAK has carried out both national and regional barrier free development projects together with the national Eläkeliitto ry. (retired peoples' union) and disabled peoples' organisations including innovation camps by D'ART and user innovation competitions. Also public space observations have been used as tool for first hand user information.

Innovation in a business context is about the commercially successful exploitation of new ideas and combinations. The INNOstudio® concept is a service and a teaching aid created by the D'ART Design Resource Centre in the North Karelia University of Applied Sciences (NKUAS). The INNOstudio® concept forms a virtual and concrete environment facilitating innovative processes with structured sessions applying various innovation methods.

The INNOstudio® concept was created on the basis of the practical experience of D'ART in organising innovation camps for company clients, which began year 2000. The development work has consisted of planning and facilitation of the innovation camps and research and development for the interdisciplinary direction. The business orientated innovation trends show the significance of interdisciplinary innovation, especially with product and service concepts and other complex value offerings or business process changes. Using knowledge and skills of diverse professionals and user involvement is important in current innovation work that strives for new combinations.

The former specialist specific stage gate model of product development is moving in the direction of multidisciplinary network interaction. The INNOstudio® development deals with the requirements of complex innovation networks, rich problem space, opportunity searching, interdisciplinary interaction and social creativity through the interplay of divergent and convergent thinking. This kind of facilitation is about taking care of the interdisciplinary communication, social interaction, goal building and development of joint work.

The organisation of innovation sessions is facilitated through various methods providing means of analysing the innovation issues, building alternatives and evaluating them. An insightful value creation process requires future thinking, customer and user understanding and evaluative skills for defining value opportunities with innovative work. The structures and methods in the INNOstudio® concept aim especially at promoting interdisciplinary innovation with the help of iterative design processes and visual design methods.

The INNOstudio® concept for product and service development assists the D'ART Design Resource Centre staff in providing innovation sessions for company and organisational clients, particularly in regional development work. The practice of interdisciplinary product development is necessary to serve the SMEs' design, technological and marketing needs in an integrated way.

⑮ Kajaani University of Applied Sciences (Finland)

Product Development Management

Goals of the process

The goals of the process are to integrate the R&D processes in the education, to clear understanding of entrepreneurship, to optimize the usage of Kajaani UAS internal elements and strengths including different schools e.g. engineering, business schools and exchange students and to contribute to regional development by assessing and creating SMEs.

Implementation

The course started on spring 2007 for the first time and then on spring of 2008 and will be starting on the spring 2009. The course emphasizes the understanding of the product from different angles (market, technical /design and production) and creating heterogeneous groups from different study and cultural backgrounds. We have used two sources of projects 1) local companies 2) student own innovations. The group size varies from 4-6 students based on the project nature, in addition to contact/ supporting person from the company. The educational part of the project is taking place through lectures/discussions forms where students introduced to the product development/ entrepreneurship processes.

Results

The process succeeded in fulfilling the goals as follows:
Students: The students have exposed to the real picture of business especially that the product is the core of any business. At the same time, they familiarized and experienced the internal functional environment of the company including understanding of different cultures (multinational participants) and technical languages (EngineeringĐ Business). Additionally, when project was involving new products innovations the students were able to produce different levels of prototypes and explore the possibility of establishing a new company around the new product. On the last two years 45 students have participated in 9 different projects.

Company: The local SMEs were able to use the students in exploring possible markets for their products in addition to what and how possible changes in the product specifications should be done. Additionally, local companies could identify possible future employees.
Kajaani UAS: KUAS has successfully integrated R&D processes into its education system and at the same time fulfil one of its main goals in contributing to regional development and initiation of entrepreneurship. The process and concept of the course have been extended and on spring 2009 we will have three courses running under the same process.

⑯ IUT Saint-Nazaire (France)

Plate Forme Technologique de Créativité Industrielle (PFTCI)

At the end of the eighties, in the employment area of Saint-Nazaire, the main industrial activity was the shipyard (Chantiers de l'Atlantique: CA). This activity generated employment for about 4000 employees of CA and about 10 000 employees of subcontracting companies (SME in general). Unfortunately, the activity of CA was cyclic, with four or five years of hard production and four or five years of low one. So the political and economic environments have converged about the idea to develop new economic activities using the competences of subcontracting companies but also developing new kind of activities. They though that research and technological transfer were one of the factors contributing to became attractive this region so they met the IUT to collaborate to the development of research activities.

One of the actions was the creation of the Institut de Créativité Industrielle (Institute of Industrial Creativity - ICI). The basic idea was to put together companies, academic world (university across the IUT, high school), the political authorities (the city and the regional government) and the chamber of commerce of Saint-Nazaire. So a non-profit-making organisation was created. This organisation was chaired by an industrial member with a council having companies, political and academic representatives. The mission of ICI is to help companies, mainly SMEs, to cover the whole steps of creation and management of project, since the specifications' drafting of a new product or a special machine until the realization of the prototype to see the industrialization of the new product. For that, the IUT created a new university diploma that became a professional bachelor called Innovation and Industrial Development. Then, on one hand, companies benefit from IUT and high school teachers and equipments and, on the other hand, the academic institutions have true and interesting subjects to submit to the students. Five jobs were created to put on the structure.

Nevertheless, in spite of a strong commercial activity, the ICI doesn't arrive to balance its budget, so it needs the help of the local grants (44% of self-financing and 56% from grants given by the region, the municipality and the chamber of commerce of Saint-Nazaire). The reason for this situation is mainly that the ICI can not offer the same service as a transfer structure because the staff must spend a part of his time accompanying the students' work.

This year, the ICI merged with the Technological Platform of Saint-Nazaire (PFT) to become the technological Platform of Industrial Creativity (PFTCI). Its missions are:
- Technological Transfer and training.
- Research and development (feasibility and realisation of new products/process) for SMEs.

⑰ Vilnius College of Higher Education (Lithuania)

The coherence between applied research and teaching/ learning processes

The coherence between applied research and teaching - learning process in Vilnius College of Higher Education is developed through lecturers and students applied scientific research activities. Lecturers, as well as other academic staff, carry out different applied research. Majority of the research carried out in the College are targeted at improvement of the quality, process and conditions of studies. Research on employers' opinion about the relevance of study programmes to the needs of labour market; research on graduates readiness for practical activities, etc, is one of the most important prerequisites for renovation of study programmes and implementation of innovations. Apart from that lecturers of the College carry out research ordered by different institutions. The mentioned research work could be divided into educational research (entrants' survey; investigations of students' adaptation; the first year students' records; students' interests, teaching innovations, quality of study and subjects programmes; quality of study process organisation); research on vocational training and labour market needs (such as investigations on reconstruction of the content of vocational training; motivation and satisfaction with the studies among graduates; rate of employment of the graduates; employers' surveys; surveys on specialists' demand) and marketing research (research on demand for study programmes; market; consumer behaviour; macro and micro environment of business enterprises).

One of the basic goals of the College is to train highly qualified specialists capable to apply the acquired knowledge and to solve problems independently. That is why the study process encourages students to develop analytic skills through analysing, comparing data, expressing their opinion and summing up their findings. Integration of applied research into the study programmes and study process covers different aspects and levels, thus developing students' competences in organising and carrying out applied research. Firstly, the competences, connected to applied research are formed through subject studies. Theoretical and practical aspects of applied research are reflected in the programmes of the subjects and in the assignments for self-dependent work. No less than one third of the total scope of a subject is designed for self-dependent studies. The regulations for organisation and evaluation of the students' self-dependent work are certified college-wide. One of the most popular forms of students' self-dependent work is different projects and presentations. Individually or in groups, according to the topics of the studied subject, students collect data, prepare questionnaires, make survey, analyse data and formulate conclusions. Such research, for example, may confine to survey on healthy lifestyle or microclimate in the group, but progressively it helps developing skills of organising a research.

Students acquire while working on their course or final papers or projects considerably better skills do to applied research; the requirements for those are indicated in methodological regulations.

A course paper is a self-dependent work, intended to develop students' skills in systemising, analysing, using scientific literature, examining problems relevant to the chosen subject-matter.

Final paper or project is based on research or data analyses. A compulsory part of the final work is the research part. While proceeding with the final work (project) students choose from different research methods, such as qualitative and quantitative, experimental and non-experimental. Usually research carried out by the students is applied research. This means, that students, having been introduced to scientific theories and their fundamental propositions, efficiently investigate a practical problem. In the final work students have to be able to define the relevance of the topic, analyse relevant sources, envisage the peculiarities of the theme, convey their point of view on the discussed topic and present the findings.

An important role in formation of research competences falls on professional practices. Students make reports on their practices in public or business institutions; in the reports they analyse situations based on real problems, formulate ways to the problems' solution, carry out research and refer to the findings. An example of a close contact between studies and applied research is programmes in Management and Business Administration study field, in which research organisation skills and ability to evaluate business environment are acquired in the process of studying marketing subjects, carrying out marketing practices.

Seeking to achieve applicability of the research carried out in the final work (project) and obtain practical benefit, there should be closer cooperation with enterprises.

First of all, in the study process we must develop students' skills to carry out theoretical and practical research, to give them possibility to show their competences to potential employers. On the other hand, with students' contribution the enterprises would have possibility to acquire the relevant information at low expenditures.

⑱ Hogeschool voor de Kunsten (HKU), The Netherlands

Dutch Gamevalley: AGS, GATE, Game Expertise Centre, DGG

The following illustrates how R&D activities by HKU-KMT have an impact on regional development and innovation processes. The case describes our involvement within the regional and national developments concerning games, virtual worlds and simulations.

Games and virtual worlds are widely recognised as an important technological and social trend that will have impact on the way we learn, communicate and work. Knowledge of game design is not only crucial for innovation within the creative industry but also for domains such as education, health care, cultural heritage and safety. The research and design activities carried out in the faculty of Art, Media & Technology helped the Utrecht region to position itself as the 'Dutch Game Valley'. Together with (amongst others) Utrecht University (UU), applied research company TNO and the Taskforce Innovation Utrecht Region (TFI) we paved the way for regional and national development and innovation in this domain. The impact of our R&D is best illustrated in describing our specific role and involvement in the three related initiatives that have led to the recognition of our region as the 'Dutch Game Valley' and the growth of the Dutch game industry.

Together with UU and TNO, HKU founded the 'Centre for Advanced Gaming & Simulation' (AGS). The rationale behind the initiation of this multidisciplinary research centre on design, development and application of games & game technology was that the domain of game design, development and application is extremely multidisciplinary. In our vision a research institute with a focus on practice based research & development in this domain should reflect state of the art research & application in computer science, artificial intelligence (UU), game design, game art & animation, interaction design, (adaptive) audio & sound design (HKU) as well as insights in potential fields of application such as safety, health, education (TNO).

AGS managed to acquire a substantial budget (20 million Euro) for carrying out multidisciplinary research in the domain of game design and development within a project called GATE. The GATE project is carried out with various partner institutions and companies. Within AGS and the GATE project HKU focuses on game design research and creating innovative pilots. We are for instance involved in pilots that use game design & technology in education, healthcare and safety ('serious games'). We design and develop games in these domains, and study the methods and processes that lead up to successful serious game design. This way our design and design research fosters the useful application of state of the art technical and social research. The pilots serve as cases for innovation in organisations in the various domains (learning, health care, cultural heritage and security) and the creative industry that will have to design and develop games and simulations for these domains in the near future.

To disseminate the knowledge that AGS develops on the application of game design & technology in areas like education, health care, safety and communication to companies, and to stimulate the translation of this knowledge into innovation and economic activity AGS recently acquired funding for developing an 'expertise centre serious games'. The centre focuses on bringing the results of our R&D to the areas mentioned and the creative industries via publications, workshops, pilots and consultancy. Within the centre TNO will focus on the articulation of demand concerning the use of serious games, and game technology in the various areas mentioned. Most companies working for these areas do not yet understand the possibilities of using games and virtual worlds, and how to successfully design and integrate this technology into their strategy and processes. The creative industries on the other hand are not yet able to help companies in these areas with the articulation of their demand, and the realisation of applied game projects because a significant part of the companies within the creative industries lack knowledge on how to design and develop applied games: the game design & development methods, models and processes they have to use in order to successfully design, develop and implement games. Within the expertise centre HKU will focus on helping and advising the creative industries. Through our research we have gained much insight in design models, methods and processes in this domain. In this way we help to bring along innovation within the creative industries and the professional practice within the creative fields.

To help the growth of young innovative companies in the domain of game design and development the research group participates in an initiative called the Dutch Game Garden (DGG). This initiative combines being a business centre for the Dutch Game industry, providing housing and consultancy for game developers and being an incubator for young game companies in the Netherlands. Just like the expertise centre the Dutch Game Garden is an channel for our R&D. Furthermore, the Dutch Game Garden serves as preferred research object and partner.

Our substantial contribution in the initiatives described above enables us to carry out applied R&D in the domain of design. This knowledge is crucial for the education of creative designers. Since creative industries consist mostly of SME's that for more then 90% are smaller than 10 fte, they have only little capacity for R&D, innovation and reflection on practice. This is recognised as a bottleneck in the growth and innovation of the creative industries. Since a substantial part of the founders and the workforce of these SME's have been educated by or are part-time teachers in our department, we consider ourselves as one of the main knowledge and innovation distributors for the creative industries. Our R&D on game design models, processes and pilots directly feeds into the curriculum, and via initiatives as the ones described above to the professional field. This way it helps generations of young professionals to acquire state-of-the-art knowledge and skills concerning the innovative application of games and game design.

Links:
AGS: http://www.gameresearch.nl/
GATE: http://gate.gameresearch.nl/
DGG: http://www.dutchgamegarden.nl/
GDD: http://www.hku.nl/gdd/

⑲ Polytechnic Institute of Bragança (Portugal)

Linking education, teaching and research

The higher education system in Portugal change significantly over the last three years. The main legislation has been changed and deep reforms were implemented, particularly the establishment of the 3-cycle Bologna degree structure. In less than three years, Portuguese HEIs changed its academic program structure, according to the new legislation and the Bologna Process. Before 2006, the Portuguese polytechnic institutions offered only undergraduate programs, in a 2-step structure. With the new legislation, they were allowed to offer undergraduate (3 to 4 years long) and master (1 to 2 years long) programs. Additionally, the Portuguese Ministry of Science, Technology and Higher Education (MCTES) encouraged polytechnic institutions to offer non-higher education professional programs (typically, 1 year long).

The Polytechnic Institute of Bragança (IPB) was created in 1983 and, all over these years, implemented a distinguished program of teaching staff accreditation, particularly by encouraging teachers to obtain a PhD degree and to develop R&D activities. This strategy allowed IPB to reach a distinctive position within the Portuguese polytechnic system, with the highest percentage of teachers holding a PhD degree. Nowadays, 37% of the academic staff holds a PhD degree, and it is expected that, by the end of 2010, this percentage will be beyond 60%.

IPB believes that teaching staff accreditation and subsequent R&D activities are of utmost importance for the quality of its academic programs and technological services. This not compulsorily represents an academic or university drift of its mission. In our point of view, teaching staff accreditation and the development of applied research activities, undertaken by the polytechnic system, can contribute to high level professional education and enhance professional integration of their graduates. Fruitfully, the recent Portuguese higher education legislation allowed polytechnic institutions to offer master programs, representing, simultaneously, an important pre-requisite and encouragement for applied research and experimental development.

Taking into account this scenario, IPB seeks to link their academic programs with research and professional work. Particularly, IPB wants to concentrate applied research in strategic areas, to create a group of quality master programs (by establishing a network of international partnerships with European HEIs), and to establish a network of companies in Europe willing to accept IPB students as interns and participants in applied research activities. This is a strategic objective that will be developed in the next years, according to the new higher education legislation.

The first effective attempts were made in the present academic year (2008/2009), by using the European Lifelong Learning Program (Erasmus). In 2008/2009, the IPB funding through Erasmus program is 285 thousand Euros, which will allow the mobility of more than 300 incoming and outgoing students (for a semester or one-year long study program). The idea is to use part of the mobility grants for the development of master thesis (SMS grants, Student Mobility for Studies) and masters placements (SMP grants, Student Mobility for Placements). In the current year, some IPB master students are developing its final work in European HEIs, technological and research centres and enterprises.

The actual Portuguese legislation states that master programs at polytechnic institutions should include a thesis or a placement report that represents, at least, 35% of the total ECTS credits and that should emphasise the acquisition of professional competences. Standard master programs at IPB have 120 ECTS credits, corresponding to 2 years of study. From those, the last 42 ECTS credits are devoted to a research master thesis or to a professional placement with final report (12 ECTS of the 3rd semester and full 4th semester are devoted to the master thesis/placement). If the master student will develop his/her master placement abroad, the academic calendar is the following: a) at the beginning of the 3rd semester, the master scientific board defines the subject of study and supervisors for each student (one at IPB, other at the enterprise/technological or research centre); b) during the 3rd semester (12 ECTS, at IPB), the student develops a state-of-the-art concerning the subject of study; c) during the 4th semester (30 ECTS, full semester, at the host institution), the student develops the experimental and research work and writes the master thesis or final report; and d) at the end of the 4th semester, the student submits to evaluation the master thesis or final report, at IPB. The standard period of permanence in the host institution is 4-5 months, between March 1st and the end of June–July.

The more representative current example concerns the area of renewable energies. Besides the master programs in Chemical, Electrical and Mechanical Engineering, IPB offers, since 2008, an undergraduate program in Renewable Energy Engineering and a master program in Renewable Energy and Energetic Efficiency. Five master students will develop their master work abroad, in the area of renewable energies. The first partnerships are with the technological and research centers of CIEMAT (Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas, Madrid, Spain) and CARTIF (Parque Tecnológico de Boecillo, Valladolid, Spain). Another master student is presently in the Federal University of Mato Grosso (Brazil), developing his master thesis in the area of biodiesel production.

Additionally, IPB will be part of the future technological park for Trás-os-Montes e Alto Douro region. This technological park will be managed by an association that includes the two main municipalities and the two main HEIs of the region: the municipality of Bragança and IPB, and the municipality of Vila Real and UTAD (University of Trás-os-Montes e Alto Douro). The park will be located in two poles: the pole of Vila Real (Régia-Douro Park, devoted to agriculture and food technology) and the pole of Bragança (Brigantia Ecopark, devoted to renewable energies and environment).

The creation of the IPB undergraduate and master programs in renewable energies were driven by the future development of this technological park and the IPB strategic plan for research activities. It is of utmost importance for IPB and the Portuguese technological park to ensure a straight collaboration with the Spanish technological and research centers in the area of renewable energies. Further developments will be carry out, in order to enlarge this collaboration to other European countries (IPB has recently established a collaboration agreement with Airtricity, Ireland, wind farms).

IPB believes that this will represent an example of good practice concerning the role of polytechnic HEIs, linking education, teaching, research and professional world. We believe that the students, partners and stakeholders feedbacks will ensure the success of this project and contribute to curricular innovation and effective applied research and experimental development.

⑳ University of Applied Sciences Northwestern Switzerland

Towards Social Integration – Professionalising Social Work Practice in the Penal System of the Russian Federation.

An International Development Project with Structural and Content-Related Links to Bachelor's and Master's Degree Programmes
Prof. Dr. Elena Wilhelm, School of Social Work

Project Context
Professional social work in Russian prisons is a recent phenomenon and still under development. The Chair in Social Work and Social Psychology at the Federal State University Vologda Institute for Law and Economics of the Federal Penal System of Russia (VIPE) has been promoting the professionalisation of social work in the penal system since 2002. The joint project of VIPE and the School of Social Work at the University of Applied Sciences Northwestern Switzerland (HSA FHNW) aims to prevent re-offence and enhance the reintegration potential of prison inmates as regards various social systems (education, employment, family, relationships, living, leisure, etc.). The project investigates the social work processes, practices, methods, and instruments employed in the penal systems of Switzerland and the Russian Federation in order to increase the reintegration potential of prison inmates. The development project is currently in phase one (May 2008 to August 2009) of four. Expected project results phase one include a concept for a process-oriented methods manual for social work in the Russian penal system, based on the methodical and systematic collection, survey, extrapolation, documentation, and critical examination of various data.

Expected Results and Impacts: Phase 1
- Jointly devised terminological and theoretical basis for social work in the penal system
- Concept for a process-oriented methods manual of social work in the penal system in Russia to be implemented in practice by VIPE
- Developing a more profound insight into the social work processes, practices, methods and instruments used in the Swiss and Russian penal systems
- The joint project will engender teaching materials and a knowledge base for BA and MA degree courses and will provide one HSA FHNW MA student with on-site project placements in Vologda
- Project insights – as regards both contents and the experience gained from a cooperation project on social intervention – will be published in a leading European journal of social work

Student Participation: Phase 1
Five students will be involved in the project:

Two students of the consecutive HSA FHNW Master of Arts in Social Work. It is envisaged that these students will be involved in this international cooperation project within the Master's module «Initiating and Designing Practice-Oriented Research Processes», and will take part in the intensive study weeks to be held in Russia and Switzerland. Within the Master's module «International Social Work and Social Policy», they will be working toward gaining credit points through their comparative analysis of social work in Russia and Switzerland.

Two HSA FHNW Bachelor's students. It is envisaged that these students will write their Bachelor's thesis within this international cooperation project, and will take part in the intensive study weeks in Switzerland.

One HSA FHNW Bachelor's student. The student is a native-born Russian. Her collaboration formed the basis of her Bachelor's thesis, which examines the history of Social Work in Russia on the basis of a detailed study of primary Russian sources. The student will have completed her Bachelor's thesis in January 2009 and will subsequently begin her Master's degree in Social Work, at the HSA FHNW in the 2009 spring semester. Within her Master's degree, she will continue to work on the «Towards Social Integration» project team, and will be responsible for running part of the module on «Initiating and Designing Practice-Oriented Research Processes» in Vologda in the context of the larger project.

Curricular Innovations: Phase 1
As regards methodology and teaching: During the two intensive study weeks the participant universities will exchange two modules focused on one of four competencies (self-competence): the HSA FHNW «ePortfolio» module and the VIPE «Supervision» module. Both modules serve to develop knowledge integration and self-reflection competencies. Further, both modules are geared toward supporting the participating students' endeavour to integrate a course of studies tending toward fragmentation under the Bologna reform and its modularisation; the modules also serve to integrate the learning processes of the individual modules into across-module, comprehensive learning. The exchange of modules comprise concept presentations and discussions as well as the running and evaluation of Master Classes. The concepts will be further developed on the established basis and adapted by the partner universities as required.

Academic contents: The findings and insights of the international cooperation project will be integrated into the Master's module «International Social Work and Social Policy», and furthermore introduced into an elective module on social work in the penal system. Communication: To intensify cooperation between the project teams, two web-based video conferences (using Skype) have been scheduled for the period until the next working meeting at HSA FHNW in April 2009. HSA FHNW aims to establish through these trials whether online cooperation can complement on-site collaboration.

Benefits for Professional Practice

The project focuses on cooperation between a Swiss (HSA FHNW) and a Russian university (VIPE). Cooperation aims to promote scientific and academic exchange, to devise a Handbook (and initially its concept) for Social Work in the Russian Penal System, and to furnish an account of social work practices in the Swiss penal system. The diffusion of project findings and insights into professional practice in Switzerland and Russia is, however, a much more essential and more important endeavour (see Fig. 1).

Fig.1: Aims: Knowledge generation and local-regional knowledge diffusion.

Cooperation will occur at inter-university level. The two partner universities will transfer project findings and results into their teaching and respective local fields of action, and will liaise and cooperate with practitioners. Transfer will be facilitated through the direct involvement of social work professionals active in the penal system. The social worker of the Office of Corrections of the Canton of Zurich took part in the intensive study week in Russia, brought to bear a practitioner's perspective, and carried intermediate project results back into practice. Transfer into practice is envisaged for Phase 4. All meetings will involve on-site visits at various organisations.

Conference Papers and Articles To Date

Gautschi, Joel/Schilling, Sigrid (2008) Towards Social Integration. Professionalising Social Work Practice in the Penal System of the Russian Federation. Paper delivered at the KFH Information Day on Development and Cooperation. Bern, 3 December 2008.
Von Arx, Christian (2008) «Am liebsten so eine Art Kochbuch». FHNW School of Social Work Devises Handbook for Russian Penal System. Contribution to Oltner Tagblatt, 31 May 2008, p. 21.
Wilhelm, Elena (2009) Professionalisierung der Sozialen Arbeit im Strafvollzug in Russland. ["Professionalising Social Work in the Russian Penal System"] Paper delivered at the Office of Probation and Correction Services, Canton of Zurich. Zurich, 19 January 2009.

Contacts

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PARTICIPATING ORGANISATIONS

Country	Organisation
Partners:	
Netherlands	Netherlands Association of Universities of Applied Sciences (HBO-raad) www.hbo-raad.nl
Denmark	Danish Rectors' Conference - University Colleges Denmark www.cvu-rk.dk
Estonia	Tallinn University of Applied Sciences www.tktk.ee
France	Association of Directors of University Institutes of Technology (ADIUT) www.iut-fr.net
Ireland	Institutes of Technology Ireland (IOTI) www.ioti.ie
Lithuania	Lithuanian Colleges Directors' Conference www.kolegijos.lt
Austria	Austrian Association of Universities of Applied Sciences (FHK) www.fhk.ac.at
Portugal	Portuguese Coordinating Council for Polytechnical Institutions (CCISP) www.ccisp.pt
Finland	The Rectors´ Conference of Finnish Universities of Applied Sciences (ARENE) www.arene.fi
Associated partners:	
Switzerland	Swiss Association of Universities of Applied Sciences (KFH) www.kfh.ch
Germany	German Rectors' Conference (HRK) www.hrk.de

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