From the bottom up

Evaluation of RDI activities of Finnish Universities of Applied Sciences

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Preface

The Finnish Higher Education Evaluation Council (FINHEEC) decided in November 2010 to launch an evaluation of the research, development and innovation (RDI) activities of universities of applied sciences (UASs)[1]. The evaluation was requested by the Ministry of Education and Culture and recommended by several international evaluations on the Finnish innovation system. The aim of the evaluation was to provide an accurate and realistic picture of the extent and quality of RDI activities undertaken by UASs and their impact on society. The evaluation was to adopt an international perspective.

The evaluation team published a preliminary report in late 2011, particularly to contribute to the activities of the Ministry of Education and Culture in the reform of the steering and core funding mechanisms of Finnish UASs. Now it is time to summarize the findings of the team.

The critical and at the same time constructive analysis of the evaluation team covers a wide range of issues connected with research, development and innovation activities. I feel that the team has found the most burning questions in RDI, discussed (but not solved) during the last ten years in Finnish higher education. They touch all main aspects: steering, legal and funding framework, internationalization, connections of RDI with education and career development of the UAS staff.

I hope that the results of this evaluation will both serve Finnish UASs in their development work and give

[1] The English translation for the Finnish term *ammattikorkeakoulu* is a politically problematic issue in Finland owing to the fact that the institutions themselves have adopted the term University of Applied Sciences. However, the Ministry of Education and Culture uses the traditional term of Polytechnic. FINHEEC and this evaluation team use the term University of Applied Sciences (UAS) for the sake of clarity.

material for wider discussions on the role and status of RDI in higher education. On behalf of the Finnish Higher Education Evaluation Council, I would like to warmly thank the universities of applied sciences in Finland for their commitment and frank contribution in this evaluation. I would also like to thank the evaluation team and its chair for their expert work and dedication.

Riitta Pyykkö, Professor
Chair of the Finnish Higher Education Evaluation Council

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1 Background to evaluation

The need to evaluate research, development and innovation (RDI) activities in universities of applied sciences has been highlighted in numerous different documents. A working group of the Ministry of Education and Culture, which looked into RDI activities in universities of applied sciences, proposed (2010) that an evaluation should be organised. The opinions put forward in the report on the Finnish innovation system (2009) and the report on the state and quality of scientific research by the Academy of Finland (2009) lend weight to the need to evaluate RDI activities. The evaluations strongly focused on research conducted by universities and research institutes, so the examination of research, development and innovation activities within universities of applied sciences needs its own evaluation. The universities of applied sciences have also expressed the wish to the Finnish Higher Education Evaluation Council (FINHEEC) for an evaluation of RDI activities. A number of UASs conducted their individual evaluations of RDI activities, but a sector-wide analysis was lacking. The Ministry of Education and Culture assigned FINHEEC the task of organising the evaluation on 26 May 2010. FINHEEC appointed a planning group in November 2010 to plan the evaluation of RDI activities.

1.1 Objectives

The aim of the evaluation of RDI activities was to produce qualitative and partially also quantitative evaluation data on the position, role, quality, effectiveness and impact of research, development and innovation work undertaken by the spectrum of Finland's universities of applied sciences. The task

of the evaluation was to produce evaluation data that covered the entire field of universities of applied sciences. The position and role of universities of applied sciences within the regional and national innovation environment varies. For this reason, the task of the evaluation was to produce a wide-ranging picture of the position and role of RDI activities within Finnish universities of applied sciences as part of the national and regional innovation environment. The evaluation was also to examine the integration of RDI activities and education within the universities of applied sciences. The evaluation was not to look into RDI activities from the perspective of individual fields of research/activity/education and/or the projects of individual universities of applied sciences, but to aim to produce strategic evaluation data and data that will develop the activities.

1.2 Process

FINHEEC appointed a group in November 2010 to plan the evaluation of RDI activities:

Riitta Rissanen (chair) vice-rector, member
of the evaluation council, Savonia UAS

Riikka Ahmaniemi, Jyväskylä UAS
Outi Kallioinen, Laurea UAS
Matti Lähdeniemi, Satakunta UAS
Karl-Erik Michelsen, Lappeenranta University of Technology
Jarmo Pirhonen, City of Kuopio
Tarja Tuominen, Confederation of Finnish Industries EK
Mikko Vieltojärvi, Oulu region UAS, Union of Students
in Finnish Universities of Applied Sciences

Matti Kajaste, FINHEEC
Johanna Mattila, FINHEEC.

The Planning group consisted of representatives of the UAS and university sectors, working life, industries and students. A member of FINHEEC Council, Riitta Rissanen, chaired the group. The Planning group produced a Project plan, which outlined the objectives and tasks of the evaluation, evaluation areas and methods utilised. The Planning group was also consulted in the forming of the evaluation team, appointed by FINHEEC on April 14 2011:

Peter Maassen (chair), University of Oslo, Norway

Outi Kallioinen, Laurea UAS
Päivi Keränen, SAMOK
Markku Penttinen, Junttan
Jack Spaapen, Royal Netherlands Academy of Arts and Sciences
Roswitha Wiedenhofer, FH Johanneum University of Applied Sciences, Austria

Matti Kajaste, senior adviser, FINHEEC
Johanna Mattila, senior adviser, FINHEEC.

The evaluation team included a wide range of expertise and experience in evaluation of research, R&D and universities of applied sciences. In addition to higher education representatives, also R&D-intensive SMEs and students were represented.

The Ministry of Education and Culture began the major reform of the steering and core funding mechanisms of Finnish UASs in the winter of 2012. To contribute to this work, the evaluation team decided to divide its analysis in two parts. First, the team concentrated on the role of RDI activities of the UAS sector in the national RDI system. Where do the activities of the UASs fit in comparison to the RDI activities of the Finnish research universities[2] and non-university research institutes, of other public organizations and of private companies? In addition, the team focused on the indicators used to monitor and steer the quality and volume of RDI activities on both national and individual UAS levels. In summer and early autumn of 2011, the evaluation team gathered material on the Finnish RDI system and the RDI activities of the UASs. Furthermore, the team received institutional review reports (10 pages each) from all Finnish UASs. Interviews were undertaken with representatives of a number of stakeholder groups, including representatives of relevant ministries, student unions, funding organizations, employers, researchers, and universities, along with the RDI directors of Finnish UASs in October 2011. The team

[2] In this report the term 'research universities' will be used to refer to the institutions that are formally part of the Finnish university sector. While using this term, we realize that not all these institutions are research intensive universities.

published a preliminary report in late 2011 to contribute to the Ministry's activities.

In January 2012, the evaluation team conducted a second round of site-visits to Laurea UAS in Espoo and Jyväskylä UAS. Mikkeli, Seinäjoki, Savonia and Satakunta UASs also provided interviewees to the interviews in Jyväskylä, in order to further deepen the coverage of the evaluation. In the second phase, the evaluation team concentrated on the actual RDI activities of the UASs. A wide range of RDI projects were presented and explored in order to gain better understanding of the forms, possibilities and problems of RDI in the UAS sector. The final evaluation report will be published in the annual UAS seminar (Ammattikorkeakoulupäivät) in May 2012.

2
International and national context in RDI

The Finnish University of Applied Science (UAS) sector was established at the beginning of the 1990s and has developed rapidly into a large and dynamic higher education sector, which enrolls currently more first-year students than the Finnish research university sector. The UAS sector was initially a 'pure' education sector, but since 2003 it is formally also expected to develop Research & Development (R&D) activities, to which in 2010 an innovation function has been added by the Ministry of Education and Culture. However, the formal status of this innovation function is in many respects unclear, as can, for example, be seen at the websites of the Ministry and ARENE[3] where only the R&D function of the sector is referred to. In addition, also in the interviews undertaken this unclear status was mentioned.

A common strategic goal of the RDI activities of any UAS is to produce information and develop services based on (applied) research that serve to strengthen the competences and competitiveness of the public agencies and the private business community in its region. Next to this, most UASs emphasize in their institutional goals the close link between their RDI and education activities. While on paper the resulting RDI function of the UAS sector is expected to perform an important role in connecting the basic research activities of the Finnish research universities with the innovation needs of the public and private sector agencies and companies, in practice the nature and role of RDI activities of the UASs is far less clear.

[3] ARENE is the Rectors' Conference of Finnish Universities of Applied Sciences (see: www.arene.fi/index.asp?main=3)

This is first and foremost the result of the lack of an overall steering framework for the development of these activities. The adding of RDI to the education mission of the UASs was not accompanied by an appropriate funding, incentive and legal support structure. In addition, a clear overall (political) vision on the role and nature of RDI in the UAS sector seems to be lacking, while also the coordination between involved Ministries about the RDI function of the UAS is apparently not as effective as one might expect. As a result the RDI activities of the UAS sector have developed bottom-up into a diverse set of institutional RDI profiles, ranging from multiple, well-connected RDI activities, including basic research, in some UASs, to a rather marginal set of especially education-based development activities, that are weakly linked to research and innovation, at the other end of the institutional spectrum in the UAS sector.

A reform of the UAS sector is currently under preparation. A working group is set up by the Ministry of Education and Culture in order to develop a reform proposal that will be implemented from 2014 on. In addition, since a number of years an overall structural reform of Finnish higher education is taking place, aimed at reducing the number of research universities and UASs. Further, general reform initiatives and expectations that confront higher education institutions around the world also apply to the Finnish UASs. Finnish UASs and this evaluation must take account of these contextual forces for better understanding the challenges Finnish UASs are facing nationally and internationally. There are, firstly, the global reform trends. With Finland's goal of having an innovation-oriented higher education system that can support the global competitiveness of the country's economy, it joins a large number of other countries with similar ambitions. Countries around the world are introducing reforms aimed at creating conditions under which their higher education institutions can become more effective in contributing to the country's innovative capacity. Secondly the European context is of particular significance for Finnish UASs, especially from the perspective of the development of the European Higher Education Area (as part of the Bologna Process) as well as the European Research Area. Thirdly in the Nordic context the interconnections are strong. In this context especially common Nordic political, academic and cultural values and traditions are of relevance.

2.1 Global and European reform contexts

In recent decades governments around the world have introduced major reforms of their higher education systems. These reforms are, amongst other things, a response to globalization and its effects on the socio-economic and political environments of the higher education institutions. These are requiring higher education institutions to meet a wider set of goals than the traditional provision of primary teaching and research activities. The underlying policy agendas show a growing focus on the following issues: the link between education, research, and innovation; the continuously growing number of students enrolling in the higher education sector and the need for a greater diversity of provision; technological change; changing competencies and skills requirements on the labour market; and changing demographic and mobility patterns. Economic competition among nations is also a part of this, with the conviction that the quality of higher education and research, and its permeability in the economy, hold the key to economic growth and social inclusion.

Also in Europe there has been a growing political focus on the consequences of globalization. A core issue in this is the assumed weaknesses of the European economies in comparison to the US economy and the rapid rise of the BRIC[4] countries as important economic powers. The heads of state of the EU member states have expressed their worries and presented their strategies for addressing the challenges for Europe in the Lisbon 2000 Agenda, which aims at strengthening the economic competitiveness of European countries and improving their social cohesion.

The growing focus on Europe's competitiveness has since the beginning of the 21st century created a clear political "momentum" for higher education in Europe. The Lisbon Summit of 2000 has emphasized the role of higher education as a central institution in the "Europe of Knowledge", and since 2000 the Commission has become actively engaged in higher education policy-making. The assumption underlying the Commission's policy focus on higher education is that the effectiveness of the connection between education, research, and innovation (the Knowledge Triangle) is of major importance for the competitiveness of Europe's economies and the level of social cohesion of its societies.

[4] BRIC refers to Brazil, China, India and Russia.

In the development of the "Europe of Knowledge" two different RDI approaches of the EU are visible. There are clear relationships between the two, but in a simplified way they can be summarized as follows. The first concerns an approach focused on curiosity-driven or frontier/basic research, the second concerns an approach focused on RDI that can lead to practical innovation that will foster economic growth. The European Research Council (ERC), established in 2007, is a core instrument in the first approach; the European Institute for Innovation and Technology (EIT), which became operational in 2010, is an EU body in the second approach. While both approaches are formally supported by the European Commission and the EU member states, there is an element of competition between them. Which approach is most effective when it comes to stimulating innovation: investing in frontier research taking place in essence in research-intensive universities, and top-level research institutes? Or investing in innovation-oriented clusters consisting of industry, academic researchers and other actors?

The underlying assumption in the first approach is that new knowledge that can lead to innovation will in general not come out of application- and problem-oriented research. Curiosity-driven research has to be the core of an RDI approach since "we do not know what we do not know"[5]. This assumes that investments in frontier research are the most effective use of public funds when it comes to producing knowledge and ideas that over time will lead to new products and jobs.

The second approach takes as a starting point that "European HE and research institutions are often isolated from the business world and do not obtain the 'critical mass' necessary for innovation. They are fragmented not only geographically but also thematically, in that they do not work together to create market-driven solutions."[6] This approach assumes that HE institutions in isolation do not produce the kind of knowledge and ideas that will lead to innovation, and that the most effective use of public RDI funds are investments in cooperation clusters of academic researchers and industry that are aimed at finding solutions for Europe's grand challenges.

[5] This is a quote from Helga Nowotny, who is currently the President of the ERC (http://www.universityworldnews.com/article.php?story=20120308181711918)

[6] See website of EIT: http://eit.europa.eu/about-us/background/

The two approaches are also of relevance in the Finnish RDI policy context, and the question can be raised whether the Finnish government explicitly emphasizes one of the two approaches, or tries to combine them.

Currently, the EU research funding context for Finnish research universities and UASs consists first of the FP7, one of the largest public research programmes ever established with a budget of over € 50 billion to be distributed in the period 2007–2013. The underlying assumption for the FP7 is that it will be a major step towards creating a world class European research environment through stimulating competition for research funding among Europe's best and most ambitious researchers; stimulating mobility of the best researchers leading to strategic concentrations of top researchers in a limited number of European universities, public non-university research institutions, and the private sector; and stimulating national research councils, ministries and university leadership to develop strategic priorities in line with the research agendas of the European Commission.

Second, EU cohesion policy instruments play a role in the funding of RDI in the UAS sector.[7]

Clearly of importance for the Finnish UAS sector is that the European Commission has an instrumental view on higher education and economic development, which allows for an active use of development funds in stimulating the specific development role of higher education institutions, especially in those regions that are regarded as less developed. It can be argued that these cohesion policy funds have in practice played a very important role in the development of the RDI profile of Finnish UASs.

[7] In 2007–2013, around € 72.5 billion EU cohesion funding will be spent on education and training, and €60 billion on research and innovation. The European Regional Development Fund has been used for investments in building or renovating higher education institutions, providing equipment and promoting digitalisation, and support incubators, spin-offs and other forms of HE-business partnerships. The European Social Fund (ESF) has financed modernisation processes, increased participation and attainment particularly for students from under-represented backgrounds, enhanced educational content and the match between programmes and labour market demand. The 2011 HE Modernisation Agenda (Commission 2011) indicates that the MFF proposal for 2014–2020 allocates a minimum of € 84 billion to the ESF, of which over € 40 billion could be expected, based upon past experience, to be made available for education and training.

Finally, we wish to mention the Bologna Process. Currently 46 European states[8] participate in this inter-governmental process, documented by the communiqués of the bi-annual ministerial conferences. The Bologna Process aims at creating the European Higher Education Area (EHEA) characterized by a compatibility and comparability of national higher education systems based on a three cycle degree structure. Stimulating intra-European mobility of students, early stage researchers, and staff, is one of the main aims of the Bologna Process. The 2009 Leuven communiqué states the ambitious goal that, by 2020, "at least 20% of those graduating in the countries of the European Higher Education Area should have had a study or training period abroad".

Although, officially, the Bologna Process is a purely intergovernmental process among nearly all European states, it is more and more driven by various stakeholders including the European Commission, the latter successfully trying to integrate EU's education and lifelong learning policies and programmes with the Bologna agenda. Also here the European context has had an important influence on the change dynamics of the Finnish UASs in the sense that its educational structures have been adapted in the framework of the implementation of the Bologna process in Finland. This adaptation allows, amongst other things, for an easier cooperation with non-Finnish higher education institutions.

2.2 The Nordic dimension

The Finnish UASs are positioned in a number of international arenas, including the Nordic region consisting of Denmark, Finland, Iceland, Norway, Sweden and the autonomous territories of the Faroe Islands, Greenland, and Åland. Nordic cooperation within higher education and RDI was established well before the current policy focus on the economic and societal impact of higher education. While the traditional rationale for Nordic cooperation within higher education was culturally and academically based, such traditions are challenged by emerging new rationales for the internationalisation of higher education and its relations to economy and market competition. Nonetheless, for understanding the Finnish UAS dynamics, it is of relevance

[8] Kazachstan joined the Bologna Process in 2010 as the first non-European country.

to reflect on the main dimensions of Nordic cooperation in higher education and RDI.

The socio-economic, political, and cultural similarities between the Nordic countries form a solid foundation for their long-term cooperation, and form at the same time a good basis for a continuing benchmarking in different areas, including education and RDI. Although there are clear political, economic, and historical differences between the countries, policy-making in this region is often characterized as being a result of the "Nordic Model". With respect to higher education, typical ingredients of this model are public higher education institutions with institutional autonomy in many areas, a democratic system level and intra-institutional governance structure with a structured involvement of staff and students, high levels of state investments, strong emphasis on equality concerning the institutional landscape and the way in which public resources are allocated throughout the system.

As a result of the agreements reached in the Nordic Council and Nordic Council of Ministers over many years, the Nordic countries have developed a common labour market, have established common institutions in various policy areas, and have developed cooperation schemes and programmes. With respect to education this has resulted in various mobility programmes for pupils, students, and teachers (including the Nordplus programme for students and teachers); incentives for developing Nordic joint degree cooperation programmes in higher education; agreements for the mutual recognition of degrees and study programmes; simplified admission requirements for Nordic students throughout the region; and various expert committees for policy issues and cooperation initiatives.

To support and stimulate Nordic RDI cooperation the Nordic Science Policy council was established in 1983, and cooperation in the area of research training has existed since 1990. Nordic RDI cooperation got a boost in 2005 with the establishment of Nordforsk and the Nordic Innovation Centre (NICe) as the Nordic organisations that are expected to cover the entire sphere of research and innovation at the Nordic level. Especially Nordforsk is of relevance for the UASs, amongst other things, because of its growing role in the funding of Nordic R&D.[9]

[9] For more information about Nordforsk's programmes, projects and R&D funding procedures, see: http://www.nordforsk.org/no/programs.

Giving the growing focus in Nordic cooperation on RDI it can be argued that for Finnish UASs the Nordic region can be expected to become more important in the coming years, for applying for RDI funding as well as for developing international RDI cooperation networks.

2.3 The concept of RDI in Finnish Higher Education

There is a lack in Finland of a clear and generally accepted definition of RDI in higher education. There are a number of formal documents that describe R&D or RDI undertaken by universities or UASs, such as the Polytechnics Act, Statistics Finland, ARENE[10], and the OECD's Frascati manual (see box 1), but these descriptions do not provide a generally used, consistent definition of RDI. Most people that were interviewed by the evaluation panel seemed to agree that RDI is about creating something new: new knowledge, new products, and new services. Also, there was in general a strong reference in the interviews to cooperation especially with private firms and to a lesser extent public organisations. Overall the evaluation panel derived from the interviews and the documents studied an interpretation of RDI in the UAS sector as the set of activities that is expected to form a bridge between academic, 'curiosity driven' basic research and practical applications in society. In general, a central role in this bridging function has to be undertaken by UAS students and staff with effective connections to academic research as well as to stakeholders from the private sector and public organisations. Together, all actors involved need to play a specific role in the further development of the RDI concept in the UAS sector.

[10]On the English version of the ARENE website the main aims of R&D in UAS are summarized as: 1. to develop education in universities of applied sciences; 2. to develop the surrounding work life and region; 3. to detect and answer the needs of the regional industry and commerce. What is, for example, striking is that on ARENE's website no reference is made to innovation, while in ARENE's description of R&D aims no reference is made to the R&D needs of the public sector. (See: http://www.arene.fi/sivu.asp?page_id=122&luokka_id=42&main=3)

Definition of R&D

The OECD's[11] Frascati manual (2002 edition) defines research & development as "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications".

In the same manual basic research is defined as: experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.

Applied research is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed. R&D covers both formal R&D in R&D units and informal or occasional R&D in other units.

Source: OECD's Frascati Manual, 2002 Edition

Description of Innovation

The latest (third) edition of the Oslo Manual defines innovation as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.

By definition, all innovation must contain a degree of novelty. The Oslo Manual distinguishes three types of novelty: an innovation can be new to the firm, new to the market or new to the world. The first concept covers the diffusion of an existing innovation to a firm – the innovation may have already been implemented by other firms, but it is new to the firm. Innovations are new to the market when the firm is the first to introduce the innovation on its market. An innovation is new to the world when the firm is the first to introduce the innovation for all markets and industries.

Innovation, thus defined, is clearly a much broader notion than R&D and is therefore influenced by a wide range of factors, some of which can be influenced by policy. Innovation can occur in any sector of the economy, including government services such as health or education. However, the current measurement framework applies to business innovation, even though innovation is also important for the public sector.

Consideration is being given to extending the methodology to public sector innovation and innovation for social goals.

Source: OECD (2010) Ministerial report on the OECD Innovation Strategy (http://www.oecd.org/dataoecd/51/28/ 45326349.pdf)

[11] OECD's "Frascati Manual", 2002 edition

Basic or fundamental research is in general part of the mission of research-intensive universities, it is often (but not always) theory-driven, and it follows certain methodological rules and norms about validity, legitimacy and generalizability. These rules and norms have been developed especially in the 20th century. A number of scholars have been central in the development of these, including the philosopher of science Karl Popper[12] with his concept of falsification (experiments and observations should be used to test every scientific theory, hypothesis or assertion in order to determine whether it can be contradicted) and the sociologist Robert Merton[13] with his CUDOS norms (Communalism, Universalism, Disinterestedness, Organized skepticism).

While these methodological and philosophical rules and norms still are felt to be important, amongst other things, in the training of researchers, at the same time they have come under pressure because the scientific research enterprise seems to be getting more and more blended with other societal domains. Most clearly, there are expectations about growing cooperation of the academic world with private corporations, as well as policy agencies and public organisations, either with regard to innovation in products or services, or with regard to solving societal challenges. Especially since the early 1990s there has been a growing attention in the academic literature as well as in governmental policy papers for the relationship between higher education and innovation, especially in the private sector. Often referred to conceptualizations of this relationship have included the mode 1– mode 2 distinction (Gibbons et al. 1994[14], Pasteur's quadrant (Stokes 1997[15] and the Triple Helix (Etzkowitz 2003[16]). All of these argue that we have to move from a separated to an interactive and partly

[12] Popper, K. (1963) Conjectures and Refutations, London: Routledge.

[13] See, for example: Merton, R.K. (1973) "The Normative Structure of Science", in Merton, R.K., The Sociology of Science: Theoretical and Empirical Investigations, Chicago: University of Chicago Press.

[14] Gibbons, M., C. Limoges, H. Nowotny, S. Schwartzman, P. Scott, and M. Trow (1994). The new production of knowledge: the dynamics of science and research in contemporary societies. London: Sage.

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

[16] See, for example: Etzkovitz, H. (2003) Innovation in Innovation: The Triple Helix of University–Industry–Government Relations, Social Science Information, vol. 42, no. 3, pp. 293–337.

overlapping organization and functioning of core knowledge and innovation domains (higher education – industry – state). The production and transfer of knowledge in higher education institutions have to become multidisciplinary and application-oriented (Gibbons), use-oriented (Stokes), or innovation-oriented (Etzkowitz). While each of these conceptualizations has a number of valuable perspectives for understanding the higher education – socio-economic development relationship, at the same time they also have been criticized for not doing enough justice to the complexity of the higher education – innovation connections. Etzkowitz' has, for example, been criticized for wanting to blend the roles of the institutions participating in innovation: universities should (also) establish firms, private firms should (also) do academic research and training, and the state should (also) act as venture capitalist. Gibbons has been criticized for assuming that we were moving away from basic research, while Stokes struggled to distinguish between curiosity driven and use-oriented research. Another aspect neglected is the issue of diversity and the division of labour between higher education institutions. Also in Finland there is a lack of a clear and transparent set of institutional missions in the university and UASs sectors. This includes the large number of research universities, the overlap (in RDI practices) between part of the research university and UAS sector, and the lack of clarity in the roles of research universities and UASs in innovation. Consequently, it has been argued in recent science policy literature and governmental documents that we have to move beyond the mode 1 – mode 2 distinction, and beyond the Triple Helix. This has also been mentioned in a number of the interviews.

The evaluation panel is of the opinion that it is of the utmost importance to further elaborate and clarify the meaning of the RDI-concept in the UAS sector. This is of relevance, amongst other things, for the public funding of RDI and the development of an UAS-specific set of RDI indicators. One aspect that could be included in this is the term co-creation of knowledge, where on the one hand collaboration between UASs and research universities has to be further developed, on the other hand collaboration with private sector companies and public agencies. There will be tensions between these two, for example, academic researchers are used to be open to international scrutiny of their work while private firms because of commercial interests are likely to be less open. Another example concerns intellectual property rights, that are very important for (parts of) the private sector,

but they used to be less of an issue in academic circles because researchers were used to other ways of recognition. Clearly, this is changing with a growing impact and use-orientation of funding councils, and other forms of validating the results of academic research. It is important that these new insights are used in the training of new academic staff in the UASs, and in the further development of the RDI-concept in the UAS sector.

3
Funding of RDI in the UAS sector

A major problem concerning the further development of the RDI activities in the UAS sector is the low level and unclear status of the basic funding for these activities. This concerns first the nature of the RDI component in the basic funding mechanism for the UASs. While formally there is no RDI component in the basic funding mechanism, in practice the Ministry of Education project funding component has been used by the UASs for funding RDI projects. Second, the limited success of UASs in applying for funds to traditional RDI funding agencies, especially the Academy of Finland, and TEKES. The evaluation panel noticed the conservatism of these agencies when it comes to their role in the funding of the RDI activities of the UASs. Another observation that the panel made is that these funding agencies apparently had received no or only weak 'instructions' from the Ministry of Education and Culture about their role in stimulating the development of the RDI activities of the UASs. Neither of them had developed specific instruments for funding RDI projects in the UAS sector. As a consequence, most funding of UAS sector's RDI activities comes from the overall internal budget of the UASs, or structural development funds from the EU.

When it comes to acquiring RDI project funding from the Academy of Sciences and TEKES the situation in which the UASs have to compete can currently be characterized as "equal competition between unequal competitors." The UASs are allowed to compete for funding from these two agencies formally on the basis of the same conditions as eligible other institutions. However, they have not been able to develop the capacity and expertise needed to compete on an equal footing with these institutions, especially research universities and

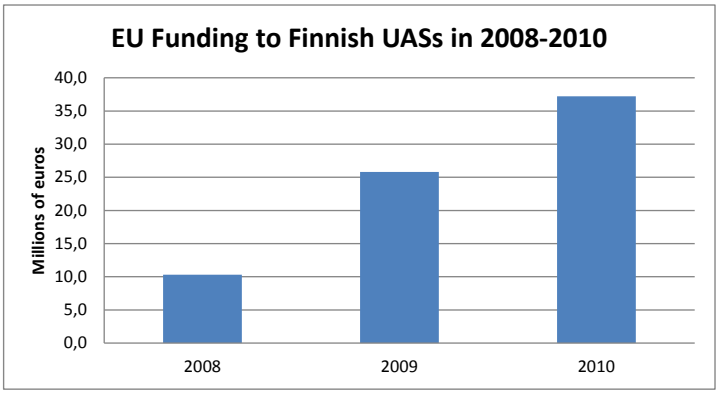

Figure 1. EU funding to Finnish UASs in 2008–2010
Source: Statistics Finland

research institutes. These have had the advantage of having been able to build the capacity needed for an effective relationship with TEKES and the Academy of Sciences, without the need to compete with stronger and more experienced competitors like the UASs currently have to do. A consequence of the current situation is that in practice the UASs that want to have success in this competition have to 'become like their competitors'. And indeed, a number of the UASs have developed a basic research capacity. But for the majority of the UASs it means that the chances for acquiring TEKES or Academy of Science RDI project funding are very low. This has led to a vicious circle in which the fact that UASs are applying to TEKES and especially the Academy of Finland at a lower level than one might expect is seen by many stakeholders as a lack of interest, or by some even as a lack of 'quality', while in practice it is the unequal nature of the competition that has kept most UASs from increasing their applications for project funding from TEKES and the Academy. This creates an important challenge for the Finnish authorities. On the one hand the UASs are expected to develop an RDI profile and a specific RDI role and capacity. On the other hand, the UASs are not able to compete on an equal footing for competitive RDI funding needed to seriously build relevant, high quality RDI capacity.

A possible way out of this vicious circle is to create a funding programme that is aimed first and foremost at supporting and strengthening the RDI function of the UAS sector. Developing and managing such a programme can be either a task of TEKES and the Academy of Finland, one of these agencies, or another existing or new agency. In such a

programme a condition for applying for RDI project funding could be that the project in question is either led by a UAS, or has an important UAS component. Overall the criteria for reviewing RDI proposals in such a programme can be expected to be developed in close consultation with all major actors involved. Such a programme would, amongst other things, give a clear signal to the UASs that even in times of public budget cutbacks the further development of the RDI role of the UAS sector is regarded to be an important political priority.

While the overall level of basic public R&D funds for the UASs can be regarded as low, the funding level is increasing in nearly all respects faster than the R&D funding level of the research universities. This concerns the total R&D funding which has increased from 2009 to 2010 with 20% for the UAS sector and 11% for the research university sector, as well as the so-called project funding, which is increased by 10% from 2009 to 2010 (research universities 4% increase). Also the funding from TEKES and the Academy of Finland has increased relatively sharply, even though the absolute amount the sector received from the latter is almost negligible. EU funds to the UAS sector increased quite dramatically (44%) from 2009 to 2010 (as explained in figure 1) and formed the largest R&D income source after the Ministry project funding. A more detailed discussion of the European level RDI funding programmes and instruments is presented in the chapter on the international dimension of RDI.

An important external condition for the further development of the RDI function in the UAS sector is formed by the announced budget cuts for the UAS sector, which altogether amount to at least € 126 million by 2015 (–13%). The student numbers will also be cut by 2200 student places. The cuts are first and foremost a consequence of the financial crisis and demographic developments, which lead to a decrease in student numbers. While these cuts concern in the first place the educational functions of the UAS sector, it is clear that there is not much financial room to manoeuver for the government and the UASs in investing in the RDI activities of the sector. This puts the UASs in a vulnerable position. The university sector has recently undergone a major 'modernisation' reform, which was accompanied by new investments, which allowed for innovations in the sector, such as the establishment of Aalto University. The announced reforms in the UAS sector will clearly not be accompanied by new investments and room for innovation in the sector's RDI function.

Finally, a specific issue in this concerns the growing focus in Europe, at the supranational as well as national level, on the so-called grand challenges[17]. Many of Europe's grand challenges are argued to have an important public sector dimension, e.g. ageing societies, security, and public health. Although most UASs have a strong emphasis on public sector topics, e.g. health care and public services, in their educational programmes and observe also a strong need for RDI activities in those areas, there is a relative lack of funding possibilities with respect to these thematic areas, even though TEKES, as well as the structural funds of the EU provide some possibilities for funding public sector research.

Conclusions/Recommendations:

- The funding situation for the RDI activities of the UASs is fragmented and lacks transparency. In addition, it can be argued that the overall basic funding level for the RDI function of the UAS sector is too low.
- The future development potential of the RDI function of the UASs is reflected in the relatively rapid increase in competitive funding income, as well as in the success of the UASs in acquiring EU structural development funds.
- The main Finnish agencies for the public funding of RDI activities, TEKES and the Academy of Finland lack a clear frame of reference for determining their role in the funding, and therefore further development of the RDI activities of the UAS sector. As a consequence these agencies operate rather conservatively when it comes to their task with respect to the UAS sector.
- It is of importance to give a clear signal to the UAS sector that the further development of their role in RDI has political priority. Such a signal could be given, for example, through the establishment of a competitive RDI funding programme aimed at the UAS sector.

[17] See, for example, the website of the ERA: http://www.era.gv.at/space/11442/directory/11794.html

4 Integration of education and RDI in UAS

4.1 Introduction and national framework conditions

One of the functions described for the UASs in Finnish legislation is to carry out applied research and development activities that serve UAS education, support the world of work and regional development, and take the industrial structure of the region into account (the UASs act 351/2003). This description has had an impact on the way RDI is understood and conducted at these institutions. According to the reports the UASs produced in response to the panel's questionnaire and the interviews made by the panel many UASs emphasize in their goals the close link between their RDI and educational activities. In practice the link is often understood and implemented as integrating the students into the RDI activities. The Ministry of Education and Culture also supports an integrated view of the RDI and education functions in the sense that the results of RDI should be applicable to education, without students being expected to take part in every RDI project. The following sections deal with some perspectives concerning the integration of RDI and education, its mechanisms, models and especially primary focus on student's participation.

4.2 Level of integration and linkage mechanisms

"RDI is a natural part of our educational activities and we thrive to contribute to the development of learning environments with the objective to provide a relevant and up-to-date training for our students in a form of challenging projects related to their area of studies". This statement of an UAS (as part of the answers to the institutional reviews) reflects the common perspective of most of the Finnish UASs when it comes to the question of integration of RDI and education. They agree on and express clearly that in the UAS sector education and RDI activities are closely linked to each other. Learning, teaching and guidance within real life business cases, development activities – often together with companies – or as part of R&D projects serve as integration mechanisms. The way of getting integrated is either described by a compulsory course in the context of a project or a "bottom up" application from the students. It has frequently been mentioned in the interviews that project managers promote their projects intensively in relevant classes, sometimes giving the impression of "targeting specific students".

There is quite a heterogeneous perspective when it comes to the question of who is doing the main part of the R&D work. The spectrum of answers ranges from mainly the staff (lecturers, professors and sometimes additional scientific or administrative staff) to mainly the students. In practice the answer to the question seems to depend on the thematic area. It was, for example, mentioned that technological research is done to a large degree by students, while business process and management research is done mostly by academic staff. In the interviews it was also indicated that in some cases students even run new user-centered forms of innovation projects (Living labs), studying e.g. various social and health care topics more or less by themselves with only little guidance.

A few estimations concerning the amount of staff time invested in RDI have been made, pointing at an average range of about 10–30%, in one case up to 40%. Since there is a lack of career development options and incentives for (senior) staff doing RDI, a further activation of staff members seems to be difficult. It was also mentioned repeatedly that a relatively large part of the staff, especially those who have worked in the UAS sector for a long time, is not experienced in RDI and as a consequence, in many cases these staff members have a lack of confidence when it comes to taking part in RDI projects.

The tight linkage between RDI and education is also demonstrated by the fact that more or less all RDI activities are integrated in teaching. Usually the students receive credits for their work, only in a very few cases they get a payment, e.g. if they approach the end of their studies and have specialized skills. In one case it was mentioned as a guideline for payment "that as long as there are is a space for learning coupled with RDI activities, this suggests a clear assignment to education and no extra reward will be given". This seems to be also valid for master students who are involved in more demanding RDI projects, as was indicated in one of the interviews.

From a student perspective getting no payment for work that is not part of a practical training was not always considered to be a fair treatment. The evaluation panel has been informed during the interviews that it is common practice in many UASs that a large number of students is integrated in a well-funded RDI project, while being awarded for their time with credits and not with any form of financial payment. In some cases this can amount to credits representing tens of thousands of (unpaid) working hours of students. This raises, amongst other things, the question how ordinary resource planning and budgeting of UAS RDI projects is accomplished and how the educational component is rated.

Only in exceptional cases RDI is accomplished without any student participation. This concerns advanced research projects that require knowledge and expertise beyond students' capabilities.

UASs consider this tight linkage between education and RDI, within the regional function and its specific shape at single UASs, as a kind of unique-selling-position. Being an emphasized part of institutional pedagogical strategies, the integration is regarded as a specific feature of the UAS sector. Many UASs have developed in the framework of the integration of education and RDI pedagogical innovations, referred to as "integrated learning" (incl. Savonia UAS, HAAGA-HELIA UAS, CO UAS, and Metropolia UAS), "learning by exploring" (Lahti UAS), "learning by doing" (KUAS), or "learning by developing" (Laurea UAS). Some of these approaches (e.g. "learning by development") are the object of research projects at specific UASs and are serving as best practice models for educational purposes.

Beyond the basic educational programme context there are also examples of UASs integrating RDI activities in further and continuing education programmes (e.g. HAMK), or are using the results of RDI activities in specific training

and education programmes (Polamk). This is generally a very interesting aspect since the nature and orientation of RDI towards professional practice suggests a possible use of the results and data for educational design purposes. This orientation and deployment of RDI results is certainly an area that Finnish UASs can develop further, also in an international context.

An interesting and in general relevant instrument for the transfer of knowledge and innovation to the business world is the entrepreneurial activities of well-educated and skilled alumni. As outlined by the Guidelines of the Research and Innovation Council 2001–2015[18] the "number of growth-oriented entrepreneurs and innovative firms is low by international standards". Thus a sound focus on entrepreneurship topics as part of the education of the students seems to be important and should be addressed by the UASs. Most Finnish UASs have integrated this focus already even within their definition of RDI at their UAS, most of them consider boosting entrepreneurial activities and promoting entrepreneurship within a regional context as a relevant point of their RDI strategy. It was mentioned during the interviews from a RDI leadership perspective that the potential generation of new ventures and start-ups also serves as a strong stimulus for doing RDI with students and a possible source of some additional financial resources. Some UASs emphasize specific entrepreneurship projects as part of their RDI work; a good practice example has been given e.g. by Seinäjoki UAS which is focusing on the "Entrepreneurial Intentions of Higher Education Students in Finland". The institution is trying to measure the change of students' entrepreneurial attitudes during their studies, develop them and do some international benchmarking. Eleven Finnish UASs and five foreign universities participate in this ambitiously managed ESF funded project. Further examples of the entrepreneurial orientation of Finnish UASs concern e.g. open lab infrastructures serving as incubators for students ideas and implementations (in Tampere UAS), or internally

[18] Research and Innovation Council of Finland, Guidelines 2011–2015, part of the presentation „Polytechnics in the Innovation System of Finland", presented on May 26th, 2011, Ilkka Turunen, Helsinki. See also: Erkko Autio (2009) "The Finnish Paradox: The Curious Absence of High-Growth Entrepreneurship in Finland." Helsinki: ETLA, Elinkeinoelämän Tutkimuslaitos, The Research Institute of the Finnish Economy, 2009, 30 p. (Keskusteluaiheita, Discussion Papers ISSN 0781-6847; no. 1197).

implemented small businesses, such as an in-house restaurant for staff and guests at JAMK UAS being accompanied by business services offered by the students. Concerning the entrepreneurship activities the panel is of the opinion that the UAS sector is relatively well equipped and motivated to play an important role in increasing the number of high growth-oriented entrepreneurs in the national economy. The further dynamic development of a still relatively lowly shaped innovation and start up component in Finland is seen as a challenging task that could be enforced by the UAS sector on the basis of a corresponding governmental support, e.g. in form a distinctive national programme aimed at stimulating and promoting entrepreneurship.

Against the background of a broad possible spectrum of integration of RDI and education ranging from organising and managing them as separated institutional areas to a tight linkage, Finnish UASs clearly pursue the latter implying the utilization of RDI as a pedagogical instrument for a practice-oriented education.

This kind of profile is not the only option as is shown by the diverse RDI practices in the UASs sectors in other European countries. There are some UASs, e.g. in Austria, Ireland, Norway and Switzerland that are promoting the conduct of international competitive research by their staff and are striving at academic excellence in selected topics. In such cases there is not such a strong focus on the academic education of students, but more on an academic engagement of the staff members and an integration of additional academics and experts performing RDI on a "professional level". For example, in the Austrian case supported by advantageous governmental framework conditions (by sector specific national R&D funding programmes) this led to a remarkable growth of RDI activities in the Austrian UASs and to the recognition of the UAS sector as a well-accepted RDI actor within the National Innovation System.

Summarizing the above the panel comes to the conclusion that a well-tuned balance of the strategic orientation of RDI between being an educational and pedagogical instrument on the one hand and a more independent scientific endeavor contributing to the application of new and existing knowledge for private and public sector problems on the other hand is of high importance. The integration of RDI and education can partly also be accomplished by a well-educated staff serving as a quality assurance and improvement of teaching and thus important base of organizational learning.

4.3 Integration of Students in RDI activities

Bachelor level

A striking feature of the RDI practice of the UASs is the emphasis on Bachelor level students in the institutional RDI activities. This involvement of Bachelor students serves two purposes at the same time, an educational purpose in the sense of contributing to the development of RDI competences and skills of the involved students, and a knowledge transfer purpose, in the sense of satisfying the knowledge and innovation needs of the public and private sector project partners. This sets individual challenges for the RDI work in UASs and is a major difference compared to the research universities, where an important part of RDI activities is conducted by PhD students and postdoctoral staff.

This characteristic feature of the UAS RDI practice can to some extent be explained by the design of the initial UAS educational structure, ending with a Bachelor degree and demanding of any student a compulsory period of practical work experience (of at least three years) before entering a UAS Master's programme. According to written answers gotten from all UASs the most popular way of participating in RDI among students is Bachelor level thesis work. Practical training is also mentioned by several UASs. In addition, a range of different forms of participation is listed in the answers: course related work, research and project work, new idea generation, cooperation with companies and working life and evaluation work.

RDI can be done as a part of courses in the form of, for example, intensive courses, course exercises and learning assignments, RDI sections in connection with teaching and studies conducted in RDI projects. Students can conduct a vast variety of R&D tasks, such as generating ideas, collecting and analyzing data, reporting, developing and testing prototypes, acting as co-authors of academic or popular articles or conference proceedings, conducting research assistant tasks, making surveys, documenting, conducting pre-studies as well as the follow-up activities. Students have in some cases taken part in the product planning, planning and conducting of RDI activities, developing new designs, defining and addressing the development tasks, conducting the product, service or production process development activities as well as in launching and spreading results and collecting information and producing material for reports and articles.

Students can also have a role in project implementation and management tasks, for example, by completing their project work as part of an RDI project or as project assistants, sub-project coordinators, steering group members or even project managers under the guidance and supervision of the teachers and other experts. Students can also participate in drafting new project plans or funding applications. In some cases students are seen as a source of new ideas, or are creating new initiatives and are cooperating with companies and customers as junior consultants and are taking part in the commercialization of product and service solutions.

It seems logic from this perspective to provide Bachelor students with the necessary problem-solving skills and competences, amongst other things, with respect to innovation-oriented tasks and project-based work, in order to be able to handle new and interdisciplinary knowledge in an effective manner. Nevertheless, through the interviews the panel has gotten the impression that the involved students are in many cases not prepared properly for their involvement in RDI projects. During any UAS Bachelor programme, courses concerning RDI methodology, design, planning and implementation seem to be limited to 3 to 5 ECTS and offered first and foremost in relation to the students' thesis work and not their involvement in RDI projects. The nature of the involvement of students in RDI projects and the accompanying requirements led to the panel's interpretation that many of these activities can be characterized as "project-based learning". The students, who were interviewed by the panel, expressed a clear wish that there should be a stronger RDI component in their education. It was, for example, suggested by the national union of students that all students should be offered RDI courses representing at least 5% of their curricular activities, aside from the thesis work.

Many of the students interviewed by the panel expressed that they would have benefited from preparatory studies on RDI methodology before participating into the RDI activities. It was also mentioned that students could benefit from hearing the experiences and notions about RDI from the senior students before entering a project themselves. The impression the panel gained was that in most cases there is not a systematic way of collecting and processing the students' experiences and feedback from RDI projects in such way that it would have an effect on the development of curricula or contribute to organizational learning. However, some

UASs mentioned that the students also participate by giving feedback and evaluating the RDI work.

The RDI directors noted that the UASs need new, innovative ways to combine education and RDI in order to integrate the major part of all students into RDI activities, not just a relatively small part of them. It should be mentioned that the intensity and volume of students' activities in RDI show major inter- and intra-institutional differences in the UAS sector. All in all there seems to be a widespread willingness to link RDI to education even more tightly, but curriculum inflexibilities, teachers' and also students' capabilities and in some cases also willingness seem to be bottlenecks in this.

Master level

The emphasis on Bachelor level students in the institutional RDI activities and the lack of PhD students and postdocs in the UAS sector also imply that there is a considerable gap between the involvement of Bachelor level students and the (limited) involvement of the senior academic staff of UASs in these RDI activities. This point was also raised during the interviews of the panel with researchers who have studied RDI activities of UAS, leading to the conclusion that the low participation of teachers in RDI activities also hinders the transfer of new knowledge obtained in RDI activities to teaching. This is an important sign of the lack of effectiveness in the integration of the educational programmes with the RDI projects in the UASs. The integration could potentially be stimulated by the structured involvement of Master level students in RDI activities, but their potential is not used fully yet.

The UAS Master level programmes are quite young. They were first introduced to UAS sector as an experiment in 2002 and were institutionalized in 2005. FINHEEC has conducted an international evaluation on UAS Master programmes prior to their institutionalization. The final report of this evaluation, "Equal but Different; An Evaluation of the Postgraduate Polytechnic Experiment in Finland", was published in 2004. For a description of the early history of Master programmes the panel refers to this report.

Once they were instutionalized in 2005 the establishment of UAS Master programmes has extended to every field of study. From the very beginning the UASs were intended to concentrate on the education and training of 'high quality

experts in working life' (Ministry of Education 2000b:1). The main aims of the policy included:

1. Providing an alternative route into higher education with a more practical emphasis, alongside the universities.
2. Increasing the international comparability of professionally oriented higher education in Finland; UASs offer vocationally and professionally oriented courses of around three and a half or four years leading to a Bachelor's degree.
3. Strengthening regional development (many UASs were owned by municipalities), and co-operation with SMEs.

The Finnish UAS Master programmes combine adult education and lifelong learning characteristics, with the structure of a formal degree programme, organised around and focused upon an R&D project to be undertaken by the student in a work-related situation. The programmes are mainly conducted as part time studies and are planned so that it is not only possible, but also expected for students to work during their studies. The students are required to have a three-year working experience after completing their Bachelor degree prior they can be admitted into the programme. Between years 2002 and 2010 UAS Masters programmes had over 20 000 applicants of which roughly 11 000 had started their studies and over 3600 had graduated after an average of 2.5 years of studying. According to these statistics, UAS Master students were working during their studies and on average had over ten years of prior working experience at the time of enrolment.

The combination of these elements makes them internationally rather unique. In 2004 the above mentioned FINHEEC report stated that: "Indeed, the value and strength of the programmes resides in its basic philosophy: students operating as experts in their own field, through studying and doing R&D work in close collaboration with highly innovative teachers and tutors, and their own working environment."

This panel's impression is that the UAS Master's programmes potential has not yet been fully utilized in regard of RDI. The UAS sector currently produces around 1000 Master graduates per year. The fact that there are relatively few Master students in the UAS institutions and the specific nature of the Master programmes has in the past led to a lack of continuity in the relationship between the UAS institutions and the employers of the Master students. Initially Master students were expected to bring along their own RDI projects and their research topics were therefore tightly linked to the needs of their employer's companies. In that situation

the activities of Master level students supported the RDI development in the UASs only to a limited degree. However, in a number of UASs attempts have been undertaken to integrate Master level activities more in the institutional education and RDI strategies, amongst other things, by developing Master programmes that are more closely linked to the institutional strategic RDI profile. In these programmes the Master theses have to be related to this profile, and are expected to foster knowledge transfer and competence building in a more general way. Nonetheless, the overall impression remains that the situation with respect to Master programmes in Finnish UAS has hardly developed since 2005. The number of Master students and graduates is much lower than was foreseen in 2005, and in general the Master level programmes and students have remained in many respects 'isolated islands' within the UASs.

It can be argued that the Master level programmes in the UASs have a great RDI potential, but this potential is not utilized in a satisfying way. Within the time frame and mandate of the evaluation panel, it was not possible to undertake a more thorough evaluation of the reasons why the UAS Master level programmes have not developed in the ways that were foreseen in 2005. Given that the previous FINHEEC evaluation of the UAS Master programmes was conducted in 2004, it can be strongly recommended to organise a new evaluation of the Master programmes. This evaluation could be aimed in the first place at getting a better insight into the reasons for the relatively lack of progress of the Master programmes since 2005. In the second place at discussing various alternative future scenarios for the UAS Master programmes.

Conclusions/Recommendations:

- The panel comes to the conclusion that with respect to the strategic orientation of RDI at the Finnish UASs there are convincing arguments for stimulating a better balance between RDI as an educational and pedagogical instrument and RDI as a more independent academic endeavor contributing to the application of new and existing knowledge for private and public sector problems. Such a balance should be firmly rooted in an explicit, transparent and clear RDI mission for the UAS sector as a whole.

- Beyond an integration of RDI into the core curricular activities of regular Bachelor level students there are also other linkage mechanisms between RDI and education that could further be deployed to a greater extent in Finnish UAS: e.g. the development of non-traditional educational programmes and courses based on the output of RDI activities. This could also be undertaken in international cooperation projects, for example, in the area of lifelong learning.
- The explication, quality assurance and reintegration of RDI results in teaching can be strengthening as an important element of organizational development and learning.
- The UAS sector is well-equipped and highly motivated to contribute to increasing the number of high growth-oriented entrepreneurs. The further dynamic development of the still lowly shaped innovation and start-up component in Finland is seen as a challenging task that could be enforced by the UAS sector on the basis of a corresponding governmental support, for example, in the form of a distinctive national entrepreneurship programme with the necessary financial resources.
- The development of basic RDI competences and skills for Bachelor level students' needs to be addressed and implemented systematically within the Bachelor programmes' curricula.
- The potential of Master programmes in the further development of the RDI function of the UAS sector needs to be examined thoroughly. This potential can be expected to be developed with a strategic alignment of teaching (design of master programmes and their project works) and RDI at each UAS. It can therefore be recommended to conduct a separate evaluation of the potential of, as well as problems and challenges facing the UAS Master programmes in becoming a more substantial part of the RDI activities of the UAS institutions.

5
Human resources management in UAS

In order to build sustainable societies and be prosperous in the international competition Europe needs at each relevant level competent academically trained experts and high quality professionals. The main responsibility for producing these experts and professionals, and providing them with adequate skills and competences, lies in the hands of the HE institutions around Europe. However, it is a challenging task to define what competences and skills are needed in the future. Equally important is to keep up with the more and more challenging competence, skills and knowledge needs concerning the academic staff in the higher education sector.

The Finnish UASs have provided the Ministry with their renewed strategies in 2010. In these strategies the UASs have also identified their profiles and focus areas. The focus areas are mainly based on the educational fields currently covered by the individual UASs. Identifying and defining adequate strategies for UASs is based on analysing the vision and mission of each UAS and defining the core competences, skills and knowledge requirements in the focus areas. It is very important for the UASs to predict the competences, skills and knowledge needs, including completely new combinations that will arise in the future, in order to respond adequately to current and future labour market demands. This has strong linkages to human resources management in UASs.

In the UASs the strategic knowledge management, competences and skills development of staff is facing new challenges both in the HE structural reforms and in regional changes of population and economic structures. Presently there are more than 12 000 people working in the Finnish UASs (Table X). In the foundation period of UASs in Finland the academic staff was mainly transferred from the previous organizations, i.e. from vocational upper secondary education institutions and only to some extent recruited from outside.

Table 1. UAS Staff by Study fields in 2010
Source: Ministry of Education and Culture

Study field	Teaching staff	RDI staff	Other staff	Grand total
Humanities and Education	244	68	16	327
Culture	729	41	53	822
Natural Sciences	221	14	10	244
Natural Resources and the Environment	240	82	24	346
Tourism, Catering and Domestic Services	304	20	19	343
Social Services, Health and Sports	1 820	127	199	2 146
Technology, Communication and Transport	1 471	308	211	1 990
Social Sciences, Business and Administration	1 007	64	84	1 155
Other	0	45	545	590
Unspecified		349	2 854	3 203
Grand total	6 036	1 117	4 014	11 167

Finland is at the bottom of the OECD country rankings when it comes to the share of the senior academic staff in UAS institutions that are doctoral degree holders: the share of the staff involved in RDI activities with an academic post-graduate degree is 19% (2009). The total number of RDI staff (full- and part-time) in UASs is 4 545 (2009).

In the next five years there will be a great number of retiring senior academic staff in the UASs and this creates a risk of losing competences. A number of mentoring processes have been established in several UASs to handle this situation. However, the change in staff structure alongside with the retirement boom creates new possibilities to further strengthen the UAS RDI capacity by setting up new recruitment processes or by creating new job arrangements within the present staff.

Among the academic staff at UASs the interest in becoming involved in RDI activities is apparently changing as the RDI function has become only recently clearly emphasized at the strategic management level of the UASs. This trend is strongly rooted in the agreement negotiations in which a relatively small amount of RDI project funding was added for each UAS. In 2004 UASs were for the first time given performance-based funding for RDI activities (number of personnel years in RDI, RDI volume and project-based thesis). Additional objectives for publications and RDI credits per student were added for 2007–2009 for the first time. RDI credits are produced by integrating RDI projects into students'

curricula and learning processes. The growing emphasis on RDI activities has naturally led to training and recruiting RDI staff either as a separate function or as embedded in staff within the educational field. The competence development in RDI activities has also taken place through benchmarking and sharing the best practices in UASs.

Some of the staff development requirements arise especially from the nature of the applied R&D and innovation activities which are in the scope of the UAS RDI function. These activities often have a multi- or transdisciplinary basis. Applied research and transdisciplinarity involve moving from field-specific competence entities to shared competence production, breaking the barriers between disciplines in unconventional ways. From the point of view of teaching at UASs, this emphasises the need for new thinking and new competences for staff. A set of new competences and skills have been identified, such as networking competence, innovation competence (including productization, commercialization and IPR), as well as emerging competence areas in development methodology and future forecasting. In the internationalisation of RDI projects also the intercultural competence and adequate language skills are needed.

Some of the academic staff would clearly like to continue in a more traditional way of keeping RDI separate from teaching. An important aspect in this is the academic culture in the UASs which is still mainly rooted in the educational profile of the original institutions. A change in the academic culture would entail for the senior academic staff of the UAS a change in the basic understanding of their academic tasks. In some UASs highlighting examples of good practices in RDI work and innovation training in the UAS sector is already part of the further educational programme for teaching staff. This could more generally be a way to change the academic culture in the UAS sector as a whole.

Teachers in the Finnish UASs are often multi-tasking in some of the following roles:

- Experts in their fields
- Educators and trainers
- Pedagogical developers and leaders
- Coaches for students' professional growth
- Researchers and developers
- Project coordinators
- Network experts and creators
- Regional developers
- Interpreters of tolerance and multiculturalism.

There are five national vocational teacher education colleges in UASs and they have carried great responsibility in the further training and development of UAS teachers as well. There have also been national projects for the transformation of teaching culture and HE pedagogy in UASs. However, it has turned out to be extremely difficult to change the teachers' habits and attitudes as embedded in their academic culture. Socialization also plays an important role in the induction of new teachers. In recent years most UASs have organized coaching and induction processes for new teachers at the beginning of their work processes but this could be given even more attention.

As indicated in the survey and the interviews undertaken by the panel, integrating RDI and education activities as part of the working practices of the academic staff is regarded to be the most urgent organizational development need in the UAS sector. From this perspective UASs have also strongly developed their pedagogy in the past ten years and there are several good examples of this, as mentioned in the previous chapter. For this pedagogical development UASs have organized staff training and development as well as undertaken pedagogical research. However, the staffing policy of UASs and the teachers' 1600 hours agreement should be analyzed more thoroughly in order to get a better insight into the possibilities of stimulating the development of new staff characteristics, including adequate competences of multi-tasking and carrying out new and changing roles within academia and the UASs environments.

Staff development with respect to UASs RDI functions is generally organized through internal or external training of the staff, annual personal career development discussions, research seminars and strategic involvement of academic staff in RDI activities. Especially in the early stages of the development of the UAS sector the academic staff was encouraged, if not required to take part in postgraduate studies. Some UASs have also organized RDI-competence surveys in order to design a more specific training plan. Especially inadequate project management skills often seem to create bottlenecks and to slow the processes in integrating RDI and education activities. However, to some extent this seems to have been taken into account in the recent training plans of UASs.

Nonetheless, overall it can be argued that an important part of the teaching UAS staff is in general lacking the adequate level of competence, skills and knowledge for

undertaking RDI activities at the level required. Therefore the actual integration of RDI into education resembles often practice-based development projects without any 'real' RDI dimension. Evidently an important underlying reason for this is that there still is no clear understanding, neither at the institutional, nor the national level, how the RDI task of the UAS sector should be interpreted and what kind of RDI aspects should be integrated in the educational practices of the UASs.

Conclusions/Recommendations:

- A focus on the integration of the three statutory tasks (education, RDI, regional development) presupposes an important change of the academic culture in UASs.
- RDI skills, competences and knowledge development should be prioritized and emphasized in staff training and staff career development in the UAS sector.
- Innovation competences, skills and knowledge requirements need to be further clarified for UAS staff development.
- Integrating RDI into teaching changes the traditional way of curricula delivery and may create a pressure to define the teachers' 1600 hours from a totally new perspective.
- Identifying and disseminating good practices, methods, tools and processes about RDI practices in the UAS sector is of great importance for the benefit of the further UAS sector staff development in the RDI area.
- Postgraduate studies are to be encouraged and enabled for academic staff of UASs. It is of the utmost importance that these postgraduate studies are oriented towards the specific RDI staff requirements of the UAS sector, instead of having a general researcher training character.

6 International dimension of RDI

6.1 Introduction and national framework conditions

The strategy for the internationalization of higher education as promoted by the Ministry of Education and Culture has a strong link also to RDI. As indicated by the Ministry, the aim of the Finnish internationalization strategy is "to create in Finland internationally strong and attractive higher education institutions and a research community that promotes society's ability to function in an open international environment, supports the balanced development of a multicultural society and participates actively in solving global problems"[19]. As stated by the Research and Innovation Council the Finnish Innovation System generally suffers from weak international linkages and low attractiveness for foreign researchers and well-educated experts.

There is a clear challenge when it comes to the international dimensions of the RDI activities of the UASs. The evaluation of the Finnish National Innovation System[20] in 2009 concluded that the production of international research and business competences at UASs is low. In accordance with that report this evaluation panel also got the impression that many RDI projects obviously do not have an international

[19]Strategy for the Internationalisation of Higher Education Institutions in Finland 2009–2015. Publications of the Ministry of Education, Finland 2009:23 (2009); http://www.minedu.fi/export/sites/default/OPM/Julkaisut/2009/liitteet/opm23.pdf?lang=en

[20]Reinhilde Ceugelers et al.: Evaluation of the Finnish National Innovation System – Policy Report (2009) http://www.tem.fi/files/24928/InnoEvalFi_POLICY_Report_28_Oct_2009.pdf18

component, although some outstanding examples were given of the contrary. Also the RDI training of (most) UAS students seems to have a rather weak international orientation and limited or no international connections. Especially with regard to the Master level students the part-time character of their study programmes seems to be an additional barrier for an involvement in international projects.

International orientation in teaching and corporate culture as basis to growth

By means of facts and figures the quantity of "international input" into the Finnish UAS sector in terms of human and financial resources exhibits a positive, growing development. At least the number of incoming, international students more than doubled between 2002 and 2010 (from around 2.5% of all students enrolled in Finnish UASs in 2002 to 5.7% in 2010), even outperforming the percentage of international students at research universities (4.6% in 2010). The zone of attraction of foreign students also shifted globally from a clear dominant focus of students from other European countries (in 2002: 45.9%, vs 29.2% from Asia) to Asia (2010: 37.9%, vs 32.7% from Europe) and Africa (26% in 2010). This trend seems to reflect the opening up and globalization of the Finnish economy and the accompanying governmental policy intentions. Nevertheless, the evaluation panel could not observe an authentic, systematically pronounced international culture at the UASs during their visits. There are obviously examples at some UASs of ambitious initiatives in international collaboration and affair management, but not in a comprehensive manner. It might be a matter of chance, but throughout its site visits the panel did not meet a single foreign student or staff member.

Strong locally and regionally oriented cultural aspects and the specific features and the distance of the Finnish language compared with other European languages still seem to form barriers to internationalization. In some cases students clearly prefer to stay within their accustomed regional home area with high ambitions of introducing change and structural development at home.

A stronger involvement in international projects and collaboration is time consuming, resources intensive and at least with some focus on RDI also demanding regarding expertise and experience. Taking into account the Bachelor students' integrative RDI orientation an international

orientation of the UAS Master programmes seems to be a goal worth pursuing. The actual design of these programmes as part time studies, the high working load for the students all together, as well as a missing international focus e.g. in the form of using English as a language of instruction, prohibits a further internationally oriented development. This lack of an international component can be regarded as an important argument for broadening the programmes, in the sense of developing full-time Master programmes next to the existing part-time ones.

Overall there are strong indications that the Finnish UAS sector is obviously working on a more internationally oriented culture and developing adequate structures. Nevertheless the actual form is still weak, since cultural changes take their time. The panel also wants to point out that a stronger international culture does not automatically mean more international RDI revenues or a higher number of international projects. But it does form the basis for an open horizon, a better global orientation, a broader knowledge basis, and a higher number of ties, which are also important nodes for innovation in all forms.

6.2 RDI activities in international programmes – an overview

As mentioned above it has to be emphasized, that there has been also a remarkable growth concerning the absolute and relative amount of EU funding with regard to the total R&D funding at Finnish UAS during the last years. Starting with € 10 Mio EU funds (11% of total R&D funding) in 2008, € 25.8 Mio (21% of total R&D funding) in 2009, about 25% (€ 37.2 Mio) of the whole UAS RDI funding in 2010[21] came from EU sources, predominantly from EU structural funds. The EU funds are distributed very unevenly among the UASs, ranging from about € 0.11 Mio as the bottom line (Mikkeli UAS) to € 4.02 Mio (Jyvaskyla UAS) as a maximum in 2010.

Again, looking at these numbers a general positive trend can be observed. But caution must be taken by the interpretation, because those UASs, which are engaged in international cooperation with regard to their RDI

[21] RDI Statistics, December 2011 – Polytechnics in the Innovation System of Finland, Evaluation of RDI activities at the Polytechnics, Research and Innovation Council, 2011.

activities most often, accomplish this through funding from structural EU funds (e.g. the Interreg programme). These programmes are oriented towards regional development and not all of them necessarily include international collaboration and thus can be taken as proof of a higher degree of internationalization.

Beyond the structural funds, the EU Life Long Learning Programme (and its subprogrammes) and some third-country funding schemes of the EU are most frequently used. In this (educational) cooperation with institutions from the Baltic Sea Region, Russia and China are of high importance.

The choice of suitable foreign partner institutions, countries and funding programmes depends to a large extent on the thematic research area of interest, the experience of the R&D staff, the research quality and the available resources. Thus it is worthwhile considering internationalization of RDI as part of an overall strategy taking into account the arguments mentioned.

Only in a few cases RDI activities of UAS institutions are funded through the EU's FP7. Given the applied, research-based nature of most of FP7's programmes, and the intense competition for getting FP7 funding the latter could also serve as a measure of the quality of the RDI projects of the UASs. Even though the overall success rate of any application to FP7 is relatively low (overall between 15–20% of all applications are selected for funding), it can be argued that Finnish UASs, which have already developed research areas beyond a critical mass and on a higher academic level, should become more active in applying for EU's research funding in FP7 (until the end of 2013) and the new Framework Programme called Horizon 2020 (to be implemented from 2014 on).

The building of international consortia and the production of competitive proposals is a resource intensive task. It can be argued that to increase the chances of UASs' success rate in applying for RDI funding in international programmes as the FP7 a (national) support scheme for proposal development and application should be available. In some European countries, e.g. Austria and Norway, national agencies offer financial support for the preparation of international proposals as well as other forms of support, such as expert checks of draft research proposals. Similar support features have also been introduced by individual UASs as services for their own RDI staff. The experience of the panel suggests that such support services do not directly

impact on the success rate of project funding applications, but an increase in the number of proposals being submitted to international programmes in general will lead to an increase of the number of successful applications. In addition the collection of experience and moving forward on the learning curve of actors, who have repeatedly applied for funding, will in time improve the success rate and thus leverage effects of invested money. Some UASs mentioned that research universities having international offices at home and in Brussels are very skilled in this very specialized knowledge and the application processes. Joining them within project and/or institutional cooperation can be regarded as a promising way for utilizing this knowledge and resources for more successful international proposals.

The panel wants to emphasize that for the further development of the RDI function in the UAS sector and a sound basis for knowledge application it is essential that all UASs are stimulated to develop an effective international component in their RDI projects. The further development and strengthening of international collaborations is also emphasized in the RDI strategies of the UASs.

In general it can be observed, that the UASs at least strive to achieve a better diversification of their RDI funding structure when it comes to programmes, funding sources and partnership institutions and countries as well. For practically all UASs educational internationalization, and especially student and teaching staff exchange has been central in their international activities until now. It can be expected that for many UASs this priority will gradually be matched by the development of international RDI partner networks, especially with European HE institutions, and corresponding RDI activities. Some of the UASs follow a policy of concentrating their RDI activities in a few selected strategic international partnerships only (e.g. Seinäjoki UAS[22]), partly being based on strong personal relationships (e.g. cooperation with Cambridge University at Seamk UAS).

Despite the above mentioned positive examples, the lack of earmarked resources for international RDI activities seems to be a crucial and in essence limiting factor for a further development of the international dimension in the RDI activities of UASs.

[22]Evaluation Report for Research, Development and Innovation Activities, Harmaakorpi et al., Seinäjoki UAS Publications B, Report 50, 2011.

Future development aspects

Generally spoken the panel sees a potentially strong role for RDI in connecting international challenges to local options for problem solution, for example, in quality of life and health care issues, lifelong learning and questions of sustainability. A good example therefore has been shown by the "BIOCLUS" project, a € 3.5 Mio project funded within the FP7 Regions of knowledge programme under the coordination of JAMK. It aims to enhance the RDI activities and boost regional competitiveness, cooperation of actors and growth in five European cluster regions (Central Finland, ES, GR, SK and PL). The thematic focus is on a sustainable use of biomass resources in all aspects. Ten organizations situated in the Jyväskylä region belong to the Finnish part of the project consortium. Besides a bundling of competences this project and its consortium serve as an effective basis for the elaboration of further international research proposals.

It is also stated as one of the issues for the further development of research at UASs in the results of the EDUPROF project of the UASNET[23], that "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.[24]" It is also recommended within EDUPROF, that some of the areas mentioned before, which are tackled at several UASs in different European countries could be prioritized and be considered as target areas for common information exchange, development and international collaboration.

Conclusions/Recommendations:

- Depending on their overall profile and (scarce) resources, and the preferred relationship with the region they operate in, individual UAS's should be more specific about their internationalization strategy, amongst other things, when it comes to the nature and expected outcomes of

[23]The European Network of Universities of Applied Sciences

[24]Research at Universities of Applied Sciences in Europe – Conditions, Achievements and Perspectives, EDUPROF Report, De Weert, E., and Soo, M., CHEPS: Enschede, The Netherlands, January 2009.

internationalization investments and activities, regional preferences, and international RDI goals and targets.

- For a further effective development of the RDI function at UASs the participation of UASs in international RDI consortia that are successful in applying for EU RDI funding programmes should be intensified. .
- Despite a strong strategic focus on the enhancement of internationalization at the national level, an effective support structure for stimulating the internationalization of the RDI activities of the UASs is lacking. The evaluation panel recommends the establishment of a national support scheme for the development of applications for international RDI funding at UASs.
- Since European RDI funding programmes often emphasize societal and economic challenges requiring relevant levels of expertise on a high, internationally competitive level, participation in such programmes can be considered as an indication for RDI quality. Consequently, special attention should be given to increase the participation of UASs in such programmes (especially FP7 and Horizon 2020).
- EU structural funds are a very important instrument in the competitive funding of RDI activities at Finnish UASs, serving especially demands of regional innovation systems. To foster regional innovation activities and technological development especially for the benefit of SME's the enlarged RDI funding opportunities of the upcoming structural development funds should be exploited thoroughly and used effectively.

7
Interaction with business and public sector

Another challenge with respect to the further development of the RDI function lies in the way in which the UASs position themselves with regard to the society and the economy. What we have learned so far is that there is mostly a rather *ad hoc* kind of relation between UASs and public and private sector organizations, especially SMEs. The panel wants to point here especially to the weaknesses in the relationship between the UASs and their private and public partner organizations; weaknesses that can be argued to be surmountable. For example, as discussed above, the UAS sector has apparently not yet managed to develop in their Master level programmes an adequate balance between the individual institution's interests in strengthening its RDI profile, and the interests of the individual students and employers of students enrolled in these programmes. Furthermore, there seems to be a lack of structured bridging mechanisms to narrow the socio-cultural gap between UASs and society. Of course, we heard interesting examples of the attempts of individual institutions to improve the connections, e.g. dissemination of RDI outcomes through regular newspaper columns, morning coffee meetings or brainstorming workshops together with representatives from private firms. Nonetheless, overall there is not much evidence for the co-creation of knowledge, for the joint development of innovation strategies on a regional or higher level in which both UASs and private firms taking part, even though a number of UASs take part in regional innovation strategy work. Further the panel did not find many structured overviews of the output of RDI projects or the RDI expertise and experiences of UASs easily accessible for interested companies and organizations. It is only fair to say that there are also very few funding mechanisms incentivizing

and supporting RDI contacts and setting up structured partnerships with public and private partners in relevant areas.

The panel did come across examples of more long-term structured connections between individual UAS units and private and public companies and agencies, e.g. in the social and health care sectors. Many of the interviewed representatives of public and private companies were pleased by the RDI-cooperation and results produced together with UASs.

Nonetheless, overall the dissemination of RDI expertise and experience occurs in a rather fragmented and unstructured way. Some important reasons for this arguably are to be found in the fact that the private sector sees UASs in the first place as a source for qualified labour and not so much as a trusted RDI partner. Apparently, it is often unclear for private companies what exactly the UAS expertise is and how it can benefit their company strategy. Clearly, there is a lack of knowledge on both sides of what could be common ground for joint activities and developments for the longer term. Therefore, it would make sense to invest more in bridging mechanisms that would allow for joint projects.

Also the cultural differences between UASs and public and private companies were sometimes seen as an obstacle. The yearly planning cycle of UASs often seems stagnant from the perspective of SME's and holiday periods can cause long hold ups. Resource management and coordination is a key element in solving these issues.

It also came across in the interviews that companies often see RDI collaboration with UASs as financially easier and more practice-oriented than collaboration with research universities or RDI institutes. In addition UASs are regarded to be more eager to listen to the needs of companies than the other RDI institutions. Although this might be a good selling point for UASs for developing structural partnerships, it also raises the question whether the UASs are pricing their RDI services correctly. The lower pricing is possible because RDI work is so closely linked to education and also because of the strong emphasis on the students in conducting the RDI activities. One of the challenges for UASs seems to be to convince the companies to pay for RDI collaboration. However, this relates also to the question of balancing the two aspects of UAS RDI, being a pedagogical instrument on the one hand and serving the development needs of the region and SME's on the other. Another issue is that in the public sector (especially in the social and health care sectors) there seems to be a strong

demand for RDI services which UASs could cater for, but the financial resources are in general tight.

Collaboration is something that can be learned (and needs to be learned) through mutual experience. This does not necessarily require large investments, because it does not require large levels of funding to bring people together and let them try out something (cf. innovation cheques of € 5000 as common cooperation incentive mechanisms in other European countries). One could also focus on the experiences of PPPs, given that in some sectors good examples can be found of more structural cooperation between public higher education institutions and private companies.

Obviously, a lot more needs to be done for developing an integrated innovation system in which public and private parties collaborate in a fruitful way. The RDI concept needs to be further developed, the relationship of research universities and non-university research institutes with the UASs needs to be investigated, further stimulated and nurtured (both institutionally and culturally), and communication and transparency have to be developed further. But given the current financial constraints, it would already be helpful to take some small but concrete steps that will provide a chance to undertake new cooperation efforts, and at the same time provide a framework for designing a longer term more structural approach.

Conclusions/Recommendations:

- UASs should become more visible for their environment, in particular regarding what they can offer for potential clients.
- More attention should be paid to attuning the agendas of a UAS and relevant partners in the environment, either through small scale bridging mechanisms or longer term collaborative practices.
- More effort should be directed towards learning how to collaborate with partners in society.

8
Indicators for RDI

Finally, in this chapter the evaluation panel will suggest a procedure for the development of new RDI indicators for the UAS sector. The panel's proposal is based on interviews conducted at different UASs, and on a number of recent studies and experiences in Europe. For the latter, the panel looked at the Dutch ERiC project and a connected FP7 project called SIAMPI. In both projects, indicators were developed based on the conceptual approach of *productive interactions*[25]. The panel also looked at the part of the UASnet project EDUPROF in which indicators were developed for applied research, partly based on the ERiC-project (in which the Dutch universities of applied sciences participate). And finally, two methods using knowledge transfer indicators were reviewed, one made for the European Commission, the other called the payback framework which was developed in the UK by Buxton and Hanney.[26]

To come up with good indicators is not easy for a number of reasons. First, as discussed in chapter 1 (international and national contexts of RDI), RDI is a concept in development in the Finnish UAS sector and there is no common definition for RDI. Second, it is clear that whatever RDI is, it is context

[25]See www.siampi.eu, an FP7 project that focused on the evaluation of the social impact of research. See also Evaluating the societal relevance of academic research:a guide, ERiC publication 1001 EN, June 2010.

[26]Håkon Finne, Adrian Day, Andrea Piccaluga, André Spithoven, Patricia Walter, Dorien Wellen, A Composite Indicator for Knowledge Transfer Report from the European Commission's Expert Group on Knowledge Transfer Indicators, 2011. See also Donovan C, Hanney S. (2011) The 'Payback Framework' explained. Research Evaluation; 20:181–3.

dependent, which makes it difficult to come up with a fixed set of indicators. Third, both in the realm of policy, and in the evaluation research community there is no consensus about how to approach this topic. On the one hand, there is a tension between the need for clear, simple and unobtrusive indicators, on the other hand, there is the recognition that innovation is a complex process in which a variety of researchers and stakeholders play a role and have different demands and expectations.

The general lesson from the interviews and the studies is that no matter what indicators you choose for RDI, they will have to be representative for a variety of outputs and activities that together make up this complex process in which research through development transgresses into practical and innovative applications. In this process, many actors are involved in the co-production of innovation, and the RDI-function is thus dependent on a variety of contextual factors, which somehow have to be represented in the evaluation procedure.

Furthermore, when developing indicators, one has to abide a number of general conditions such as validity (does the indicator measure what is intended?), objectivity (is the indicator based on robust data?) and availability of time sequences (how far back can we go?). In the case of RDI some more specific conditions are also important, such as the availability of regional and sectoral data and the comparability with other relevant countries.

Given all these conditions, it cannot be a surprise that the indicators that were introduced some years ago for the Finnish UASs are up for discussion since from an UAS perspective they exhibit several shortcomings.[27] More specifically, a main criticism was that they were created based on indicators assessing scientific research in research universities. Furthermore, the nature of the indicators seems not to be suitable to measure the realization of certain policy goals related to RDI development, and finally the data collection for these indicators is argued to be too complex. This critique was followed by recommendations for redesigned indicators, which are expected to overcome those obstacles. These have been elaborated by a working group of the UAS rectors' conference and they shall be included in the considerations of the Ministry of Education and Culture.

[27]Reference to the document in which these indicators were introduced.

The proposal of the AMKtutka working group for indicators entailed the following five: 1. Application-based funding for RDI activities; 2. Direct client funding of RDI activities; 3. International funding of RDI activities; 4. Number of publications; 5. Number of credits gained by students in RDI activities. The first three indicators focus on funding, and number four regards publications. Number five was in the proposal of the working group transferred to the indicators of education. While we do not know yet the final results of the piloting process in 16 UASs, it appears to be a proposal that finds support in the sector. However, while we recognize the value of these indicators in some cases, it is also clear that they cover only part of the RDI-process. Our proposal aims at indicators being representative for the variety of innovation processes UASs are involved in.

8.1 No consensus about RDI

A problem with the development of indicators is the fact that, as we learned from the interviews and documentation, there does not exist consensus about the definition of RDI. However, as we have stated above, this should not hinder the further development of the RDI-function. Given the fact that we are dealing with a new concept that is still developing this lack of consensus is of course not surprising. A main conclusion is that a one-set-fits-all approach for indicators is not possible or meaningful. This is aggravated by the fact that first the R&D component was introduced as a specific task for the UASs, and some years later innovation (I) was added. With hindsight, this may have complicated things, in particular because innovation is a very broad concept which in some definitions entails the whole process of academic research, applied research and practical applications, while others are much more limited, basically referring to what is done in commercial enterprises. In most interviews we noticed that the conceptual awareness of R&D is still much more prominent than that of RDI. We also noticed that UASs took the liberty to develop their own view on what is RDI, depending on specificities of their own policy development which are as a rule related to a regional context. The variety we found in the ways UASs develop the RDI-function ranges from a focus on producing innovative products and services for local businesses, to an orientation towards larger international companies. Still other UASs focus on social innovation or community services or public

transport. Some work in narrow collaboration with companies or public agencies, others work perhaps more distant without specific assignments or contracts. Clearly, innovation in the health care sector differs in many respects from innovation in, for example, nanotechnology. All these different modes of operation arguably are in need of specific quality indicators, however, there might also be ground for common indicators.

8.2 Two distinct approaches for indicators

From the European reports on indicators we reviewed the following can be concluded. There are two main currents visible in the development of indicators for valorisation. We use the concept of valorisation here as an umbrella for all those activities of researchers to somehow improve the external value of their research, be it for economic, socio-cultural or technological purposes (or often a mixture of these). The one current we call 'contextual', meaning that researchers focus on involving the relevant societal context in the evaluation procedure. Indicators will try and capture the interaction between researchers and relevant stakeholders. For example, the SIAMPI (www.siampi.eu) project distinguishes three indicator categories: direct or personal, indirect or through media, and financial/material support. Indicators in the first category refer to the network around the researchers and the personal contacts, indicators in the second category reveal the audiences that are interested in the research, and finally, indicators in the third category give concrete evidence of collaboration in projects. The second current starts from a more linear perspective often referred to as knowledge transfer. Arguably, some kind of logic model is followed, in which consecutive stages of an imaginary line from basic research to practical application is followed (the Finne et al. report or the payback method). However, it is recognized also in this current that innovation does not follow a strictly linear pattern, witness the fact that feedback loops are built in the evaluation models here.

Interestingly, the outcome of both currents is not that different when it comes to the overall indicator framework. In both, first a distinction is made into several sub-categories (three to five in the studies we looked at) and then for each of these sub-categories, indicators are suggested. However, the main difference is that in the contextual approach the decision about indicators is made by researchers and stakeholders

together (and thus can differ per context), while in the linear approach, indicators are presented as a fixed set. The Finne et al. report (linear approach) distinguishes people, co-operation and commercialisation as the three categories, while the SIAMPI approach distinguishes people, media and financial/material support as the three main sub categories. From table 2, it becomes immediately clear what the problem is with the fixed set of indicators: they will only fit a small number of RDI-modes. For example, the third column is mainly geared towards patent activity, which only makes sense in a limited number of cases.

Table 2. Proposed component indicators for knowledge transfer (Finne et al. 2012)

Knowledge transfer through trained people	**Institutional co-operation in R&D and other phases of innovation**	**Commercialisation of research**
Stock of HEI graduates employed in business enterprise sector	Number of R&D contracts in HEIs/PROs with firms and other users	Invention disclosures from HEI/PRO employees
Stock of doctorate holders employed in business enterprise sector	Number of consultancy contracts in HEIs/PROs with firms and other users	Priority patent applications submitted from HEIs/PROs
Continuing professional development revenue for HEIs	Revenue to HEIs/PROs from R&D contracts with firms and other users	Patent applications submitted from public sector actors to EPO
Employed adults (age 25–64) engaged in university level training or education	Revenue to HEIs/PROs from consultancy contracts with firms and other users	Patents granted to HEIs and PROs
Teaching in HEIs performed by people with their primary job outside the HEI/PRO sector	Firms co-operating with HEIs	New licensing agreements
Entrepreneurship propensity among HEI students	Firms co-operating with PROs	Licensing revenue to HEIs and PROs
	R&D in HEIs/PROs funded by business	International licensing trade from HEIs and PROs
	Co-publications between private and public authors	Number of new spin-offs

HEI = Higher Education Institute *PRO = Public Research Organisation*

The SIAMPI approach provides more flexibility to adapt the indicators to what is really representative for specific fields. SIAMPI distinguishes three types of interaction channels and suggests indicators for each of these three, but it does not prescribe which indicators to use. The decision about that is made by the research community and the stakeholders together. While in principle this can lead to an infinite number of not very meaningful indicators, it is the experience of the SIAMPI project that this does not happen in practice. As long as responsible people take part in the process of developing indicators, and the conditions for robustness and validity are respected, the outcome of this process is a good set of indicators that is representative of the particular RDI policy. The advantage of such a joint effort is also that people are more committed because they designed the indicators themselves, and moreover, it raises mutual understanding of interests and needs. Table 3 shows examples of indicators in the three SIAMPI categories.

Table 3. SIAMPI indicators for productive interactions

Direct, personal actions with stakeholders, both staff and students	**Indirect interaction with stakeholders through media**	**Financial / material interaction with stakeholders**
• face-to-face meetings • double functions, other mobility arrangements • phone conferences • email • social media • videoconferencing • public debate • radio, tv, internet • etc.	• academic journals • professional journals • non-academic journals • popular media • exhibitions • artefacts, models • films • master theses, graduate projects • standards, protocols • social media • etc.	• research contracts, public and private, and mixed, national, international • facility, instruments sharing • start ups • contribution "in kind" (people) • IPR arrangements, patents, licenses • professional training • other stakeholder interest • etc.

The outcome of the EDUprof project is similar to the SIAMPI/ERiC approach. They distinguish a number of common indicator categories (money, people, publications and media appearances, artefacts and services, patents/ licenses, start-ups/spin offs and awards and prize) and within those broad categories, indicators are suggested. The main

difference with the SIAMPI approach is that SIAMPI explicitly leaves room for input from the researchers and stakeholders in indicator development.

It is the panel's view that while developing indicators for RDI one has to be careful not to use a fixed set of RDI indicators with respect to the UAS sector at this stage of early development. Obviously, if one wants to compare different institutions with similar missions, you need a common set of indicators. Therefore, it would be wise to set some common indicators in each of the three categories, and at the same time leave room for flexibility. Whatever choice is made, indicators can only be meaningful if they are based on robust datasets. For a lot of the indicators mentioned above, these are not yet in place. Thus, attention has to be paid to the development of a solid data-system according to national or even international principles.

Given the lack of clarity about the role and nature of the RDI function in the UAS sector, and also given the limited staff input and insufficient overall international embeddedness of RDI, it will be a challenge to measure the actual effects of the RDI activities in a meaningful way. In such a premature situation, it is more effective to use indicators that will tell something about the developments with respect to realizing the main goals of the UASs with respect to their interaction with a relevant environment, including the pitfalls and possibilities in this. The question then becomes how one can make sure that a new set of indicators will be used for supporting the further development of the RDI function of the system, and not for punishing (and awarding) specific institutions?

The prime answer to this question is that at this stage in the development of the UAS sector it can be recommended that RDI function indicators should primarily be used as learning tools for all involved actors and not for accounting purposes. Indicators used this way will help to construct an evidence-based concept of research quality and impact. At this stage it is questionable whether it is realistic to work with system-wide indicators. It would be preferable to develop a two-tier set of indicators in which one set consists of a small number of RDI-indicators that refer to general quality and impact measurements, for example, focusing on some output and use categories, and another set that exists of RDI targets and related indicators for each individual UAS that do justice to the varied state of development of the RDI function at each institution. This would entail a clear definition of policy

targets for the short, medium and long term. In developing such a system both intrinsic values for RDI and extrinsic or contextual considerations have to be taken into account. It can be expected that some innovative indicators will be created, for example, regarding 'knowledge co-creation', 'artefacts', open innovation, or connection between European Grand Challenges and local solutions. In addition, indicators with a special focus on the regional function and entrepreneurial activities of a UAS will be of high potential importance from the perspective of an institutional RDI director.

As the projects at the European level show, the clear and targeted definition of effective indicators that are covering the applied and user-oriented nature of RDI at UASs is a difficult and complicated endeavour, as is the collection of relevant data and information in the use of the indicators. It should be mentioned that developing an effective set of indicators is still a work in progress also internationally.

With respect to the new university funding matrix proposal the Ministry of Education and Culture has just launched for 2013, it would be unproductive to ignore these developments and come up with a completely new set of indicators. What we advise to do is to look at these documents critically from the development perspective that we described above and use (some of) these indicators in the spirit of learning (and not accounting) to see whether they are helpful in (further) developing the RDI function in the UAS sector.

Conclusions/Recommendations:

- Given the premature stage of the development of the RDI function at UASs, indicators should be used to learn and improve, not to account and punish.
- A practical lead in the development of UAS RDI indicators can be found in recent European projects, in particular the EDU-prof and SIAMPI project. The key is to distinguish a number of main indicator categories (3 to 5), and then within these broad categories place a number of more specific indicators that are on the one hand representative for the general aspects of the RDI function and on the other leave enough room for specific differences
- In doing so, the current proposals for indicators (AMKtutka, ministry matrix) should be taken into account, but handled in the perspective of the above two tier approach.

- It is also recommended to make use of the international (European) developments regarding indicators. The hard work needed to develop indicators and collect robust and reliable data cannot be underestimated.

9
Final reflections

In this report a rather critical review of the development and current situation of the RDI function and the RDI tasks of the Finnish UAS sector is presented. In the evaluation panel's view there are a number of aspects of the overall steering, legal and funding framework of the RDI function and tasks that need considerable strengthening before the UAS sector will be able to perform RDI activities at its full potential.

Nonetheless, we want express here our admiration for the progress made since 2003, and the commitment and enthusiasm with which all the actors involved in the UASs work on the further development of the sector's RDI function. Also the environment of the UASs is positively dedicated to the further development of the UAS sector's RDI function, as is illustrated by the interest in the evaluation and the willingness of all agencies and interviewees invited to participate in this evaluation, as well as by the fact that the funds invested in RDI activities at UASs are increasing relatively rapidly.

As discussed in the report UASs face important challenges in their efforts to institutionalize a sector specific RDI profile. This concerns, for example, the lack of a generally accepted RDI definition, the relatively small basic funding basis for RDI, the fragmented and in some respects uninviting external funding context, the education dominated academic culture in the sector, the weak international dimension in the sector's RDI projects, the relatively weak institutional links to public and private organisations in the UASs' environments that are in need of RDI services, and the absence of an effective, sector specific set of RDI indicators that can be used for funding and policy purposes. A number of these challenges have to be addressed intra-sectorally, in the sense that important

strategic choices have to be made by the UAS sector as a whole and by individual UASs. Concerning the latter this implies that in order to convince their main internal and external stakeholders that the UAS sector has a role to play in the Finnish RDI landscape all UASs have to make strategic decisions and investments with respect to their RDI profile which go in general way beyond the current ad hoc and piecemeal commitments made by the institutional owners and leadership. However, even if all UASs were to make these decisions and investments, the UASs cannot overcome the above presented challenges all by themselves. Major decisions and investments also have to be made in the environments of the UASs. After nearly one decade of in essence bottom up RDI developments, the time seems ripe for a set of top down measures in areas such as RDI funding, RDI support structures, RDI networks and links, and RDI indicators, for stimulating a more coherent, more integrated, more focused and more effective RDI development in the UAS sector. Obviously the UAS sector should be involved in the development of these measures, but the final responsibility for initiating, developing and taking these measures clearly lies outside the sector.

From an international perspective the development since 2003 of the RDI function and tasks of the UAS sector has given Finland a unique advantage over many other countries where the RDI role of institutions comparable to the Finnish UASs is more controversial and at best in an earlier stage of development. The evaluation panel hopes that this report will contribute in a constructive way to the next phase of this development, i.e. the planned reform of the UAS sector, and especially the strengthening of the way in which this sector can develop in a more coherent, sector-wide way its potential in the Finnish RDI landscape. If succeeded it will undoubtedly allow Finland to profit in the years to come from the contributions the UAS sector will make to the Finnish R&D, and innovation systems.

ABSTRACT

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From the bottom up – Evaluation of RDI activities of Finnish Universities of Applied Sciences

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Abstract
The evaluation team finds that there are a number of aspects of the overall steering, legal and funding framework of the RDI function and tasks that need considerable strengthening before the UAS sector will be able to perform RDI activities at its full potential. The funding situation for the RDI activities of the UASs is fragmented and lacks transparency. In addition, it can be argued that the overall basic funding level for the RDI function of the UAS sector is too low. The main Finnish agencies for the public funding of RDI activities, TEKES and the Academy of Finland lack a clear frame of reference for determining their role in the funding, and therefore further development of the RDI activities of the UAS sector. It is of importance to give a clear signal to the UAS sector that the further development of their role in RDI has political priority.

A well-tuned balance of the strategic orientation of RDI between being an educational and pedagogical instrument on the one hand and a more independent scientific endeavor contributing to the application of new and existing knowledge for private and public sector problems on the other hand is of high importance. The potential of Master programmes in the further development of the RDI function of the UAS sector needs to be examined thoroughly.

In staff training and career development, RDI skills, competences and knowledge development should be prioritized and emphasized. Innovation competences, skills and knowledge requirements need to be further clarified for UAS staff development.

Despite a strong strategic focus on the enhancement of internationalization at the national level, an effective support structure for stimulating the internationalization of the RDI activities of the UASs is lacking. The evaluation team recommends the establishment of a national support scheme for the development of applications for international RDI funding at UASs. UASs should become more visible for their environment, in particular regarding what they can offer for potential clients.

Given the premature stage of the development of the RDI function at UASs, indicators should be used to learn and improve, not to account and punish. It is also recommended to make use of the international (European) developments regarding indicators. The hard work needed to develop indicators and collect robust and reliable data cannot be underestimated.

Keywords
Evaluation, polytechnics/universities of applied sciences, R&D, RDI

TIIVISTELMÄ

Julkaisija
Korkeakoulujen arviointineuvosto

Julkaisun nimi
From the bottom up – Evaluation of RDI activities of Finnish Universities of Applied Sciences
(Suomen ammattikorkeakoulujen tutkimus-, kehitys- ja innovaatiotoiminnan arviointi)

Tekijät
Peter Maassen, Outi Kallioinen, Päivi Keränen, Markku Penttinen, Jack Spaapen, Roswitha Wiedenhofer, Johanna Mattila ja Matti Kajaste

Tiivistelmä
Arviointiryhmän näkemyksen mukaan ammattikorkeakoulujen TKI-toiminnan ohjausta sekä lainsäädäntöä ja rahoitusta on vahvistettava huomattavasti, jotta ne voisivat saavuttaa täyden potentiaalinsa. Ammattikorkeakoulujen TKI-toiminnan rahoitus on sirpaleista, ja siitä puuttuu läpinäkyvyys. Lisäksi rahoituksen tasoa voidaan kokonaisuutena pitää liian alhaisena. Merkittävimmille suomalaisille tutkimusrahoittajille, TEKESille ja Suomen akatemialle ei ole osoitettu selvää roolia TKI-toiminnan rahoituksessa, joka osaltaan tukisi koko sektorin jatkokehitystä. Olisi myös hyvin tärkeää antaa ammattikorkeakoulusektorille selvä signaali TKI-toiminnan jatkokehityksen poliittisesta merkityksestä.

Strategisen TKI-toiminnassa olisi löydyttävä tasapaino koulutuksellisen välineen ja toisaalta itsenäisen tieteellisen toiminnan välillä. Myös ylemmän amk-tutkinnon asemaa TKI-toiminnan kokonaisuudessa tulisi selvittää tarkemmin.

Henkilökunnan koulutuksessa ja urasuunnittelussa tulisi nykyistä selvemmin priorisoida ja korostaa TKI-taitoja, -valmiuksia ja -tietoja. Vaikka kansainvälistymiseen onkin luotu varsin vahva strateginen painotus, TKI-toiminnan kansainvälistymistä ei stimuloida tehokkaalla tukirakenteella. Arviointiryhmä esittää kansallisen tukimekanismin perustamista kansainvälisten TKI-rahoitushakemuksien kehittämiseksi. Ammattikorkeakoulujen TKI-tarjonnan ja -osaamisen tulisi lisäksi olla näkyvämmin esillä alueellaan.

Ammattikorkeakoulujen TKI-toiminnan varhaisesta kehitysvaiheesta johtuen, indikaattoreita tulisi hyödyntää toiminnasta oppimisen ja kehittämisen apuvälineenä, ei laskentaan tai rankaisuun. Lisäksi olisi eduksi hyödyntää kansainvälisten, lähinnä eurooppalaisten, tunnuslukuprojektien työtä suunnittelussa. Indikaattoreiden kehittämiseen ja luotettavan datan keräämiseen liittyvää edessä olevaa raakaa työtä ei tulisi aliarvioida.

Avainsanat
Arviointi, ammattikorkeakoulut, T&K, TKI

SAMMANDRAG

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Publikation
From the bottom up – Evaluation of RDI activities of Finnish Universities of Applied Sciences
(Utvärdering av de finländska yrkeshögskolornas forsknings-, utvecklings- och innovationsverksamhet)

Författare
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Abstrakt
Utvärderingsgruppen ansåg att flera aspekter i verksamhetsstyrningen, lagstiftningen och finansieringen måste förstärkas avsevärt före yrkeshögskolornas FUI-verksamhet kan uppnå sin fulla potential. Finansieringen av yrkeshögskolornas FUI-verksamhet är splittrad och saknar genomsynlighet. Vidare kan man påstå att basfinansieringen är för låg. Tekes och Finlands Akademis, de viktigaste offentliga finansiärerna av FUI-verksamheten i Finland, roller i finansieringen är oklara. Tydliggörande av rollerna skulle stöda hela yrkeshögskolesektorns fortsatta utveckling. Det är även viktigt att ge en tydlig signal till yrkeshögskolesektorn beträffande den politiska betydelsen av FUI-verksamhetens fortsatta utveckling.

Det vore ytterst viktigt att den strategiska riktningen för FUI-verksamheten skulle hitta en balans mellan å ena sidan FUI-verksamheten som ett utbildningsinstrument och å andra sidan som mera oberoende vetenskaplig verksamhet som bidrar till tillämpning av ny och existerande kunskap på privata och offentliga sektorers problem. Högre yrkeshögskoleprogrammens potential i fortsatt utveckling av FUI- verksamheten borde utredas grundligt.

FUI-färdigheter, -kompetens och -kunskap borde prioriteras och betonas i personalutbildningen och karriärplaneringen. Innovativa kompetenser och färdigheter samt kunskapsbehov borde klarläggas med hänsyn till yrkeshögskolornas personalutveckling.

Trots att det finns en stark strategisk fokus på internationalisering på nationell nivå, saknas det en effektiv stödmekanism som skulle stimulera internationalisering av yrkeshögskolors FUI-verksamhet. Utvärderingsgruppen rekommenderar att det införs en nationell stödmekanism vars uppgift skulle vara att bistå i utveckling av ansökningar om internationell FUI- finansiering. Yrkeshögskolorna borde bli mer synliga regionalt, framförallt angående vad de kan erbjuda sina potentiella kunder.

Med anledning av den tidiga utvecklingsfasen som yrkeshögskolornas FUI-verksamhet befinner sig i, borde indikatorer användas för att lära sig om och utveckla verksamheten inte för räkenskaper eller för att bestraffa. Det rekommenderas även att internationella (europeiska) utvecklingsprojekt gällande indikatorer utnyttjas. Det hårda jobbet som krävs för att utveckla indikatorer och samla hållbar och tillförlitlig data kan inte underskattas.

Nyckelord
Utvärdering, yrkeshögskolor, FUI, FuI

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