

Toward education– research–education triangle

Where are we starting from?



European Commission
TEMPUS



University of
Zagreb

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Foreword

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The Partner Countries are still significantly lagging behind the achievements of EU countries, including Austria, Belgium, France, and Germany, particularly in terms of the education–research–innovation triangle (ERIT). In order to develop means for the exploitation of academic research outcomes and to create harmonized and efficient relationships between universities and industry, this project is conceived to trigger the creation and implementation of adequate structural measures. Doctoral education in particular has recently received significant attention in international communities and is undergoing a radical reform throughout Europe. The impact of globalization worldwide, combined with developments in the Bologna Process, has heightened awareness of the potential benefits to societies of developing highly skilled personnel who are capable of adapting to and dealing with a rapidly changing environment. In addition, the Lisbon Process, which began in 2000, has had a major impact on developments in higher education and research policy; EU leaders decided on a process to boost the Union’s competitiveness and growth to create “a Europe of knowledge”. As a consequence, the European Union has become increasingly assertive in its efforts to influence the behaviour of higher education and research organisations. To face rising challenges, the education of future graduates needs to be reconsidered, and doctoral training is certainly the major link between the Bologna Process and the Lisbon Agenda.

Introduction

The editors

The OPUS project is a Tempus Structural Measure in the area of Higher Education and Society (HES). It involves regional Higher Education Institution (HEI) partners from Bosnia and Herzegovina, Croatia, the Former Yugoslav Republic of Macedonia (FYROM), and Montenegro. Also participating are universities from Austria, Belgium, France, and Germany. Joining the HEI partners are representatives from national and local governments, innovation support, and advisory organisations and commercial enterprises.

Background of the project

All of the Partner Countries involved in this project, Bosnia and Herzegovina, Croatia (which was awarded EU candidate status in 2004), the Former Yugoslav Republic of Macedonia (FYROM), and Montenegro, have demonstrated a strong commitment to join the EU and to implement the necessary reforms. For this purpose, they need to fulfil the economic and political Copenhagen criteria, which include the capacity to cope with competitive pressure and market forces.

The Partner Countries are still significantly lagging behind the achievements of EU countries, including Austria, Belgium, France, and Germany, particularly in terms of the education–research–innovation triangle (ERIT). In order to develop means for the exploitation of academic research outcomes and to create harmonized and efficient relationships between universities and industry, this project is conceived to trigger the creation and implementation of adequate structural measures.

Although financial support is important, the lack of educated and trained human resources is the greatest constraint. These problems are particularly prominent at smaller universities and those established recently that suffer from insufficient numbers of researchers and lack of institutional infrastructure.

Doctoral education in particular has recently received significant attention in international communities and is undergoing a radical reform throughout Europe. The impact of globalization worldwide, combined with developments in the Bologna Process, has heightened awareness of the potential benefits to societies of developing highly skilled personnel who are capable of adapting to and

dealing with a rapidly changing environment. In addition, the Lisbon Process, which began in 2000, has had a major impact on developments in higher education and research policy; EU leaders decided on a process to boost the Union's competitiveness and growth to create "a Europe of knowledge". As a consequence, the European Union has become increasingly assertive in its efforts to influence the behaviour of higher education and research organisations. To face rising challenges, the education of future graduates needs to be reconsidered, and doctoral training is certainly the major link between the Bologna Process and the Lisbon Agenda.

The general aim of the TEMPUS OPUS project is to develop and implement structural measures in the area of higher education, in particular in the third cycle of education (doctoral studies); research and its application (technology transfer) in order to achieve both better quality Higher Education (HE) and research outcomes; as well as to improve communication between academia and industry.

The project unites twenty-three (23) partner organisations and one named individual expert for a period of three years from January 2009 to January 2012. A full list of the partners can be found at the end of this publication. More information about the project is available at the project web-site: www.opus.unizg.hr

Specific objectives of the project

The Specific Objectives of the TEMPUS OPUS project are:

- To understand the present status of the education-research-innovation activities related to knowledge transfer and academic entrepreneurship
- To define necessary measures at the local, national, and regional level – to initiate changes of legislature related to research, intellectual property rights, and technology transfer
- To improve the entrepreneurial and management skills of researchers and to raise awareness among researchers about the importance of research, innovation, IPR, and entrepreneurship
- To develop sustainable networks among universities, industry, and public authorities
- To disseminate results to stakeholders and the general public

This present report supports the objectives:

- To understand the present status of the education-research-innovation activities related to knowledge transfer and academic entrepreneurship and
- To disseminate results to stakeholders and the general public

The role of doctoral education in boosting research and innovation/ technology transfer at the University of Vienna

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Doctoral education has recently received significant attention in international communities and is undergoing a radical reform throughout Europe. The impact of globalization worldwide, combined with developments in the *Bologna Process*, has heightened awareness of the potential benefits to societies of *developing highly skilled personnel who are capable of adapting to and dealing with a rapidly changing environment*. On the other hand, the *Lisbon Process*, which began in 2000, had a major impact on developments in higher education and research policy; EU leaders decided on a process to boost the Union's competitiveness and growth to create "a Europe of knowledge". The major goal is that by 2010 the European Union should be "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth, with more and better jobs, and greater social cohesion" (European Council, 2000, par. 5). As a consequence, the European Union has become increasingly assertive in its efforts to influence the behaviour of higher education and research organisations. To face rising challenges in the education of future graduates needs to be reconsidered, and *doctoral training* is certainly *the major link between the Bologna Process and the Lisbon Agenda*.

When in 1999, 29 European ministers of education signed the Bologna Declaration to create the European Higher Education Area (EHEA), to promote mobility and employability, and to increase the compatibility and comparability of European higher education systems, a major reform was initiated.

Academic institutions all over Europe have accepted this challenge; the Univer-

doctoral training

the major link between the
Bologna Process and the
Lisbon Agenda

sity of Vienna has recognised that making teaching and training activities compatible with the Bologna objectives must be a central task. The additional focus on the doctorate level emphasised by “Bologna ministers” (Berlin Communiqué, 2003, p. 7) was reflected in the Universities Act 2002 (UA02) amendment in 2006. Universities in Austria are obliged to offer only three-year doctoral programs for newly admitted doctoral students from winter term 2009 onwards. By introducing the new doctoral programme, the University of Vienna focuses on its doctoral candidates and their research projects. Students and their prospective supervisors organise and structure their cooperation as well as subsequent supervision together “to ensure that their doctoral programmes promote interdisciplinary training and the development of transferable skills, thus meeting the needs of the wider employment market” and their personal career development (Bergen Communiqué, 2005, p. 4). Moreover, UA02 stipulates the *autonomy of Austrian universities*: it enables them to set their own priorities, to develop their own specific profiles, to pursue their own policies, and to use their own quality assurance measures. For the University of Vienna, doctoral education and the advancement of young researchers have been identified as central development goals and have been embedded in its institutional strategy in line with recommendations given in the London Communiqué (London Communiqué, 2007). While doctoral study means “*training through research*” and top priority is given to scientific achievement, the University is well aware that in fact most doctoral graduates will find their careers not only in academia, but also in private sector research and development (R&D) laboratories, in government, and in general management positions. Therefore, the *need to offer a broader experience* than core research skills is well recognized.

Re-thinking doctoral education the University of Vienna aims at *transforming supervision from being a “private” relationship between one professor and one PhD candidate to becoming a collective research group inclusion*. Candidates have to interact with more than one supervisor and must collaborate with fellow PhD candidates. In addition, *supervision contracts* will be mandatory: arrangements for supervision and assessment will be based on a contractual framework of shared responsibilities between doctoral candidates, supervisors, and the University. Supervisors and the students being supervised have to agree on communication rules; yearly addenda will include reports on progress and future plans that may include the attendance of lectures or conferences or participation in workshops (transferable skills training). The University of Vienna emphasizes its institutional responsibility by setting up an institutional framework (“*centre for doctoral studies*”) to support all doctoral candidates: Complementary to supervision provided by the faculty, additional workshops, courses, and seminars dealing with topics such as scientific writing, project management, IPRs, etc. will be offered. All these *activities will help doctoral students to become more efficient with respect to their research project and to become more employable, inside and outside academia*, as well as contribute to their transferable skills development. Following Frans van Vught (2009, p 10), “the basic philosophy of the EU research

policy is that excellence in research can be promoted by increasing co-operation and further investments. But stronger links with business and industry are also needed, and knowledge transfer processes need to be strengthened”. With the implementation of UA 02, the *University of Vienna moved from professor’s privilege to institutional ownership*, and knowledge with respect to *technology transfer became a new challenge* for the University. In the process of change a lot of effort was put into communicating new rules and responsibilities within the University; a technology transfer office was established. In 2004 the Austrian government set up a funding scheme for universities to promote knowledge transfer, and from 2010 onwards universities are in charge of maintaining the established structures. During the *process of change, legal barriers as well as cultural differences between academia and business communities* were identified. However, to foster knowledge transfer and to provide fruitful ground, not only formal knowledge transfer arrangements between universities and industry have to be established (such as joint university–industry research ventures or spin-off incubators, but an emphasis must be placed on soft linkages and creation in a more open and entrepreneurial mindset.

It is evident that output of academic research such as publications and patents and their performance measurements remain important to foster excellence. However, based on excellent research, the production of *highly skilled human capital such as doctoral graduates is equally significant to boost research and innovation both inside and outside academia*. It is therefore the overall goal and the *academic institution’s responsibility to promote interdisciplinary, collaborative, and innovative training through research* in order to equip coming generations of academics with skills relevant to work in complex, knowledge-intensive environments in which the rate of change has accelerated to unprecedented levels.

highly skilled human capital such as doctoral graduates is equally significant to boost research and innovation both inside and outside academia

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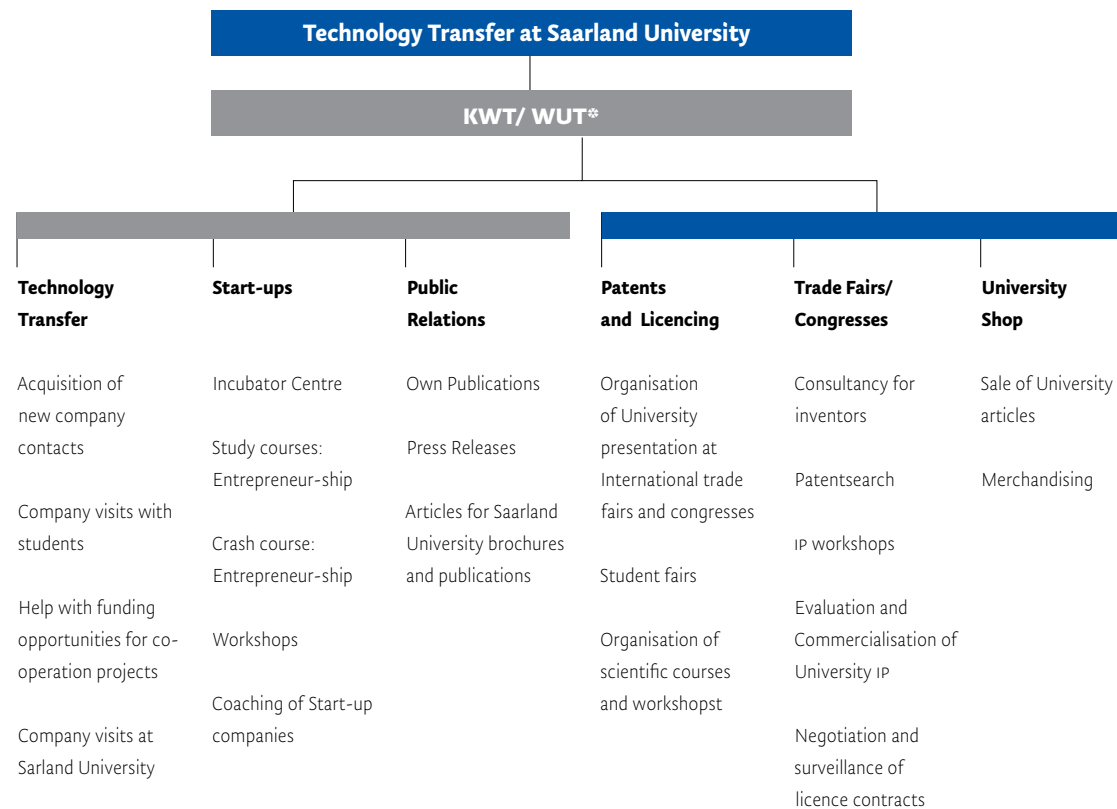
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The role of technology transfer system within Saarland University (correlation and cooperation)

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Best practice Germany: Technology Transfer at Saarland University

At Saarland University, technology transfer activities are divided into two sections. General activities, such as awareness raising and consultancy of scientists, are organized by the internal technology transfer department – Kontaktstelle für Wissens- und Technologietransfer (KWT). All rather commercial activities are done through a company, Universität des Saarlandes Wissens- und Technologietransfer GmbH (WuT), which is a 100% subsidiary of Saarland University.



* All commercial activities are handled by the WuT GmbH.

The three main activities are the incubator center (Starterzentrum), the patent and licencing agency (PVA), and general knowledge and technology transfer activities:

first incubator center founded within a German university

1. The Starterzentrum was founded in 1995 and was the *first incubator center founded within a German university*, which made it much more visible to students and employees. With over 200 new companies having more than 1,400 employees, it is one of the most successful incubators at German universities. The reason for this success story is its holistic approach: already during their studies, students can participate in special entrepreneurship courses as part of their studies. Once students or employees have developed a new business idea, the Starterzentrum supports those young entrepreneurs in all aspects. It offers offices and laboratories at very low rent. Workshops and courses are organized to teach the necessary management skills. In addition, the entrepreneurs get assistance at no charge from experts through a special coaching programme. Furthermore, the Starterzentrum has built up a very good network including different

organizations such as business angels, banks, venture capital companies, governmental agencies, and consultants.

2. In 2002, the patent and licence agency PatentVerwertungsAgentur (PVA) was created after the revision of the German Employees Inventions Act. It is responsible exclusively for the evaluation and commercialisation of all intellectual property generated at Saarland University. PVA offers awareness-raising seminars on patent searching and patent law and conducts patent searches as a service for the university scientists. Once an invention is made it is responsible for the evaluation of the new idea based on patentability and marketability aspects. If an invention is claimed by the university, PVA organizes the patent application procedure in cooperation with outside attorneys and starts to actively commercialize the invention. *In 2008 PVA was among the most successful university licencing offices in Germany concerning the number of inventions disclosed, the number of patent applications and the licence income generated per scientist.*

in 2008 pva was among the most successful university licencing offices in Germany concerning the number of inventions disclosed, the number of patent applications and the licence income generated per scientist.

A rather small agency, PVA focuses on the development of a close personal relationship with the university's scientists and is heavily engaged in international networking projects in order to support its licence activities.

3. For the last 15 years, general knowledge and technology transfer has continuously been an integral part of Saarland University's tech transfer activities. The main task is to get actively in touch with regional companies, but also to promote the possibility of cooperating with Saarland University in research and development (R&D) projects. The overall aim is to create a win-win situation for the company and the university. To reach that aim, Saarland University offers a variety of cooperation models, including cooperation in R&D projects subsidized by public support programs, commissioned work, and even the possibility of submitting topics for diploma and doctoral theses.

Saarland University applied successfully in 2008 for a funding programme called KoWi². This programme is designed for regional companies that want to cooperate with Saarland University. *The focus is on small- and medium-sized enterprises (SME) which can receive 75% funding for cooperative projects with Saarland University.* For big companies the funding is 50%.

The focus is on small- and medium-sized enterprises (sme) which can receive 75% funding for cooperative projects with Saarland University.

With this programme Saarland University wants to pave the way for companies which have had no experience in research cooperation or which are even prejudiced against collaboration with a university. Aside from the high funding rate, the flexibility of the programme is its main asset, having a very easy and fast application and decision procedure without fixed deadlines.

Based on these three main activities, Saarland University can offer a very comprehensive service for scientists and companies willing to engage in technology transfer activities or to found a start-up company. For all relevant questions they can find an experienced contact person within the tech transfer

office who will always be available in case of problems even if the direct contact between scientist and company has already been established or the start-up has already been created.

The commitment to act as a full service agency as well as the “one point of contact policy” for both companies and professors has given knowledge and technology transfer at Saarland University a sustainable good reputation.

The present status of the education-research-innovation activities related to knowledge transfer and academic entrepreneurship: towards a better understanding

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This summary document presents and analyses data provided by the TEMPUS OPUS partners, in the wider context of the role of doctoral education and the technology transfer system. The goal of this publication is to establish the present situation with the objective of informing a future Policy White Paper for the region.

Education-Research-Innovation: towards Policy Development

Introducing Policy and Policy making

‘Policy is a plan of action or a measure developed in response to a perceived need, in order to achieve a particular outcome’. Policy making is the process by

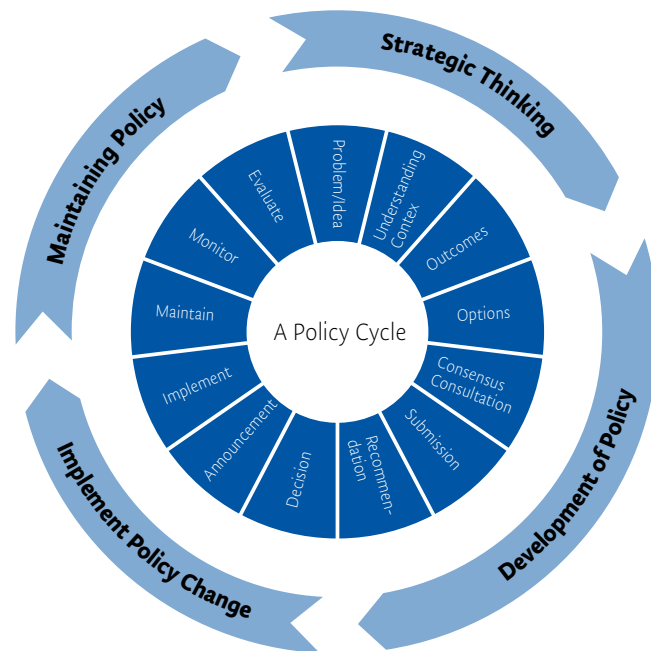
‘Policy is a plan of action or a measure developed in response to a perceived need, in order to achieve a particular outcome’

¹ Science in to Policy: taking part in the process, Clayton and Culshaw, Natural Environment Research Council

which the administration translates its vision into actions to achieve desired outcomes'. Good policy making is therefore essential if government is to achieve its aims and deliver real change and benefits.

There is no single uniform approach to policy making which can be applied to all areas and all departments. However, it is important to remember that the policy process is cyclical and continuous and that there are a number of broad steps or stages which can be applied to most policy areas. The key is to tailor the policy process to needs.

One representation of the policy cycle is shown diagrammatically below (see Ref 2 'The Policy Tool-kit, Effective Policy Making'):



For practical policy development the process can be broken in to 5 main steps:

1. Justification and Set-Up
2. Developing and Analysing the Evidence Base
3. Identifying and Appraising Policy Options
4. Impact Assessments
5. Consultation and Announcement

UK Second edition: May 2009

2 The Policy Tool-kit, Effective Policy Making, Office of the First Minister and Deputy First Minister Northern Ireland, Policy Innovation Unit, 2007

This document focuses largely on Stage 2: **Developing and Analysing the Evidence Base**

Evidence-Based Policy

Government departments increasingly stress the need for evidence-based policy. To be of value, evidence must be seen to be credible, reliable, and objective. Sound policy-making relies upon the government receiving a flow of reliable information from all relevant sectors, public and private.

Developing Policies for Science, Technology, and Innovation (ST&I)

National policies for science, technology, and innovation (ST&I) are now widely recognised as having an important impact on a country's growth and development prospects³. These policies are particularly relevant in changing and developing economies. Countries that have experienced strong economic transitions often lack significant ST&I capacity. Many new members of the EU and ascension states face the challenge of catching up with more advanced economies if they are to overcome their relative underdevelopment and contribute effectively to the Lisbon Agenda.

ST&I policies have many different components. They include measures to promote research and technological progress directly, whether in regions, industrial sectors, or national economies. But the relevant policies also embrace the institutional, organisational, and politico-administrative measures needed to strengthen a National Innovation System (NIS) as well as to integrate such systems into a country's wider policy framework.

Effective ST&I policies should:

- pursue clear strategic objectives
- identify priorities for action and
- demonstrate a high level of coherence.

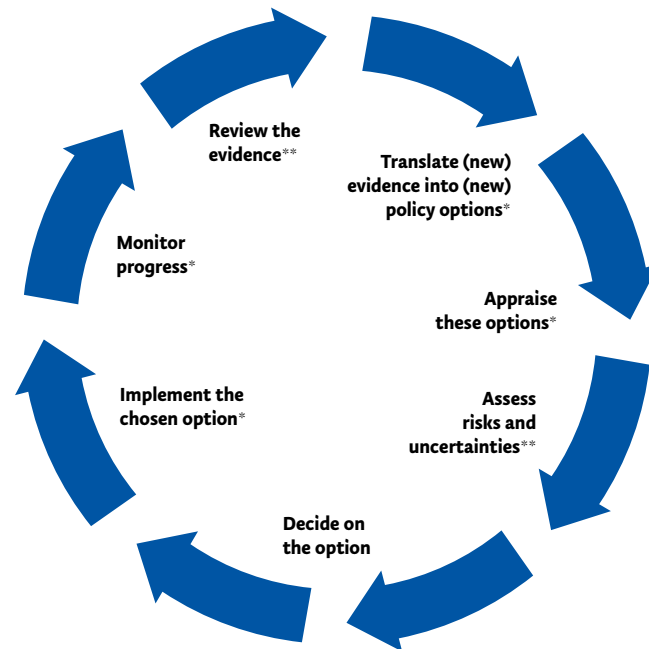
Effective ST&I policies usually require a range of policy instruments, sustained public funding, and effective mechanisms for implementation. It is also crucial to remember that an effective ST&I policy must be formally linked to private sector stakeholders who are engaged in indigenous innovation and technology transfer. The TEMPUS OPUS partnership deliberately unites partners from both the public and private sectors to ensure that the opinions of all stakeholders in the innovation process have been consulted.

Effective st&i policies usually require a range of policy instruments, sustained public funding, and effective mechanisms for implementation

3 Building science, technology and innovation policies, Joachim Ahrens, Science and Development Network, 1 May 2005

The policy-making process, with particular reference to ST&I and the involvement of scientists, is represented below:

The policy-making process



* Some opportunity for scientists to be involved
 ** Significant opportunities for scientists to be involved

Developing and Analysing the Evidence Base

Objective of the activity

This report represents a ‘Review of Evidence’ and draws on Output/ Outcome 2 of the TEMPUS OPUS Terms of Reference:

‘development of strategic documents, regulations, procedures, and good practices used to define necessary measures at the local, national, and regional level in order to initiate changes of legislation related to research, IPR, and technology transfer. These measures will be used as a legal framework for a set of activities that will increase the awareness and understanding of the role of innovation, IPR, and entrepreneurship among researchers in order to improve their entrepreneurial and management skills’.

⁴ Taken from Ref. 1: ‘Science in to Policy: taking part in the process’

Scope and limitations of the data

The data collected represents that which could be made available by the partnership at the time of writing (January 2010). While every attempt has been made to identify all data available, there may be gaps caused by partners being unable to access or obtain the information that they required. Out of necessity, the input also represents the opinion of individuals within an organisation. For this reason, the OPUS partnership involves representatives from senior management within the partner organisations. However, while every attempt has been made to come to a consensus, it is possible that others may hold differing opinions or interpretations of the data. One should also recall that some activities are now developing quite quickly with the availability of new funding for projects, and thus the situation may have changed.

Format of the data collection

Data for this summary publication was collected from the HE and Research organisations and Enterprises Partners using a standard format template. It was intended that this would enable the same kind of data to be collected and in a format that would facilitate comparison. The data was discussed during roundtable sessions by the OPUS partners to further clarify their meaning and context. *The data takes the form of individual and collective SWOT analyses and individual institutional analyses by partner country institutions of their situation in the field of the education-research-innovation triangle.*

The original template and the individual contributions of the partners can be found in the Chapter 7, and collective and individual SWOT analyses tables in Chapter 8.

The context in which the data was interpreted was informed by two useful summary papers:

University of Vienna in Austria, ‘The role of doctoral education in boosting research and knowledge transfer: European policy and local implementation’, and

Saarland University in Germany, ‘The role of technology transfer system within Saarland University (correlation and cooperation)’.

Discussion of the results – emerging issues

In analysing the information and data collected, the following three key areas were considered:

- (I) THE CURRENT POSITION AND BASELINE;
- (II) THE RELATIVE POSITION; AND
- (III) POSSIBLE FUTURES.

Innovation and technology transfer–an overview of the present situation

Research, Doctoral Studies, and Innovation- The Present Status In The Partner Countries

The partner countries of Bosnia and Herzegovina, (BiH), Croatia, the Former Yugoslav Republic of Macedonia (FYROM), and Montenegro are all in the process of restructuring and improving their activities in the areas of research and doctoral studies. Croatia, Montenegro, and Macedonia have demonstrated clear recent progress in strengthening and improving national Policy and legislation, including laws on scientific research; both Croatia and Montenegro are developing science and technology policies and action plans for implementation. However, while Croatia is presently setting up a national innovation system, Montenegro reports that there is as yet no national innovation strategy, and BiH reports that they have yet to structure a law on scientific research.

There are also clear moves to modernise and regulate postgraduate education at national and institutional levels, including that taking place through international dual doctorates. For many of the HEIs, these changes have been initiated by the introduction of the Bologna process, e.g. at the University of Zagreb, but for others there is also evidence of the catalytic influence of experience gained at the institutional level in international collaborations, e.g. at UKIM, Macedonia. Recently revised laws in Croatia include the obligation to appoint a mentor to a post-graduate student and the formalisation of this relationship at some HEIs through a signed contract. Montenegro has developed regulations for dual doctorates to accord with the national law in anticipation of their need in the future.

Funding for doctoral students remains a challenge, with most financing coming from national governments. A small number of students are supported by international funds or, in a few cases, by private foundations and commercial enterprises.

Support for an emerging national innovation system will come from quality assurance in research and also through the dissemination of quality research activities. All the partners acknowledge the importance of establishing a strong quality system for their doctoral studies programmes. Croatia has a well-regulated quality system through the Act on Quality Assurance on Science and Higher Education, while Montenegro has established a Quality Assurance Centre at the University. The University of Mostar in BiH has established doctoral studies according to Bologna at some individual faculties, while others are still structuring their studies. UKIM proposes that organising doctoral studies in the form of a PhD or Doctoral School would be the most rational way to provide unified criteria for quality assurance and quality administrative procedures.

The dissemination of data relating to doctoral studies and research outputs remains an area for development for many of the individual partners. National databases specifying information about doctoral students are still lacking. Some of the individual Universities do maintain databases with information relating to doctoral students, but other partners cite the need for better databases as important for their doctoral studies development.

All partners see the benefit offered by participation in international projects, and not only because they offer a further source of research funding to complement often low levels of national Funding. UKIM, Macedonia has already seen the benefit from the influence of alternative methods of organising studies, gleaned from interactions with international partners. However, most EU research funds were not open to all partner countries for many years leading to a loss of internal know-how in applying for and managing such projects, and even now, some partners acknowledge the challenge faced by their researchers from the requirement for fluency in English demanded by such participation.

For some Universities, there is already a strengthening link to innovation activities in terms of a stronger relationship with research directed at the commercial sector and the establishment of organisation units that will support these activities. Research Offices are often the first units to emerge, often at the central university level (Zagreb and Montenegro) followed by technology centres (BiH), and Incubators and Science Parks (Osijek and Rijeka in Croatia). Provision of information and involvement in the European-wide enterprise network (Enterprise Europe Network-EEN) has been an important starting point for innovation activities at UKIM Macedonia. For other partners, the need to establish and regulate these activities is strongly acknowledged, but there are still major issues relating to capacity and funding to initiate. It can also be argued that strengthening the quality and quantity of research should be the priority in order to generate sufficient activity to nurture innovation activities. Naturally evolving interdisciplinary research and collaborations with local industry are cited by BiH and also by the Republic of Macedonia, where there is strong evidence of diverse national funding and utilisation of international collaborations.

Issues emerging from the SWOT

Despite the fact that the partner organisations are diverse, representing very different examples of size, research strengths, and management structures, a number of common issues emerge from the perspective of innovation and technology transfer.

All partners see the benefit offered by participation in international projects

common issues emerge from the perspective of innovation and technology transfer

clear moves to modernise and regulate postgraduate education at national and institutional levels

1. Effective change management towards a more innovative research base supporting a knowledge-based society and economy.

Only a few universities in South Eastern Europe (SEE) are 'integrated'. By this it is meant that most universities are composed of 'constituents' that are themselves autonomous legal entities for the purposes of much decision making. The exceptions to this rule are presently Dubrovnik and Zadar in Croatia and the Universities of Montenegro and Skopje (UKIM, Macedonia). The power of decision-making and subsequent implementation at non-integrated universities lies with the faculties and departments. While university-level committees may seek to create a consensus of opinion and to provide for services and activities at a central level, they continue to struggle to implement their decisions. Non-integrated universities express a sense of fragmentation and perceive their struggle to make strong headway with centralised policy-making as a weakness. They do, however, express satisfaction that they are receiving more active support at the Government level for efforts to reorient the University components towards the production of a more knowledge-based society.

Of particular importance for Innovation activities, the ownership of IP in Croatia rests with the employer, and in most cases this means the faculty and not the University. This situation is not encountered at most Western European Universities, where an Intellectual Property Policy and preferred centrally funded commercialisation unit, or 'TTO', can be relatively easily established at the university level; in such a situation, negotiation with a faculty regarding assignment of IP rights is unnecessary. This is also the situation for institutes like Rudjer Boskovic Institute in Zagreb, where, once a decision has been agreed upon at the management level to engage in the commercialisation of research results, a TTO may be set up and activities regulated relatively quickly.

Universities in the SEE region are, however, fortunate in not also needing to negotiate the professor privilege, (ownership of IP linked to research results resting with the researcher). This issue has been problematic for both Germany and Italy in recent years. The ownership and commercialisation rights of the employer are clearly regulated by law in most of the partner countries; a great issue is the lack of an entrepreneurial environment, which enables the faculties to make use of both these rights and recent improvements to IP Laws.

For those universities who do have an integrated structure, for example Dubrovnik, it will be possible to establish IP Policy and commercialisation processes at a central level. This may have advantages in terms of setting up a central patenting fund and creating critical mass and specialisms amongst the staff of a Technology Transfer Office. However, before there is a real demand for such a centralised unit undertaking classical intellectual property protection and transfer activities, the level of research results will need to become more competitive and the approach to automatically publishing results will have to be re-

viewed. Zadar University has drafted an IP Policy but acknowledges that at this time there is little genuine need to implement or to establish a commercialisation unit due to the low level of science and research activity at the university. In contrast, the University of Zagreb has established a functioning centralised TTO, using funds from the S&T project, and addresses the issue of Faculty ownership by imposing Rules on how the Office may function that must be adhered to by researchers who wish to use the service. The level of research activity at the University of Zagreb makes the presence of a centralised Office viable even with the added complication of full assignment of IP rights from the faculties. Other non-integrated universities have set up centralised TTOS, but the absence of any formally adopted structure (procedures and processes for its method of operation with regard to IPR) raises questions about their present effectiveness.

For the establishment of 'technology transfer' or 'innovation activities' at the university level, it will be critically important to consider the needs of the research base. A TTO focused on patenting when research activity and quality is still low will not meet the needs of the community. Innovation support must be tailored to the research and teaching profile of the host institution.

2. The Quality and quantity of research and researchers including project evaluation and assessment of results

The majority of the OPUS partners indicate dissatisfaction with the present method of gathering and presenting data that could be used to inform the current position, particularly with respect to peer organisations and to help structure a strategic plan for development. Some Institutions are maintaining data on their publications, for example the Rudjer Boskovic Institute in Zagreb and some government ministries publish lists of funded projects (e.g. MZOŠ in Croatia). However, data gathering is regarded as being low, and of further concern to the partners is that the processes for evaluating project bids to award funding and examining the quality of research outputs remains poor.

Many partners see the lack of quality data collection as a threat to the development of their regional and international profiles and to improving researcher mobility and participation in International projects – all activities that are perceived to bring with them considerable benefits to both individuals and their institutions. Many of the partners report a positive trend in 'brain gain' rather than 'brain drain', but being able to involve young researchers in International projects is also seen as crucial for their professional development. Success at winning both national and international projects remains at a disappointingly low level for the more ambitious research group. Improved data gathering and better procedures for awarding research funding is seen as key to address this issue. Bibliometric analysis is considered to be an increasingly important part of a broader 'toolbox' of evaluation methods available to R&D policymakers to sup-

Universities in the
see region are
not also needing to
negotiate the professor
privilege

port decision-making⁵. In many countries where Innovation is an established part of university culture (the US, the UK, and Australia) there is evidence of a gradual convergence over the past ten years towards a model of university research assessment and ranking incorporating the use of bibliometric measures. Such research rankings are demonstrably useful for securing research projects that are funded by the private sector.

From the perspective of innovation and knowledge exchange with commercial partners (e.g., research collaborations and projects undertaken for industry) being able to develop and demonstrate excellence is critical. The commercial sector understands clearly the concept of competitive advantage and specialisms, even those that are designed to serve a niche local market.

3. The division of time and funding between teaching and research

Almost without exception, the partners cite the *challenge of finding sufficient time away from the teaching commitment to generate significant research outputs*. It is clear that the primary purpose of universities is still to teach and that locating resources to engage in research is a struggle. This is a common problem for this region and beyond; countries that have had a history of government funded research institutes struggle to obtain government funding to enable research to take place at the universities. It is interesting to note, however, that teaching is well established at the Research Institutes and encouraging that eligibility for research funding is presently not restricted, with both Research Institutes and Universities being equally eligible to apply.

The amount of funding for research continues to be a problem, with some universities reporting that it is very low (Montenegro) to 'non-existent' (Mostar) at the national level. Croatian universities note that the funding is not well distributed, with a tendency for nearly all research applicants to receive a rather small sum rather than there being an emphasis on funding the best projects or those that address national priorities. There is still a strong reliance on government money, although some universities are beginning to see the potential for diversifying their research budget through a closer relationship with local industry; Rijeka University in Croatia has made the development of a stronger relationship with their local economy part of their strategic plan, and the focus of their new Science Park facility and TTO is on interactions with local business. For other universities, this approach is more difficult: the University of Montenegro cites the low demand for research outputs from the local community as a problem for them in seeking alternative (non-government) sources for research activity.

There is also concern about a possible move to designate some universities as 'teaching' and others as 'research'; this designation might see some of the smaller

⁵ RAND

Universities lose their research activities entirely and with them their doctoral programmes. However, the move also has the potential to affect the larger Universities, whose sheer size and number of undergraduates threatens to mask the strength of their research output. The universities themselves are taking action to address this threat by seeking to attract more young researchers and developing research specialism that would act as a source of competitive advantage at the national level.

4. The role of the University and orientation towards the changing needs of society.

While support from the national government for universities to help create a knowledge-based society is cited as a strength, there is considerable resistance to change from individuals within the universities and considerable pressure to maintain the status quo. This resistance, coupled with the fragmented management structure of the non-integrated universities may make it hard to realise opportunities to develop the knowledge triangle (education–research–innovation). The strategically thinking universities are investing in their younger researchers – seeing in them the potential force for change. The availability of new funding from EU sources is enabling others to make top-down investments into infrastructure - setting up a TTO or Science Park, expanding the campus to make it more attractive to students and businesses alike.

The use of structural funding to improve the knowledge triangle is supported at the highest level in Europe⁶. However, infrastructure alone is unlikely to effect real and lasting change. And a focus on transferring processes and procedure will give disappointing results if a similar focus is not made on developing the human resources to ensure that they fully function.

Comment on the present position and possible futures

Compared to activities in Austria, Germany, France, and Belgium, *the SEE partners are still at a very early stage, particularly with regard to innovation and formalised technology transfer*. Several partners indicate that they have opened or 'established' an Office or physical focus for an activity. However, there is much less information regarding the intended activities and goals of the Unit and short- or long-term targets that might indicate success. The benchmarking of innovation activity is very low, although some projects funded in Croatia through the STP have targets, particularly related to patenting.

It is clear that Universities in the region see modernisation and change as offering significant benefits to the education system and their contribution to society. They also face significant challenges related to the lack of funding and the fragmented (non-integrated) system for implementation of decisions. However, the drive for change is strong, the aims are well articulated, and the rate of change significant and impressive.

⁶ Energising Europe's Knowledge Triangle of Research, Education and Innovation through the Structural Funds

strong reliance on government money

Universities may appear *resistant to change*, but they are home to those who are fascinated by new ideas and possibilities, and this can provide a strong counter-balance to the natural tendency to embrace the status quo. Researchers and the academic community are also constantly exposed to ideas from collaborators in other countries, and there is a natural drive in the scientific community to prove themselves best in their class. These positive attributes of the university environment will be an asset to the TEMPUS OPUS partners as they move to support the emergence of a knowledge-based society.

All the partners show a strong willingness to examine and adopt 'best practice' from other countries and have cited the need for certain documents, regulations, and procedures that are in evidence at other more advanced research institutes. This is a positive trait, but best practice tends to focus on setting up systems and processes. It could be argued that 'Good people can make any system work and bad people can make any system fail'.⁷ It is equally critical to develop people and to focus on ensuring that the processes and procedures are not just in existence, but functioning to produce the desired results. For this reason, it is important that any implementation plan includes benchmarking against similar organisations to measure progress towards full functionality. Unless this is done, there can be no clear differentiation between the existence of a physical building and a programme giving rise to demonstrable benefits to the host organisation and the national economy. It is perhaps interesting to note the recent trend towards 'virtual' networks for innovation support; such initiatives, including incubation, are moving from a focus on a physical location towards transferable support services; success for the host organisation is judged on results, and not merely on physical evidence of existence.

Processes will always be carried out by people, and change management and innovation have historically needed the presence of champions: inspirational leaders and thinkers who can effect change through their power to communicate their vision to others. Developing and nurturing talented individuals therefore needs to be a priority for university innovation systems. The TEMPUS OPUS project places advanced systems of education of people at its heart. This is a significant step, as those who pass through this system have the potential to be the next generation of innovation leaders and champions.

⁷ T. Hockaday, Oxford University Technology Transfer Office 2009

Abbreviations

EHEA	European Higher Education Area
ERA	European Research Area
ERIT	Education– Research–Innovation Triangle
FYROM	Former Yugoslav Republic of Macedonia ()
HE	high Education
PRO	Public Research Organisation
ToR	Terms of Reference

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Reflection from the university perspective

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The role of universities in society is a crucial role in various respects. This role has been described in the so-called knowledge triangle connecting education, research, and innovation. Each of these components is important for the formation of students and staff, and for welfare and well-being of the society the university is embedded in. Universities create various kinds of values. They fulfil important intellectual and cultural needs, and they have an important added value for the economy and for the administration of a country, through the education they offer, the knowledge they generate and the innovation they create. The three components can function optimally only if they are integrated and mutually reinforcing, and their very integration is required to fulfil the tasks of a university. It is not in the nature of universities to be isolated organizations. Historically, they were often founded for reasons directly related to society and not only for the intellectual and professional formation of young people. After a period which one might call the ivory tower era, in the past few decades one can notice a renewed trend to open up towards society. Universities are of course part of society, they are funded at least partly by the tax payer, and they have the potential to contribute to society in a substantial way. On the other hand, society and its concerns are an important source of inspiration for universities and the research that is taking place there. A better way of formulating would be to consider universities as important and interactive parties within society. They have a responsibility towards other parties and towards society as a whole and at the same time, the other parties and society are an opportunity for the universities to better achieve their goals.

Universities create various kinds of values

At the heart of the university is research. Research is an important basis for teaching and for the formation of students as intellectuals and professionals who can deal with the challenges of the future and find new and creative solutions. Research is also an important basis for innovation in various respects, through new findings and technological improvements, as well as through a better understanding of the human mind, culture and societal processes.

At the heart of the university is research

It is equally true that universities are at the heart of research. There are *three major strengths* that universities have with regard to research. First, they *cover a very broad range of disciplines*. Most universities are comprehensive, and when some are not, they still cover several disciplines. This makes universities ideal institutions for interdisciplinary and multidisciplinary research. Today's major breakthroughs are based on multidisciplinary collaborations and the integration of various disciplines. Second, *universities are an ideal mix of senior and junior people*. Because of the strong link between doctoral programmes and research, there is an ever lasting renewal of researchers and outside inspiration, while the tenured staff provides the basis and the strength for this renewal to be fruitful and guided in the appropriate way. *Third, universities can afford to have less external time pressure for part of their activities*, so that they may provide an environment where ideas and research can have the time to grow if it is beneficial to have this time available indeed. Of course, other activities at universities, including some research activities, are subjected to a high time pressure as well, and in cases of less time pressure, there is still the pressure to deliver and guarantee high quality. Universities are more and more integrated institutes where concerns and ambitions of various kinds meet, so that a good balance is kept and the risks of one-sidedness are rather low.

For all these reasons, it is important that universities set an agenda for how to foster research and its role in both education and innovation. This is why the TEMPUS Project OPUS "Opening University towards Society: Linking Education-Research-Innovation" is so important. This understanding of universities explains why doctoral programmes, the volume and quality of research, and technology transfer are the major components of the project. The doctoral programmes provide a research-based education and a perspective on innovation activities. Technology transfer units and activities are the vehicle to connect research and economic activities. The volume and quality of research are the fundamentals to build on for doctoral programmes and technology transfer activities. The latter also require more specific activities, and they also provide important feedback and new input for research, but research itself is the emergence force at the basis.

I will further focus on universities, their strengths, weaknesses, opportunities, and threats as they appear to me from participating in the project and from the self-descriptions and the descriptions of the context. This is not to downplay the role of research institutes and research within the industry. Research institutes and industry are essential partners in research. It is great that they collaborate in the project, but they are not so much the focus of my comments here.

Strengths

An important strength of the participating universities is their high motivation for this project and their strong will to achieve. It is highly important that

universities take such initiatives and that they succeed. The circumstances are perhaps not easy, because of the financial and economic crisis, because resources are often lacking and because change processes may take much time. Other important strengths are the following:

important strengths

1. Most universities have installed a research office and a technology office, and the organization of doctoral programmes receives a lot of attention. These are all important facilitating factors for the aims of the project. They have an interesting side-effect as well, because they are a form of service to the academic community which will attract the interest of the faculties, so that a higher level of coordination is possible. One may also want to consider developing strong coordination between the activities of the research office, the technology transfer office, and the policy behind the doctoral programmes. Depending on the local situation, one may also consider appointing a *vice-president for research*, if there is not yet such a position. All *three elements* should be *in her or his policy portfolio* (*research office, technology transfer, doctoral programmes*).

2. The collaboration between the universities is broad and based on a common determination to succeed. This is important for two reasons. First of all, this is clearly a more efficient way to achieve the goals of the project. One can learn from one another, there is mutual reinforcement, and there is bundling of efforts. In general, the project group has thus far formulated excellent ideas for their common endeavour. Secondly, a joint and strong effort from so many universities from the same region is an excellent basis for having influence at the level of the government and convincing politicians that reforms are necessary and that the level of research funding should be increased.

3. The universities have a clear research ambition and an international orientation. They are highly motivated to stimulate research and to participate in the Framework Programme of the EC. It will not be possible, just as it is also not possible in other European countries, to reach a top research level at all universities. This should not prevent us from striving for a very high quality level of all universities. In order to do so and also for the long run, it might be beneficial to form consortia of universities and to look for an optimal division of labour within these consortia. Research can roughly be situated along two dimensions. The first dimension refers to the topics, while the second dimension refers to the range from basic research to practice-oriented research. I believe "topics" is a better term than disciplines, because more and more research is organized around topics which are approached in an interdisciplinary and multidisciplinary way. Focusing on somewhat different but complementary parts of two-dimensional space can lead to concentrations that yield the critical mass required to be successful, while avoiding inefficient duplications. The optimal situation is a balance between interuniversity competition and a collaborative division of focus among universities.

clear research ambition and an international orientation

Weaknesses

Several weaknesses are mentioned in the self-description of the universities. Perhaps the major ones that are mentioned are all related to the *divided structure within the universities*. There is a universal law that organizational units by their sheer existence hinder collaboration. This is not to say that collaborative diversification cannot work. It is actually a necessary organizational feature. The crucial criterion is whether there is sufficient identification with a larger unit, in this case the university. From the self-descriptions I tend to conclude that the situation can be improved substantially, for reasons of coordination, efficiency, and interdisciplinary research. I believe the universities should do all they can, including political lobbying, to undo the legal separations within the universities.

In several self-descriptions, the focus on teaching is mentioned as a weakness. I would rather not look upon teaching as an activity with a cost for research, although it may be true to some extent that more teaching implies less research. On the other hand, it is also true that *teaching is very important and cannot be reduced below what a programme requires*. I would rather reformulate the weakness as follows. Perhaps teaching is not sufficiently research-oriented, including that it is insufficiently based on first-hand research experience. Teaching does not only imply transferring knowledge to the students and making them understand the most important notions of a discipline, it should also foster investigative way of thinking, finding new paths to approach problems, based on creative ideas, and a scientific way of evaluating these ideas and the facts and findings related to them. This view is not only important for the way one teaches; it can also lead to the active participation of students in research. One can even go as far as making this participation part of the curriculum. It is evident for these reasons that being an active researcher is an important quality of a university teacher. The minimum should be that all teaching staff belong to an active research team.

Opportunities

Major initiatives are being taken to enhance the volume and quality of research and to open research to society. This is a wonderful opportunity to introduce reforms, some of which are also mentioned in the self-descriptions.

1. A good system for positive incentives can help to reach the goals. If one wants people to change and to do the best they can, it is important that they are trusted and are given autonomy on the one hand and have positive incentives on the other, so that the system regulates itself, without a withdrawal of trust or autonomy in case of poorer achievements. Promotion policies and various kinds of recognition can help in this regard. It does not necessarily imply a high financial cost. For example, an annual publication on new research grants and scientific publication is a form of recognition and it may encourage others to enhance

their ambitions. An interesting side-effect is what one commonly considers the main goal of such lists, which is the (digital) availability of a publication archive. It is of course also important to have good research evaluation criteria, but negative evaluations are often not productive. Instead they are a possible source of conflicts, defensive reactions and opposition with a detrimental impact.

2. Another helpful tool is a policy document with quantitative targets, regarding the acquisition of research funds, the number and quality of publications, citations, number of doctoral degrees, patents, spin-offs based on own research findings, research-based one's contracts with private companies and the government, and income from contracts in general. Such a tool is again interesting in several respects. First, it provides a basis for self-assessment. Second, it is motivating because one can closely monitor one's own progress. Third, setting targets is an inspirational and fruitful exercise in itself.

3. Given the interest in doctoral programmes, one can take this opportunity to organize doctoral schools with a broader scope than faculties. Doctoral schools can bring faculties closer together, they create a new ground for collaboration between faculties, and they may increase the efficiency and the quality level. The specific disciplines involved are not without importance because, for example, there are discipline-specific quality criteria to be respected, but the doctoral schools are also an ideal opportunity for interaction, to create more common ground, and to initiate more interdisciplinary research.

Threats

The major threat I can see is the frustration that may stem from the discrepancy between the motivation of the universities and the plans they make on the one hand, and the availability of research resources and the limited interest from potential industrial partners on the other. Given that there may not be any sudden and substantial increase in research funds coming from the government and that the economy first has to grow substantially in order for research collaborations with industry to develop, it may require a subtle balancing exercise to keep the motivation high and to live with slow progress at the same time. International collaboration is one way to partly handle the problem, but it is not sufficient. Setting up new offices and organizing new kinds of activities may be reinforcing in the short run, because they are visible and genuine improvements, but they are instruments and not goals. Creative solutions are needed to combine high ambitions with rather difficult circumstances.

a policy document with quantitative targets

Doctoral schools can bring faculties closer together

A good system for positive incentives can help to reach the goals

Analysis of individual Partners

Data has been collected under two main headings:

Part 1 of each individual entry begins with a short introduction to the status of research, doctoral studies and innovation at the organisational level. This is then followed with a more detailed review of the status of each area including a review of European projects, connection with Doctoral Studies and a review of relevant documents.

Part 2 contains comments and observations on new activities that might improve the cooperation between industry and academia. This includes an analysis of needs, activities for improvement and discussion on the connection between public research innovation and industry.

The data was collected from each participating partner using a template document. Input into the document was sought at the highest level. However, the views expressed do represent the consensus of opinions sought by the participating TEMPUS representative; other individuals at each organisation may hold differing opinions. The data proffered represents that they was available to participants at the time of collection and may not be representative of the full data and information set of an organisation.

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UNIVERSITY OF ZAGREB, CROATIA

I. ANALYSIS OF THE SITUATION

The University of Zagreb is by far the largest University in Croatia as well as the strongest Croatian University with regard to research outcomes.

The University of Zagreb has a goal of developing as a university with a clear research profile, whose excellence in research will be internationally recognized. By increasing the quality of research, the University of Zagreb will achieve its fundamental goal of strengthening of its research profile

In 2008, the Senate of the University of Zagreb approved Research Strategy 2008-2013, which encompasses a central strategic issue, the future development of the University as a research and teaching institution.

Innovation Strategy

In 2009, the University of Zagreb approved its *Innovation Strategy*.

Today, one of the biggest issues at the University is providing optimal conditions (including funding) for the direct involvement of students, especially doctoral students, in scientific and technical research.

I.1 ANALYSIS OF THE SITUATION - RESEARCH

The Senate of the University of Zagreb unanimously approved the text of the University of Zagreb Research Strategy 2008-2013 at its meeting of June 10th, 2008. The Research Strategy of the University of Zagreb is designed to help organise and maintain the development of the University, its Faculties, departments, research teams, and individual academics over a longer term. The Action Plan for the implementation of the Research Strategy is in the developing phase.

Relevant offices (Research Office, Technology Transfer Office, Office of Doctoral Studies) are now being set up, staffed by experienced as well as junior experts, who possess high qualifications in specific areas, especially in technology transfer, participation in international projects and programmes, and support of study programmes offered in cooperation with foreign universities and other research centres.

The Research Office web-site contains an international research projects database. The University of Zagreb is/was participating in 58 FP6 projects and in 35 FP7 projects. Within the TEMPUS III programme, the University of Zagreb was the coordinator institution in 28 JEPS, a partner in 24 JEPS, the coordinator in 7 SCM TEMPUS projects and a partner in 6 SCM TEMPUS projects. In the TEMPUS IV programme (2008 call) the University of Zagreb is the coordinator institution and grantholder in 1 SM project and in 1 JP, and partner in 4 JPs. In the TEMPUS IV

programme (2009 call) the University of Zagreb is the coordinator institution and grantholder in 1 JEP, and a partner in 1 SM project and in 4 JPs.

I.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

Since the adoption of the Bologna process, doctoral studies at the University of Zagreb have gone through a major change. In 2008, the University of Zagreb formed a working group with the sole purpose of creating a document that would modernise the (still dominating) traditional way of getting a PhD diploma. A working group produced a *Doctoral Studies Rulebook* that is now *close to adoption by the Senate*. Some of the novelties include less teaching, more time for original scientific research, more structure in the supervisor-supervisee relationship, strict rules for the monitoring of student progress, and a contract agreement between the student and the PhD programme. This contract agreement details the rights and obligations of all members included in the PhD completion process, and specifies the ways of solving problems that may arise during the study.

In early 2009, the University founded the *Office of Doctoral Studies*, the task of which is to provide the *administrative and logistic support* for the above-mentioned working group, and with the more general task of raising the quality of doctoral education. To do that, the office has started working on the organisation of generic skills workshops, workshops for the training of supervisors, the implementation of quality assessment and quality control procedures into the PhD programmes, and has started work on a doctoral student database. The office also contributes to the process of evaluation and accreditation of new PhD programmes.

Regulations for international dual doctorates have been in place since 2008, and since that time *8 dual PhDs have been awarded* at the University of Zagreb. Although the regulations have been adopted, there are still some administrative problems left, mainly in the process of issuing the diploma (the same problems exist with the interdisciplinary doctoral programmes).

Office of Doctoral Studies,

raising the quality
of doctoral education

Regulations for
international dual doctorates
have been in place since 2008

I.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

The University of Zagreb Research strategy 2008-2013, among the other issues, defines the objectives and tasks related to the *strengthening of cooperation between the academic community and the business sector regarding joint projects and technology transfer*. The Senate of the University of Zagreb approved its Innovation Strategy in September 2009, which further confirms and elaborates the guidelines, and defines the indicators of innovation activity.

The Technology Transfer Office was established in January 2008 to encourage and support commercialization activities of innovative research results and new knowledge created at the University. Almost from its establishment, *the Office*

The Technology Transfer
Office was established in
January 2008

is supported by a Science and Technology project of the Ministry of Science, Education and Sport, which is funded by a World Bank loan.

The TT Office is designed as a place which can provide service and support to researchers regarding the following issues: the commercialization of innovative research results, intellectual property management in research and development projects, assistance in establishing cooperation with companies, information providing for the education (workshops, lectures) of researchers in the protection and commercialization of intellectual property, cooperation with industry and academic entrepreneurship.

The Technology Transfer Office provides commercialization of innovative research results in accordance with the Regulations on the Technology Transfer Office. The regulations define the process of commercialization (innovation commercialization procedures) and the distribution of income from successful commercialization.

The Office is currently preparing a Spin-off Rulebook, and it will address the definition of university spin-offs, the decision-making process in creating new University spin-offs with equity stake, and licensing to university spin-offs.

The University is also aware of local industry needs, and it acts as the agent to help organise multidisciplinary projects that would help solve industry needs. As the Technology Transfer Office is planning to take a more active role in coordinating knowledge exchange activities, an internal procedure is being developed.

In the long term, the University plans to link the knowledge and technology transfer services that are now developing with the infrastructure support to innovative R&D that will be settled in the Science and Technology Research Park at the University's Borongaj Campus.

2. NEW ACTIVITIES FOR IMPROVEMENT

As its next step, the University of Zagreb plans to establish the Centre for Research, Development and Technology with aim of embracing and coordinating different activities and staff, which can collaboratively contribute to increased research performance and knowledge transfer. Also, the intention is to establish a Centre that will have open doors to industrial partners, public authorities, academic researchers, and university policy makers from other Croatian universities (especially the small ones that have limited institutional resources) and other universities in the region.

Along with research and teaching, the University of Zagreb also has the objective of enabling economic progress and sustainable development of the society as a whole by developing and applying new ideas and technologies.

Through the creation of new ideas and technological solutions, and through critical thinking and creativity, the University will become one of the engines of the economy and sustainable development.

Raising awareness about the value and protection of intellectual property as well as the mechanisms of management and transfer of intellectual property will facilitate more successful cooperation between the University and the business sector.

One of the tasks of the University is to increase the funding of research and to improve the research infrastructure.

Also, it is necessary to introduce entrepreneurial culture and skills in doctoral programmes, because they are representatives of the new generation of researchers in the region who are supposed to establish and to facilitate cooperation between academia and industry.

the University will become one of the engines of the economy and sustainable development.

provide service and support to researchers

The Technology Transfer Office provides commercialization of innovative research results in accordance with the Regulations on the Technology Transfer Office.

Centre for Research, Development and Technology

UNIVERSITY OF DUBROVNIK, CROATIA

I. ANALYSIS OF THE SITUATION

The University of Dubrovnik is composed of six departments, two institutes, one language centre and one innovation centre. Research is primarily executed in two departments, Aquaculture and Electrical Engineering & Computing, as – as in the Institute for Marine and Coastal research (projects financed by MZOŠ and EU funds). A number of professional programmes are executed by the Maritime Department.

At present, we collaborate on six doctoral programmes in cooperation with Croatian universities and institutes.

Innovation is currently strong in the field of mariculture and is being realised at *MARIBIC – the Mariculture Innovation and Business Centre*. The newest innovation is a patent of a device and method for the inactivation of organisms carried in ballast waters that has been developed through a TEST project.

The University of Dubrovnik adopted a Research Strategy in 2009 which it published at www.unidu.hr. The general strategy is divided according to sectors and is also posted on the official web site. The Action Plan is currently under preparation.

I.1 ANALYSIS OF THE SITUATION – RESEARCH

The Research Office was founded in 2008, but at this point does not have a manager, due to a re-organisation of the university administration that is under way. A research productivity database is available on department web sites, while research production for 2008/09 will be published shortly. A database of all papers published by the university's researchers is available in the Annual University Report, dating back to 2003. A complete report on the research productivity of staff, departments, and the whole university is now under construction. It will serve as a base for future scientific accreditation of the university.

A database covering all projects has been posted at www.unidu.hr, in the section titled "istraživanje" (currently only in Croatian).

The University of Dubrovnik is currently a partner in one FP7 project and one project in the EU CIRCLE funding scheme.

The University was a partner in 11 TEMPUS projects. Ten of these have been completed. One project was approved in the latest call for projects.

I.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

Seven doctoral programmes are offered at the University of Dubrovnik, all in collaboration with other Croatian universities.

Seven doctoral programmes

These include the following:

- Life sciences: molecular biosciences, biology of new forms, applied marine sciences
- Technical sciences: maritime science
- Humanities: population history
- Economics: european integration, management and controlling in a global business

Each doctoral study has its own Committee composed of staff from all institution partners in specific study.

The Doctoral Studies Office was established in 2007. The students' database is established at the university and plays a major role in each programme.

There is no training for supervisors.

The fees are paid by students, except for those students who are employed by university, whose tuition is paid by the university and later refunded by the Ministry.

No quality assessment procedures have yet been developed.

I.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

There are no officially adopted documents dealing with Innovation issues.

No procedure for innovation commercialisation has been adopted.

2. NEW ACTIVITIES FOR IMPROVEMENT

Current activities are oriented towards strengthening research activity and creating a stronger orientation to EU funded projects. Research should be connected with the university's doctoral programmes, and PhD students have to be more involved in research.

Current activities are oriented towards strengthening research activity

Connections between scientific research and industry should be enhanced, but the level of these activities is still too low to initiate the establishment of a separate TT and Innovation Office.

UNIVERSITY OF JOSIP JURAJ STROSSMAYER OSIJEK, CROATIA

I. ANALYSIS OF THE SITUATION

UNIOS has established the Technology Development Centre Osijek Ltd. (tera), which serves as Research office and Technology Transfer Office for unios. All important issues are discussed at the level of the Committee for International Research Projects. UNIOS completed its *Strategy for international research projects in 2007* (approved by the University Senate) and it will be valid until 2012.

Strategy for international research projects in 2007

There are 11 doctoral programmes at UNIOS, 2 of them interdisciplinary programmes. In this academic year there are a total of 558 students at the PhD level, most of them at the Faculty of Medicine, Agriculture, and Electrical Engineering.

The Technology Development Centre Osijek Ltd. (TERA) was established in 2002 as a result of an initiative of Josip Juraj Strossmayer University in Osijek, the City of Osijek, and Osijek-Baranja County. The university owns 85 % of the Centre. TERA is registered as a limited company. and serves as Technology Transfer and Research Office.

The Technology Development Centre Osijek Ltd. (tera) was established in 2002

I.1 ANALYSIS OF THE SITUATION – RESEARCH

The strategy of international research projects was prepared on the basis of the guidelines of the University constituents.

More intensive involvement in international research projects is a prerequisite for the further affirmation of our University and university teachers, as well as a prerequisite for the education of young researchers within their scientific and research work.

The University of Osijek established a Research Office as one of the outcomes of the TEMPUS CBRC. The Research Office is in charge of the administration of international projects. There is an internal projects data base available on the website www.unios.hr. There are 9 active Tempus projects and 2 active FP6/7 projects. The faculties and departments have applied for 4 FP7 projects. Prominent areas: civil engineering, medicine, biology, chemistry.

For the period 2009-2012, we plan to apply for 8 IPA projects in the fields of medicine, civil engineering, food technology, and physics. In terms of bilateral cooperation, there are 32 bilateral projects planned until 2012.

The University of Osijek established a Research Office as one of the outcomes of the TEMPUS CBRC internal projects data base

I.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

Nature and Environment Protection and Molecular biosciences are interdisciplinary doctoral studies. *All issues related to programme organization and implementation are regulated by unique Study Regulations* at Josip Juraj Strossmayer University of Osijek. Each university postgraduate interdisciplinary programme is managed by the head of the programme in collaboration with the Postgraduate Programme Committee.

All issues related to programme organization and implementation are regulated by unique Study Regulations

Doctoral programmes can be financed from different sources:

Budgetary funds of the Croatian Ministry of Science, Education, and Sports (young researchers, scientific projects);
by the student or the company or institution which sent student to the study;
funds from foundations, funds, scholarships.

Monitoring and assurance of education quality is carried out by the University Centre for Education Quality Assurance, which acts as the unique university centre for the monitoring of education quality dealing with surveys of students and teachers. Quality of module implementation will be evaluated by questionnaires regarding:

- teachers
- teaching and modules.

Monitoring and assurance of education quality is carried out by the university centre for Education Quality Assurance

I.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

As one of the outcomes of the TEMPUS CBRC, we established the Research Office within the International Relations Office.

The Research Office is in charge of all research project activities on the international level. One employee serves as science manager for projects in social and humanistic sciences, whereas one employee at the Faculty of Medicine serves as science manager for biomedicine.

The University has a strategy for development of international scientific projects.

University is co-founder of TERA – the Technology Development Centre Osijek.

2. NEW ACTIVITIES FOR IMPROVEMENT

Technology Transfer Development Program at the University
The main program components are:

I. TECHNOLIS There is a consensus of the University of Osijek, local self-government, and other supporting institutions from the region regarding the realization of the project. In the first phase of project realization, potential clients have been identified, being commercial subjects and craftsmen.

2. Centre for Excellence in Agriculture – this establishment includes an experimental station for experiments within the field of agriculture and food processing technology. It is planned to be built at the location TEHNOPOLIS as a joint venture of the Faculty of Agriculture, the Faculty of Food Technology, the Institute of Agriculture, and the Technology Development Center in Osijek.

3. Development of the Technology Development Centre in Osijek includes the establishment of the office for technology transfer on the University campus.

Realization of the above enables the University to fulfill its mission in supporting technology and a knowledge based economy.

Adoption of the Regulation on Technology Transfer that regulates issues on technology transfer based on research funded from public resources. The adoption of this Regulation is important for successful technology transfer from the university to the community. It will assure the systematic process of technology transfer and will be applied to all projects realized at the University.

All principal investigators and potential researchers will be offered continuous training and education and provided with advisory services for specific project requirements.

Adoption of the
Regulation on Technology
Transfer

UNIVERSITY OF RIJEKA, CROATIA

I. ANALYSIS OF THE SITUATION

The University of Rijeka comprises nine faculties, one academy, and four University Departments.

The University of Rijeka set itself a goal to fully develop a profile as a *research University* by the year 2013. Its research and the age structure of the personnel, its large number of research assistants, and its immense investments in infrastructure and integration into the ERA will enable the enhancement of research activities at the University in basic research. Organised basic research projects are a mission of all the University's constituents, which means that it is necessary to improve the organisational and legislative framework and develop financial instruments for the enhancement of research activities at the University of Rijeka. According to the Strategy, the *innovation structure* of the University should be implemented before the end of 2010. Hence, we have already established a Science and Technology Park and a Technology Transfer Office.

The regulations for *doctoral studies* at the University of Rijeka are defined by a University document. As legal entities, the faculties are solely responsible for the organisation of doctoral programmes. However, the situation is changing, and the University is nowadays taking more control over the organisation and quality assessment of the programmes.

I.1 ANALYSIS OF THE SITUATION – RESEARCH

The University of Rijeka *Strategy 2007-2013* is the main instrument for the *integration of university functions*.

Strategy 2007-2013
is the main instrument
for the integration of
university functions

THE STRATEGY IS DIVIDED INTO FIVE STRATEGICALLY IMPORTANT AREAS:

- Study Programmes and Students
- Scientific Research and Innovation
- Capacities – Human, Financial, and Material Resources
- Ties with the Community and the Economy, and Harmonisation with Community Needs
- Integration into the European Union, Openness towards the World and Mobility.

The *Intellectual Property Policy* of the University of Rijeka is in the process of its final drafting.

A Research Office was established at the University of Rijeka five years ago. The Office has prepared the University of Rijeka *Database of R & D projects*, which contains data about national and international projects, as well as projects carried out in cooperation with the local community and the economic sector involving the University and its constituents. By the end of 2009, the Database will be filled in with projects that were or are still active this year and will serve the purpose of tracking the fulfillment of goals proposed by the Strategy of the University of Rijeka.

The University of Rijeka is or has been involved in 7 FP6 projects (Health – 6, ICT – 1), 4 FP7 projects (Health – 3, Transport – 1), and 16 Tempus projects

1.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

The regulations for doctoral studies at the University of Rijeka are defined by the *University document that regulates undergraduate and postgraduate studies*. The document is harmonized with the recommendations and practice of the EU. It defines doctoral programmes as 3- or 5-year programmes for full-time or part-time students, respectively. Although these programmes offer some flexibility in respect to curriculum, there is still a need for considerable improvement. We still do not have practice in contracting supervisor-supervisee relations, although this is envisaged in the document and is currently in the process of being implemented in practice. Several *interdisciplinary doctoral programmes* have recently been established at the University, which is in accordance with the Strategy of the University.

Since *Faculties* are still legal entities at our University, they were and still are *completely responsible* for organisation, doctoral student databases, training, financing, and quality assessment of the doctoral programmes. Therefore, the organisation, training, and quality assessment of the doctoral programmes differed considerably from faculty to faculty. However, the situation is changing, and the University is now taking more control over the organisation and quality assessment of the programmes. *The office of doctoral studies* has recently been established, and it has to coordinate activities regarding the organisation and quality assessment of the doctoral programmes. The doctoral student database still does not exist for the entire University, nor is there organised training for supervisors.

1.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

According to its strategy, the University of Rijeka is developing its profile as a research university. The innovation strategy is determined in the chapter Scientific Work and Innovations of the University Strategy, and it requires the complete *innovation structure of the University to be set before the end of 2010*.

The Intellectual Property Policy of the University of Rijeka is in the process of final drafting. This document will define procedures at the University level regarding disclosure, evaluation, legal protection, and commercialisation of intellectual property generated at the University.

The Science and Technology Park of the University of Rijeka (steP) was established in June 2008 as a limited liability company. The aim of steP is to encourage synergy between scientists, technologists, and entrepreneurs of the Region. The SteP premises include an Incubator, Workshops, and a Generic services area and are situated on the new University Campus.

In 2008 the University also established its *Technology Transfer Office (TTO)* with the aim of developing an innovation culture and strengthening the ties between the University and the economy.

Both SteP and TTO already have produced a number of procedures and documents in order to enhance and encourage commercialisation activities at the University.

2. NEW ACTIVITIES FOR IMPROVEMENT

One of the biggest issues at the University of Rijeka is the legal framework that defines the *faculties as legal entities*. On the other hand, the University also has departments that are not legal entities, but are represented in the University Senate in the same way as the faculties. It is obviously very difficult to efficiently govern such a complicated structure. In such a legal framework, the University strives to find a solution through *functional integration*. Therefore, in line with the University Statute, many common functions are being transferred to the university level. The Strategy of the University, being accepted by all of the constituents, is also one of the examples of a *synergetic result*. In the long term the University will try to become one legal person, but the process will have to be conducted very carefully.

In the beginning of 2010 some faculties and all departments will move to the *new buildings at the University Campus* on Trsat. Moreover, according to the integration processes, many administrative functions of different constituents will be unified. The Science and Technology Park as well as the Technology Transfer Office are already established on the Campus, which will obviously enhance the possibility of implementing the innovation strategy of the University.

first tenants have already entered into steP

At present, the *first tenants have already entered into steP*. Given the fact that all the basic infrastructure and administrative support for the tenants is now established, we expect that the steP will be full of tenants very soon.

interdisciplinary projects

The TTO is currently in negotiation with some large companies in order to agree on joint *interdisciplinary projects* between the company and the University. These agreements will include various capacities from University constituents, including PhD students.

In the future, upon the acceptance of the IP Rulebook by the Senate, the University will become fully operational with respect to intellectual property management and commercialisation procedures.

UNIVERSITY OF ZADAR, CROATIA

I. ANALYSIS OF THE SITUATION

- Research at the University of Zadar is performed through research projects funded by the Ministry of Education and Sport (the majority) and international projects (fewer). International projects are the result of individual efforts, not of a systematic approach by the University.
- In the past, we have had 10 PhD programs, but now 7 are no longer enrolling students.
- in the year 2009/2010, University is preparing three new doctoral programmes.
- Innovation activity at the University is negligible.

I.1 ANALYSIS OF THE SITUATION – RESEARCH

- The *Development Strategy of Science* at the University of Zadar is defined and was approved by the University Senate in July 2009. It contains an *action plan for the period 2009-2014*.
- The Common Strategy of the University of Zadar is still under development (today, the second working version is valid).
- The University of Zadar has a “Rulebook of Intellectual Property rights” (final version), but it has not yet been approved by the Senate.
- A *research office was established in November 2007*.
- Research productivity is performed through eight scientific journals, as well as books, but we do not yet have a central database of all researchers’ productivity.
- The research office has compiled a “*Database of international and national research projects*”, which is available on the University web page.
- Up until today, 2 *FP6* projects were performed at University and 2 *new FP7* project were applied for in 2009. (Evaluation in progress).
- the most prominent areas are the social sciences and the humanities (FP6 & FP7) and today natural science (FP7 - ICT, REGPOT)
- Up until today, 19 *TEMPUS* projects have been implemented at the University of Zadar, (CD, JEP, SM).

action plan for the period 2009-2014.

research office was been established in November 2007.

database of international and national research projects”

I.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

- Based on the fact that the “old” doctoral programmes were discontinued with the advent of the new Bologna process, today at our University there are only *two* “new” programmes. One is a reformed programme and the other is completely new.
- The University of Zadar’s *Rulebook for Doctoral Studies*, issued 11 July 2006, is available on the University web page.
- Contract-based supervisor-student relations do not exist at our University.
- We do not have regulations for international dual doctorates.
- one of the “new” programmes is an interdisciplinary doctoral programme based in the Department of Library Science: The curriculum of the doctoral programme “Knowledge Society and Information Transfer” is available at :http://ozk.unizd.hr/pismohrana/programi/Knowledge_Society_en.pdf
- A *doctoral studies office* has been established with 2 employed persons.
- No doctoral student database exists, and no training or courses were performed according generic skills.
- There are two models of doctoral student financing:
 - regular students (assistants) are financed by the Ministry of Science Education and Sport, while
 - irregular students: either finance themselves or are financed by the institution where they are employed.
- quality assessment/procedures are in the developing phase but have not yet been established.

Rulebook for Doctoral Studies

doctoral studies office

I.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

Unfortunately, the University of Zadar does not have an innovation strategy, not even in draft form. Consequently, neither the TTO policy paper/ rulebook/ guidelines nor spin-off policy paper/ rulebook/ guidelines have been established.

A General University Strategy is under preparation, and an action plan will be part of it.

The *TT Office has not yet been established* at our University. Some activities in early phase of TT will be prepared by the Research office.

TT Office has not yet been established

A technology / science park is planned to be built on a new campus location, but now it is still under construction.

Due to the fact that since the establishment of the University, its faculties have been mostly directed toward social sciences and humanities, innovation and its commercialization were not clearly visible, and therefore there have been no significant results in the field of technology transfer.

a technology / science park is planned

2. NEW ACTIVITIES FOR IMPROVEMENT

AREAS NEEDING IMPROVEMENT:

Less developed natural science and engineering,
Insufficient number of independent research units,
Lack of large/major projects.
Industry in Zadar region has a low R&D profile,
Lack of experience in technology transfer and innovation.

SHORT-TERM ACTIVITIES:

Improving communication channel between the researcher and relevant office (research office, web portal, new TT Office),
Continual internal education of researchers through workshops and seminars performed by Research Office or visiting colleagues.
Establishment of a TT Office at the University of Zadar by developing the Research Office (involving new activities (TT Activities).
Establishment of a TTO policy paper/ rulebook/ guidelines
Establishment of Spin-off policy paper/ rulebook/ guidelines

LONG-TERM ACTIVITIES:

Building positive awareness, especially among young researchers, on the importance of innovation for both the university and the individual (commercial value).
Establishment of a Technology / Science Park with spin-off and start-up companies arising from university human resources.
Establishment of connections between research/technology and industry

SS. CYRIL AND METHODIUS UNIVERSITY, SKOPJE, MACEDONIA

I. ANALYSIS OF THE SITUATION

Within the scope of the processes of change being implemented within the Ss. Cyril and Methodius University (UKIM) in Skopje as part of the European programme for institutional evaluation, particular attention has been paid to activities related to the assessment, consolidation, and increasing of quality in higher education.

The quality assurance issue in higher education is closely linked to the *Common European Framework* of higher education, which involves catering for the mobility of both students and university staff within the European academic market.

Quality assurance is achieved on an institutional, national, and European level. The key factors responsible for securing quality in higher education are the institutions themselves. More precisely, it is the institutions which are capable of laying down the foundations for true quality assurance within the national academic system.

Within the framework of effectuating the Action Plan and the Strategy aimed at developing the Ss. Cyril and Methodius University in Skopje for the period of 2004-2010, the process of change at the University has concentrated on the following aspects: *updating and modernising the jurisdiction*, which will offer a novel approach regarding the relations between the University and the joining faculties, scientific and research institutions in all spheres of their work; devising a strategy for the development of higher education and research activities; establishing new regulations of study which are student-centered and responsive to students' needs; composing an innovative concept of study according to the principles of the Bologna process by introducing the credit-transfer system; implementing a system of assessment thus securing quality assurance in higher education through self-evaluation, including evaluation of academic staff at the University; intensifying activities to promote participation in international programs and projects, with the aim of a swifter unification with European higher education.

updating and
modernising the jurisdiction

I.I ANALYSIS OF THE SITUATION – RESEARCH

Ss. Cyril and Methodius University in Skopje has adopted the *Development Strategy for the Period 2004-2010* as a general University strategy.

Development Strategy
for the Period 2004-2010

It was not preceded by an action plan for research strategy or a research rule-book.

A centralised research body was not established during this period at UKIM.

A restriction in funding by the relevant ministries in the government caused a *decrease in the number of research projects initiated on the national level*. The evaluation results, however, indicate that certain faculties and institutes within the University, have intensified their research activities as a result of utilizing international grants and funding.

The funding for projects stems from domestic or internal sources, such as the Ministry of Education and Science, the Ministry of Culture, the Treasury Department, the Ministry of Defense, the Ministry of Agriculture and Forestry, the Water Supply Company, Macedonian Telecommunications, the Electricity Distribution Company, the Macedonian Academy of Arts and Sciences, the Institute of Earthquake Engineering, other investment organizations, and local self-government organizations. External sources include foreign donors such as the following organizations: UNICEF, UNESCO, DAAD, FIOOM, the EU, the EC, FEP, and FAO. Also, there have been donations from the governments of the following countries: Germany, Austria, Turkey, the United States, Canada, Finland, Japan, Sweden, Spain, Switzerland, Portugal, Italy, Slovenia, Croatia, Romania, Greece, and the kingdoms of the Netherlands, Norway, and Denmark.

Also, the funding for projects stems from international organizations, foundations, and programs (EUC, TEMPUS, COPERNICUS, SOCRATES, FARE, FP5, FP7, USAID, the British Council, TUBI TAC, the World Bank, foreign academies of science, and others.

Quite a few of the faculties and institutes have initiated interdisciplinary networking in order to expand the amount of research and research fellows involved exploring various programs of study. The outcome of these projects has consisted of monographs and research reports that have been subsequently published as research papers in international scientific journals. For example, the European Commission has funded projects to support the introduction of new study programmes and upgrade existing ones.

a few of the faculties
and institutes have initiated
interdisciplinary networking

According to UKIM research statistics, the amount of research in the 2008/9 academic year was:

National Research Projects - 104

Bilateral Projects - 89

NATO for Peace Projects - 4

Projects in the EU FP6 – 10

Projects in the EU FP7 - 11

1.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

The subject of the following lines is the organisation of doctoral studies in Macedonia. It is important to note that the *Law on higher education adopted in 2000 defines the legal possibility to acquire a PhD in two ways* – traditionally, by the proposing a research theme and preparing a doctoral thesis, or by attending an organised doctoral programme that lasts for three years. It should be emphasized that this took place three years before the official Bologna policies concerning this issue emerged.

However, the universities and the faculties in Macedonia, in spite of the possibility stated in the Law on Higher Education, did not take advantage of this opportunity, but have still practiced the traditional model. One should mention the example of the Institute of Earthquake Engineering and Engineering Seismology at UMIK, which implemented a doctoral studies programme in the 2007/08 academic year. Still, this is a single positive example which is certainly not an accidental case, keeping in mind the extensive international cooperation that this institution has.

The Law on Higher Education adopted in 2008 determined that the PhD could be acquired *only* by attending *organized doctoral programmes quantified by 180 ECTS points*, starting from the 2009/10 academic year (which is more precisely 15 September 2009). This solution is rigid in the sense of ECTS quantification.

The organisation of doctoral programmes indicates that the third-cycle students, as well as the first- and second-cycle students, would have to apply to an enrolment call opened by the Universities, once or twice a year.

All the candidates who have acquired the Master's Degree in accordance with the previous Law on Higher Education can have 60 ECTS points verified by the university if they enroll in a doctoral programme, as pointed out in the transitional and concluding provisions in the new Law on Higher Education. This solution would undoubtedly ensure the equal treatment of these candidates and the candidates who had applied for a research theme for a doctoral thesis by 14 September 2009.

Now, some words concerning the organisational concept of doctoral studies proposed by UMIK. Before defining the model of doctoral studies organisation, the experience of the doctoral studies organisation by the members of the EUA and UNCA networks were reviewed and considered:

The doctoral thesis representing a primary original research study is the com-

mon feature of the traditional and the new concept for acquiring a PhD diploma.

Various forms are implemented in order to organise the attainment of general knowledge of the candidates

Workshops, seminars, and conferences are organised in order to enable the third-cycle students to continuously present the progress they have made in their work by means of discussion with a wider audience and to get an impression of the validity of the direction in which their research is going.

In order to provide the needed number of third-cycle students and the expected high quality, doctoral programmes are organised in the form of a PhD and Doctoral school at the University level

Still, all the above-mentioned characteristics of the new concept of doctoral studies are more concentrated on organizational elements, while the essentially new concept consists of the need to enable third-cycle students to get an impression of their competencies and how to use them. *The general goal is to give these highly qualified young people a way to find their place not only in the academic setting, but in the economic sector* in order to give the European economy a new and necessary impulse in the global battle for the market. The only way to provide a sense of one's own competencies is to *communicate with one's real surroundings* – industry, business, and the society – *during all stages of the research*.

Besides the above-mentioned principles, it is important to estimate the specific characteristics of the University. The Ss. Cyril and Methodius University is comprised of 22 faculties and 5 Research institutes with study programmes in all scientific fields starting with arts, than humanities, social sciences, technical and biotechnical sciences, ending with the basic and applied natural sciences, including medicine and health. These facts point to an extraordinary resource of intellectual capacity, but at the same time mean various experiences and implemented procedures in the field of doctoral thesis preparation and research practice. It is essential to define a solution that would anticipate all the differences and would represent a distillate of the common essential values.

On the other hand, statistics shows that in the last 5 years, an average of 100 candidates per year have acquired the title of PhD. Half of them have acquired the title in the social sciences and humanities, and the rest are generally equally distributed among the other scientific fields.

The above-mentioned information and the experiences of the European universities point out that organising doctoral studies in the form of a PhD and Doctoral School would be the most rational way to provide unified criteria for quality assurance and quality administrative procedures. An important achievement in the organisation of doctoral studies in the form of a PhD and Doctoral school is also the rational usage of the available research capacity, as well as the possibility of organising interdisciplinary studies that are undoubtedly the future of research work. The recognition of this model on the map of European universities is a value that also has its own importance.

law on higher education adopted in 2000 defines the legal possibility to acquire a PhD in two ways

The Law on Higher Education adopted in 2008

organized doctoral programmes quantified by 180 ects

The general goal is to give these highly qualified young people a way to find their place not only in the academic setting, but in the economic sector

1.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

The UKIM Development Strategy for the Period 2004-2010 was not preceded by an action plan for innovation strategy or a TTO policy paper, rulebook or guidelines.

However, Ss. Cyril and Methodius University in Skopje participated in establishing the *European Information & Innovation Centre* in Macedonia (EIICM) in 2007, as a part of the Enterprise Europe Network and gateway to competitiveness and innovation.

The Enterprise Europe Network is made up of close to 600 partner organisations in more than 40 countries, promoting competitiveness and innovation at the local level in Europe and beyond. EIICM services are specifically designed for small and medium enterprises (SMEs) but are also available to all businesses, research centres, and universities in Macedonia.

The involvement of full-time faculty members and research associates in projects varies depending upon the programme of study and according to the study discipline. In the domains of the technical sciences and mathematics, 17% of the projects have been included in the programmes of study, and 20.8% of the projects include the participation of faculty members and research associates. This ratio varies in other disciplines, for instance: *Social Sciences* 4.2%-4.2%, *Medical Sciences* 4%-30%, *Biotechnical Sciences* 23.3%-17.4%, *Arts* 0%-30%, with *Scientific Institutes* 31%, and finally at UKIM 12.2%-11.6%.

Participation in projects as demonstrated during the last year of the evaluation period shows a sharp downward trend. This could be due to the involvement of research fellows in a number of projects from other study disciplines, thus the actual state of affairs does not appear to be evident from the evaluation data, that is, the findings do not illustrate the distinguished results achieved by members such as those from the Technical, Biotechnical, and Scientific Institutes. The UKIM data fails to give the impression that the majority of its members have achieved synchronization through their research on programmes of study. Furthermore, the evaluation results do not demonstrate the definitely positive movement towards interdisciplinary cooperation, including the transfer of knowledge and professional specialization and improvement.

2. NEW ACTIVITIES FOR IMPROVEMENT

The short-term activities aimed at the improvement of research, innovation, and technology transfer at UKIM should include the following documents:

Action plan for research strategy

research rulebook

Action plan for innovation strategy

TTO policy paper, rulebook, or guidelines.

Spin-off policy paper, rulebook, or guidelines

Also, *UKIM has to establish a centralised research body, a technology transfer office, and a technology or science park*

UKIM has to establish a centralised research body, a technology transfer office, and a technology or science park

The existence of innovation commercialisation procedures has to be increased.

The connection between research and technology transfer and industry has to improve.

UNIVERSITY OF MONTENEGRO, PODGORICA, MONTENEGRO

I. ANALYSIS OF THE SITUATION

The University of Montenegro is the only public university in the country (until recently, it was the only university in the country) and *the main performer of research activities*, through the work of its units - faculties and institutes.

Due to the overall situation in the country over the last two decades, the general level of research has unfortunately decreased, prevailing as a consequence of a lack of earmarked funds. However, certain steps forward have been made, thanks to targeted activities of both the University and Ministry of Education and Science.

Doctoral programmes are being implemented in most accredited fields. Their duration is three years, divided into courses and research work.

Innovation activities are currently underdeveloped, characterised by the absence of partnerships with industry and low transfer of knowledge.

I.1 ANALYSIS OF THE SITUATION – RESEARCH

Regarding the strategic framework for research activities on the STATE level, the *Government adopted the S&T Strategy (2008-2016) in July 2008*. The Strategy defines functional and thematic priorities and sets the following priority tasks:

- Reform of institutional framework for RTD activities
- Encouragement of innovation and technological development
- Encouragement of international cooperation, at all levels of RTD
- Implementation of functional priorities of RTD activities
- Increasing investment in RTD activities

There is also an *Action Plan that accompanies the Strategy*. For each of the above-mentioned tasks, it proposes a set of activities¹.

Apart from that, RTD activities at the national level are regulated by the Law on Scientific-Research Activities (2005). Currently, new by-laws regarding the financing of RTD are being developed.

At the level of the University of Montenegro, a research strategy is in the process of development, as part of the FP7 project EVOLUNIMONT (supported under FP7-REGPOT-2008-2 call), comprising the evaluation (self and external) of research activities and strategic planning.

Research activities are not regulated by any individual act of the University, but

¹ Text of the Strategy is enclosed as an Annex to the questionnaire

by parts of the general Law on Higher education, as well as the Statute of the University of Montenegro.

Currently, *within the framework of the TEMPUS project “Development of RTD Capacities”, the establishment and capacity development of the research office at the University level is being carried out.*

As for the research productivity database, there are currently no unified data. However, some steps have been made towards the compilation of a database of scientific papers in internationally recognized journals, and the appropriate database is in the process of development.

As for the database of international projects, each of the University’s units keeps records of their activities.

Montenegrin participation in FP6 in general was limited. The University had only 2 projects in the programme. As for the FP7, so far there are 6 ongoing projects, and 2 more have been approved for funding and are to start implementation.

Within TEMPUS, the UoM has so far participated in 39 projects.

I.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

The Rules on Doctoral Studies provide for general and specific conditions for conducting such studies (organization, enrolment, expert bodies, submission and defence of dissertation, graduation of PhDs).

The expected duration of PhD programmes is 3 years, thus providing for courses (one-third) and independent research (two-thirds of the overall duration of study)

The contracts are at the level of the University units, i.e., the deans and rector are in charge of them.

There are no specific regulations for international dual doctorates. However, there are also no legal restrictions to their organization and implementation.

Currently, no interdisciplinary doctoral studies are being carried out. However, the procedure for introducing them has been initialised. In the curricula there is no evidence of generic skills training disciplines. There is no formal training of supervisors doesn’t, but there are some regulations concerning their role and responsibilities within the Rules on Doctoral studies (renewed version, 2008)

As already mentioned, *each of the UoM units is in charge of managing its own doctoral programmes*, and, therefore, each of them has its own database of doctoral students. Also, the University of Montenegro has a *complete database of all its doctoral students*.

Doctoral students are financed by the University, if they are employed at one of the units, or otherwise through the student fees. In addition, the Ministry of

Doctoral programmes are being implemented in most accredited fields

Government adopted the S&T Strategy (2008-2016) in July 2008

Action Plan that accompanies the Strategy

At the level of the University of Montenegro, a research strategy is in the process of development

the Rules on Doctoral Studies

The contracts are at the level of the University units

each of the UoM units is in charge of managing its own doctoral programmes

Education and Science, through one of its human resources development programmes, supports the inclusion of PhD students, with the purpose of completing their studies.

Quality Assurance
Centre

The establishment of the *Quality Assurance Centre* at the University level is currently under way, under the umbrella of an IPA project and the WUS Austria project. Under the projects' activities, the Quality assurance management board, as well as the QA implementation group at the level of the University, has been established. An international implementation agency (WYG) is in charge of the development of the Strategy of QA introduction until the end of 2010.

1.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

For the time being, there is no strategic document solely dedicated to innovation, either on the state level or on the level of the University of Montenegro. The issue of innovation is tackled through the national Strategy for Scientific-Research Activities and the accompanying Action Plan, in which issues of research, innovation, and technological development are treated inseparably, as coherent parts of a system.

Through the proposed measures, it is planned to set up a system of policy development and support by all stakeholders (different governmental actors, industry, academia), which will replace the current system, which, due to the overall state of the society, was limited to the participation of the Ministry of Education and Science and academia (UoM prevalingly).

As an integrative part of the RTDI system, TT has been tackled as well.

On the University level, as has already been mentioned, the creation of the strategy for development of the University is currently under way, under the umbrella of the FP7 project EVOLUNIMONT (the document will be ready in February 2010).

Currently, there is *no TTO at the University*, and it is not legally regulated.

But we can consider the aforementioned *RTD Service Centre as the first nucleus for the establishment of TTO*. The same is true of spin-off policy and legislation.

Innovation commercialisation procedures are underdeveloped.

2. NEW ACTIVITIES FOR IMPROVEMENT

Among the main identified problems, the following are the most deserving of mention: low level of inter-disciplinary connection, poor research infrastructure, poor relations with the labour market, lack of inter-disciplinary research, poor attraction of international researchers, insufficient library capacities as regards research, poor visibility of university researchers in the industrial environment.

Possible solutions are rooted in the *formal integration of the University*, since the stronger integration is, the stronger the inter-disciplinary connections would be. The University should develop an Action Plan, dedicated to *improving support to research and library capacities*. One of the ways of improving the research infrastructure is through visibility at the international level, especially in FP7.

formal integration
of the University

improving support to
research and library capacities

For this reason, work on the promotion of the specific FP7 programmes and calls is very well developed and intense. In addition, the University cooperates closely with the NCP system in the country.

One of the important long-term activities is certainly the *development of a research strategy at the UoM*, through which the University will formulate its vision. In addition to that, another important issue is the *establishment of connections with governmental directorates in charge of the promotion of contacts with industry and SMES*. In that respect, the signing of the agreement between the UoM and the aforementioned Directorates has been initialised.

Short-term activities are mostly related to the *promotion of and support for inter-disciplinary activities* within the University, and an increase in the level of library capacities by subscribing to new databases and connecting all the University libraries into a unique cataloguing system.

The research/technology and industry transfer system at the UoM is rather limited to personal or very specific scientific fields and links, so that we could not speak about any broader connections that the University used to have during the 1980s. Aware of this fact, we are at the point of creating the first nuclei through formal centres and legislation stipulating the enablement of these connections.

development of a
research strategy at the
UoM

establishment of
connections with
governmental directorates
in charge of the promotion
of contacts with industry
and SMES

promotion of and support
for inter-disciplinary
activities

UNIVERSITY OF MOSTAR, BOSNIA AND HERZEGOVINA

I. ANALYSIS OF THE SITUATION

The University of Mostar management is persistent in leading its policy in accordance with the defined mission and vision of the University. The result of that is *the improvement of the teaching process, interuniversity cooperation, investment in infrastructure, and research activities*. However, it is not always easy to harmonize policy and management activities of some faculties, which have their own goals and priorities, with the goals, mission, and vision of the University, especially in situations when *faculties are independent legal entities*. In that sense, the Senate has a decisive coordinating role. It gathers all deans and the management of the University at one place, harmonizes, and makes all decisions strategically significant for the work and development of the University. The problem is the fact that in the current structure there are no mechanisms which would guarantee implementation of the Senate decisions at the faculty level.

faculties are independent legal entities

I.1 ANALYSIS OF THE SITUATION – RESEARCH

A university strategy which will include a research strategy is currently being drawn up. *The faculties*, which are independent legal entities, have *their own strategies and research plans*. In general, applicative research is carried out for economic purposes. *A technological innovation centre has been formed at the Faculty of Mechanical Engineering and Computing (FSR)*.

A technological innovation centre has been formed at the Faculty of Mechanical Engineering and Computing (FSR)

Because of the general situation and status of Bosnia-Herzegovina (BiH) and its exclusion from most research programmes funded by the EU, the University and the faculties have not been able to send their applications in the framework of research programmes and projects. However, some of the faculties have taken advantage of the opportunity to apply within the sphere of educational programmes such as TEMPUS programmes. They have managed to rebuild a minimal research infrastructure, strengthen their staff base and prepare themselves for transition. Today the situation is more favourable, and BiH can apply for getting significant funds for research work, e.g. FP7, etc. But, it is obvious that a significant number of teachers and associates are not able to take advantage of the possibilities offered because of their low level of English language knowledge and lack of project management skills.

Since 2005, the University has been involved in 30 international projects (mostly TEMPUS).

I.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

At the University of Mostar, innovations have been introduced into the curriculum and the programmes offered have been harmonized with the Bologna process, which was one of the proposals from the 2004 self-evaluation. *Beginning with the academic year 2005/2006 all students study in the undergraduate programmes that have been harmonized with the Bologna process*. In the academic year 2008/2009 the first students were enrolled in the graduate programmes of all the University's faculties at which the first cycle (undergraduate study) lasts for three years and graduate study lasts for two years. Our goal was to finish designing the curricula of doctoral programmes in many specific areas. *The Faculty of Medicine, The Faculty of Philosophy, and The Faculty of Economics had already organized doctoral programmes, and the Faculty of Mechanical Engineering and Computing structured doctoral study and will start with it next year*. Curricula for other areas, in which the students of the University are educated, will be made in the next two years (till the finish of graduate cycle). We are capable to organize very good doctoral studies in the cooperation with the universities from BiH and abroad but also respect the needs for professional staff of the social community where we work.

Beginning with the academic year 2005/2006 all students study in the undergraduate programmes that have been harmonized with the Bologna process

I.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

So far, *Bosnia and Herzegovina does not have structured the law on scientific research, nor funding for scientific research by the State*.

On 20 May 2009, Parliamentary Assembly of Bosnia and Herzegovina adopted the Framework Law on the basis of scientific-research activities and coordination internal and international scientific research cooperation of Bosnia and Herzegovina. In this difficult financial situation *University of Mostar has no technology/science park nor technology transfer office*. Some faculties do applicative research for local economy and industry. This year Faculty of Mechanical Engineering and Computing (FSR) organised its *Centre for Technology and Innovation* in an attempt *to establish better cooperation with local industry*.

Bosnia and Herzegovina hasn't had structured the law on scientific research, nor funding for scientific research by the State

University of Mostar has no technology/science park nor technology transfer office

Centre for Technology and Innovation in an attempt to establish better cooperation with local industry

2. NEW ACTIVITIES FOR IMPROVEMENT

The problems at the University are:

- insufficiently solved funding by the founders-cantons,
- insufficient domestic teaching staff overload with teaching activities,
- a lack of quality administrative staff for support in activities of international relations, inclusion in different international networks and projects
- the University's organisation as a semi-integrated institution, which obstructs the University's ability to govern and to realise strategic projects
- the non-existence of funds for scientific research work
- the non-existence of a coherent integral University information system
- the non-existence of a centre for life-long learning, a centre for technology transfer, etc.
- insufficient inclusion of students in scientific research.

Planned activities for improvement (from Action Plan of 2008):
To accelerate development of the joint infrastructure of the University through the following:

- forming an IT centre, which should establish an efficient internal data base what would create the basis for efficient integration
- forming a centre for the transfer of knowledge
- forming a centre for promotion of research with a goal to create environment to encourage research work.
- forming a centre for life-long learning
- forming a centre of excellence that would work on establishing a technological park and/or different business innovation incubators.

Alumni – forming the association of the University of Mostar graduated students. The goal of this Alumni club would be, besides others, to stimulate and establish connections and cooperation between the University and similar educational and research institutions in BiH and worldwide.

Special interest should be paid *to increasing the University's sources of funds through more intensive cooperation with business*; motivation for applying and participation in BiH and international contents for scientific-research projects, through the Centre for Technology Transfer and the Centre for life-long learning.

The founding of doctoral programmes should be stimulated, especially in cooperation with partner universities in BiH, the region, and the EU.

Work should be done to develop efficient control mechanisms to monitor the implementation of the decisions of management at all levels.

For the implementation of these planned activities it is necessary *to achieve the commitment of all actors* in their realisations. In order to succeed, it is necessary to provide for the *understanding of the mission, vision, strategies, and goals of the University* and of the mechanisms for their achievement through constant communication and informing at all University levels.

to increasing the University's sources of funds through more intensive cooperation with business

to achieve the commitment of all actors

understanding of the mission, vision, strategies, and goals of the University

MINISTRY OF SCIENCE, EDUCATION AND SPORTS, ZAGREB, CROATIA

I. ANALYSIS OF THE SITUATION

The R&D and higher education sector in Croatia consists of 25 public institutes, 13 private scientific institutions, 10 technology centres, 11 research centres in industry, the Academy of Science and Arts, 7 universities, and 30 colleges and polytechnics.

The Ministry of Science, Education, and Sports (MSES) performs administrative and other activities related to the development of scientific-research activities and technical information and communications; the development of scientific-research and other legal persons; the development of science and application of scientific achievements in certain areas, the harmonization of the financing program of constant research activity and contractual projects for the purpose or realization of national scientific-research programmes; planning, harmonization, and implementation of IT development; monitoring, recording, and realization of scientific, technical, and technological cooperation with foreign countries and international organizations pursuant to international agreements; sending Croatian experts abroad, participation of foreign experts in research in Croatia, and cooperation with Croatian experts abroad; and scholarships and training for Croatian and foreign experts pursuant to international, national, business, and other agreements.

I.1 ANALYSIS OF THE SITUATION – RESEARCH

The main national documents concerning science and research are:

- *Science and Technology Policy of the Republic of Croatia 2006-2010* – main strategic paper which presents the vision of the development of science and technology and defines key objectives of science and technology policy in Croatia;
- Action plans that propose measures for the implementation of the strategy: *Action Plan 2007-2010 – Science and Technology Policy of the Republic of Croatia, Action Plan to Encourage Investment in Science & Research, and Action Plan for Raising Absorption Capacity of the Republic of Croatia for the 7th Framework Programme for Research and Technological Development 2009-2010.*

Science and Technology Policy of the Republic of Croatia 2006-2010

R&D at the national level¹:

- Investments in R&D (2008): €424 mil (0.9% of GDP).
- Number of researchers (2008): 10,767 (5,723 PhDs).
- R&D personnel (2008): 1.1% of total employment (2003-2008: approximately 85% of total number of researchers employed in public and 15% in business sector).
- Total number of published research works (2006): 9,762; published in publications: 2,427 (own), 4,106 (other domestic) and 3,620 (foreign). (source: crostat)

International projects:

Bilateral cooperation programmes for joint science and research projects with 12 countries: *Austria, China, France, Germany, Hungary, Israel, Italy, Japan, Macedonia, Slovenia, Serbia, USA*.

Currently, about 200 bilateral science and research projects in all fields are being implemented. Most represented scientific fields: natural sciences, biomedical sciences, technical and biotechnical sciences.

Funds allocated: approximately €460,000 in 2009.

Total number of funded projects within FP6: 134.

Most prominent areas:

Specific measures in support of international cooperation: 26 projects

Information society technologies: 20 projects

Sustainable development, global change, and ecosystems: 15 projects

Life sciences, genomics, and biotechnology for health: 11 projects

Food quality and safety; Policy support and anticipating scientific and technological needs: 10 projects each.

Total number of funded projects within FP7 (last updated 15 October 2009) for all specific programmes: 75 (Cooperation: 42, People: 4, Capacities: 29).

Most prominent priority areas:

Research Infrastructures: 8 projects (10.67%)

Food, Agriculture and Fisheries, and Biotechnologies; ICT; Research for the benefit of SMEs and Research Potential: 7 projects each (9.33%)

Environment (Including Climate Change): 6 projects (8%)

Energy: 5 projects (6.67%).

Total number of funded projects within TEMPUS programme since 2000: 101. Total number of TEMPUS Individual Mobility Grants: 65.

1.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

Postgraduate studies in Croatia are regulated by the *Act on Scientific Activity*

and Higher Education (NN² 123/03, 105/04, 174/04, 02/07 Decision of the Constitutional Court, 46/07, 45/09) and University Statutes or other University Acts.

The above-mentioned law stipulates that it is obligatory to appoint a mentor for each postgraduate student. The University Acts may prescribe the signing of a contract between the higher education institution (HEI) conducting postgraduate study and the postgraduate student.

International dual doctorates are regulated by the University Acts.

Currently, there is no national database specifying information about doctoral students in great detail. According to the data collected by the Central Bureau of Statistics, in 2009 there were 3,102 doctoral students enrolled in 97 doctoral programmes in Croatia.

Junior researchers employed at Public Research Institutes or HEIs receive, through the institution that employs them, financial support from the MSES that covers the costs of tuition fees up to a certain amount. Junior researchers employed at faculties where they are enrolled in doctoral programmes do not pay tuition fees. Doctoral students with disabilities can apply for State Scholarships awarded by the MSES. The National Foundation for Science, Higher Education, and Technological Development of the Republic of Croatia awards scholarships for postgraduate study abroad. Besides state sources of funding, scholarships from private foundations and enterprises, as well as scholarships from foreign countries and international agencies, are also available.

Quality assessment procedures as well as initial programme accreditation are regulated by The Act on Quality Assurance in Science and Higher Education (NN 45/09), which stipulates that university programmes must be adopted by the Senate of the University after evaluation by the internal audit unit and confirmation of minimal quality compliance by the Agency for Science and Higher Education. Self-assessment procedures are regulated by the University Acts.

1.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

Documents:

National Strategy for the Development of the Intellectual Property System 2005-2010

Science and Technology Policy of the Republic of Croatia 2006-2010

Action Plan 2007-2010 – Science and Technology Policy of the Republic of Croatia

Action Plan to Encourage Investment into Science & Research and Action Plan for Raising Absorption Capacity of the Republic of Croatia for the 7th Frame-

¹ Source of data: MZOŠ; if found elsewhere, this is specially indicated in the text.

² Narodne novine, the Official Gazette of the Republic of Croatia

work Programme for Research and Technological Development 2009-2010.

The National Innovation System (NIS)

The National Innovation System (NIS) is a network of public and private institutions that finance or create and transfer scientific-research results into commercial innovation and affect the spreading of new technologies. In line with the above-stated Science and Technology Policy and related action plans, the National Innovation System has been working intensively on the realisation of the defined goals and proposed measures. A Council for the NIS has been formed.

Data on innovation:

Data on innovation:

Technology transfer centres: 3 – at the University of Rijeka, the University of Zagreb, and the Ruđer Bošković Institute.

Organisations of innovators and authors: 9 (source: SIPO)

Turnover from innovation, as a percentage of total turnover: 13% in 2006. (EU27: 13.4%). (source: Eurostat)

Number of patents filed with SIPO in Croatia in 2008: 400. (source: SIPO)

International patent applications filed with SIPO in 2008: 40. (source: SIPO)

Granted patents (SIPO): 491.

Total number of valid patents in Croatia: 1,938. (source: SIPO)

2. NEW ACTIVITIES FOR IMPROVEMENT

The Action Plan to Encourage Investment in Science & Research (2008) defined the following *five structural issues* which require improvement³:

1. Lack of researchers.

It is necessary to increase the number and quality of researchers, their mobility within the international scientific community and between industry and the public sector.

2. Low level of investment by individual researchers.

The level of investment by individual researchers has to be significantly increased. It is also necessary to stimulate change in the financing structure in order to give more importance to the role of the business sector, individually and in cooperation between science and industry, especially academic entrepreneurship.

3. The volume and quality of research results.

This is motivated by the internal, often unreasonably low standards of individual scientific areas, and not by international standards. It is especially important to focus on the improvement of the quality of investment.

4. Insufficient adaptation of the researchers' structure to the needs of the Croatian economy, the transformation of research into innovations, the protection of intellectual property, and links between business and the scientific sector.

5. Public financing of research projects that does not establish enough quality

³ Action Plan to Encourage Investment in Science & Research, p 6.

competitiveness among scientists.

Public financing of research projects should be even more in line with criteria of excellence and the individual responsibility of researchers.

The above-mentioned Action Plan proposes *measures and instruments*⁴ which can gradually resolve these structural issues. The proposed measures are related to the following:

1. Capacity for research and innovation:

- Human resources
- Financing public research
- Infrastructure
- Excellence and quality assurance;

2. Research for economic development;

3. Popularization of science and research, encouragement of the study of natural and technical sciences, and preparation of the research base.

As far as doctoral studies are concerned, current legislation gives universities a wide scope of autonomy in regulating all issues regarding study programmes. As such, the majority of deficiencies regarding doctoral programmes fall within the scope of the university's autonomy.

Two issues that need to be addressed on the national level are (1) tuition fees for all postgraduate students and (2) the difference in the status of doctoral students between junior researchers/teaching assistants and others. The deficiency of tuition fees has originated from the complete autonomy given to public universities in setting tuition fees for doctoral students. In some doctoral programmes doctoral students who are not junior researchers have to cover the full cost of the programme, despite the fact that the national budget covers all the costs of implementing doctoral education (teachers' salaries, administrative costs, teaching materials, etc.).

⁴ Action Plan to Encourage Investment in Science & Research, pp 7-22.

MINISTRY OF EDUCATION AND SCIENCE, PODGORICA, MONTENEGRO

I. ANALYSIS OF THE SITUATION

Doctoral studies are organized and carried out at the University of Montenegro, in accordance with Bologna declaration principles, with a minimum duration of 180 ECTS, or three years. *Doctoral studies are regulated by the Rulebook on Doctoral Studies.* The Rulebook defines the organization and performance of doctoral programmes, enrolment in doctoral programmes, the examination and research process, application procedures, and the procedure for defending the doctoral thesis. The rulebook also defines the rules for the graduation of doctors, as well as all other issues of relevance for the realization of doctoral programmes at the University of Montenegro. The Rulebook can be found at the web site of the University of Montenegro: www.ucg.ac.me

Research is organized at the faculties and research institutes of the University of Montenegro. Research can be performed within research projects, which can focus on basic, applied, and developmental research. *These research projects employ students enrolled in doctoral programmes, who are co-financed within these projects.*

I.1 ANALYSIS OF THE SITUATION – RESEARCH

Relevant existing documents:

- Strategy for Scientific and Research Activity (2008-2016)
- Law on Higher Education
- Law on Scientific/Research Activity
- Action plan of the Scientific/Research Strategy

Within Tempus project 145180-TEMPUS-2008-AT-SMHES “Creating R&D Capacities and Instruments for Boosting Higher Education-Economy Cooperation”, an *R&D centre has been established at UMN.*

The R&D centre is supposed to provide some services to the University’s research groups for participation (and possibly management) in international research projects. In addition, *the R&D centre could in the future serve as a TTO (Technology Transfer Office)* for connecting the university and industry in innovative projects.

Doctoral studies are regulated by the Rulebook on Doctoral Studies.

R&D centre has been established at umn

the R&D centre could in the future serve as a tto (Technology Transfer Office)

I.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

Relevant existing documents:

- Law on Higher Education
- The Rulebook on Doctoral Studies
- Strategy for Scientific and Research Activity

So far, no international dual doctorates have been realized, but regulations for international dual doctorates do exist in accordance with the Law on Higher Education. For the time being, *no interdisciplinary doctoral programmes have been organized.*

There is a database at the University of Montenegro which keeps records of all students enrolled in doctoral programmes. The Rulebook defines the *criteria for the appointment of the doctoral students’ supervisors.*

Students taking part in research projects may be financed by the Ministry of Education and Science, as well as through the announcement of calls for the professional development of researchers. Doctoral programme descriptions are evaluated by committees appointed by the Council for Higher Education in accordance with the relevant by-laws, as well as the Quality Assurance Centre established at the University of Montenegro.

no interdisciplinary doctoral programmes have been organized

criteria for the appointment of the doctoral students’ supervisors

I.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

There is *no national innovation strategy* in Montenegro at the moment. Some project-based measures include activities of the Directorate for the development of SMEs.

The Directorate established the European Information and Innovation Centre in 2008, as an EU-CIP financed project. *The University of Montenegro – Faculty of Mechanical Engineering is a partner in module B: Services for innovation, technology transfer and knowledge.*

The Directorate is also joining the enhanced FP7 WBC-INCO.NET project (starting in Nov 2010), which includes intensive work on the promotion of innovation policies and an Action Plan for Innovation for the WB region.

no national innovation strategy

2. NEW ACTIVITIES FOR IMPROVEMENT

The Ministry of Education and Science of Montenegro is *joining a regional initiative to develop a WBC Strategy of Research and Development for Innovation*, a project that will be proposed for funding through Multi-beneficiary IPA in 2010. Potential partners in this project will be the UoM and other national stakeholders (Ministries, Directorates, business associations).

joining a regional initiative to develop a wbc Strategy of Research and Development for Innovation

BICRO, ZAGREB, CROATIA

I. ANALYSIS OF THE SITUATION

The Government of the Republic of Croatia started the preparation of its S&T Programme in order to develop a national innovation system, coupled by the other complementary systems of innovation (regional, at the level of industry, at the level of networks of companies, and at the company level).

The role of BICRO in STP implementation is of high importance, since it can be considered as one of the leverages for the National S&T Policy, implementing some of *the most relevant technology commercialisation and promotion programmes*.

BICRO is a key organisation in the National Innovation System for innovation and technology support. The resources for R&D and innovation are limited; therefore, *BICRO's main role is to further support and invest additional funds in research and development activities*. The implementation of BICRO's programmes (RAZUM, TEHCRO, VENCRO, IRCRO, and KONCRO) should have *a significant impact on fostering cooperation between science and industry, the revitalisation of industrial R&D, and the commercialisation of research results*.

I.1 ANALYSIS OF THE SITUATION – RESEARCH

BICRO was established by the Croatian Government in order to support technology transfer and innovation. Through BICRO's programmes, *research is supported in the following manner*:

A) RESEARCH INFRASTRUCTURE

The *TEHCRO* programme strengthens the infrastructure for research, through the development of, among other things, R&D Centres. Within the R&D Centres, research and development within a thematic area is supported and strengthened; R&D infrastructure resources are concentrated within one specific field; emphasis is on building strong international competence within a specific R&D field of expertise; and the aim is to transfer know-how and R&D results to business in order to develop products and services.

B) R&D IN SMES

The *RAZUM* programme - one of its main tasks is to ensure funding of research and development for new products or services in existing companies.

C) COLLABORATIVE R&D

The *IRCRO* programme encourages and stimulates demand for services of public research institutions, and also encourages SMES to invest in research and development activities.

By a decision of the Ministry of Science, Education and Sport, BICRO took over the role of the Head Office of the *EUREKA* programme. *EUREKA* is a pan-European network for market-oriented, industrial R&D. *EUREKA* brings together SMES, research institutions, and universities from 38 European countries and the EU to collaborate in a 'bottom-up' approach to developing and exploiting innovative technologies. The results of the project are new products and services which promote advanced technologies and which will have their place on the market.

I.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

In its efforts to create an innovation ecosystem capable of transferring innovative ideas into highly competitive products, BICRO is working together with other stakeholders in the National innovation system to produce three necessary prerequisites:

- an excellent and strong scientific base,
- appropriate sources of funding
- an adequate business and technology infrastructure.

In order to help in establishing an adequate business and technology infrastructure, BICRO has introduced the following programme:

• the *TEHCRO* programme

The successful commercialisation of research output and the transfer of knowledge from universities and scientific institutions to business are possible with the help of an adequate technology infrastructure within which the academic community can use various services for technology transfer, while knowledge-based start-up companies can use all the resources necessary for their development and growth.

On the other hand, two other programmes are trying to develop adequate sources of funding; these are:

• the *RAZUM* programme

Besides funding R&D activities in SMES, *RAZUM's* main task is to initially fund newly established knowledge-based companies with an emphasis on the development of new innovative products that have exceptional market potential.

BICRO's main role is to further support and invest additional funds in research and development activities

a significant impact on fostering cooperation between science and industry, the revitalisation of industrial R&D, and the commercialisation of research results.

TEHCRO

RAZUM

IRCRO

EUREKA

TEHCRO

RAZUM

- **the IRCRO programme:**

An essential element of business innovation is research and development. With arising awareness for the necessity of research and development in SME's, the creation of demand for services from scientific research institutions is supported. The IRCRO programme stimulates:

- Cooperation between industry and technology institutions
- Maximum usage of infrastructure in scientific research centres
- Support for industrial companies to substantially increase their R&D activities

These three programmes fund innovative technology projects with the aim of increasing the competitiveness of Croatian small and medium-size enterprises and creating other conditions which are necessary for the successful flow of knowledge between the scientific community and the business sector.

EU PROGRAMMES:

1. EEN

BICRO is one of the partners in the most important European support network, the *Enterprise Europe Network* (EEN), where it has a key role in technology transfer and innovations. EEN Croatia implements objectives in national science and technology development by promotion of SMEs based on knowledge. EEN offers them necessary information and advice, supports demand and investment of the business sector in R&D, and highlights the importance of innovation and IPR.

2. BIOCENTRE - IPA

BICRO aims to establish a *BIOCentre* project (Biosciences technology transfer and business incubation facility) in partnership with the MSES, the University of Zagreb, and the City of Zagreb. This operation consists of a specific project for developing a high-technology incubation and business development support institution that creates a network of all necessary knowledge, skills, and corresponding material resources essential to supporting the establishment and growth of knowledge-based enterprises (start-ups and SMEs) in the area of the biosciences. It is envisioned as a central national resource in the highly propulsive technology sector, which Croatia has made one of its national developmental priorities and, also important, as a first good-practice model for developing other technology-based incubation infrastructures for the R&D sector throughout Croatia.

2. NEW ACTIVITIES FOR IMPROVEMENT

Increasing the level of cooperation between science and business is one of the most challenging tasks of the social development policy for any transitional country.

But it is also the one that is required the most, since it will generate large benefits for the economy if things are done right. There are three main activities that should be implemented to improve this cooperation:

RAISING AWARENESS

By introducing the importance of innovation and technology transfer at all levels of the educational system, keeping in mind the adequacy of the information provided for each level, the education system should provide to new generations the importance of R&D in the transfer of technology and in economic development. This should be presented in such a way that everyone should understand that inventions and most innovations are the result of hard scientific work and not, as some believe, ingenious sparks in the heads of some people playing around in their garages. On the other hand, an awareness campaign should also target people working in academia and explain to them the importance of their role in the economy and try to explain to them that it is not enough to provide benefits just for society, because the economy needs them as well.

TECHNOLOGY TRANSFER CAMPAIGN

Universities should initiate, using all available instruments, the facilitation of technology transfer, establishing TT offices (where there are none), providing them with adequate human and financial resources to create measures for the successful transfer of technology inside the University. Since these activities should provide income for them, it should not be a problem to put on hold other non-income-generating projects. Also, universities should start thinking of using a part of the research budget for funding R&D projects that have goals defined in collaboration with industry partners (pilot for centres of competence). In that way, if any outcomes are achieved, commercialisation should not be a problem.

CENTERS OF EXCELLENCE

Creating research groups that can provide state-of-the-art output in a particular technology using existing infrastructure could be a beneficial factor for improving technology transfer. These research groups should compete for basic research grants and should be able to provide support in a certain field of technology to companies interested in acquiring these services.

RUDJER BOSKOVIC INSTITUTE, ZAGREB, CROATIA

I. ANALYSIS OF THE SITUATION

The Ruđer Bošković Institute (RBI) is the largest Croatian research centre for basic sciences. The Institute has 136 projects in basic research, which are funded by the Ministry of Science, Education and Sports (MSES). In addition, the RBI is involved with more than 40 international projects. Despite the fact that the RBI is primarily a research institution, our *participation in education activities is very strong*. Scientists from the RBI contributed to 78 undergraduate courses and 245 graduate courses in programmes of higher education at seven universities in Croatia. *The RBI has founded 8 joint doctoral studies* in collaboration with universities in Croatia as well as with other research institutes and centres.

In 2007 the RBI established its own company for technology transfer (Rudjer Innovations Ltd - <http://www.r-i.hr/en/>), which is engaged in activities related to the protection of intellectual property and its commercialization. Currently, 27 innovations have been classified under the banner of “know-how” and 3 of them are close to attaining commercial status.

I.1 ANALYSIS OF THE SITUATION – RESEARCH

The RBI has ratified a new Statute governing the future operation and structure of the institute (<http://www.irb.hr/hr/uprava/Statut/>). This document, currently only available in Croatian, was approved by the MZOŠ and the Croatian National Science Council. The Strategy for Science at the RBI is currently in its final draft and should be approved by the RBI Scientific Council imminently. The institute’s Action Plan for research strategy is currently under preparation. Among several operational rulebooks, the “Rulebook of Intellectual Property Rights” has been approved by the RBI Scientific Council and Board of Governors (all rulebooks are available at <http://www.irb.hr/uprava>).

A research productivity database for the RBI is available on the Croatian Scientific Bibliography pages (CROSBI) as well as on the web pages of each division and centre (www.irb.hr). Since 2003, the (condensed) English version of the RBI Annual Report has contained summarized selected papers and research highlights. The full Annual Report (in Croatian), which contains all published papers, complete research, development, education, new methods, and equipment, has been published since 1993.

In 2004 the International Project Office was established at the RBI to provide information, consultation, and administrative support to researchers involved in international research projects.

Currently the RBI is involved in 20 FP6, 7 FP7, 5 IAEA, 3 NATO, 1 INTEREG, 2 COST,

73 bilateral projects, 4 HITRA, 10 UKF, 5 NZZ and 1 Tempus-Opus project, as well as 20 applied and commercial projects.

The most prominent thematic areas of the Framework Projects are ICT, security, nuclear technologies, and life sciences.

I.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

In order to increase its contribution to higher education in natural sciences, the RBI organized joint graduate and postgraduate programmes in Medicinal Chemistry in collaboration with the University of Rijeka and the GlaxoSmithKline Research Centre Zagreb. In addition, six joint graduate programmes were launched by RBI and other universities in Croatia. These include a Biophysics programme with the University of Split, an Environmental Management and Oceanology programme with the University of Zagreb, an Environmental Protection and Natural Conservation programme with the J.J. Strossmayer University in Osijek, a Molecular Biosciences programme with the Universities of Osijek and Dubrovnik, and a Biology of Cancer programme with the Universities of Split, Dubrovnik, and Zadar. Although the latter national graduate programme passed through an international evaluation procedure and some of the joint graduate programmes are intended to become international PhD programmes, a set of regulations for international dual doctorates is currently lacking.

A database for all graduate and undergraduate courses in which the RBI’s researchers are involved exists and is updated every year.

While most of the PhD students at RBI are financed by MSES, several are financed through international projects.

A database for all PhD students and young researchers has been established at the RBI. This database contains all relevant data for each student, including his/her education, PhD thesis proposal, supervisor, etc.

Quality assessment procedures for supervisors and students, which need to be developed and defined, are currently under discussion.

I.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

In 2007 a company for commercialization of knowledge, Rudjer Innovations Ltd (RI), was established by the RBI to handle the protection and licensing of IP, know-how, and industrial projects.

The current portfolio of RI IP contains 27 innovations in different fields (chemistry, physics, biomedicine, informatics, etc) and a total of 55 patent applications. Three of these have been approved and granted.

The RBI has established a series of on-line forms and procedures for patent and innovation applications, which are only available to the RBI’s researchers.

Three spin-off or joint-venture companies have been established since 2007. The largest ongoing company is that related to the *Rudjer Medikal Cyclotron* company, being a joint venture of RBI, RI, and the private investor Medikal Diagnostics

In 2007 the rbi established its own company for technology transfer (Rudjer Innovations Ltd

In 2007 a company for commercialization of knowledge, Rudjer Innovations Ltd (ri), was established

Rudjer Medikal Cyclotron

Ltd. In this context, a new cyclotron has been installed at the RBI and used for both fundamental research and the commercial production of radionuclides for PET diagnostics in Croatia and the entire region.

The other spin-off companies established at the RBI are *Rudjer-Medikol Diagnostics*, involved in hereditary breast cancer genetic testing and *Biozyne*, a start-up biotech-company involved in the screening of the novel anti-cancer compounds.

The Innovation Strategy and Action Plan for Rudjer Innovations Ltd is part of the RI's Business plan, which has to be approved annually by the RBI's Board of Governors and the Supervisory Board of RI.

In 2009 an IPA (*Instrument for Pre-Accession Assistance*, founded by the European Commission) project, entitled "Development of Innovation System at Rudjer Bošković Institute and University of Rijeka", was submitted with the aim of establishing a Technology Transfer (TT) office at the RBI.

2. NEW ACTIVITIES FOR IMPROVEMENT

Currently, the RBI is undergoing an international evaluation and reorganization procedure. *The strategic reinforcement of selected research areas through this process is expected not only to improve the quality of scientific output but also to boost the competitiveness of RBI scientists in international project applications.* Naturally, this initiative requires an improvement in administrative support as well as improved communication between scientists and administrators. Intensive efforts in this direction, through the reinforcement of *the International Project Office*, are planned to take place in parallel with the scientific reorganization.

Apart from the clear need for better organization and increased external financial support, the RBI is also striving to *improve cooperation with industry*, including the incorporation of research results into technological processes. In the first instance, this requires increasing the awareness of employees to the available opportunities in this direction. On a related front, the IRB is also working hard to improve TT through the more efficient running of RI and the establishment of the aforementioned IPA-sponsored TT office.

The RBI is also acutely aware that, as a publicly funded institution, its public image is of the utmost importance. In order to improve this aspect, the Institute has recently established a public relations office. The mission of this office is to present the RBI's work more effectively to the public. Apart from obvious local efforts involving internet presence, this also includes intensive interaction with all forms of media to increase the public's awareness and appreciation of the work taking place at the RBI.

The strategic reinforcement of selected research areas through this process is expected not only to improve the quality of scientific output but also to boost the competitiveness of RBI scientists in international project applications

improve cooperation with industry

ERICSSON NIKOLA TESLA, ZAGREB, CROATIA

I. ANALYSIS OF THE SITUATION

Ericsson Nikola Tesla is very much oriented towards the constant innovations in daily business. We specialize in the area of ICT technologies, which requires innovative solutions to secure market presence and market sustainability. To be able to create innovative solutions, we have built an *innovative environment* with well-defined processes and reward policies. This *enables any employee to take part in innovative thinking*. To be possible to correlate ongoing business needs and time demands well, we must be prepared and have some technological proof of concepts to go to the market, and for that reason, we have our own research unit within the organization. In addition, we have *good cooperative relationships with local universities*, and we are *carrying out common applied research projects*. We have our own students in doctoral programmes and involve students from cooperating universities in our common research projects.

innovative environment
enables any employee to take part in innovative thinking

good cooperative relationships with local universities, and we are carrying out common applied research projects

I.1 ANALYSIS OF THE SITUATION – RESEARCH

Ericsson Nikola Tesla has about 750 employees engaged in R&D activities for the company. It is one of the strongest R&D organizations outside the corporate headquarters in the Sweden. We mainly work on software development in the domain of ICT. The majority of our employees have studied at the post-secondary level (96% have bachelor's degrees, 8% have master degrees, and 1% have received the Ph.D.).

We are currently participating in one FP6 European research project, and in FP7 we are executing one STREP project, have accepted one IP project which will start in February 2010, and we are a waiting reviews of two STREP projects from call 5 and one project for part PEOPLE. All of these participations are correlated with strategic business requirements and interests since we can receive only 50% of research cost support from the EU because we are a large company. We also participate in TEMPUS projects (e.g., the recently completed TEMPUS – KISEK project).

We have *well-defined processes for research and innovation* that we follow. We have internal regulations regarding applying for doctoral study if the employee requests a company scholarship.

well-defined processes for research

We have *well-defined cooperation agreements with our partners from universities* that cover the entire project scope, expected results, time, and financial expectations and fully regulate intellectual property rights and confidentiality.

well-defined cooperation agreements with our partners from universities

1.2 ANALYSIS OF THE SITUATION – DOCTORAL STUDIES

Ericsson Nikola Tesla deals with three categories of doctoral students. The first category consists of our *own employees*, who must follow internal regulations and pass through the internal decision board in order to enroll as doctoral students. Candidates' research interests must be correlated with the company's business strategy tendencies. The second category includes *the doctoral students who we select at the university* to be researchers of interest based on their research topic. We give these candidates salary compensation. The third category consists of *doctoral students at a university who cooperate with the company through common research projects*. The main benefit of such interactions is twofold: the company has direct contact with the newest research activity and results, and the candidate has the opportunity to discuss and prove theoretical achievements in a practical business environment (real problems).

the doctoral students who we select at the university

doctoral students at a university who cooperate with the company through common research projects

In addition, employees from the company participate in the education process and act as mentors of the doctoral students.

1.3 ANALYSIS OF THE SITUATION – INNOVATION/TECHNOLOGY TRANSFER

For many years, the Ericsson Nikola Tesla company has had a bylaw for the regulation of innovations. We now have an improved version that regulates all stages of the innovative process from idea to patent and all appropriate rewarding mechanisms. According to the Labour Law, it has well-defined ownership, and all other requirements to follow positive law directions. It is part of the company culture for the innovation process to be implemented in all segments of the company's activities, which are reviewed regularly. *Innovations are part of the company's Key Performance Indicators.*

For many years, the Ericsson Nikola Tesla company has had a bylaw for the regulation of innovations

Innovations are part of the company's Key Performance Indicators

The company is aware of the good process of collecting ideas and innovative proposals but certainly needs improvements in the area of transferring ideas towards products.

We have a *defined policy regarding transfer of technology that has resulted in cooperative (joint) research projects with universities*; this is regulated by cooperation agreement. If it is a fully ordered and paid research task from the company's side, the company has complete ownership. In the European projects, we follow the regulations of the EU and define each case individually in terms of technology transfer decisions (joint ownership, open source, etc.).

defined policy regarding transfer of technology that has resulted in cooperative (joint) research projects with universities

2. NEW ACTIVITIES FOR IMPROVEMENT

For many years Ericsson Nikola Tesla has had continuous and fruitful cooperation with Academia. We have passed through different stages of cooperation models: from ordered studies to common applied research projects and exchanging persons. The essential factor in all stages of cooperation is the existence of a common view that the problem exists and the common potential to find a solution to the problem.

The essential principle in Academia is to carry out basic research, and in industry the essential principle is to make and sell products. In the creation of new or improved products, a lot of new knowledge is needed. This is an area that makes a clear point of cooperation and an area of applied research and technology transfer. Today our industry is under pressure to quickly come up with new solutions and new products, while there is very little time to spend on basic research, which is a pre-condition for successful decisions about new products or sometimes completely new business directions. *It is essential to develop and strengthen cooperation between industry and Academia and to fully ensure the circulation of knowledge between these two partners in order to enable general wellness for society.* The most important thing is *continuous discussion* between these two partners in order to enable mutual understanding and correlate short- and long-term strategies. It is well known that Academia needs at least five years to produce newly requested employees with specific knowledge. When we are going in new directions or have new business opportunities, it is even more important to have a fast mechanism to shorten the time needed to create a *temporary school in the Academia* environment that can fulfil existing business needs. Such a school can be based on the majority of existing knowledge but with some extensions in some topics that will fully provide the requested knowledge. The same process sometimes can be solved through LLL mechanisms. The most important factor is *constant discussion and mutual understanding* of true business needs and potentials in the community and the correlation of basic research activities and cooperation between Industry and Academia. The results are twofold: graduate students will find jobs in their own community, and Academia will have the possibility to boost local development and more efficient transfer of knowledge towards society.

essential principle in Academia is to carry out basic research, and in industry the essential principle is to make and sell products

constant discussion and mutual understanding

It is very important to distinguish these ideas from a purely business-driven university, because here the general goal is to *set up cooperation and common research topics* that create wellness for society and fulfill common long-term strategies.

set up cooperation and common research topics

SWOT Analysis – Intro

The following data represents the output of a SWOT Analysis (Strengths, Weaknesses, Opportunities and Strengths) of the TEMPUS partner organisations in the area of 'Education, Research and Innovation'.

Part 1 offers individual partner responses; Part 2 seeks to summarise those issues that are common for several partners.

Analysis was undertaken at three levels:

- **Individual Level (IND)**: attributes that operate below the level of a legal entity and so where the ability to influence up-wards is at its lowest i.e. individual researchers, research groups, departments.
- **Organisational Level (ORG)**: attributes that operate at the level of a legal entity and so where the ability to influence up-wards is relatively strong i.e. Faculties and Schools or Institutes and Universities.
- **National (NAT)**: attributes that operate at Government level and so have a strong effect on the policy development e.g. Directorates for Science and Ministry level department.

In some cases respondents are indicating the strength of their present relationship with a lower or higher level e.g. the ability of a Rectorate to influence the University components (Faculties and Schools) or its relevant Ministry department. This should be obvious from the accompanying text in each case.

SWOT ANALYSIS ON THE LEVEL OF INDIVIDUAL PARTNER

STRENGTHS (strong points, recognized for .., sufficient resources ...)

Dubrovnik UNI:	INDIVIDUAL LEVEL: human resources, research teams ORGANISATIONAL LEVEL: integrated university NATIONAL LEVEL: regionally recognized organization for marine issues
Montenegro UNI:	IND: stable staff (low risk of brain drain; linked to departments), ORG: integrated university, the only state university in the country, the only comprehensive university (located in 5 towns) NAT:
Mostar UNI:	IND: quality of young teaching staff, openness to collaboration with teachers and associates in the country and abroad. ORG: management commitment to change, building of the University campus in process, increasing international cooperation NAT: location advantage, studies in all crucial scientific disciplines
Osijek UNI:	IND: high number of teaching and research staff ORG: strong regional university; big plans for development - building of university campus in process; increasing of international cooperation in past five years; rising number of students in last five years; good cooperation with industry at some faculties NAT:
Rijeka UNI:	IND: job security, young teaching staff ORG: positive internal environment attracts people (brain gain), who then introduce new research potential and momentum; good cooperation with the local community (city, county); environment that encourages innovation (university's Science and Technological Park); new

Rijeka UNI:	university campus; wide-ranging international co-operation and participation in international projects. NAT: orientation towards a knowledge-based society
Skopje UNI:	IND: human resources, research teams ORG: integrated university (in 2009); largest in the country; leading the push for innovation in the country, centre of excellence – Chemistry; joint degree diplomas (PhD) with foreign universities NAT: orientation towards a knowledge-based society
Zadar UNI:	IND: increasing brain gain (PhD holders joining the university) ORG: integrated university with significant historical and cultural heritage; first university on Croatian soil; long and prominent tradition in humanities and social sciences NAT:
Zagreb UNI:	IND: high potential of young researchers ORG: comprehensive - all disciplines represented; long tradition; excellence of research in a large number of areas; good cooperation with industry; strong international cooperation; largest university in Croatia NAT:

WEAKNESSES (needs improvement, insufficient resources...)

Dubrovnik UNI:	INDIVIDUAL LEVEL: weak cooperation within the university, low level of funding for research activities ORGANISATIONAL LEVEL: orientation towards teaching, weak cooperation among departments and researchers NATIONAL LEVEL:
Montenegro UNI:	IND: lack of an organised and systematic approach to the collection of science-related information ORG: equipment of laboratories and level of practical work; weak cooperation with industry; relations with labour market (small labour market), lack of interdisciplinary research; poor facilities for students NAT: lack of statistical information link to science

Mostar UNI:	IND: imbalance between teaching and scientific research at the cost of research, insufficient internal teaching staff, overload of teaching activities. ORG: lack of resources (for research & innovation), semi-integrated university, weak follow-up of implementation of decisions NAT: non-existence of funds for scientific research
Osijek UNI:	IND: ORG: not integrated university; uneven intensity of scientific work at different faculties and Departments; low level of interdisciplinary research and low level of joint projects within the University NAT:
Rijeka UNI:	IND: unequal quality of teaching and research; the number of employees with required qualification is not balanced ORG: university not integrated; weak interdisciplinary research; low level of doctoral studies; poorly defined criteria of excellence and of motivating reward and promotion; poorly defined monitoring of research outputs (database); lack of educational programmes that target the needs of local industry; poor flexibility and adaptability to changes in the environment; fragmentation of resources, study programmes, and research NAT: insufficient research evaluation criteria for national funding; high dependence on budget resources
Skopje UNI:	IND: weak cooperation within the university, low level of funding for research activities ORG: PhD studies need to be introduced as a structured program NAT: insufficient research evaluation criteria for national funding; high dependence on budget resources
Zadar UNI:	IND: emphasis on teaching commitments ORG: less developed (natural) science and engineering fields, insufficient number of independent research units; lack of large/major research projects, especially international NAT:

Zagreb UNI:	IND: ORG: functionally non-integrated university; unequal quality of teaching and research; low intensity of interdisciplinary research; too many doctoral programmes, low level of utilisation of research resources NAT: insufficient research evaluation criteria for national funding; a high dependency on budget resources
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OPPORTUNITIES (existing opportunities, positive trends...)

Dubrovnik UNI:	INDIVIDUAL LEVEL: ORGANISATIONAL LEVEL: establishment of RTD culture in younger researchers NATIONAL LEVEL: centres of excellence at the state level: for marine issues, rural development
Montenegro UNI:	IND: more research at international level; young researchers and increased participation in international projects-invited to participate, ORG: organisation of international conferences (attractive location); financial support for publishing in international journals NAT: intensified usage of pre-accession funding (for example, IPA)
Mostar UNI:	IND: attractiveness of curricula and studying conditions for students from entire Bosnia-Herzegovina region and wider ORG: increasing partnership in international projects, networks, and postgraduate studies NAT:
Osijek UNI:	IND: ORG: raising the amount of interdisciplinary research; improving cooperation within the university; raising the level of cooperation with industry; regional centre for research and development; networking within the region NAT:

Rijeka UNI:	IND: professional training of employees; staff exchange; mobility ORG: creating joint services at the University level; creating a diversified financial support portfolio for the University; establishment of inter-regional links; profiling the university in the context of the knowledge and entrepreneur market; adopting the life-long learning education model NAT: better linkage at the Ministry-University-Faculty level
Skopje UNI:	IND: more research at the international level; young researchers and increased participation in international projects-invited to participate ORG: regional orientation; access to international funds NAT: new research areas with better potential for collaboration with industry
Zadar UNI:	IND: ORG: capitalizing on cultural and natural advantages and unique location on the Adriatic (for example, the ARHIPELOGOS programme); intensification of research activities NAT: new research areas with better potential for collaboration with industry
Zagreb UNI:	IND: use of international sources of funding, many students interested in pursuing research careers (trend) ORG: high concentration of industry in the area, potential development into a regional centre, strengthening of international cooperation; University able to offer centralised services that are difficult to develop at the faculty level due to lack of resources NAT:

THREATS (obstacles, negative trends...)

Dubrovnik UNI:	INDIVIDUAL LEVEL: weak competitiveness of research teams; low success rate in research project applications ORGANISATIONAL LEVEL: placing more and more emphasis on teaching (path of least resistance); NATIONAL LEVEL: inappropriate financing of education and research in the Republic of Croatia (degrees)
Montenegro UNI:	IND: conflict of commitment - linked to providing services to industry ORG: lower quality standards for degrees (esp. PhD, but all Bsc, MSc), lack of equal opportunities for young people (PhD programmes charge tuition) NAT: lack of interest in natural sciences, weak implementation of the national strategic document
Mostar UNI:	IND: constant "brain drain" ORG: orientation more towards teaching than research NAT: lack of strategy at the national level, insufficient understanding of basic problems of higher education and the university among those who make political decisions, insufficient legal regulations
Osijek UNI:	IND: ORG: uneven development of the faculties and departments; uneven criteria for excellence in different scientific fields; low level of interest for research NAT:
Rijeka UNI:	IND: weak motivation of employees for change. ORG: criteria of excellence and evaluation (an internal and external factor); fragmentation of functions; a closed academic community NAT: changes in the economy (crisis) and insufficient financial support; less support for the development of industry in the Rijeka region (and the largest loss of industry); criteria of excellence and evaluation (an internal and external factor)

Skopje UNI:	IND: weak competitiveness of research teams; low success rate in research project applications ORG: lower quality standards for degrees (esp. PhD, but all Bsc, MSc), lack of equal opportunities for young people (PhD programmes charge tuition) NAT: financing of research by national government
Zadar UNI:	IND: ORG: placing much more emphasis on education than research; danger of transformation from a university into a school NAT:
Zagreb UNI:	IND: low level of readiness for change ORG: weak flow of information among constituents NAT: inadequate system for research funding in Croatia; industry with low R&D profile (lack of state incentives); lack of efficient implementation of already adopted strategies

SWOT ANALYSIS ON THE LEVEL OF COMMON ISSUES

STRENGTHS (strong points, recognized for.., sufficient resources...)	WEAKNESSES (needs improvement, insufficient resources...)
INDIVIDUAL LEVEL	
<ul style="list-style-type: none"> • Openness to collaboration through EU funded programmes • Weakening of brain drain and beginnings of brain gain • Awareness that change is necessary 	<ul style="list-style-type: none"> • Level of total actual time commitment devoted to teaching compared to research • Lack of recognisable profiles of researchers/labs • Low level of willingness to implement changes
ORGANISATIONAL LEVEL:	
<ul style="list-style-type: none"> • Openness to collaboration through eu-funded programmes 	<ul style="list-style-type: none"> • Too much focus on teaching as opposed to research (within heis); • Lack of interdisciplinary research (and measures to stimulate & support interdisciplinary projects); • Lack of experience in technology transfer and innovation; • Lack of inter-university cooperation • Lack of research outcome tracking (at institutional level); • Lack of follow up of students post-graduation (to verify relevancy of education to labour market); • University management issue-- need for better integration and organisation both at strategic and operational levels

STRENGTHS (strong points, recognized for..., sufficient resources...)	WEAKNESSES (needs improvement, insufficient resources...)
NATIONAL LEVEL	
<ul style="list-style-type: none"> • Awareness of the need for a knowledge-based society orientation 	<ul style="list-style-type: none"> • Low interest in natural science and engineering among high school students; • Low interest of state government in promotion of national science achievements • Lack of international evaluation of institutions • Lack of databases and statistical tracking of research activities • Weak implementation of adopted strategies • Lack of measures to link high school and university education (e.g., education for high school teachers)

OPPORTUNITIES (existing opportunities, positive trends...)	THREATS (obstacles, negative trends...)
INDIVIDUAL LEVEL	
<ul style="list-style-type: none"> • International sources of funding and associated increase in mobility • Researchers more willing to collaborate with university level support structures than with faculty structures • Peer evaluation introduced through international projects 	<ul style="list-style-type: none"> • Lack of employee motivation for change.
ORGANISATIONAL LEVEL:	
<ul style="list-style-type: none"> • Increase in research collaborations and interdisciplinary research • tempus opus project will contribute to analysis of research outcomes • Change in funding allocation (funding will be allocated on central level, which will allow development of support structures (Croatia)) 	<ul style="list-style-type: none"> • Large share of university budget allocated to salaries • Lack of extensive experience in tech transfer and innovation;
NATIONAL LEVEL	
<ul style="list-style-type: none"> • More intensive use of pre-accession and (later) structural eu funding • Regional cooperation networks and schemes provide a chance for smaller universities; 	<ul style="list-style-type: none"> • Lack of people with skills necessary for optimal use of eu pre-accession and structural funds • Lack of defined criteria for research funds allocation • Lack of well-defined system that would lead to set up of funding programmes in accordance with strategic priorities

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