Tempus IV programme

Study of the Achievements of Tempus IV Projects

in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

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<tr>
<td>ECTS</td>
<td>European Credit Transfer System</td>
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<tr>
<td>ERASMUS</td>
<td>European Region Action Scheme for the Mobility of University Students</td>
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<td>EU</td>
<td>European Union</td>
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<td>ICT</td>
<td>Information and Communication Technology</td>
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<td>NEO</td>
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Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe
Executive Summary

This study provides an analysis and evaluation of the Tempus IV projects in curriculum development in Engineering and Environmental Sciences at Master level in Eastern Europe, with a particular focus on the impact and sustainability of the results achieved both during the project’s implementation and upon its completion. Additionally, the study identifies good practices and important lessons which could be of particular interest to institutions that are considering conducting similar EU projects in the future, within the framework of the Erasmus+ programme.

The survey report is divided into the following four thematic sections: Introduction, Impact of the projects, Challenges and constraints in the implementation of the projects and Conclusions and recommendations.

The survey methodology included quantitative and qualitative approaches, namely desk research, questionnaires, interviews and case studies.

As for the findings, the curricula development and curricula modernisation activities in Engineering and Environmental Sciences allowed Eastern European universities to improve their understanding of the curricula development processes and the curricula quality standards, but also of the quality assurance mechanisms and assessment methods aligned with the Bologna process. This impact can be confirmed by the fact that other academic institutions from the Eastern European countries concerned, though not directly involved in the respective TEMPUS projects, expressed intention to expand curriculum development activities on their own, using guidelines developed during the TEMPUS projects lifetime.

It should be noted that joint, double, and multiple diplomas/degrees are rather an exception, even though there was an increase in the number of programmes and courses run at least partly in English, as in the number of modules implemented as distance and e-learning resources.

Visits to partner institutions, capacity building and mobility activities had a significant impact on all the actors involved in the TEMPUS projects. For example, the way of teaching has been modernised, teaching skills have improved, and networking activities intensified, which in turn influenced the internationalisation of research, the improvement of management, and the establishment of cooperation with stakeholders outside the academic sector. The lack of foreign language skills is though still an open issue.

The modernisation of curricula and the harmonisation of studies in Engineering and Environmental Sciences with labour market needs have contributed to better employability and mobility of graduates and, in some cases, the establishment of university-based units dealing with students’ employment.

Meanwhile, the promotion of new study programmes and student recruitment and enrolment are areas with room for improvement.

Participation in TEMPUS projects influenced the managerial, reporting, organisational, and financial management skills of the academic and non-academic/administrative staff employed at the partner universities in Eastern Europe, as well as cooperation and coordination at the institutional level.

The purchasing of equipment is very much appreciated, however concrete arrangements of the equipment supply should be considered in the future due to the differences between the various countries, as well as the availability of national resources for such purpose.
The development of new teaching and learning materials has had significant impact on the improvement of teaching and learning processes, scientific research activities, and networking.

The offices dealing with international affairs were established within projects and are today fully functional.

The majority of partners continue their initial partnership through bilateral agreements and within new projects. The cooperation with representatives of non-academic institutions and organisations has also continued in most of the cases.

The strong involvement of local expertise and resources is one of the success factors and contributed to the sustainability of the projects’ results.

In the future, a full understanding of modern curriculum concepts (e.g. learning outcomes, types of modules, modern teaching and learning methods, ECTS etc.) should be sought and a quality assurance system should become a mandatory part of curriculum development.

It is recommended to cooperate with representatives from the economy sector and employers at every stage of curriculum development.

Academic and administrative staff, as well as students, should improve their English language skills in order to take advantage of all the benefits of capacity building and mobility activities. The experiences gained during the participation in such activities should be widely shared among all stakeholders.

Universities should develop clear visibility and promotion plans in order to secure the enrolment of future students in their respective study programmes. It is equally important to ensure proper maintenance arrangements for purchased equipment.

Longer duration of students’ placements abroad should be considered in the future. EU programmes should also be more focused on the development of joint, double, and multiple diplomas/degrees.

It is very important to ensure regular monitoring in terms of the transfer of funds and sound use of EU financial contributions.

Regarding project management, it is fundamental to ensure a clear definition of roles and responsibilities for all partners, in addition to the establishment of clear decision making mechanisms.
1. Introduction

The overall objective of the Tempus programme (1990-2013) was to contribute to an area of cooperation in the field of higher education between the European Union and partner countries surrounding the EU and nearby (the Western Balkans, Eastern Europe and Central Asia, North Africa and the Middle East). The latest phase of the programme, Tempus IV, covered the period 2008-2013.

The specific objectives of the Tempus IV programme were to promote the reform and modernisation of higher education in the partner countries, enhance the quality and relevance of their higher education systems, build capacity to help them internationalise and create better links with the labour market, develop human resources, enhance mutual understanding between people and cultures and promote cooperation and networking within the regions covered by the programme.

Tempus IV was financed by three of the European Commission's external assistance instruments: the Instrument for Pre-accession Assistance (Western Balkans); the European Neighbourhood and Partnership Instrument (Eastern Europe, North Africa and the Middle East); and the Development and Cooperation Instrument (Central Asia). The Education, Audiovisual and Culture Executive Agency (EACEA) was responsible for the management of Tempus IV, under powers delegated by the European Commission.

Six different Calls for Proposals were published during this period and 550 projects selected, representing a budget of EUR 483 million. Each project received funding of between EUR €0.5 million and €1.5 million and lasted either 2 or 3 years. Tempus IV partnerships are made up of consortia including higher education institutions, businesses, ministries, NGOs, and other organisations working in the field higher education, from inside the EU and from the partner countries.

Given the success of the Tempus programme over the past 20 years, Tempus-like activities now continue to be financed by the Capacity-building in Higher Education action (CBHE) component of Erasmus+ programme for education, training, youth and sport, which started in January 2014. These are now open to a wider range of countries throughout the world. International cooperation between the EU and Partner Countries outside the EU represents an important component of the Erasmus+ programme.

Now that the last Tempus IV projects are coming to an end in 2017, there is a clear need to assess the impact of Tempus IV projects and use the results to help further develop capacity-building activities in the Erasmus+ programme. The European Commission's Directorate General for Education and Culture, with the support of EACEA, launched a series of thematic studies to look at the impact of the programme in key areas of reform and gather examples of good practice for the future. These are to help promote the Capacity Building in Higher Education action of Erasmus+ in all eligible countries, and provide an overview of what can be achieved with these kinds of projects, pit-falls to avoid and examples of best practice for inspiration.

One key reform area was chosen for each of the four Tempus regions:
- Western Balkans: the development of student support services at universities;
- Southern Mediterranean: university-business cooperation;
- Eastern Europe: curriculum development at master level in the fields of engineering and environmental sciences/agriculture;
- Central Asia: internationalisation of higher education, including convergence to Bologna.

Under Tempus IV, around 40% of the funded projects involved partners from Eastern Europe and, congruently, 40% of the awarded budget was allocated to the projects in this region.
One of the main actions of the Tempus programme involves reforming curricula, which was particularly relevant in the context of the socio-economic changes in the early 1990s. During Tempus III, more than one third of all projects in the Eastern Europe region focused on curriculum reform, while in Tempus IV the percentage of projects in this field increased to around 60%. Via Tempus, a number of new fields of study have been introduced or developed in the region, such as environmental science, renewable energy and biotechnology.

Taking into account the different types of curricular reform projects in the region, the Master level seems to be the most relevant (70%). The most addressed topics are engineering and environmental sciences/agriculture, which represented 20% and 30% of the curricular reform projects funded in the region, respectively. Thus, the Study on the Achievements of Tempus IV projects in curriculum development in Engineering and Environmental Sciences at the Master level in Eastern Europe covered 15 selected projects in seven countries, namely Armenia, Azerbaijan, Belarus, Georgia, Moldova, Ukraine and Russia (project fiches including information on project description, main coordinating institutions, and budgets are presented in Annex 4).

The objectives of this particular study were:

- to review the curriculum development activities in the relevant Tempus IV projects;
- to evaluate the impact and sustainability of the results achieved, and to relate these achievements with the different socio-economic contexts in the countries of interest;
- to identify the most prevalent obstacles and shortcomings;
- to identify good practice examples to be used as case studies, showing the positive impact of particular aspects of the project's management and organisation on the results achieved, and
- to produce a set of recommendations for the new generation of Erasmus+ Capacity Building projects.

The development of new and updated courses and programmes in the field of engineering and environmental sciences in Eastern Europe assumes a specific socio-economic context of Eastern Europe and its higher education contexts. The countries have embarked on the common Bologna Process related reforms; hence the developed programmes have been assessed taking into account Bologna related principles (e.g. ECTS, learning outcomes, evaluation procedures, etc.). However, the countries under this study have also specific challenges (e.g. inherited practice to have a national set of standards for higher education curricula) and therefore, the study has analysed if such practices have influenced the impact and sustainability of the project activities.

It should be underlined that, for the purpose of this study, the curricula development is conceptualised as a process which leads to a specific curriculum framework as an output. However, the process itself is seen to have much wider goals and has been expected to have a broader impact on the individual students, academic and non-academic staff directly and indirectly involved, on practices at the institutional level, as well as an impact on the higher education system as a whole. Hence, the review of project activities, as well as the evaluation of impact and sustainability, has been addressed from a broad perspective based on the assumption that these projects had an effect not only on the students and academic and non-academic staff directly involved, but on the entire higher education institution, and potentially the higher education system, as a whole.

Additionally, this evaluation had a focus on Master programmes which are specific as they operate between two other levels in higher education. On the one hand, this means that the entry levels to the Master programmes need to correspond to the learning outcomes of the existing Bachelor programmes. On the other hand, the Master...
programmes need to provide a solid foundation in research for those students who wish to continue their studies at PhD level, while at the same time providing competencies needed for the employability of their graduates. Therefore, all of the abovementioned specifics were taken into consideration.

Furthermore, developing a Master¹ programme in engineering and environmental sciences assumes that the appropriate equipment and learning environment are ensured at the institution where the programme is conducted.

In this context, the study specifically evaluated: (1) **impact of the 15 selected projects**, understood as direct or indirect, intended or unintended, short-term and long-term effects, and (2) **sustainability of the project results** understood as ‘results and its effects’ after EU funding has stopped. In other words, the study evaluated whether the projects’ impacts have successfully continued after the EU funding ceased.

For these purposes, a comprehensive methodology was developed, based on three research principles: **validity of data**, collected by means of triangulation; **highly participative approach**, achieved through the careful selection of participants from amongst a range of relevant stakeholders, graduates and current students interviewed during the site visits; and finally, **comparability of country data collection**, accomplished by development of clear procedures for data collection at all stages (i.e. desk research, surveys, site visits and interviews) which were then used across the countries in question, both for desk and field research.

The applied methodology is both quantitative and qualitative, with desk research, questionnaires, interviews, and case studies included in this study.

The primary aim of the **desk research** was to conduct a review of the curriculum development activities in the selected Tempus IV projects, with the goal of developing a set of quantitative and qualitative indicators for the evaluation of the impact and sustainability of relevant projects.

The desk research has been conducted through thematic document analysis of primary and secondary sources. Primary sources included the project applications, the projects’ logical framework matrix, the project budgets, the project reports, and the project reviews. The analysis of the primary sources has been complemented by the available data from the secondary sources (e.g. the previously published evaluations of the Tempus programmes which were relevant to this study).

In order to secure consistent and comparable document analysis, it was structured around the themes identified for the evaluation of the projects, while leaving enough flexibility to identify additional thematic areas for analysis stemming directly from the documents.

Based on the desk research, a set of quantitative and qualitative indicators for the evaluation of the impact and sustainability of the projects was developed. The quantitative and qualitative indicators responded to the research questions and thematic areas, but were broadened with additional indicators stemming from desk research. Having in mind the set of indicators developed during desk research, a written **questionnaire** for collecting data from academic institutions involved in the selected projects was designed and distributed to 69 academic institutions in the seven countries under study. Upon the collection of 35 completed questionnaires, the data was collated.

¹ In many cases in the analysed countries the aim of the older TEMPUS projects was to develop not Master programmes under the Bologna process terms, but rather to develop so-called specialist one year programmes or two year programmes called magistratura according to the old system of studies. This is due to the late changes in national curriculum standards.
systematically, enabling comparisons and identification of commonalities between projects and countries.

Even though the sample was adequate for drawing up general conclusions, it should be underlined that comprehensive questionnaires, as this one, seem not to be the most appropriate survey instrument, especially in situations where the time span between completion of the project and its evaluation is more than five years, and the possibility that the staff involved has been replaced is high. Another methodological obstacle is related to the language barrier. Translation of the questionnaire from English into Russian increased the response rate (out of 38 questionnaires, 21 were filled out in Russian).

According to the desk research findings and the analysis of the data collected through the questionnaire-based survey, an initial list of recurrent obstacles and shortcomings in the design and implementation of relevant projects was drafted, along with an initial list of good practice examples. These were used in preparation for the design of the interview guides.

**As for the interviews**, two groups of interviewees were involved.

**Fourteen coordinators**, apart from one coordinator from Russia, were from EU countries. They were contacted for a Skype or telephone interview. Representatives of the coordinating institutions were very responsive, and the ten of them who responded provided very useful and, for the purposes of the evaluation, relevant information.

**Interviews with representatives from the partner universities in Eastern Europe** were conducted during site visits, with a total of four site visits to four different Eastern European countries. The primary criteria for the selection of countries eligible to make a site visit were the number of participating institutions in the fifteen pre-selected projects, and the number of projects in which a country had participated. The Eastern European countries chosen for site visits were Russia (Moscow and St. Petersburg), Ukraine (Kiev), Belarus (Minsk) and Georgia (Tbilisi). Representatives from participating institutions in Armenia, Azerbaijan and Moldova were interviewed by telephone to follow up on the questionnaires received from these institutions.

Structured interviews were implemented in accordance with key themes identified for evaluation. Special effort was made in order to distinguish and explore different levels of impact, namely individual, institutional, national, regional and systemic. The interviews were recorded and analysed thematically.

The primary target groups interviewed during the site visits included the individuals directly involved in project implementation; current students and graduates of the developed study programmes; academic, management and administrative staff at the institution where the programme was developed who were not directly involved in the project implementation, and representatives of study programme graduates; representatives of national authorities, in particular the ministries in charge of higher education. The site visits also included interviews with the National Erasmus Offices’ (NEO) representatives.

Collected data enabled triangulation with the data obtained through desk research and survey, hence ensuring that the findings are verifiable. The interviews enabled an in-depth exploration of the projects’ impact and sustainability in the particular socio-economic contexts of the countries in Eastern Europe. Site visits enabled the collection of qualitative data, such as experience and perceptions of those directly and indirectly involved in project implementation, which promoted more effective and relevant exploration and the identification of obstacles, shortcomings, and good practices in the project implementation.
The final phase is comprised of the synthesis and integration of quantitative and qualitative data collected throughout different phases of the research.

The synthesis and integration were primarily based on the systematic comparison of country and project based findings with the aim of identifying commonalities that would lead to the identification of key achievements and enable recommendation-oriented generalisation.
2. Impact of the projects

This section contains the evaluation of the impact of the selected fifteen projects in seven Eastern European countries, and the evaluation of the sustainability of the projects’ results.

The data provided by participating institutions and individuals is presented in the form of general conclusions at different levels: institutional, individual, national, and regional. Also, whenever possible, the conclusions are supported by case studies which present good practice examples.

This section finishes with considerations related to the sustainability of the projects and exploitation of the project outputs and outcomes.

It should be underlined that the study refers only to the impact of the projects related to curriculum development in the field of Engineering and Environmental Sciences in general, and that this chapter covers only the positive developments, whilst challenges and constraints are addressed in Chapter 3.

2.1. Impact at institutional level

This subsection focuses on the impact at institutional level and the analysis is related to the impact of the curriculum reform (identifying if new/updated curricula are developed in accordance with Bologna requirements; if implementation of new/updated curricula is followed by changes in the teaching process and student evaluation; if representatives of the business sector were involved in curricula development and implementation).

Student enrolment in new and updated study programmes is dealt with separately since it can be perceived as an indication of sustainability of the projects.

Since equipment supply was part of the projects, the impact of the purchased equipment on the production of teaching and learning materials, networking, and modernisation of the teaching process is also assessed.

Bearing in mind the traditional university management in the respective Eastern European countries, it was to be expected (even though not directly addressed by TEMPUS projects) that exposure to international practices would trigger a certain level of changes in this area. Therefore, the impact of this area has also been analysed.

Also, this section serves to identify to what extent the project contributed to the development and improvement of cooperation between the academic and non-academic sector.

2.1.1. Curriculum reform

2.1.1.1. Participation in TEMPUS programme as driver of curriculum modernisation

The TEMPUS programme was one of the drivers of the higher education curriculum modernisation at the universities in the Eastern European countries analysed. This is confirmed by the fact that more than a third of university representatives underlined that the project was important to their institution to the full extent; while half of the respondents answered that the project was important to a large extent.

Prior to TEMPUS projects, academic staff from the participating Eastern European countries were not in a position to cooperate with their colleagues from the region to
develop new or modernise existing study programmes/courses. The projects hence seemed to be a useful channel for the establishment of such cooperation, as well as an opportunity to work on the very much needed modernisation of the study offer.

It should be underlined that in the former USSR, environmental protection was understood as a set of engineering measures; the interests and expertise of stakeholder groups were often ignored. This attitude also drove the development of environmental sciences and professional training. Before TEMPUS projects, the implementation issues of environmental policy were still considered to be unimportant in many universities, but this significantly changed after the exposure to international experience and the cooperation with EU partners during the participation of Eastern European universities in TEMPUS projects.

However, the impact of modernisation of curriculum in the field of engineering and environmental science depends largely on the size of the country and the involvement of the ministries in charge of higher education.

2.1.1.2. Curriculum development/updating process and its results

More than half of the respondents shared the opinion that the curricula development process was very successful, as was the cooperation among partners during curricula development/updating, while there were no respondents perceiving this process as unsuccessful. In the vast majority of the cases, requirements for graduates' competencies were formulated by both national and international professional organisations dealing with the accreditation of programmes, and with the recognition of professional qualifications.

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**Project: Curricula Reformation and Harmonisation in the field of Biomedical Engineering (No. 144537-TEMPUS-2008-GR-JPCR)**

This project involved 23 universities and academic institutions among which were Georgian Technical University (Georgia), Orbeli Institute of Physiology (Armenia) and Khazar University (Azerbaijan) from Eastern Europe.

The project illustrates the modernisation of the curricula in the Engineering domain. In particular, it has contributed to the improvement of higher education in the field of Biomedical Engineering through the reformation and the harmonisation of the existing Biomedical Engineering programmes or the development and establishment of new ones, addressing new emerging interdisciplinary domains that appear as a result of the Research & Development progress and respond to the Biomedical Engineering job market demands.

The first step in curriculum development and updating was to review the existing educational programmes in Biomedical Engineering in Europe and the respective Eastern Europe countries through collection of information, preparation of reports and documents, discussions and approval in meetings between the participating institutions. For the purposes of the project, 50 countries in Europe and the neighbouring area, which are offering study programmes in this field were identified and reviewed.

Also, a study was carried out on the situation and recent developments in the medical device industry, and the future trends in the medical device market.

The second step was the preparation of the generic programmes on graduate and postgraduate education in Biomedical Engineering, based on the findings of the aforementioned review and study. The new programmes focus on the present and
forecasted need for competencies and skills of biomedical engineers, based on job requirements. Additionally, an analysis of the relationships between competence, learning outcomes, and credits has been performed in order to propose the most efficient ways to reach the goals.

The updated programmes contain a basic core of topics and elective courses with special attention paid to the implementation of student-centred programmes. The contents and duration of each of the developed/updated Biomedical Engineering programmes was precisely analysed, as well as the different methods of student instruction and teaching.

The updated generic programmes are fully compatible with the ECTS system.

This, in turn, supported the creation of Master programmes in accordance with the needs of all parties involved. One of the benefits of such an approach was the identification of the shortcomings by stakeholders, so that new/updated programmes could serve as a bridge between students’ core academic orientation and the practical implementation of knowledge and skills gained.

At the same time, the assessment of the newly developed and updated Master’s programmes often involved various other groups of stakeholders, such as teaching staff from different departments, representatives of scientific communities, students, European partners, and national experts.

As a result of the joint efforts of all project partners, new and updated Master programmes in the respective Eastern European countries become increasingly more flexible (e.g. curriculum is developed in such manner that it allows flexible modes of participation from students, location and pace of study, timing of assessments, and technologies used to participate). These programmes also became more open to adjustment based on the shortcomings identified (e.g. established practice of curriculum development and updating now allows flexible institutional processes of curriculum development, updating, review and validation, so that the study programme/course offerings can be kept up to date and responsive to the needs of stakeholders).

Furthermore, even though the process of curricula development/updating was challenging in itself for most participating universities, the new/updated courses/programmes are mainly developed according to respondents in substantial compliance with Bologna requirements (in 85% of the cases), with specific reference to ECTS, three-cycle system and focusing on the definition of learning outcomes, competence oriented curricula, preparing for independent life-long learning, and continual professional development. In such cases, more attention is given to arrangements related to international recognition of the curriculum through the development of certification criteria, quality assurance, academic mobility, and convergence with EU higher education policies.

In other cases, curricula are developed and updated in accordance with national accreditation rules and national common practice, but significant impact is visible through the fact that the majority of the developed and updated curricula are based on defined competencies, or in some cases on learning outcome approach.

Also, most of the curricula are modularised, but although national recognition of the developed and updated Master programmes took place in all cases, very few of the newly established study programmes are rewarded with international accreditation certificates.

Within the project Master programme "Ecological Management in the Volga-Caspian region", an adaptation to the European Standard was developed. The newly developed programme is structured according to the three-cycle system, the application of ECTS, defined general and specific competencies, and has a modular structure. The license of the Ministry of Science and Education of the Russian Federation has been obtained and the diploma is nationally recognised. The Master Programme is introduced, while regular study programmes are offered in technical universities of Samara, Saratov, Volgograd, Astrakhan, and Kazan.

This programme covers the problems of air quality, solid waste and waste water control, and treatment technologies in multidisciplinary approach. It provides students with multidisciplinary education between management, ecological, and engineering issues necessary to work in the industry of waste management. The programme is created on the base of the Master programme "WASTE (Air Quality Control, Solid Waste and Waste Water Process Engineering) of Stuttgart University as well as the other EU universities involved in the project consortium.

The newly developed Master programme consists of five modules: Module 1. Environmental science (14 credits), Module 2. Economic analysis and environmental management (14 credits), Module 3. Information Technology in Environmental Management (11 credits), Module 4. Environmental pollution and quality control (11 credits), and Module 5. Technologies and methods of environmental protection (16 credits). This Master programme also includes the course “English language for professional communication” (4 credits), Research Project (14 credits), Practical Training (6 credits) and Master Thesis (30 credits).

Joint, double and multiple diplomas/degrees are rather an exception in the analysed region. It seems that negotiations for the introduction and recognition of double degree procedures between universities in Eastern European countries and EU universities have been initiated, constituting part of an on-going sustainability strategy. Nevertheless, despite positive attitudes towards joint, double, and multiple diplomas/degrees among universities, there are external aggravating factors preventing the establishment of such cooperation.

It should be noted that participation in projects resulted in higher numbers of modules implemented as distance and e-learning resources. These types of programmes are often identified as something brought by TEMPUS projects, or as a practice adopted from previous TEMPUS projects. Additionally, in some of the participating institutions, courses of the new Master programmes are conducted as open classrooms for undergraduates.

2.1.1.3. Exchange of experiences and establishment of research training networks

According to the majority of respondents and interviewees, the opportunity for the direct exchange of experience with EU partners in curricula development and modernisation increased their understanding of curricula development processes, since the representatives of Eastern European countries had insight into the practical examples of outcome-based curricula from EU countries. It also supported the alignment of modernised study programmes with European standards.

Before the projects, the participation of Eastern European universities within international academic and research communities was generally weak. Now it seems that networking
has contributed to more substantial curricula changes, since there are plans for further curricula modernisation processes in different study fields. There is also evidence on established research training networks in the field of environmental sciences. In more concrete terms, those networks are established for the two following purposes:

The first purpose was to support inter and intra-project cooperation through opening up possibilities for the development of new collaborative research projects and to provide a framework for the training of researchers who are in the early stages of their research career.

The second purpose was to make newly developed study programmes more visible, as well as courses, parts of which were created as a sort of demonstration for students in the same or similar professional fields.

**Project: Environmental Governance for Environmental Curricula (No. 511390-TEMPUS-1-2010-1-SK-TEMPUS-JPCR)**

Within this project, EU universities had a significant role in transferring expertise (including management and networking expertise), in particular by organising, co-organising and contributing to all project training or networking events (including discussions with employers and the Alumni Conference) and running a series of three summer schools on adaptation and adaptive governance.

EU and Eastern European partners jointly developed and piloted more than ten undergraduate and postgraduate courses. These courses served not only for the purposes of both the transfer of thematic environmental expertise, but also for transferring expertise in curriculum development, teaching methodology, and the organisation of teaching and learning activities.

Teachers and students from universities in Russia, Belarus, and Ukraine (Belarusian State Technological University, Belarus; International A. Sakharov State Environmental University, Belarus; Joint University Of Belarus And Russia, Belarus; Kharkiv State Academy Of Municipal Management, Ukraine; Odessa State Environmental University, Ukraine; Pskov State University, Russia; Siberian Federal University, Russia) also had the opportunity to participate in the courses developed and piloted under the research training network “Governance of Global Environmental Change”. Under this initiative, three summer schools in Pskov (July-August 2011), Lviv (July-August 2012) and Krasnoyarsk (July 2013) were organised, four autumn and spring events in Minsk (November 2011), Kiev (April 2012), Odessa (September 2012) and St.-Petersburg (St.-Petersburg), and nine joint courses developed and piloted.

Also, within this network nine joint courses worth 21 ECTS have been developed by teams of young teachers.

In addition, all the courses developed under this project and all the textbooks, teaching, and learning materials are uploaded on a Moodle-based e-learning platform -http://envgov.osenu.org.ua/course/index.php.

Perspectives of the value of regional cooperation in curriculum development vary to a certain extent. While interviewees in some countries would like to see more cross-regional cooperation in curriculum development (around 30%), other interviewees see more benefit and potential impact on national curriculum development projects if major EU universities in the specific field are involved.
2.1.1.4. Harmonisation with the labour market needs

The basic principles of the curricula development/modernisation within selected projects were in harmonisation with the real needs of the labour market (more than 65% of the respondents underlined that surveys of employers’ needs were used as the basis for the development of new and updated courses and programmes), and learning outcomes/competence-based orientation.

**Project: Improvement of education on environmental management (No. 144746-TEMPUS-2008 RU-JPCR)**

Participating universities in Russia (Saint-Petersburg State University), Belarus (Belarusian State University), Ukraine (Kharkov Karazin National University and Taurida National V. I. Vernadsky University) and Moldova (Moldova State University) took a step forward in the improvement of higher education systems in their countries by modernising curriculum in the area of environmental management and environmentally-safe nature management. To do so, they analysed the labour market and the professional requirements to be met by environmental managers. This study was undertaken by the Ukrainian Scientific and Research Institute of Ecological Problems and "ETB-Technology Trade" Ltd. The results of the study encouraged the consortium members to list precisely the competencies to be targeted by the new Master study programme and, later, to assess the newly developed Master programme in Environmental Management.

In the study development, the Ukrainian Scientific and Research Institute of Ecological Problems and "ETB-Technology Trade" Ltd. implemented three steps/procedures:

1. Firstly, they analysed the requirements of the labour market for skills and competencies expected from a “good” environmental manager, by carrying out a survey amongst concerned enterprises and businesses in Eastern European countries. The requirement analysis performed was transformed into recommendations for the participating universities in charge of the development of the new MSc curricula. The recommendations contained a list of top-priority general and professional competencies required from an environmental manager by a potential employer.

2. In cooperation with experts from all project partners and involved institutions, criteria for peer-review of the new curricula and the constituent courses were developed, after which the peer-review procedure was carried out amongst all Consortium members.

3. Finally, building upon the training received, "ETB-Technology Trade" Ltd, in support of other partner institutions, designed a questionnaire for collecting feedback from the participating university students regarding the new Master programme introduced.

This Master programme “Environmental Management” was formally recognised at national and international level, and fully corresponds to the Bologna requirements.

**Representatives of the economy sector** and related organisations were involved in curricula development/modernisation and close interaction has been initiated. In many cases, interviewees reported that, due to the requirement of TEMPUS projects to consult with employers, they established communication and consultation, which was not a common practice prior to TEMPUS projects (in the vast majority of cases, the economy
sector representatives were involved in the development of new or modernisation of existing courses/programmes). In most cases, curricula were designed, implemented, and revised in order to meet the needs of private companies, public agencies and authorities. Representatives from the business sector were involved in the discussions about the definition of the desired competencies and the professional relevance of new courses or study programmes.

2.1.1.5. Study programmes in foreign languages

The language of instruction of the new Master programmes is most frequently the official country language, although some participating institutions have reported introducing textbooks and other teaching and learning materials in English. There is no evidence that textbooks or other teaching and learning materials are developed in any other language than English or in the official country language(s).

In some of the study programmes, teaching languages are both the official country language and English, with very few institutions reporting to have new Master programmes exclusively in English. However, a **strategy of introducing courses at least partly in English** appears to have been adopted in more and more Eastern European universities. This **had a positive impact on the enrolment of international students, as well as on the employability of domestic students in the international labour market.**

2.1.1.6. Quality assurance

Even though no important changes happened at policy level or in legislation, **significant improvement took place as regards the regulatory framework governing quality assurance at university level**, since most universities developed new (around 50%) or improved existing (around 20%) quality assurance frameworks and systems.
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

Project: Curricula Reformation and Harmonisation in the field of Biomedical Engineering (No. 144537-TEMPUS-2008-GR-JPCR)

Besides its contribution to modernisation and harmonisation of existing Biomedical Engineering programmes to the job market demands, this project contributed to the improvement of the Eastern European universities quality assurance system.

Within the project, a review of the Quality Assurance and Accreditation systems in education in the EU and Eastern European countries was accomplished. For the purposes of this activity, a questionnaire was designed by the responsible working group, proposed and approved by the project consortium. The work has been carried out through the collection of information from the project participants, the preparation of draft reports and documents, as well as discussions and approvals in meetings. The results from the partners’ questionnaires were processed and a report on the current status of the Quality Assurance and Accreditation systems in the education was prepared.

Following the review of the current situation regarding quality assurance and accreditation systems in education, as well as the general discussion between the project partners, the external experts and assigned working groups were able to create a guidance document for the implementation of Quality Assurance systems in Biomedical Engineering programmes. It was distributed to all project partners for corrections, suggestions, and in the end, approved by all partners. Before final establishment, the pilot implementation of the Quality Assurance guidelines was performed in selected Biomedical Engineering programmes in some of the partner institutions.

2.1.2. Teaching and learning process

2.1.2.1. Changes in teaching methodology and its results

One of the aspects that the projects had a significant impact on is the teaching and learning process (almost all respondents report that changes have been introduced to teaching during the project). Project impact is reflected in more frequent application of interactive teaching methods, establishment of group work as a regular part of the teaching process, laboratory work and problem solving exercises. In other words, TEMPUS projects, in the view of the majority of respondents and interviewees, helped align teaching methodology in participating Eastern European universities with the teaching and learning methods used in EU higher education institutions. As a result, the teaching methodology today in the participating departments and faculties of the Eastern European universities comprises a combination of lectures, practical exercises or experiments, case studies, project work, team based learning, modelling field trips, internships, and thesis research.

Respondents note that improvements of the teaching and learning process have been greatly influenced by training seminars of teaching staff, not only in the area of modern teaching methodologies, but also in the area of using ICT in the teaching process. For example, in some cases, demonstration lectures were conducted for teachers aiming to upgrade teachers’ skills in regard to the application of modern technology, and to show how information and communication technologies could be used in the teaching process, in order to promote better understanding of lecture materials. Some of the older teachers started using PowerPoint presentations instead of using only the blackboard during their lectures, after seeing that the practice is used by foreign colleagues.
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

**Project: Improvement of education on environmental management (No. 144746-TEMPUS-2008 RU-JPCR)**

In all participating Eastern European universities (Saint-Petersburg State University, Russia; Belarusian State University, Belarus; Kharkov Karazin National University, Ukraine; Taurida National V. I. Vernadsky University, Ukraine; Moldova State University, Moldova), teachers, thanks to the participation in capacity building activities organised within the project, learned new methods of teaching and learning, and had the opportunity to apply these in practice.

Capacity building activities were organised and implemented in cooperation with EU partners and were composed by training events dedicated to professional knowledge in the field of environmental sciences (e.g. Water management and quality of water, Ecosystem Vulnerability to Climate Change: Methods for Assessment, Observations, and Forecast, Ecosystem, biodiversity, water and land-use management, Adaptation and adaptive governance, Adaptation of Natural and Social-Ecological Systems etc.) and by training events dedicated to the improvement of teaching and learning processes (e.g. teaching and learning techniques and methodology, multi-disciplinary knowledge, developing curricula for inter-disciplinary environmental courses and supervision of interdisciplinary student research papers, computer technologies for education process (how to compile and use computer tests), pedagogical and psychological mastery, etc.).

Participation in capacity building activities influenced the introduction of work on case studies as regular methods of working in classrooms, and role play became much more used as teaching and learning methods than was the case before participation in the project. As a result, effectiveness of lectures and practical classes increased, as evidenced by greater activity in the classroom, and the students' interest in the result, in addition to students becoming more creative in problem solving exercises.

At the same time, teachers introduced into their every-day practice, the application of ICT, which increased the development and application of electronic tests, the quick development of teaching and learning materials, and computer exercises for the practical work of students.

As it has been reported, these innovations in the area of teaching and learning triggered higher students’ interest, as evidenced by greater students’ activity in the classroom. Of equal importance is also finding that applied new methodologies are more powerful in helping students to move away from traditional content reproduction and towards developing competencies as critical thinking, decision making, and problem solving in the areas of their academic and professional interest. Combined with improved skills in independent research and new e-resources usage, these competencies are highly appreciated in the evolving and modern industry sector at international level, and widely supported by the Bologna process.

Nevertheless, the impact is often limited to specific subjects of study programmes or to specific departments within universities which participated in TEMPUS projects. The evidence of the broader institutional impact on teaching is scarce in countries with large higher education systems. However, it is encouraging to note the interview responses which indicate that some of the members of teaching staff, who did not participate in TEMPUS projects due to their lack of English language skills, show increasing interest in project results and in the new pedagogical approaches used by some of their more internationally oriented colleagues.
2.1.2.2. Introduction of distance and e-learning courses

The teaching and learning process has been, at least at participating departments and institutions, transformed in a positive way by introducing distance and e-learning courses, which are more flexible and inclusive, thus making participation possible for students previously unable to enrol in higher education programmes, and opening courses up to the pool of international students. Distance and e-learning resources and courses are often identified as a practice developed and initiated by TEMPUS projects.

2.1.2.3. Changes in students’ assessment and evaluation

Unfortunately, previous conclusions do not apply to the students’ evaluation process: half of the respondents reported on strict students’ evaluation rules prescribed by national legislation. Nevertheless, in a quarter of the cases, more frequent assessment and peer evaluation were introduced. For example, some Eastern European universities reported the introduction of regular feedback sessions with students as part of the internal evaluation process.

2.1.3. Equipment/libraries/laboratories and teaching and learning materials

2.1.3.1. Teaching and learning materials

In most projects, one of the project objectives was to produce teaching materials: textbooks, case study descriptions, in addition to sets of course materials (detailed course descriptions, descriptions of assignments, etc.) and the majority of respondents reported that changes had been introduced to teaching materials during the project. Unfortunately, in many cases, this was only a continuation of the common institutional practice and requirement that each subject within a study programme must have a specific collection of published materials and teaching aids, usually referred to as “scientific and methodological complex”.

In a third of the cases, whole textbooks (e.g. on water governance, forest and land-use governance, municipal environmental governance, energy governance etc.) are developed as well as a number of textbooks covering specific issues, which, in the view of respondents and interviewees, facilitated the teaching process and increased the relevance of the teaching and learning materials.

In the case of interviewed institutions, there was no reported instance of partners translating complete books or research publications from abroad into local languages. Respondents claim that published and updated materials provided up-to-date knowledge on the topics of interest, which can be further be used during students’ academic and professional work. Nevertheless, the present report could not verify this statement, as it would require in-depth content analysis of the materials.

In some cases, developed and updated teaching and learning materials were collected on the e-learning platforms, which enabled easier access to learning sources. The positive sign of the projects’ impact is the fact that, partly due to easier access, teaching and learning materials are widely used by students from different programmes/courses (almost all respondents reported that), as well as new equipment (almost 80%). New software is the only part of the purchased items not widely used by students from different programmes/courses, with half of respondents reporting such software utilisation.
Beside curriculum development, one of the project objectives was the development of a set of textbooks covering multidisciplinary issues of environmental studies. During the project lifetime, four common textbooks on energy, forestry and land use, water, and municipal governance were developed.

The textbooks were developed in close cooperation by participating universities from Eastern Europe (Belarusian State Technological University, Belarus; Central Research Institute For Complex Use Of Water Resources, Belarus; Ecoproject, Belarus; Independent Environmental Chamber Of Krasnoyarsk Kray, Russian Federation; Institute Of Carpathian Ecology, Ukraine; International A. Sakharov State Environmental University, Belarus; Joint University Of Belarus And Russia, Belarus; Kharkiv State Academy Of Municipal Management, Ukraine; Odessa State Environmental University, Ukraine; Pskov State University, Russian Federation; Siberian Federal University, Russian Federation), research institutions and civil society organisation and EU partners.

The Textbook on Energy Governance considers the current state of energy development in the world, including the European Union, Belarus, Ukraine and Russia, the impact of energy on the environment and human health, as well as governance in the energy and urban sectors, sustainable development of these branches of economy, legal framework, participation of various organisations and agencies in energy governance. Particular emphasis is given to climate change mitigation, the impact of hydrocarbon energy on the environment, and the perspective of renewable energy development. The textbook was prepared by an international team from Belarus, Slovakia, Ukraine, and Hungary.

The Textbook on Forest Governance includes a methodology for forest governance (from the perspective of sustainable development), sustainable forestry and its instruments (from the perspective of environmental economics and green forestry), forest ecosystem services, forest as a social-ecological- and economical system, and the governance mechanisms of the Bielavienskaja Forests. The textbook was prepared by Belarusian, Russian and Hungarian partners.

The Textbook on Water Governance is devoted to the issue of balanced and environmentally sound management of water resources. Section 1 of the textbook reveals the institutional, legal, and social aspects of the use and management of water resources, while Section 2 is devoted to the analysis of the technical means and methods for the protection and management of water resources. The textbook was prepared by a regional team representing Ukraine, Belarus, and Russia.

The Textbook on Environmental Governance for Cities, Municipalities and Communities covers environmental governance and governing to sustainability for cities, municipalities and communities; effective public management at local level; accountability of governance in cities and municipalities; contemporary environmental problems in cities and municipalities (incl. topics relating to urban ecosystem, urban biodiversity, climate change and its consequences in urban areas). The textbook was prepared by an international team comprising of partners from Ukraine, Slovakia, Belarus and Czech Republic.

Within the project, teaching materials also included sets of case studies collected during research-intensive summer schools in Lviv-Vorokhta (Ukraine) in 2012 and Krasnoyarsk (Russia) in 2013, where methodological tools of environmental governance for analysing the issues of local sustainability were used in cooperation.
with the Earth System Governance Global Research Alliance). The team of researchers worked on a textbook on case study research and analysis methodology and published it in autumn 2014.

2.1.3.2. General and ICT equipment

In general, the acquisition of modern equipment by universities has contributed to a better quality of the teaching and learning process. The modern equipment, such as laptops, interactive boards or projectors benefitted not only teachers, but primarily students, since the quality of teaching at participating Eastern European universities improved significantly.

ICT equipment also positively influenced the quantity of academic work. According to the questionnaire respondents, equipment purchased during the implementation of projects allowed for quicker preparation of lecture materials, practical exercises, and learning materials for each student. This also demonstrates the benefits of equipment modernisation for teachers in terms of time gains in the preparation of lectures and practical work.

Involvement of ICT in the teaching and learning process has also provided an opportunity for teachers to participate in distance training programmes for professional development, designed according to the recommendations of EU universities that have already experienced Bologna reform of higher education.

Also, modern ICT equipment contributed to the establishment of international offices in respective Eastern European universities, and facilitated the regular organisation of (video) conferences, seminars and other forms of experts’ gatherings. Easier and faster communication through newly introduced modern ICT devices vastly expanded opportunities for staff and students’ network-building and professional exchange with their colleagues.

**Project: Improvement of education on environmental management (No. 144746-TEMPUS-2008 RU-JPCR)**

During the project, five universities in Russia (Saint-Petersburg State University), Belarus (Belarusian State University), Ukraine (Kharkov Karazin National University and Taurida National V. I. Vernadsky University) and Moldova (Moldova State University) were supported in the implementation of modernised curriculum in the area of environmental management and environmentally-safe nature management by supply of general equipment (e.g. computers, video projectors, servers, printers etc.).

General and ICT equipment was purchased and installed in the target universities for two purposes: (1) as office equipment in order to facilitate project management and partners’ communication as well as for organisational and dissemination activities, where access to the internet is particularly important, and (2) as equipment for the teaching and learning process.

Regarding the teaching and learning process, computers and other ICT equipment are established in so-called interactive classrooms and available to academic staff and students. In these classrooms, the equipment is used for development of interactive teaching and learning materials and PowerPoint presentations and further
development of textbooks; for video conferences and distance learning of teachers and students (e.g., for conducting harmonised modern training courses for Eastern Europe and EU universities, aimed at building the students’ academic and professional competencies in the field of environmental management); preparation of Master dissertations; improvement of Internet access for all students and, hence, availability of electronic publications and knowledge databases; use of GIS and GPS technologies in education process; scientific work of academic staff and students.

This equipment was used also to disseminate information about the project implementation and organisation of public events aimed at the establishment of relationships of involved universities with business and academic communities, which is important for the dissemination and sustainability of the project results.

2.1.3.3. Specialised equipment and new software

Through students’ practice on up-to-date equipment in renewed laboratories, simulation of real-life working environment took place and therefore has greatly contributed to the preparation of students for the tasks and challenges to be encountered in their later professional life.

An especially high impact was reported in cases where new software solutions were purchased, as well as video conferencing equipment, compared with the purchase of general equipment like computers or computer labs which have already become obsolete by the time of this study. The funds allocated for the equipment purchase in the TEMPUS project that are divided between many partners often are reported as insufficient to buy more specialised modern equipment.

*Project: Curricula Reformation and Harmonisation in the field of Biomedical Engineering (No. 144537-TEMPUS-2008-GR-JPCR)*

The project aimed at providing generic programmes and guidance documents, based on an in-depth analysis of the existing situation and needs in the field of Biomedical Engineering. In order to meet recent and future developments in the area, laboratory equipment was purchased for the Georgian Technical University, Georgia and Khazar University, Azerbaijan.

At the Georgian Technical University, a new laboratory including 20 educational places, was created and fully equipped with personal computers (20 pcs), notebooks (3 pcs), multimedia projectors (3 pcs), network equipment and specialised hardware and software developing kits (FPGA boards, Xilinx and VHDL).

Khazar University purchased and installed equipment in order to modernise the existing Biomedical Engineering laboratory. Specifically, the purchase included mainly personal computers (6 pcs), notebooks (1 pc), printers (4 pcs), multimedia projectors (1 pc), network equipment and specialised training hardware (Biomedical Measurement System, Basic Communication Lab, Transmitter & Receiver System, Fiber-Optic Transmission Training System, Basic Electricity Circuit Lab, etc.).

The acquired equipment contributed directly to the modernisation and creation of new Biomedical Engineering laboratories in the Partner Countries’ Universities and new laboratories has allowed conducting the educational process according to the curriculum that was updated in compliance with the EU guidelines, allowing both undergraduate and postgraduate students to benefit from a modernised working environment.
2.1.4. Student enrolment

Rules of students’ enrolment in new/updated programmes/courses have not been changed. The recruitment of students and their enrolment is still carried out in accordance with the national procedures, which set the rules, terms, and requirements. Nevertheless, in the majority of cases, the fact that new TEMPUS study programmes and their curricula are developed/updated in accordance with labour market demands positively influenced the attractiveness of developed/updated Master programmes, and overall increased the students’ enrolment rates.

In a small number of cases, the number of students enrolled in new study programmes was less than planned. Such cases were associated with difficulties related to publishing newly developed study programmes, and to the limited number of bachelor level graduates in a relevant discipline. Responsible departments were working on developing plans to ensure that a viable number of students enrol in the programmes in future academic years.

2.1.5. Governance and management

Although there was not a high impact in this area, it should be mentioned that exposure to different international (EU) experience in management and different ways of working through cooperation with EU partners could have a more significant impact in the future, since interviewed university management referred to EU management practices as more efficient and creative. Of course, benefits resulting from the exposure to international experiences may depend on the extent to which Eastern European universities’ management open themselves to foreign practices and the level of “freedom” prescribed in national regulations.

There are, however, some specific changes and novelties regarding this aspect of higher education.

Firstly, as mentioned, offices dealing with international affairs were established at many institutions at which they have not existed before, which prove the relevance and significance of international networking at individual and institutional level amongst universities of Eastern European countries. If such offices already existed within observed Eastern Europe universities, then they were reorganised in order to include units in charge for managing project applications, grants, as well as participation in both local and international projects – among which TEMPUS projects represent a significant majority.

Secondly, organisational units have also been established at some institutions in participating Eastern European countries to facilitate the transition of students from universities to the labour market. This is reported to be a highly efficient method to increase students’ employability.
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe


Russian universities (Astrakhan State Technical University, Russia; Kazan Tupolev Technical State University, Russia; Samara State Technical University, Russia; Saratov State Technical University, Russia; Volgograd State Technical University, Russia) involved in this project succeeded to transfer the educational experience of EU universities in the field of ecology and complex nature management into their universities’ practices and into a two-year multidisciplinary Master Programme "Industrial Ecology," especially developed for the Volgo-Caspian Basin and harmonised with the labour market needs.

All involved Eastern Europe universities were successful in achieving the other important project objective, i.e. the establishment of Centres of professional competencies in the fields of environmental safety. The work of these centres is based on capacity development activities in the field of ecology, environmental management, quality management systems and cooperation with employers, in order to secure that students’ competencies are harmonised with labour market needs, therefore increasing student employability.

An important spin-off of the project is that Astrakhan State Technical University together with the Chamber of Commerce has established with its own funding a "Research and educational Centre of Professional competence," working directly with employers and regional administration on environmental issues. The Centre, also, develops and implements short skill building programmes for employees of enterprises. The Centre is funded by Astrakhan State Technical University and is cooperating with Astrakhan State Technical University Quality Agency. It participates in international quality management system audits, promoting training in quality management systems in the field of vocational education and industry in the region.

Also, within the same project, an international division has been established at Kazan Tupolev Technical State University and is in charge of the development and submission of applications for tenders and grants.

Apart from that, these units often provide programmes for continual vocational development for those who have already integrated the labour market. This has proven to be an excellent mechanism to maintain strong relations between academic institutions and the industry, making it a highly recommendable practice for all Eastern European universities.

Some participating Eastern European universities have set up alumni offices or focal points for alumni relations.

Furthermore, a few institutions have reported performing regular external and internal audits as a part of establishing quality management systems, and a few of the participating universities introduced some other self-evaluation tools such as feedback sessions with students, and filling in anonymous surveys at the end of programmes/courses.
2.1.6. Cooperation with non-academic institutions and organisations

Within the projects, the newly introduced practice of interviewing employers, alumni and students became regular (e.g. interviewing employers on what skills and knowledge they need and will need in the future, what kind of equipment they use; interviewing alumni on the most useful study subjects and contents they learned while studying; asking students about their employment plans, etc.). Today, when developing/updating curricula, most Russian and partner countries’ universities conduct consultations with various institutions and organisations: national, regional, and international, professional societies and associations, government departments etc.

Leaflets related to the benefits of cooperation between universities, employers, alumni and students were produced and disseminated between local enterprises and universities. Such leaflets are still one of the tools for raising awareness. Many universities attribute this practice directly to the philosophy of the TEMPUS programme in curriculum development, and see it as a direct impact of the programme.

In a significant number of universities (85%), non-university representatives (e.g. employers) greatly influenced the theoretical knowledge to be gained by students by being involved in the Master programme design and delivery, and the development of textbooks and other teaching and learning materials. They have also been involved in programme evaluation.

Another important contribution by business/industry representatives was in the area of practical skill building, which included activities like planning and delivering training, and setting up case studies for future professionals. In general, non-university representatives acted as consulting bodies for the development of new study programmes from the point of view of labour market needs.

Defining the learning outcomes according to the needs of the industry and business sector was one of the main activities in introducing the Bologna reform, in which non-university institutions and organisations took part.

One of the cooperation strategies applied was the signing of agreements regarding the provision of internships for students in enterprises, research organisations, and government agencies.

Some universities made agreements with business enterprises on cooperation in the area of research, conducting joint seminars and conferences on topics of common interest. Of importance is also that subjects of Master theses in participating universities are becoming more and more oriented towards issues proposed by the corporate and industry sectors. Applied strategies enabled practical trainings for students in the real-life working environment, and familiarity with current developments and challenges within students’ professional interest, hence further promoting student employability.
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

**Project: Environmental curricula at agricultural universities (No. 159188-TEMPUS-1-2009-1-PL-TEMPUS-JPCR)**

This project aimed at modernisation of curricula at four Partner agricultural Universities in Russian Federation and in Ukraine, namely - Saratov State Agrarian University (Russia), Buryat State Agricultural Academy (Russia), National University of Life and Environmental Sciences of Ukraine (Ukraine) and Lviv National Agrarian University (Ukraine).

During the project, partner universities significantly increased cooperation with institutions and organisations representing the non-academic sector.

Most often, non-academic partners were local agricultural producers as State Saratov Agrochemical Station "Saratovskaya", Scientific and Analytical Centre "Sigma-Eco" in Saratov, Federal Registration Service in Saratov Region, Kiev Territorial Agricultural Center, Yavoriv National Nature Park, Regional Department of Environmental Protection in Lviv, Regional Landscape Park "Znessinya" and Ecological Inspection in Lviv Region.

Joint seminars on subjects of common interest were organised, bilateral agreements on student placement for practical trainings and externships were signed and, in a significant number of cases, the students’ theses were proposed by representatives from the economy sector.

All these activities positively influenced and strengthened the practice-oriented component of student trainings and the adaptation of study programmes towards modern features and needs of the labour market.

As mentioned before, organisational units have been established at many participating universities to facilitate students’ transition from universities to the labour market. At some universities, through the centres for professional advancement and/or similar units, training courses were established for future mentors in enterprises (who supervise students during their internship as well as during employment time). This is reported to be a very efficient way of facilitating the students’ transition from the education world to the labour world.

**Project: Practice-oriented Master Programmes in Engineering in RU, UA and UZ (No. 510920-TEMPUS-1-2010-1-DE-TEMPUS-JPCR)**

At each of the nine universities, an ELM (Engineers in Labour Market) office has been established.

To establish the ELM Offices, and to let them operate, each target university has developed and approved the Regulations governing the operation of the ELM Office (goals, objectives, scope of activities), given a separate room, appointed a responsible contact person and formed a working group (4 persons for each ELM Office). The ELM Offices are under the budgets of these organisations.

ELM Offices cover the following activities: assistance in job placement and adaptation of graduates to work conditions, organisation of professionally-oriented trainings for students at industrial enterprises, marketing research on educational services and labour markets’ development with recommendations for upgrades; needs analysis for graduated engineers and analysis of enterprises feedback on the
quality of knowledge of graduated engineers and possibilities for their career growth; information and advertising; coordination with ELM Offices of the other universities which participated in this project.

The target universities signed a series of agreements with the companies on the organisation of work placements as part of the regular studies and cooperation in research projects. The ELM offices receive orders from small companies (e.g. spin off companies) that are run by the students and university staff, aiming to generate tight links with industry and, specifically, to improve the chances of graduates in the labour market.

Also, the consortium has established a project joint group "Work team of the International ELM Offices Network". This group proposed a business model and a draft activity plan about the future activity. Besides commercialisation activities of the project results, the activity plan provides support for university graduates employed in industrial enterprises or support for the development of small businesses by graduates (spin-off companies). To this end, the target universities have conducted competitions amongst graduates to select the best business idea to start their own businesses. Furthermore, target universities have organised lectures/trainings on employability and legal issues, and have arranged the meetings with the future employers.

2.2. Impact at individual level

This section aims to identify if the impact happened at the level of the different groups of individuals: students, teaching/academic, and administrative staff including assessment of impact of the capacity-building activities (which mainly included conferences, training seminars, study visits, summer schools, and internships of academic staff and students).

Furthermore, the employability of the beneficiary student is considered as part of this subsection, because increased employability is one of the expected projects’ results.

2.2.1. Teaching and administrative staff

2.2.1.1. Impact of the capacity building activities

Activities related to capacity building, supported development/updating of programmes/courses, the implementation of new/updated programmes/courses, the establishment of networks of academics involved in multidisciplinary research and teaching, and the improvement of management at university level contributed to the initiation, establishment or strengthening of cooperation with companies and organisations employing graduates.

In accordance to the aforementioned observation, visits to partner institutions (in EU or Eastern European countries), as a way of capacity building, are one of the most appreciated activities (the majority of respondents see visits to partner institutions as very important, while there were no respondents perceiving such visits as unimportant). These visits are considered by teaching staff as one of the most influential factors influencing their way of teaching.

At some partner institutions, mobility activities proved to be beneficial not only for staff members who had the opportunity to directly take part in the activities, but also to the rest of the university personnel. Upon return from guest universities, activities have been organised for the remaining staff with the aim to further disseminate gained knowledge and skills.
Project: Environmental curricula at agricultural universities (No. 159188-TEMPUS-1-2009-1-PL-TEMPUS-JPCR)

Eastern Europe universities (Saratov State Agrarian University, Russia; Buryat State Agricultural Academy, Russia; National University of Life and Environmental Sciences of Ukraine, Ukraine and Lviv National Agrarian University, Ukraine) staff training was carried out within the institutional capacity-building activities. In order to secure the effectiveness and sustainability of the project results, the selection criteria for training were the direct involvement in project implementation, future potential impact, the capacity to train other people, and language skills.

Part of the training included staff mobility to EU partner universities, combined with work on new course development. Staff members were trained in new advanced study subjects, study programme development according to the Bologna process, and new teaching methods such as presentation techniques and the application of information and communication technologies.

Additionally, members of the management staff from Eastern European universities took part in a mobility scheme and got acquainted with different university management aspects. This resulted in the improvement of the Eastern European universities’ management.

Another form of training applied within the project was a one-week intensive course on “Distance and e-learning methodology” implemented at the National University of Life and Environmental Sciences of Ukraine, in June 2011.

In order to improve the language capacity of staff members, English language courses were also provided as a capacity-building activity.

Results of mobility programmes were, later, presented and discussed at the Eastern European universities’ seminars and during meetings of methodological commissions.

The Eastern European universities recognised the training events as very important and took them into consideration during staff evaluation procedures and staff promotions.

Intensive training of the Eastern European universities’ staff members increased their professional knowledge and skills since they were re-trained on new advanced study subjects and new teaching methods, like presentation techniques and application of ICT. It directly upgraded their individual teaching capacities and behaviour and, at the same time, resulted in the improvement of teaching methodology and in the enrichment of course content.

All of the above-described activities brought benefits for three main target groups: teachers, students, and university managers.

2.2.1.2. Exposure to good EU practice and its results

In the views of the majority of respondents and interviewees, exposure to good EU practice contributed to a deeper understanding of the innovations in the fields of engineering and environmental sciences and had an impact on their performance.
During networking and international exchange activities, teachers had the opportunity to see how various teaching methods (e.g. problem solving through project work, case studies etc.) could be implemented in their teaching practices as a supplement to the traditional lecturing. In particular, group work assignments based on students’ teamwork were reported as a novelty in some study programmes.

Teachers were introduced to the new curricula elements and advanced study subjects in addition to being acquainted with contemporary scientific research in their respective fields. It provided them with the opportunity to stay up-to-date with scientific and technological achievements, to expand and modernise their theoretical (know-what) knowledge. In most cases, teachers reported that they exchanged their teaching materials, however, in some cases they have not incorporated any foreign literature into the list of required reading, using mostly national sources and justifying it by the poor foreign language skills of students.

In addition, they were often trained in the use of modern software applications. In other words, for teachers, those visits produced opportunities for continuing professional development through updating not just know-what, but also their know-how knowledge, enabling them to contribute to the scientific advancements in their area of interest, on top of their teaching accomplishments.

Through different training events, staff members from the participating universities also gained knowledge on curricula development, curricula quality standards, and quality assurance mechanisms, as well as assessment methods aligned with the Bologna process. This proved to be a capacity-building activity of huge importance, given that a significant proportion of participating institutions reported to have been struggling with a deeper understanding of core Bologna concepts (such as the credit transfer system, learning outcomes oriented curricula etc.) and, hence, with their practical implications and implementation.

2.2.1.3. Impact on non-academic/administrative staff

Apart from the teaching staff, non-academic/administrative staff also had the opportunity to improve their capacities through participation in project activities which required exposure to international experiences and practices, as well as to acquire new skills needed for successful project administration and financial management. In other words, as a result of participation in projects, which produced in many cases opportunities to learn about organisational and administrative principles in EU institutions, non-academic/administrative staff increased their capacities in the field of organisational and financial management in accordance with EU rules.

Since new equipment and teaching materials procurement was part of all projects, non-academic/administrative staff reported that their capacities in this area increased significantly.

2.2.1.4. Cooperation and its results

TEMPUS projects contributed to the cooperation and coordination at institutional level. As a result of working together during project implementation, a higher level of joint responsibility for the achievement of results among academic and non-academic staff members has been reached.

Activities implemented within TEMPUS projects also seemed to be very important in triggering and improving cooperation and staff networking at national, regional, and international level. Joint academic research work and agreements on annual staff exchange are of the uttermost importance for continuing staff network-building, and all are direct consequence of joint TEMPUS participation.
As a result of cooperation, **additional impact was reported in the field of internationalisation of research**. After the project, many teachers have maintained contact with some of their colleagues that they met during TEMPUS projects and visits to other universities (EU and Eastern European countries). They established personal links, which often led to joint articles and publications, co-supervision of doctoral students, and invitations to conferences.

What should also be mentioned is the fact that international cooperation within the TEMPUS programme in many cases forced staff members to **improve their English language skills**, which were reported to be unsatisfactory in some Eastern European institutions, and which are a basic condition for any future collaboration. Also, in some countries, the interviews report that professors belonging to the “old school” started learning English and became increasingly interested in ERASMUS+ activities upon seeing the experience of their younger and more engaged colleagues.

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**Project: Chemical Engineering: Curriculum Development and International Recognition (No. 144935-TEMPUS-1-2008-1-UK-TEMPUS-JPCR)**

As there was little need to retrain Russian and Kazakhstani teachers in the core subjects of chemical engineering, special attention was paid to their exposure to international experience in the field of modern methodologies of teaching, the use of European criteria for quality control and assurance, the ECTS and the development of 3-cycle system of higher education etc. Thus the subjects covered by the training/capacity building events included for instance: methodology of transition of the educational systems to the 2nd and 3rd cycle educational structures; inclusion of ECTS; development of curricula based on Learning Outcomes; development of laboratory activities within the curricula; international recognition of educational programmes; modern methods of training based on active reception of knowledge, such as Project Management and Team-based learning; development of creativity, critical thinking and experimental investigation; and quality assessment procedures.

Special training was organised for the staff members responsible for the organisation of the laboratory work of students and maintenance of the laboratory equipment purchased under the project, and installed in the target universities.

For the purposes of development of new curricula, working group meetings were regularly conducted. These meetings took place in Novosibirsk, Moscow, London, and Brighton. They were attended by leading teachers from the partner universities (responsible for elaboration of conceptual ideas of new curriculum) and managers (responsible for project management) with the following objectives: to exchange experience in the field of education in the sphere of chemical engineering between European and Eastern European partner universities; to analyse proposals concerning the adaptation of the experience of the European partners into the educational systems of Russia and Kazakhstan; to assess the developed methodological approaches and courses of the programme; to discuss solutions for current issues related to the introduction of the new developed programme in the existing educational systems of Russia and Kazakhstan, including interaction with governmental authorities and ministries.

A number of working meetings held at the European partner universities allowed Russian and Kazakh teachers to study original methodological materials, inspect the library resources, and take part in courses from the 1st and 2nd level degree programmes.
2.2.2. Students

2.2.2.1. Employability

Even though there is no systemic way of tracing students’ employability, nor the permanent establishment of graduate tracing studies, more than 80% of respondents report that they occasionally contact graduates to follow up on whether they had found jobs. Also, the limited available indirect information from alumni, and more generally used information collected from companies employing students, support the claim that the employability of graduates has increased compared with graduates from an older type of degrees. Employment prospects are very high in the case of programmes developed directly to answer the burning need of the private sector in the analysed countries. Additionally, small sample studies conducted by some of the universities indicated that the graduates of modernised programmes have higher employability ratios in comparison to other technological Master degrees.

Project: Environmental Governance for Environmental Curricula (No. 511390-TEMPUS-1-2010-1-SK-TEMPUS-JPCR)

The participating universities in Russia, Belarus, and Ukraine noted that environmental practitioners and educators do not cooperate and that such situations affect the quality of training and employability of graduates. Bearing that in mind, during the project, the consortium paid attention to the employability of the graduates by modernisation of the study programmes/courses with the aim of providing students with new (labour market needed) qualification and by enhancing cooperation with employers.

Activities related to the improvement of student employability successfully addressed during the project included:

- In Belarus, universities annually distributed questionnaires on knowledge and skills needs to employers, analysed the results in order to keep the study programmes/courses up-to-date, and organised regular meetings and seminars with employers in order to increase students’ employability.

- In Ukraine, the National University of Urban Economy in Kharkiv created an agreement with Kharkiv City Administration for the practical placement of students involved in training in Environmental governance courses and concluded agreements with enterprises related to future student employment. Also, Odessa State Environmental University established similar arrangements with research institutions, agricultural production organisations and regional centres on Hydrometeorology and Environmental Science.

- In Russia, Pskov State University secured student work practice within potential employer organisations and institutions and included some topics in their study programmes/courses as requested by employers (e.g. Water governance, Environmental risk assessment, International cooperation in nature resource management, Wetlands managements).

2.2.2.2. Skills improvement

Computer rooms, multimedia presentations, electronic tests, computer exercises, and simulations are often identified as factors which contribute to the students’ skill-building activities, and they have significantly contributed to the development of the students’ academic and professional competences.
In addition, during the projects, the staff of participating Eastern European universities who were trained intensively on new teaching methods (presentation techniques and use of ICT in education) reported that such an approach in the teaching process improved the students’ technology literacy, information literacy, and skills necessary for the 21st century’s workplace.

It should also be noted that projects in some cases enhanced the entrepreneurship skills of the new graduates, as a certain number of graduates went on to start their own business after the completion of their studies.

2.2.2.3. Impact of mobility activities

Mobility activities within the projects were important impact drivers and there is a wide consensus among respondents and interviewees concerning their impact. The summer schools, training and networking events for teachers, administrative staff, and students, in addition to engaging them in international networks, in general increased their capacities to perform assigned project tasks. More importantly, all implemented mobility streams directly contributed to a higher level of quality in teaching and studying, and to the increase of intercultural competences of teachers and students.

Specifically, during their mobility activities, students made site visits to various campuses, scientific research centres, and laboratories and were introduced to contemporary developments in the field of their professional interest. Additionally, students became familiar with non-traditional and more efficient ways of gaining professional knowledge and skills, as by participating in group projects and doing practical assignments in groups instead of individually.

Project: Curricula Reformation and Harmonisation in the field of Biomedical Engineering (No. 144537-TEMPUS-2008-GR-JPCR)

The organised student mobility within this project greatly helped to exchange experience and to widen the knowledge in the biomedical engineering field.

Students from the participating Eastern European universities had the opportunity to perform capacity building and training activities during the third project year. All mobility arrangements were organised by signing bilateral agreements between the participating universities. The students, after their expression of interest, were evaluated by hosting universities and were selected based on their research interests, grades, CV, motivation, and information provided during the personal interview. After the selection, nine students from participating Eastern European universities were trained at universities in EU countries for a period of up to three months. Specifically, the student mobility schemes were the following:

- 1 MSc student from GTU - Georgia stayed 3 months at UP Greece
- 1 MSc student from SEUA - Armenia stayed 1,5 months at UNIBO - Italy
- 1 MSc student from SEUA - Armenia stayed 1,5 months at TUV - Bulgaria
- 1 MSc student from SEUA - Armenia stayed 1,5 months at WPUT - Poland
- 1 MSc student from KZU - Azerbaijan stayed 1 month at OU – Finland
- 2 MSc students from UNIZG - Croatia stayed 3 months in total at UNILJ – Slovenia
- 1 MSc student from ETF - Serbia stayed 2 months at UNIBO - Italy
- 1 PhD student from ETF - Serbia stayed 1 month at UNILJ – Slovenia

After completion of the mobility activities, the students assessed their stay at the host institution by the preparation of individual activities’ reports in which they expressed satisfaction with all aspects of capacity building/training and all of
them made strong connections with the research teams in biomedical engineering from the hosting universities, making plans for future collaboration and publications of the their project results.

All students who attended capacity-building/training activities abroad received certificates and ECTS from their host universities, and were able to transfer them to their home university, while all results of the mobility activities were distributed through the project dissemination and promotion activities.

The novelty of group work and project work as a teaching and learning method was especially emphasised by many interviewed students. Also, the Bologna principles and practices were intensively promoted during the students’ study visits. All of the above-mentioned practices, in the majority of cases, contributed to the change of students’ views of the higher education process towards more flexible, more participative and more practice-oriented approaches in accordance with the Bologna reform.

Despite the positive general conclusion about the impact of mobility streams on students, many interviewees noted that the impact of these visits within the programmes is somewhat limited in scope and extent, due to the relatively short duration of student mobility abroad and due to the lack of language competencies. Summer schools and longer period of studies abroad are often praised as one of the more effective and most beneficial mobility forms for students.

2.2.2.4. Impact on other students

Apart from the immediate beneficiary students, these projects have impacted also students from other courses/programmes, since the newest literature and equipment were available to them too.

At the same time, the situation is somewhat different when it comes to the use of new software. Indeed, the majority of respondents reported that purchased software was not available to students from other programmes/courses.

2.3. Impact at national level

The harmonisation of developed/updated curricula with the Bologna requirements and the accreditation of newly developed study programmes bring important changes if the processes are recognised by national authorities. Therefore impact at national level is being considered within this chapter.

It is also presumed that all those changes at institutional level could trigger changes of higher education systems in the direction of implementation of the Bologna reform, or, at least some changes within the higher education system connected to the accreditation of study programmes, introduction of ECTS as well as legislation changes related to the recognition of qualifications obtained through joint/double degrees.

The impact at national level is perceived by interviewees as indirect and visible in a few cases:

First, in a third of the cases, TEMPUS projects in curriculum reform played a role of “pioneer efforts” in the process of changing national curriculum standards in some areas, and sometimes led to the extension of the list of degrees by the introduction of new interdisciplinary study programmes.

Second, the model of curricula development for the Master level of education in the analysed Eastern European universities was reported to have been adopted by some
other state universities. This is another way of spreading Bologna principles and practices nationwide.

Third, training seminars dedicated to representatives of national authorities, when organised within projects, led to a deeper understanding of Bologna principles and increased openness to European policies in higher education. Also, in that way, the visibility of project activities and understanding of the projects’ outcomes is secured and more firmly established within the higher education system.

Project: Environmental curricula at agricultural universities (No. 159188-TEMPUS-1-2009-1-PL-TEMPUS-JPCR)

Within the project framework partner universities (Saratov State Agrarian University, Russia; Buryat State Agricultural Academy, Russia; National University of Life and Environmental Sciences of Ukraine, Ukraine and Lviv National Agrarian University, Ukraine) intensively collaborate with the authorities of their respective countries on the creation of new laws and regulations.

For example, Buryat State Agricultural Academy cooperated with the Ministry of Natural Resources of the Republic of Buryatia on the modernisation of the Law on Waste Management: “On the improvement of the regional regulation in the area of production wastes management and recycling” and “On the production of ecologically safe products” and the National University of Life and Environmental Sciences of Ukraine evaluated several methodical and legislative projects for the Ministry of Agrarian Policy of Ukraine, and the Ministry of Ecology and Natural Resources.

At the same time, the project had substantial impact on the ongoing reform of higher education in the Russian Federation and in Ukraine, both at institutional level, by leading to introduction of a modern education system consistent with the European higher education reform, and at national level, because the dissemination of project results and experiences promotes the implementation of the Bologna process.

Active participation of partner universities’ representatives in the works of the National Teaching-Methodological Association on Agrarian Education in the Russian Federation and the Standing Commission for Environmental Education in Ukraine resulted in modernisation changes in the legal and regulatory framework of higher education systems.

This project’s results are also important for the contemporary economic and environmental state of the Russian Federation and Ukraine, as it closely matches their needs in the area of ecological education, environmental protection, and safe and effective use of natural resources.

2.4. Sustainability

Several years after the projects’ completion, 75% of respondents were very satisfied with the overall sustainability of project results, while 25% were satisfied.

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For example, the training seminars for representatives of the ministries in charge of higher education, representatives of the accreditation commission etc. on EU practice in curriculum development or principles of Bologna reform.
Curriculum development/modernisation, in most of the cases, is based on local expertise (although supported by advice, literature, training courses and visits arranged by EU partners) which is a presumption for long-lasting sustainability.

**Capacity-building activities indirectly help sustainability** since the strengthening of capacities of the involved Eastern European universities’ representatives in curriculum development ensured they are able to respond to the future updating and development of the curricula. Nevertheless, as the sustainability of capacity-building efforts largely depends on the efforts invested in the dissemination of knowledge and experience to the colleagues who did not participate directly in project activities, the institutions developed various knowledge dissemination strategies which vary in success and impact.

The main indicator of sustainability is whether the programmes/courses developed/updated under Tempus are still under operation after several years.

It is good to see that almost 90% of the participating universities still enrol students in those programmes. In more than half of these, the number of enrolled students is stable from year to year, while in the minority of the cases, the number of students is not as planned by enrolment plans.

Nevertheless, there is also evidence that in a small number of cases student interest exceeds the number of students planned to be enrolled in the new and updated programmes and courses. The remaining 10% of the cases, in which it is reported that the developed/updated programmes/courses are not under operation anymore, are justified by the insufficient number of students who graduate in the relevant bachelor programmes leading to the Master programmes developed within TEMPUS programmes. Another reported reason is students’ insecurity about diplomas obtained within newly developed study programmes and concerns that they will not be recognised by employers.

**Contacts with the relevant industry sectors and related organisations are maintained after the end of the projects** - the universities reported that in more than 70% of cases, industry/employer representatives are still involved in curricula development and updating from a full to moderate extent.

Another sustainability indicator is the fact that the majority of the partners continue their initial partnership through bilateral agreements and within the framework of new projects. A significant number of cooperation agreements (for example, on joint educational and research projects or in the field of student and staff mobility) is agreed upon, and a number of institutions continued with internship practice. Thematic networks are, as reported, continuingly expanding, involving more and more key stakeholders and academic institutions, both at national, regional, and EU level.

Sustainability is also indicated by the fact that participating Eastern European universities and other academic institutions not directly involved in the respective TEMPUS projects, expressed their intention to expand curriculum development activities on their own, using guidelines developed during the TEMPUS projects lifetime.

Furthermore, representatives from other state universities are interested in the introduction of developed/updated Master programmes at their institutions. Also, there are intentions to implement different mechanisms and tools developed during TEMPUS in other fields and disciplines, as well as an expressed need for the development of corresponding PhD programmes (which is already planned in some of the partner countries’ universities).
Fairly ambitious ideas were also proposed, namely to apply learned course development skills in order to create additional educational programmes for students from preschool through university levels in the field of engineering and environmental science.

**Project: Chemical Engineering: Curriculum Development and International Recognition (No. 144935-TEMPUS-1-2008-1-UK-TEMPUS-JPCR)**

Since one of the main project objectives was to develop a modernised three-cycle curriculum in Chemical Engineering based on the best European practices, and ensuring adequacy of academic content to the requirements of student and employer communities, there were two aspects to the sustainability represented by this project.

The first was the development and introduction of modern chemical engineering degree programmes, internationally comparable to similar programmes delivered at the top universities around the world and established in such a manner as to be sustainable for decades to come. This was achieved through a combination of expert-driven curriculum design supported by high-level governance and quality assurance, and not of lesser importance, the setting of national standards and the transition to the 3-cycle system of higher education.

The second was the sustainable development of Russia and Kazakhstan, and the surrounding regions, where chemical engineering plays a central role in the sustainable use of natural resources, the provision of clean potable water, healthcare products, and the remediation of polluted environments.

The project partners (Berlin Technical University, Germany; Institute for Chemical Technologies (ICT), Czech Republic; Institution of Chemical Engineers, United Kingdom; Kazakh National State University, Kazakhstan; L. N. Gumilyov Eurasian National University, Kazakhstan; Moscow State University of Engineering Ecology, Russia; Novosibirsk State Technical University, Russia; Russian Association for Engineering Education (RAEE), Russia; Siberian Technological Association, Russia; Sochi State University Of Recreation And Tourism, Russia; University of Brighton, United Kingdom; University of L'Aquila, Italia) have taken steps to ensure that both aspects of sustainability are being addressed in the project:

- The curricula were developed, with new laboratories established and teaching materials prepared. New study programmes/courses are today included in the list of regular teaching programmes of Chemical Engineering departments.
- The project partners advised both the Russian and Kazakhstani education ministries as to the nature of any new national standards in chemical engineering education and provided ministers with updates on the project’s progress.
- The system of credit units maintained because it met requirements of the Bologna process, the realisation of which is the basis of recent governmental decisions.
- Teacher training activities were successfully done, complementing other activities that took place in the target partner institutions to prepare staff for the transition to a national 3-cycle education system.
- Activities related to the establishment and maintenance of cooperation with employers took place through signing different agreements (e.g. agreements on students’ internships; agreements on consultations during curriculum development process etc.) which are still valid.
- The laboratory units established within the project today are fully funded by the respective universities.
- Promotional activities related to the attraction of students to enrol modernised study programmes are still ongoing.
Apart from sporadic dissemination activities aiming to promote the projects’ outcomes, other activities of that kind are lasting longer, and they are particularly beneficial for the project’s sustainability. Those activities include the creation and maintenance of websites in both the local and English languages, as well as setting up regular annual seminars and conferences.
3. Challenges and constraints in the implementation of the projects

From the previous chapters, it is clear that the impact and benefits of the projects are great, but there are some elements of the projects which were challenging for all or some of the stakeholders as well as constraints that prevent the full impact of the implemented activities. The following subchapters are addressing the main challenges and constraints, which should not be considered separately from the previously described impacts, but could indicate directions and aspects in which future project planning and related activities are to be improved.

3.1. System and curricular differences

The great diversity in curricula, higher education organisation and governance, teaching methods and students’ evaluation, as well as certain cultural differences between the educational systems in Eastern European Countries and the EU proved to be important obstacles for the smooth and effective implementation of the projects.

At the same time, some institutions see cross-regional and regional projects as not having a lot of impact due to the very different levels of knowledge and experience in countries, as well as different national standards for curriculum, which sometimes makes the creation of a joint or core curricula very difficult.

Apart from that, great curriculum differences of Master programmes amongst certain Eastern European countries were reported, which is especially evident in the variations of programme duration (from 1 to 2 years), and which significantly prevented the process of creating a uniform curricula in the respective region.

National curriculum standards in different countries are to different extents prescriptive concerning obligatory courses which are to be provided in Bachelor and Master programmes, making the agreement of core curriculum, or on joint Bachelor and Master programmes, extremely challenging.

Also, it should be underlined that each of the analysed Eastern European countries was (during the project lifetime) at different stages of involvement in the Bologna process, as well as the adoption of European educational standards and, therefore, representatives of some of the universities from Eastern European countries reported challenges related to the interpretation of the core Bologna concepts and their practical implementation.

Even though not yet fully at a satisfactory level, employers’ interest in higher education is substantially heightened during the implementation of TEMPUS projects. On the other hand, there is evidence that in some participating Eastern European countries, the low interest of employers in higher education was a significant obstacle in the processes of aligning educational systems with labour market needs.

3.2. National legislation and higher education reforms

Unfortunately, one of the lessons learned is that even with a high degree of commitment to reaching quality outputs during the project implementation, it remains challenging to secure commitment with regard to the transfer of good experience at system level. All respondents underlined that education systems seem to be more resilient to change than other sectors. The specific problem in Eastern European countries represent the usual practice that curriculum is predefined at national level in the form of national curriculum standards which to different extents in various countries define the mandatory courses in study programmes or list of degrees and titles.
The standards seem to be more flexible in the case of Master programmes and, therefore, most projects focused on the development of the new specialist or Master degrees, or the updating of existing courses within the Bachelor programmes.

Only 25% of the questionnaire respondents reported that the project they participated in was important in relation to the higher education reforms in the country.

In a number of cases, national authorities (e.g. ministries in charge of higher education) saw project outcomes as something imposed from outside. This strongly impacted sustainability and project influence at national level.

One of the main constraints is the lack of legal framework regarding the definition and status of interdisciplinary study programmes. In some cases, national legislation and bylaws severely constrained the establishment and the full accreditation of newly developed programmes. Universities often complained about rigid rules at national level and about relatively narrow administrative windows of a few weeks each year when applications for accreditation of new study programmes are accepted.

In addition, continuous changes of legislation in most countries, even connected to the reform processes of their education systems, prevented the sustainability of some of the mechanisms established within TEMPUS projects (e.g. mechanisms of curricula development, students’ internship agreements etc.). Some typical examples are the Ukrainian one where the “Higher Education Law” (to align the system with the Bologna Process) was still not endorsed during the lifespan of the projects and the Belarusian one where Belarus had not yet joined the Bologna process.

The example of conflict between project goals and national regulations is most evident in the case of PhD programmes in line with the Bologna principles. The introduction of such programmes would require changes in the legislation which still stipulates the old two-stage system of doctoral training, typical of Eastern European countries.

Some universities in Eastern European countries identified as one of the obstacles, the lack of interest of the national bodies in charge of education in the introduction of postgraduate study programmes in accordance with the Bologna process.

The lack of understanding of core concepts and practices of the Bologna reform of higher education is identified as one of the key constraints for the successful implementation of the TEMPUS projects. A main obstacle at the beginning of some of the projects was the lack of understanding of what a “Master” is and how it differs from the classical “engineer diploma”, combined with the misunderstanding of the “credit” term. In addition to that, a lack of knowledge of requirements related to the Bologna process for the development of Master and postgraduate programmes was observed.

Also, among members of the academic staff in Eastern European universities, the lack of knowledge about the Bologna process requirements in curricula development was detected. As a result, inadequate attention was paid to the "European dimension" of the study programmes, in comparison to the attention paid to the strictly scientific matters.

Another challenge was budget limitation from the corresponding ministries of education that would not allow development and introduction of new study programmes. In these cases, the tendency was to restructure the existing programmes where possible, in order to meet the new requirements for reformation and harmonisation.
3.3. Teaching and research activities

The internationalisation of research in the analysed countries is lagging behind the rest of the European continent, which does not create optimum conditions for the internationalisation and modernisation of teaching practices or study programmes. For instance, subscriptions to the international scientific journal data-bases are a relatively new phenomenon in almost all of the analysed Eastern European countries. It is hard to imagine modern and state-of-the art teaching programmes at institutions in which research activity is not sufficiently developed and internationalised. As an outcome of not sufficiently developed and internationalised research practices, the lack of relevant research papers and tutorials is identified as one of constraints for efficient teaching processes.

Additionally, the organisation of the academic practices and laboratory studies, as well as the development of necessary methodological provision, was hindered by insufficient materials and technical resources to meet project requirements.

3.4. Equipment

In some countries which are in precarious budgetary situations, the TEMPUS programme was identified as the only, or certainly the most significant, source of equipment funding, while in other countries interviews noted that TEMPUS equipment funding is an important, but not the most significant, taking into consideration the generous state funding programmes in recent years.

Sharing a piece of very expensive lab equipment between several universities does not seem to be a feasible solution based on the experience of some projects. It is due to the large distances between universities in some countries, but also to the legal constraints which prevent joint ownership of equipment. Also, in the case of specialised equipment, it was reported that formal tendering requirements are very difficult to satisfy as it is often challenging to provide three offers for very specific equipment in the local markets.

3.5. Students recruitment and enrolment

Some Eastern European universities reported a low recruitment rate of newly developed Master programmes. While some of the reasons identified were only technical and easily solvable, other reported causes appear to be more severe and hence require serious effort from the partner countries’ institutions in order to be alleviated (e.g. lack of understanding of new developments in higher education, the opinion that the national higher education system is good enough and that there is no need for reform, etc.).

Another obstacle is that students do not readily choose newly developed/updated programme/courses from amongst all other courses offered at a particular university, since it is also a novelty for them and they would rather stick to traditional programmes/courses. This is closely connected with the lack of well-established systems of professional orientation and with the fact that not all of the participating countries’ institutions conducted adequate promotional activities to present the benefits of graduating in the new programmes/courses introduced. Also, continuous changes in education systems in the studied countries contributed to the students’ insecurity in being enrolled in new programmes/courses, and that in most of the

3 Recruitment in developed/modernised programmes in Russia was expected to be low in the first years, as Russia was at a time in the middle of the process of introducing the three cycle system, which means that the first graduates from the Bachelor level of education would appear in 2 years.
countries there is generally low interest for the continuation of education after obtaining Bachelor degrees. Furthermore, the perception of the importance and value of some of the professions (e.g. Forestry) was still reported to be highly underappreciated in most countries.

Finally, a strong intention to leave the home country upon the improvement of their skills and competences has been detected among graduates or retrained junior staff, which is characterised as very negative by the Eastern European universities’ representatives.

3.6. Language skills

The lack of good command of the English language (which serves as main language of communication between the EU and Eastern European universities) among staff members and students proved to be one of the important factors affecting the projects’ objectives, and the long term impact. A poor or complete lack of English language skills among some teachers (especially during the initial stage of the projects) hindered communication during staff meetings and led to some loss in overall consortium communication efficiency. Foreign language skills among students were also reported as a problem affecting access to relevant scientific literature, limiting mobility and networking opportunities, and eventually lowering the students’ value in the international job market.

The insufficient command of the English language is very often identified as a factor which contributes to the limited impact of projects and TEMPUS programmes, in general limiting the impact to a relatively small number of already quite internationalised academics and specific departments and disciplines which attract such individuals. The dissemination activities and spill-over effects of the TEMPUS project, although present, do not have sufficient outreach and efficacy.

3.7. Project management

In most cases, representatives from participating Eastern European institutions reported project management to be a serious challenge. Firstly, the high volume of documents, procedures and activities that had to be handled made it especially difficult when the project consortium was large and involved many countries in the region, which in turn caused delays in the response of several partners regarding relevant input on project activities.

Additionally, for some participating Eastern European institutions, the differences in national legislation, capacity, local needs and research specialisation made project governance and management one of the most challenging dimensions.

While some challenges of Eastern European universities were connected to differences in the approaches to the implementation of the project by partner universities, others mentioned centralisation of the management as an issue. Related to the aforementioned point, given that all relevant project-related matters depended on individuals in charge, shifts of those persons that occasionally happened in participating Eastern European institutions produced severe constraints for the implementation of planned activities.

Repeatedly, the importance of an adequate institution as the project coordinator was underlined by all Eastern European countries’ representatives. Some projects are characterised as too ambitious in the design made by EU coordinators, but also some of EU coordinators did not have the most transparent and structured style of project and financial management.
Furthermore, **limited experience in the implementation and management of international projects**, as well as a lack of experience were identified as the main challenge in communication with partner institutions.

Lastly, participating Eastern European universities reported to have had **insufficient budgets for involving more teaching staff to participate in training seminars organised at EU universities**.

### 3.8. Other issues

In some cases, European coordinators were identified as spreading scepticism about the importance and relevance of the introduction of certain Bologna process principles, like a two-cycle system of studies or ECTS, which in the view of National Erasmus offices jeopardises Bologna-inspired reforms in Eastern European countries and the intended impact of the projects.

Some project partners have experienced challenges related to financial management due to the differences between national and financial rules defined by the TEMPUS IV programme, especially within the field of accounting standards and cost accounting practice.

Also, when organising study visits and summer schools, the obtainment of visas for entrance to EU countries was a challenge in a significant number of European as well as Eastern European countries since it required additional efforts from the side of EU universities to get students’ visas on time.
4. Conclusions and recommendations

This part of the study contains the synthesis and integration of conclusions based on data collected throughout different phases of the research. This synthesis and integration is primarily based on the systematic comparison of country and project-based findings in order to identify commonalities that lead to the identification of the main impacts and enabled recommendation oriented generalisations.

4.1. Conclusions

Since the analysed projects aimed to modernise the curricula in engineering and environmental science, it can be concluded that the harmonisation of studies with the labour market has contributed to better employability and the mobility of graduates through recognition of degree equivalence in the EU and neighbouring countries. Transition to the labour market is also, in some cases, facilitated by the establishment of university-based units dealing with this issue.

The analysed projects contributed to the gaining of knowledge and better understanding of the curricula development process, curricula quality standards, quality assurance mechanisms and assessment methods aligned with the Bologna process. Nevertheless, diversities in curricula, legislation and higher education systems, in general, between Eastern European countries and EU countries, as well as the lack of understanding of core concepts and practices of the Bologna process, were important obstacles during the projects’ implementation.

Significant changes of programmes on the basis of feedback provided by non-academic institutions is reported to be an important factor contributing to the increase of interest by business companies. Also, it is worth mentioning that established networks of universities and non-academic partners are still functioning in most of the observed countries, and there is evidence that models similar to those established were used later in other universities in participating Eastern European countries.

Strong links with industrial partners and individuals who have worked across the university/industry interface, have ensured that universities have been able to produce up-to-date study programmes that meet the needs of national economies.

Also, it is very important to underline that some universities and other academic institutions from the participating Eastern European countries which were not directly involved in the respective TEMPUS projects, expressed intentions to expand curriculum development activities on their own using guidelines developed by TEMPUS projects.

Staff training seminars (both in subject-related fields and in curriculum development) aiming to modernise their professional competences based on modern management tools and ICT, the introduction of new teaching materials, purchase of equipment, application of newly developed or revised quality control measures, as well as providing regular feedback from the various stakeholder groups are of particular importance.

The significance of international networking at individual and institutional level has been recognised. In a number of universities, offices dealing with international affairs are presently fully-functional after their establishment within TEMPUS projects. Also, visits to EU partner institutions, capacity-building and mobility activities contributed to personal and professional development of Eastern European university teachers and students (e.g. language skills, way of teaching and teaching skills etc.), networking (at national, regional and international level) and, consequently, the internationalisation of research, improvement of management and the establishment of cooperation with stakeholders outside the academic sector.
Joint, double and multiple diplomas/degrees are rather an exception. Nevertheless, the number of programmes/courses at least partly run in English, and of modules implemented as distance and e-learning resources, has increased.

Equipment supplies, as well as the development of new teaching and learning materials, have had a significant impact on the implementation of the new/updated programmes/courses, the teaching and learning process, scientific research activities, and networking. Therefore, access to modern equipment has been identified as a precondition for the achievement of anticipated learning outcomes.

Familiarisation with the latest scientific innovations and inventions (thanks to the projects) through access to the newest literature and e-sources on topics of interest, and modern software and laboratory equipment greatly expanded possibilities of scientific contribution of teachers and students.

Considering the nature of the projects analysed, the projects had a smaller impact in the area of higher education reforms. Constraints are mostly connected to rigid national legislation systems, different stages of higher education reforms in particular countries, and national and international political situations. The impact is hence mostly limited to the institutional level (e.g. introduction of study programmes in compliance with the Bologna requirements, changes of the internal rules and regulations related to quality assurance etc.). Nevertheless, the impact at national level is achieved by indirect contribution to the familiarisation with and implementation of the Bologna reform and, hence, to convergence/harmonisation of the involved Eastern European universities with EU universities.

It should be underlined that the majority of the partners continue their initial partnership through various bilateral agreements and within the framework of new projects, including cooperation with representatives of non-academic institutions and organisations.

Students’ recruitment and enrolment are areas which need improvement, as in some cases, the number of enrolled students in newly developed study programmes was less than planned.

In general, it can be concluded that the participation in TEMPUS projects influenced the managerial, reporting, organisational, and financial management skills of academic and non-academic/administrative staff employed at Eastern European universities, as well as the cooperation and coordination at institutional level.

There are important parameters for efficient project management: good consortium composition, clear benefits for the parties involved, trust and motivation amongst partners, transparent administrative and financial management, financial resources available on time, established quality assurance mechanisms (including continuous self-evaluation) and regular communication amongst partners. However, it seems that the high volume of documents, differences in national and EU legislation, rules and procedures (e.g. financial and procurement), as well as activities to be handled when the project consortium is larger, are the biggest challenges for successful project management.
4.2. Recommendations

Institutional and individual level

- In order to secure the smooth implementation of the developed/updated study programmes/courses, as well as to secure the appropriate future curriculum development by institutions, it is necessary to secure the full understanding among all academic staff members of learning outcomes, the structure of the curriculum, the types of modules and their content, teaching and learning methods and materials, assessments, and ECTS.

- The development of a quality assurance system for the new curriculum and curriculum quality control system should be mandatory parts of curriculum development in the future. In more concrete terms, the evaluation of the new study programmes should be carried out by review teams, which include expertise both in international accreditation and the national education system. In particular, it is important to obtain the students’ perception on the programmes and that the participation of students in different phases of curriculum development, updating, monitoring, and evaluation is integrated into the quality control mechanisms.

- If cooperation with employers is not set up as a regular part of the curriculum development system, it should be conducted in order to obtain their validation of the learning outcomes for the Master curriculum, and to identify learning outcomes per each module.

- In the future, when development of new study programmes take place, the European dimension of study programmes should be strongly considered by making use of the Tuning methodology/recommendations in designing quality assurance systems, teaching and learning, identification of competences/learning outcomes.

- The universities should consider means to motivate academic and administrative staff to learn foreign languages, especially English. This should be promoted at university level, as a tool for enhancing positive aspects of internationalisation. Also, English language skills of teachers and students should be significantly improved in order to exploit all the benefits of capacity building and mobility activities.

- Universities should develop clear visibility and promotion plans in order to secure enrolment of future students in their study programmes.

- Even though institutions from the European Union played a significant role in the project implementation (e.g. in the transfer of expertise including management and networking, etc.), a strong(er) involvement of local expertise and resources is recommended as it is a prerequisite for long-lasting sustainability.

- It is important to ensure proper maintenance arrangements of purchased equipment.

- There is evidence that the sharing of knowledge and experience gained through training and mobility activities by staff members, who have not had the opportunity to directly take part in the project, was a powerful mechanism for enhancing institutional capacities and multiplying positive outcomes of the TEMPUS projects. It is therefore recommended that such approaches should be promoted as a regular practice at the institutional level.

- To ensure sound project management, it is fundamental that clear roles and responsibilities are defined for all partners and that clear decision-making mechanisms are established. It would be advisable to form a steering committee to maintain effective communication with all partners for project activities and to agree on a quality control system.
### Future projects

- The duration of students’ placements abroad should be considered in favour of longer periods, bearing in mind that summer schools are praised as the most effective and beneficial mobility forms.
- When it comes to the planning of study visits and summer schools, it should be taken into consideration that students and teachers from the majority of the Eastern European countries need a visa to visit EU countries, which could be a lengthy and rather complicated process. This influences both the participation rate and the organisation of such activities in a timely manner.
- Future EU programmes should be more focused on the development of joint, double, and multiple diplomas/degrees, and this area should be the part of project sustainability strategies.
- Equipment supply should be reconsidered and adapted to the context of particular countries, as in some countries EU projects are the only chance for equipment supply, while in others national equipment supply funds exist and are available to higher education institutions.
- It is very important to ensure regular monitoring in terms of the transfer of funds and sound use of EU financial contributions.
- Intensive capacity building activities of representatives of public authorities should be taken into consideration (in the design of new projects), in order to ensure a full understanding of the curriculum development/modernisation activities and, therefore, to secure full accreditation and national recognition of newly developed/modernised study programmes/courses.
- It is strongly recommended, in designing new projects, to assign clear roles and responsibilities of each and every partner involved in the project and to develop and agree on a common action plan. Later, this action plan should translate the roles and responsibilities into specific, time-bound actions, which can be monitored at regular intervals in order to ensure the implementation of activities and achievement of project objectives.
Annex 1 - Bibliography and other sources of information

- European Commission / Executive Audiovisual Culture & Education Agency (2014). *Key data on the TEMPUS IV programme - Issue 3 Main themes in TEMPUS IV projects.* Brussels: EACEA.
- European Commission / Executive Audiovisual Culture & Education Agency (2014). *Key data on the TEMPUS IV programme - Issue 1 Core statistics on applications, projects and budget 2008-2013.* Brussels: EACEA.
- Different project documents, such as reports, summaries, leaflets, brochures, textbooks, etc.
Annex 2 – Overview of completed questionnaires and conducted interviews

Table 1: Number of completed questionnaires by country

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of distributed questionnaires</th>
<th>No. of completed questionnaires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>38</td>
<td>14</td>
</tr>
<tr>
<td>Ukraine</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>Belarus</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Georgia</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Armenia</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Moldova</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>69</td>
<td>35</td>
</tr>
</tbody>
</table>

Table 2: EU coordinators interviews overview

<table>
<thead>
<tr>
<th>No.</th>
<th>Coordinating institution interviewed (EU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>University of Patras, Greece</td>
</tr>
<tr>
<td>2.</td>
<td>Georg-August-Universität Göttingen, Germany</td>
</tr>
<tr>
<td>3.</td>
<td>Technische Universität Berlin, Germany</td>
</tr>
<tr>
<td>4.</td>
<td>Università degli Studi di Genova, Italy</td>
</tr>
<tr>
<td>5.</td>
<td>Politecnico di Torino, Italy</td>
</tr>
<tr>
<td>6.</td>
<td>University of Newcastle, the UK</td>
</tr>
<tr>
<td>7.</td>
<td>Warsaw University of Life Sciences, Poland</td>
</tr>
<tr>
<td>8.</td>
<td>Hochschule Wismar, University of Applied Sciences, Germany</td>
</tr>
<tr>
<td>9.</td>
<td>Comenius University in Bratislava, Slovakia</td>
</tr>
<tr>
<td>10.</td>
<td>University of Stuttgart, Germany</td>
</tr>
</tbody>
</table>
### Table 3: Study visits overview

<table>
<thead>
<tr>
<th>Country</th>
<th>Total no. of institutions in the selected projects</th>
<th>Project references</th>
<th>Study visit dates</th>
<th>Number of interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>10 Moscow + 6 St. Petersburg</td>
<td>144746, 144747, 144935, 145167, 159188, 159305, 159311, 510920, 511092, 511121, 511390</td>
<td>14 – 18. March</td>
<td>27</td>
</tr>
<tr>
<td>Ukraine</td>
<td>6 Kiev</td>
<td>144563, 144746, 158886, 159188, 510920, 511390</td>
<td>3 - 4. March</td>
<td>6</td>
</tr>
<tr>
<td>Belarus</td>
<td>3 Minsk</td>
<td>144746, 511390</td>
<td>9 – 11. March</td>
<td>20</td>
</tr>
<tr>
<td>Georgia</td>
<td>2 Tbilisi</td>
<td>511172 144537</td>
<td>29. February - 2. March</td>
<td>14</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>67</td>
</tr>
</tbody>
</table>
Annex 3 - Complementary statistics – questionnaire answers

Has the project reached its original objectives? (n=35)

To what extent are the expected results, activities and overall objectives still valid? (n=35)

To what extent was the project important for your institution? (n=35)
To what extent was the project important for local/regional stakeholders? (n=33)

1 To the full extent
2 To the large extent
3 To the moderate extent
4 To the small extent

To what extent was the project important for your country? (n=31)

1 To the full extent
2 To the large extent
3 To the moderate extent
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

Which of these groups were involved in and contributed to the project and to what extent? (n=31)

- Partners from business sector
- Teaching staff from other Partner Countries
- Teaching staff from other institutions of your country
- Teaching staff from EU institutions
- Administrative staff of your institution
- Rector and vice-rectors of your institution
- Deans and vice-deans of your institution
- Teaching staff of the course/programme concerned
- Former graduates
- Students

How successful do you think curriculum development was in this project? (n=34)

- 1 Very successful
- 2 Fairly successful

- 39%
- 61%
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

How partners worked together to develop new/updated course/programme? (n=33)

- 1 Very successful: 39%
- 2 Fairly successful: 61%

What was the basis for development of new/updated course/programme? (n=29)

- Survey of student opinions
- Survey of graduate opinions
- Existing courses and programmes of one or more partners in the project
- Survey of similar existing programmes in the EU/in your country/in the...
- Current research trends in the field
- Survey of employers' needs

Who were involved from your country in the development of new/updated course/programme during the project? (n=35)

- The management from your university (deans, vice-deans, rectors, vice-rectors)
- Students from your university
- Economy sector representatives (e.g. employers, companies) from your country
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

How important were visits to partner institutions (European or Partner Country) for the quality development of new/updated course/programme? (n=32)

- Very important: 89%
- Fairly important: 11%

Have changes been introduced to teaching during the project? (n=34)

- Yes: 94%
- No: 6%

Have changes been introduced to the way students are evaluated (given marks) in new/updated course/programme? (n=34)

- Yes: 50%
- No: 50%
Have changes been introduced to teaching materials during the project? (n=31)

- Yes: 94%
- No: 6%

What of the following items were purchased thanks to the project? (n=33)

- New software
- Equipment for new laboratories/Equipment for renovation of old laboratories
- General equipment (e.g. computers)
- Teaching materials

Percentage of purchased items still in use (n=33)

- New software
- Equipment for new laboratories/Equipment for renovation of old laboratories
- General equipment (e.g. computers)
- Teaching materials
Are the new teaching materials used by students from other courses/programmes? (n=33)

- Yes: 94%
- No: 6%

Are the new laboratories or the new equipment used by students from other courses/programmes? (n=33)

- Yes: 24%
- No: 76%

Are the new software used by students from other courses/programmes? (n=33)

- Yes: 53%
- No: 47%
Have new quality assurance procedures been established (e.g. monitoring of new/updated course/programme? (n=34)

- 1 Yes: 41%
- 2 No: 41%
- 3 To some extent: 18%

Does your institution contact graduates to follow whether and where they found jobs? (n=27)

- 1 Yes: 84%
- 2 No: 5%
- 3 I don't know: 11%

How many students from the new/updated course/programme find a job within 6 months after graduation? (n=23)

- Less than 50% students: 7%
- 50%-70% students: 8%
- 70%-95% students: 23%
- 95%-100% students: 62%
Please mark the statement you agree with most (n=35)

- 1 Graduates from the new/updated course/programme have significantly higher chances in finding a job than other students in the country.
- 2 Graduates from the new/updated course/programme have higher chances in finding a job than other students in the country.

How would you rate the support in project implementation of the...
(n=27)

- the dean and/or the vice-deans of your institution?
- the rector and/or vice-rectors of your university?
- the administration at your university to the implementation of the project?
- the management of the project at your university?

0% 50% 100%

1 Very satisfied 2 Satisfied 3 Neither satisfied, nor dissatisfied
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

 Were quality assurance procedures established as regards the management of the project? (n=32)

- 74% Yes
- 16% No
- 10% To some extent

How did the inter-faculty/university structures allow the following stakeholders to participate in the development/implementation of the new(updated) course/programme? (n=26)

- Representatives from other organisations/businesses involved in the project
- Teaching staff from other Partner Countries
- Teaching staff from other institutions of your country
- Teaching staff from EU institutions
- Administrative staff of your institution
- Rector and vice-rectors of your institution
- Deans and vice-deans of your institution
- Teaching staff of the course/programme concerned
- Former graduates
- Students

- 1 To the full extent
- 2 To the large extent
- 3 To the moderate extent
- 4 To the small extent
- 5 Not at all
How important do you think involvement of the following groups in the project management was for the overall success of the project? (n=23)

- Representatives from other organisations/businesses involved in the project
- Teaching staff from other Partner Countries
- Teaching staff from other institutions of your country
- Teaching staff from EU institutions
- Administrative staff of your institution
- Rector and vice-rectors of your institution
- Deans and vice-deans of your institution
- Teaching staff of the course/programme concerned
- Former graduates
- Students

1 Very important  2 Fairly important  3 Not very important  4 Not important at all

With how many partners outside the academic sector did you work on TEMPUS project(s) before the start of the project? (n=31)

- None
- 1 partner
- 2 or 3 partners
- 4 or 5 partners
- More than 5 partners
With how many academic/non-academic partners of this project are you still in contact with? (n=34)

- 2 or 3 partners: 63%
- 4 or 5 partners: 16%
- More than 5 partners: 21%

Has your team taken part in similar EU project after this project? (n=27)

- No, never: 5%
- Yes, 1 time: 15%
- Yes, 2 or 3 times: 5%
- Yes, 4 or 5 times: 40%
- Yes, more than 5 times: 35%

How satisfied are you with the overall sustainability of project results? (n=35)

- Very satisfied: 25%
- Satisfied: 75%
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Are students still being enrolled into new/updated course/programme? (n=34)

- 89% Yes
- 11% No

Which of these groups are still involved today in the improvement/revision of new/updated course/programme? (n=27)

- Representatives from other organisations/businesses involved in the…
- Teaching staff from other Partner Countries
- Teaching staff from other institutions of your country
- Teaching staff from EU institutions
- Administrative staff of your institution
- Rector and vice-rectors of your institution
- Deans and vice-deans of your institution
- Teaching staff of the course/programme concerned
- Former graduates
- Students

1. To the full extent
2. To the large extent
3. To the moderate extent
4. To the small extent
5. Not at all
## Annex 4 - Project fiches for all reviewed projects

<table>
<thead>
<tr>
<th>Reference:</th>
<th>144537-TEMPUS-1-2008-1-GR-TEMPUS-JPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title:</td>
<td>Reformation and Harmonisation in the field of Biomedical Engineering</td>
</tr>
<tr>
<td>Description:</td>
<td>Given the impressive progress and the advancement of the Biomedical Engineering (BME) sector, there was a strong pressure on education and training programmes in BME to continuously adapt their objectives and curricula, in order to face existing or forecasted needs, in terms of knowledge, skills and attitudes for Biomedical Engineers of today and tomorrow. These programmes must be in full compliance with the European policy for Higher Education, the ECTS and the Quality Assurance and accreditation approaches. The main objective of this project was to provide generic programmes and guidance documents, based on an in depth analysis of the existing situation and needs in the field of Biomedical Engineering, in order to meet recent and future developments in the area. Those outputs are used by the participating institutions to restructure their existing graduate and/or postgraduate education programmes in BME. The proposed programmes are focused on present and forecasted needs for competencies and skills of biomedical engineers based on job requirements. Additionally, an analysis of the relationships between competence, learning outcomes and credits was performed for proper implementation of the ECTS. An additional objective was the recreation of the BME thematic network and its enlargement that would act as a catalyst for the sustainability of the results.</td>
</tr>
</tbody>
</table>
| Coordinator: | University of Patras  
University Campus  
Rio-Patras 26504, Greece |
| Contractor: | University of Patras  
University Campus  
Rio-Patras 26504, Greece |
| Partners: | Budapest University Of Technology And Economics, Hungary; Faculty Of Electrical Engineering, Serbia; Georgian Technical University, Georgia; Institute Of Biomedical Technology, Greece; Karolinska University Hospital, Sweden; Khazar University, Azerbaijan; Masaryk University, Czech Republic; Orbeli Institute Of Physiology, Armenia; Riga Technical University, Latvia; Szczecin University Of Technology, Poland; Tallinn University Of Technology, Estonia; Technical University Of Crete, Greece; |
Technical University Of Varna, Bulgaria; Universidad Politecnica De Madrid, Spain; University Federico II Of Naples, Italia; University Of Bologna, Italia; University Of Ljubljana, Slovenia; University Of Oulu, Finland; University Of Zagreb, Croatia; University "Politehnica" Of Bucharest, Romania; Vrije Universiteit Brussel, Belgium.

<table>
<thead>
<tr>
<th><strong>Original Project Budget:</strong></th>
<th>1,489,310</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum Grant Awarded:</strong></td>
<td>1,042,075</td>
</tr>
<tr>
<td><strong>Contract Duration:</strong></td>
<td>39 months</td>
</tr>
<tr>
<td><strong>Approved Project budget:</strong></td>
<td>1,093,470</td>
</tr>
</tbody>
</table>

**Reference:** 144563-TEMPUS-1-2008-1-FR-TEMPUS-JPHES

**Title:** Master "Interoperability/Security/Certification" in the area of international rail in Ukraine and Central Asia

**Description:** The project’s aim is to design and implement a compatible Master 2 "Interoperability, Security and Certification" in the field of International Railway Transport ("Transport International Ferroviaire – MISCTIF"). The project aims also at issuing a double certification delivered by the "Conférence des grandes écoles françaises » for a specialised Master programme. This double certification will create a strong attractiveness factor for the students and will contribute to the fame of partner countries' universities. The programme will be implemented in Ukraine, Kazakhstan and Kyrgyzstan in cooperation with the railways of these countries. The originality of this project is to closely associate universities and companies and also to respond to the problematic in a dual way: from the professional point of view – to promote interoperability and improve the safety of rail transport corridors between Asia and Europe (via Central Asia and Ukraine) and to implement a certification which complying with European requirements; from the academic point of view - to enable the 'railway universities' in charge of the training of railway companies’ specialists to innovate and propose new trainings. The MISCTIF project will help these three universities modernise their curricula by building and implementing a new curriculum in line with the Bologna principles. This 3-year project is divided into 3 phases: 1. Development of Master programme training repository/Specialized Master and teaching materials development, 2. Composition of the teaching teams (28 university professors and 18 experts from the labour market) and transfer of the teaching content to these teams, 3. Implementation of training sessions for groups of 60 students group in Ukraine, 30 students in Kazakhstan.
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

and 10 students in Kyrgyzstan (overall 1,400 students are targeted in the coming 10 years). An international symposium (in Kiev, Ukraine) will close the project.

| Coordinator: | Conservatoire National des Arts et Métiers 25 Boulevard Guy Mollet Nantes 44311, France |
| Contractor: | Conservatoire National des Arts et Métiers (Centre régional des Pays de la Loire) 25 Bd Guy Mollet Nantes 44311, France |
| Partners: | State Administration of Rail Transport in Ukraine (Ukrzaliznytsia/UZ), Ukraine; Kazakhstan temir zholy (KTZ), Kazakhstan; "KazATC" JSC, Kazakhstan; Kyrgyz State University of Construction, Transport and Architecture, Kyrgyzstan; Kyrgyz Temir Jolu, Kyrgyzstan; Riga Technical University, Latvia; SNCF (Société Nationale des Chemins de Fer) International, France; Dnepropetrovsk National University of Rail Transport (DIIT), Ukraine; Warsaw Technical University (Politechnika Warszawska), Poland. |
| Original Project Budget: | 1,198,967 |
| Maximum Grant Awarded: | 986,511 |
| Contract Duration: | 36 months |
| Approved Project budget: | 1,084,189 |

Reference: 144746-TEMPUS-1-2008-1-RU-TEMPUS-JPCR

Title: Improvement of education on environmental management

Description: The objective was to improve higher education system in the domain of environmental management and environmentally-safe nature management, using experience of EU and Partner countries on application of up-to-date information technologies. The key tasks were (a) improvement of two/three cycle education system in Universities on environmental management, based on national features, specifically for each country, and oriented on application of approaches, approved in EU (Water Framework Directive, hazardous waste management system); (b) modernisation of curricula in the domain of environmental protection and environmentally-safe nature management in Universities, oriented at harmonisation with European higher education structure, in particular, focus of education programmes on European credit transfer system (ECTS); (c) study, introduction and application in education process of international system of environmental data, such as GEO, GEOSS and GMES, standardisation methods for...
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

Data presentation, storage and access in line with creation of single Pan-European information space; (d) development and introduction of international interactive education system in the domain of environmental management and environmentally-safe nature management for Universities- members of the consortium; (e) promotion and support to mobility of qualified education staff and students within Europe, that have inputs to strengthening Pan-European interaction within the higher education space, improvement of understanding of education strategies and problematic aspects, occurring during harmonisation of education systems in various countries, and speed up experience exchange. The following project implementation results were achieved: (a) creation of integrated system of single space for higher education in the domain of environmental management and environmentally-safe nature management in Universities, members of the consortium, harmonised with the European requirements and recommendations; (b) development and introduction of international interactive education system in the domain of environmental management and environmentally-safe nature management in Universities, members of the consortium. During the project implementation, curricula and programmes on training programmes were developed and attested; text-books, methodological materials and test system were compiled and published. Language and special training courses were organised for teachers and lectures; a basic group of teachers and lectures was able to start training process on harmonised international education programme on environmental management and environmentally-safe nature management. Developed training materials were adopted for distance learning, Internet-resources and DVD - courses were created and introduced into education process.

Coordinator: Saint-Petersburg State University – SPSU
Korpusnaya st.18
ST. PETERSBURG 197110, Russian Federation

Contractor: Saint-Petersburg State University – SPSU
Universitetskaya nab, 7/9
Saint-Petersburg 199034, Russian Federation

Partners:
Belarusian State University - BSU, Belarus; Central European University - CEU, Hungary; "ETB-Technology Trade" Ltd, Ukraine; Geographical Information Systems International Group - GISIG, Italy; Kharkov Karazin National University - KKNU, Ukraine; Moldova State University - MSU, Moldova; Scientific Research Centre for Ecological Safety, Russian Academy of Sciences - SRCES, Russia; Taurida National V. I. Vernadsky University - TNU, Ukraine; Technological Educational Institute of Athens - TEI-A, Greece; The Institute for Environmental Studies (Instituut voor Milieuvaagstukken, IVM) at the VU Univ Ukrainan Scientific and Research Institute of Ecological Problems – USRIEP; Ukraine University College CORK, Ireland; University of Natural Resources and Applied Life Sciences - BOKU, Austria.

Original Project Budget: 1.417.285
Maximum Grant: 1.080.488
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

| Awarded: |  |
| Contract Duration: | 40 months |
| Approved budget: | 1.133.460 |

Reference: 144747-TEMPUS-1-2008-1-FR-TEMPUS-JPCR

Title: Master in Energy and Sustainable Development Engineering Economy

The wider aim of the project is as follows: in cooperation with the Technical and Economics Universities in Russia (St. Petersburg, Samara) and in Kazakhstan (Almaty), to develop new courses and "Economist Engineers" Master diplomas, creating knowledge and professional skills synergies, responding to the initial and continuous training needs for sustainable development management in companies or energy industry organisations and in line with the new requirements and international standards for these activities.

The specific objectives of the project are: create or implement economics and management teaching modules by Economics Universities and have them integrated into engineering curricula and degrees by Technical Universities; create or implement teaching modules in industrial technologies and energy by Technical Universities and have them integrated into economics curricula and degrees by Economic Universities; create or implement, with the specific contribution of European Universities, specialised modules covering the fundamentals and tools (economics, management) for sustainable development in the energy sector, to be integrated both in the economics and engineering curricula and degrees in Russian and Kazakh universities; develop double degrees (RU or KA with FR or DE or IT or FI) combining on-site and distance learning; obtain the accreditation of these new curricula (economist engineers in the energy and sustainable development sectors) as Master or vocational degrees, depending on the interest of the students; develop quality and innovation in the projects' best practices, through the participation of non-university stakeholders (companies, cultural organisations, school networks, students associations) in the implementation of the newly developed programmes; the ability to work in project teams involving multidisciplinary skills, knowledge synergies and the possibility of acquiring a dual "technical and economic" competency, are decisive factors as regards professional efficiency, both for engineers from technical universities and for managers or executives from economic universities.

In order to implement multidisciplinary studies for their engineering and economy students, Economics and Technical Universities from the two partner countries will work together, as a "regional tandem" (St Petersburg, Samara, Almaty), exchanging their teaching contributions. Grenoble, Rome, Dortmund and Kuopio Universities will offer specialised courses in Energy and Sustainable Development Economics and Management, as well as teaching methods building on project team work and entrepreneurial or innovative approaches among the students. To do so, distance learning will be combined with on-site seminars. The distribution among partner institutions will be done according to their specificities and complementarities: energy economy and sustainable development (e.g. Grenoble), management of energy companies (e.g. Dortmund), quality and innovation management (e.g. Rome), project teams and entrepreneurship (e.g. Kuopio). Partner companies (INTEGRA, RWE, E.ON, Schneider Electric) will be involved from the project start, at Master development stage, and will better respond to the changes in professional skills and competences faced by the energy sector with the emerging requirements for sustainable development and internationalisation.

Coordinator:  


### Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

| Contractor: | Université Pierre Mendes France  
1241 rue Des Résidences BP47  
Grenoble 38040 cedex 9, France |
<table>
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<tr>
<td>Partners:</td>
<td>AIESEC, Russian Federation; Eni Corporate University, Italia E.ON AG, Deutschland; Faculté de Economie - Université &quot; La Sapienza &quot; - Rome, Italia; Institut de l'Energie et de la Communication d’Almaty, Kazakhstan; International School of Management (ISM) gGmbH, Deutschland; L'Université Kazakhe Nationale Technique du nom de K.I.Satpaev, Kazakhstan RWE Westfalen-Weser-Ems, Germany; S. A. “INTEGRA-Management ”, Russian Federation; Savonia University of applied Sciences, Suomi/Finland; Schneider Electric, France; Université d'Etat déconomie de Samara, Russian Federation; Université d'état d'économie et de finances de Saint Pétersbourg, Russ; Université dEtat technique de Samara, Russian Federation. Université économique de Kazakh, Kazakhstan; Universite Nationale Polytechnique de Saint-Petersbourg, Russian Federation.</td>
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<td>Title:</td>
<td>Chemical Engineering: Curriculum Development and International Recognition</td>
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<td>Description:</td>
<td>The project implementation strategy included the following steps: to develop modernised three-cycle curricula in Chemical Engineering based on the best European practice and ensuring adequacy of academic content to the requirements of student and employer communities (over 300 stakeholders involved in consultations and development of the curricula); to train teachers in line with the developed curricula based on a strongly participatory methodological approach and individual capacity building process (at least 70 teachers were involved); to develop new and up-dated courses within the curricula with participation of retrained teachers and the project experts (at least 22 courses were developed and up-dated); to prepare manuals, textbooks and other methodological aids for teachers and students, in line with the new curricula, and new and up-dated courses (at least 20 manuals and other aids were prepared); to provide new infrastructure for creation of poles of teaching excellence and ensuring the institutional capacity building process (1 new laboratory created and 3 more up-graded); to initiate teaching of the programmes to students based on their active involvement through interactive communication/participation in the adjustment of the teaching methodology (at least 300...</td>
</tr>
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</table>
students involved); to establish arrangements for international recognition of the curriculum through development of criteria of certification, quality assurance, academic mobility and convergence with EU higher education policies (curriculum is certified at international level); to organise an effective system of dissemination of the project outcomes, so as to ensure sustainability of the project and its wider impact on modernisation of engineering education in Russia and Kazakhstan.

Coordinator: University College London, University of London
Torrington Place
London WC1E 7JE, United Kingdom

Contractor: University College London, University of London
Torrington Place
London WC1E 7JE, United Kingdom

Partners: Berlin Technical University, Deutschland; Institute for Chemical Technologies (ICT), Czech Republic; Institution of Chemical Engineers, United Kingdom; Kazakh National State University, Kazakhstan; L.N.Gumilyov Eurasian National University, Kazakhstan; Moscow State University of Engineering Ecology, Russian Federation; Novosibirsk State Technical University, Russian Federation; Russian Association for Engineering Education (RAEE), Russian Federation; Siberian Technological Association, Russian Federation; Sochi State University Of Recreation And Tourism, Russian Federation; University of Brighton, United Kingdom; University of L'Aquila, Italia.

| Original Budget: Project | 1.372.100 |
| Maximum Grant Awarded: | 1.305.661 |
| Contract Duration: | 36 months |
| Approved Project budget: | 1.372.100 |

Reference: 145167-TEMPUS-1-2008-1-IT-TEMPUS-SMHES

Title: Development of Qualifications Framework for Cycles of Higher Education in Aircraft Engineering

Description: The project’s scope was to increase international recognition of the Russian Higher Education and Doctorate Systems within EHEA and ERA by contribution to the development of National Qualification Frameworks (NQF) for all three cycles and to develop competence-based academic programmes in Aircraft Engineering (AE). The basic principle of AIRQUAL was its appeal to the real needs of the aircraft industry and its leading enterprises. Therefore, representatives of the industry and related organisations were involved and close interaction with them was established both during the project and further on. The second principle was applying a competence-based approach to curriculum development. Through the specific “interface”, competences of occupational profiles and standards were transformed into QFs and learning outcomes for 3 cycles of HE in AE. The basic action lines of the AIRQUAL were as follows: 1. Adoption of the European experience in QF and competence-based curriculum
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

development. 2. Strengthening of interaction of HEIs with the industry to train qualified graduates demanded on the labour market. 3. On the basis of the situation in Aircraft industry analysis, development of QFs in terms of knowledge, skills and competences and the corresponding curricula for different specialisations in AE. 4. Development of competence-oriented curricula for 3 cycles of HE based on ECTS. 5. Promoting best practices and methodologies aiming to facilitate the Bologna reforms in general and the dissemination and sustainability of the project results in particular.

Coordinator: Politecnico di Torino C.so Duca degli Abruzzi, 24 Turin 10129, Italia

Contractor: Politecnico di Torino C.so Duca degli Abruzzi, 24 Turin 10129, Italia

Partners: Chamber of Commerce and Industry of the Republic of Tatarstan, Russian Federation; Ecole Nationale de l'Aviation Civile-ENAC, France; Ecole Nationale Superieure de Mecanique et d'Aerotechnique - ENSMA, France; Kazan Engine Production Corporation, Russian Federation; Kazan Helicopters, Russian Federation; Kazan State Technical University, Russian Federation; Ministry of Education and Science of the Republic of Tatarstan, Russian Federation; Ministry of Industry and Trade of the Republic of Tatarstan, Russian Federation; Royal Institute of Technology - KTH, Sweden; Samara State Aerospace University, Russian Federation; Ufa State Aviation Technical University, Russian Federation; United Aircraft Corporation, Russian Federation.

Original Project Budget: 528,550
Maximum Grant Awarded: 501,549
Contract Duration: 30 months
Approved Project budget: 528,550

Reference: 158886-TEMPUS-1-2009-1-UK-TEMPUS-JPCR

Title: National Safeware Engineering Network of Centres of Innovative Academia - Industry Handshaking

Description: The key goal of the project was to produce a new generation of engineering and research staff capable of performing constructive development in safeware engineering. This outcome contributed to satisfying the needs of Ukrainian enterprises and institutions of different critical domains and partner country regions. Critical Domains (e.g. nuclear power plants; oil and gas industry
and communications; aerospace; air traffic; maritime; power industry; e-health and medical systems; railway and automotive transport). To reach the main objective, the international Master programme and doctoral programme on Safeware Engineering for Ukrainian universities was developed. Developed courses and introduced within the eligibility period: MSc1. Safeware engineering foundations; MSc2. High availability systems and technologies; MSc3. Co-design of safety-critical embedded systems; MSc4. Service-oriented business-critical systems and technologies; MSc5. Distributed critical systems and infrastructures. PhD1. Formal methods-based technologies for safeware; PhD2. Scalable diversity-based technologies for safety-critical applications.

These MSc courses established the Master specially. Safeware Engineering was taught at the target departments of Ukrainian universities since September 2012. All developed courses have ECTS-compatible structure. The members agreed on the introduction of the mechanism for using the ECTS grading scale together with the existing one. Each participating university issues the English diploma supplement for the graduates of the new specialty of Safeware Engineering. In order to enhance the sustainability of the gained results and provide the financial basis for the future extension and dissemination, the National Network of Consulting Centers was established. The network comprises 5 consulting centres opened at the basis of target department of each Ukrainian academic member. The key tasks of the Centres included: 1. Training of Master and doctoral students of Ukrainian universities with developed Master programmes via e-learning model (1st specific target group); 2. Providing in-service training sessions and workshops on demand by developed 3 in-service training modules TM1-TM3. The lecturers from partner universities were invited to carry out the training event for the specified group of external participants needed in such seminars (2nd specific target group); 3. Providing consulting activities for the companies and individuals in the area of safeware engineering and risk assessment by means of offering the following services (3rd specific target group). The 1st activity provided the dissemination of the developed curriculum among wide groups of students at different universities within Ukraine; and the 2nd and 3rd domain of activity ensured the financial sustainability of the NNC and develop the basis for its self-financing.

Coordinator: University Of Newcastle Upon Tyne Claremont Tower, Claremont Road Newcastle NE1 7RU, United Kingdom

Contractor: University Of Newcastle Upon Tyne 6 Kensington Terrace, Newcastle upon Tyne, NE1 7RU Newcastle NE1 7RU, United Kingdom
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

Partners:
Abo Academy University, Suomi/Finland; Adelard Llp, United Kingdom City University, United Kingdom; Institute Of Information Science And Technologies Isti - Cir, Italia; Institute Of Mathematical Machines And Systems, National Academy Of Science of Ukraine (IMMSP NASU), Ukraine; Khmelnitskiy National University, Ukraine; KTH - Kungliga Tekniska Hogskolan, Sweden; Ministry Of Education And Sciences Of Ukraine, Ukraine; National Aerospace University, Ukraine; Odessa National Polytechnic University, Ukraine; Poltava National Technical University Named In Honour Of Yurii Kondrat “Polysov” Design Bureau, Ukraine; "Radiy" Research Production Company, Ukraine; Sebastopol National Technical University, Ukraine; University Of Naples Federico II, Italia.

Original Project Budget: 693.191
Maximum Grant Awarded: 620.791
Contract Duration: 41 months
Approved Project budget: 691.691

Reference: 159188-TEMPUS-1-2009-1-PL-TEMPUS-JPCR

Title: Environmental curricula at agricultural universities

Description: The ENAGRA Project aims at modernising curricula at four Partner agricultural Universities in the Russian Federation and in Ukraine. Project results led to the harmonisation of Russian and Ukrainian higher education systems with the European one, and they directly supported the implementation of the Bologna process in Project Partner Countries. Modernised three-cycle curricula in the area of environmental studies consisted of the four-year Bachelor programme followed by a two-year Master programme and a three-year PhD programme. Two specialties were selected for development/modernisation: 'Agroecology' for the Russian Partner Universities and 'Ecology and Environmental Protection' for the Ukrainian ones.

During curricula modernisation/development, the following issues were discussed on the basis of learning outcomes: planning reference profile of professional experience, technical project of the design of subject courses within analysed specialties and necessary educational resources. It allowed for exemplification of methodological approach for the expression and description of the curricula (modules, units and qualifications) and qualification descriptors associated with the being introduced within Bologna process so called national qualifications frameworks for Russian Federation and for Ukraine. The structure of the modernised study programmes was based on EU standards comprising 60 ECTS per year of study. Study programmes consist of compulsory subjects, restricted optional subjects and fully optional subjects. The teaching methodology combines lectures, practical exercises or experiments, case studies, team projects, modelling field trips, internships and thesis research. The staff of partner universities are trained on new, advanced study subjects and new teaching methods (presentation techniques and use of ICT in education). Educational computer and environmental quality laboratories were developed/upgraded as well as library resources. Selected course modules were developed as distance and e-learning resources. New study programmes are approved by the authorities of each Partner University and are accredited by the Ministries of
Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

| Coordinator: | Warsaw University Of Life Sciences ul. Nowoursynowska 166 Warszawa 02-776, Poland |
| Contractor: | Warsaw University Of Life Sciences ul. Nowoursynowska 166 Warszawa 02-787, Poland |
| Partners: | Association For European Life Sciences Universities (Ica), Poland; Buryat State Academy Of Agriculture Named After V.R. Philippov, Russian Federation; European Network Of International Relations Officers At Higher Educa Ghent University, Belgium; Institute Eduter Of National School Of Higher Education In Agronomy, Food and Environmental Sciences (Dijon), France; National Agrarian University (Lugansk), Ukraine; Ministry Of Agricultural Policy Of Ukraine, Ukraine; Ministry Of Education And Science Of The Republic Of Buryatia, Russian Federation; Ministry Of Education And Sciences Of Ukraine, Ukraine; Ministry Of Natural Resources Of Republic Of Buryatia, Russian Federation; National University Of Life And Environmental Sciences Of Ukraine - Nule Saratov State Agrarian University Named After N.I. Vavilov, Russian Federation; University of Lleida, Spain; University Of Natural Resources And Applied Life Sciences Boku, Austria. |
| Original Project Budget: | 756.912 |
| Maximum Grant Awarded: | 656.807 |
| Contract Duration: | 36 months |
| Approved budget: | 724.837 |
| Reference: | 159305-TEMPUS-1-2009-1-DE-TEMPUS- JPCR |
| Title: | Advanced M.Sc. Programme in Ecology for Volga-Caspian Basin |
| Description: | The main objective of the Project was to transfer educational experience in the field of ecology and complex nature management from EU universities to universities of partner countries. It upgraded training to European standards, on the basis of curricula harmonisation, experts' professional skill development, introduction of up-to-date training methods, development and publication of necessary educational data, technical re-equipment of training laboratories, development and introduction of educational process current methods and students' knowledge assessment. Besides, it introduced and developed short-term courses to improve the qualification of experts working in the field of ecological management. Also, the main principles of the Bologna declaration, such as module structure of curricula and introduction of ECTS, were integrated in the design of the study programmes. The Project implementation made an essential contribution into the higher education modernisation of the partner countries. It also created a common virtual medium of training, including electronic libraries as a part of international education. It gave the opportunity to conduct business games in the field of ecological management with the help of computers on the...
basis of distant training technologies. Thus it allowed the creation of the international network of universities and other institutions interested in the field of ecological management for students' training, experts' reorientation and information exchange within the Project and afterwards.

| Coordinator: | Universität Stuttgart  
Keplerstraße 17  
Stuttgart 70174, Deutschland |
|-------------|------------------------------------------------------------------|
| Contractor: | Universität Stuttgart  
Keplerstraße 7  
Stuttgart 70174, Deutschland |
| Partners: | Astrakhan State Technical University, Russian Federation; Kazan Tupolev Technical State University, Russian Federation; Samara State Technical University, Russian Federation; Saratov State Technical University, Russian Federation; Polytechnic University of Catalonia – UPC, Spain; University of Parma, Italy; University Of Warsaw, Poland; Volgograd State Technical University, Russian Federation. |
| Original Project Budget: | 951.383 |
| Maximum Grant Awarded: | 813.823 |
| Contract Duration: | 36 months |
| Approved Project budget: | 901.995 |

**Reference:** 159311-TEMPUS-1-2009-1-IT-TEMPUS- JPCR

**Title:** Network for Master training in technologies of water resources management

**Description:** Achieved results: Existing curricula reformed inside six Russian Federation Universities (hereinafter referred to as RUU) in order to establish study programmes oriented towards joint degrees, both at Russian Federation and at EU level, and to allow for comparability of the courses between RUU and European Union Universities (hereinafter referred to as EUU). New study programme established according to the Russian educational standards of the 3rd generation. Agreed protocol for the designing, implementation and delivery of the reformed curricula according to the eight main steps identified by the "Tuning" pilot project in the process of designing a study programme and considering the "Dublin" descriptors. Widened and improved the RUU teachers' knowledge in Environmental topics linked to technologies of complex water resources management and treatment, also thanks to the cooperation with public authorities and industrialists representatives, so that the new qualifications are better understandable, comparable and suitable to the labor market needs (industrial strategic sectors such as food industries,
agricultural, consumption water; public companies and offices operating in water treatment and recovering). Developed "Lifelong Learning" (LLL) policy by training some specialists, i.e. not only university staff but also non-university trainees such as officers and managers of public authorities having environmental competences and of companies involved in water management and treatment. Teaching processes focused on new methods such as interdisciplinary and interactions forms of lectures and seminars, evaluation strategies. Features in the improvement of the current study programmes in the RUU applied. Ensured medium / long-term perspectives by development of joint teaching, mobility and research programmes, by setting-up in each RUU consortium member of an updated 'Membrane-techniques based Water treatment Didactical Lab', and by establishment of "Technological Transfer and Innovation" offices.

| Coordinator: | Universita Degli Studi Di Genova Via Balbi, 5 Genova 16126, Italia |
| Contractor: | Universita Degli Studi Di Genova Via Balbi, 5 Genova 16126, Italia |
| Partners: | Agency For Higher Education Quality Assurance & Career Development, Provincial Administration Of Genova, Italy; Bauman Moscow State Technical University, Russian Federation; BMT - Baromembrannaya Tecnologiya Ltd (Bmt), Russian Federation; Fondation of Amga (Famga), Italy; Middlesex University In London (Mdx), United Kingdom; Ministry Of Natural Resources And Protection Of The Environment Of The Moscow State University Of Land Use Planning (SULUP), Russian Federation; Slovak University Of Technology In Bratislava (SUTB), Slovakia; Stavropol State Agrarian University (SSAU), Russian Federation; Tambov Regional Administration (TRA), Russian Federation; Tambov State Technical University (TSTU), Russian Federation; Union Of Manufacturers And Entrepreneurs Of Sverdlovsk Region, Russian Federation; Ural Federal University N.A. "Boris N. Yeltsin" (URFU), Russian Federation; Vladimir State University, Russian Federation. |
| Original Project Budget: | 1.104.700 |
| Maximum Grant Awarded: | 985.178 |
| Contract Duration: | 42 months |
| Approved Project budget: | 1.094.125 |

Reference: 510920-TEMPUS-1-2010-1-DE-TEMPUS-JPCR

Title: Practice oriented Master Programmes in Engineering in RU, UA and UZ

Description: The main features aimed at improving of Master Programmes in Electrical Engineering according the needs of modern society of target partner countries RU, UA and UZ bringing the universities closer to changing Labor Market and European Education Area; It allowed them to stay responsive to employers' needs; to ensure employability throughout professional lives of graduates.
The wider objectives were: to ensure that the targeted Universities in RU, UA and UZ can offer new advanced Master Programmes in Engineering in line with the new development in the area, the market demand and according to the Bologna Process, last recommendations in Leuven communiqué and best practice. The specific objectives were: To update the current curricula in Electrical Engineering MA according to Bologna requirements and the new developments in Engineering by the end of the project; to develop, implement and accredit new practice oriented curricula and modules for Engineering Programmes (MA); to bring the Higher Education Institutions of PC closer to Labor market. According to the specific project objectives the following tangible Outputs and intangible Outcomes in the frames of development were achieved: 1. Reviewed/analysed/upgraded the current curricula in Electrical Engineering (MA) according to recent advances in the target field; 2. Developed four new generic curricula (Applied informatics and data transmission systems; CAD/CAM/CAE for Electrical Engineering; Quality Engineering; Environment management and Engineering) and five modules (Problem solving for Engineers; Modelling of production systems; Re-Engineering; Audit and Certification according ISO; Soft skills for Engineers) with integrated supporting infrastructure (laboratories and PC pools); 3. Retrained academic staff in the new curricula methodologies/train of the non academic teachers/mentors from partner enterprises; 4. Piloted teaching/operation; 5. Established ELM Offices (Engineers in Labor Market) with stakeholders support.

| Coordinator: | Technische Universität Berlin  
Marchstr, 12  
Berlin 10587, Deutschland |
|-------------|-----------------------------|
| Contractor: | Technische Universität Berlin  
Straße des 17. Juni, 135  
Berlin 10623, Deutschland |
| Partners: | Bauman Moscow State Technical University, Russian Federation; Centre of Development of Higher and Secondary Education of UZ, Uzbekistan; Chamber of Commerce and Industry, Kazan, Russian Federation; Chamber of Commerce and Industry of Uzbekistan, Uzbekistan; Donetsk Chamber of Commerce and Industry, Ukraine; Engineering, Consulting and Management Office, Deutschland; Federal Agency on Education of Russia, Russian Federation; Fergana Polytechnic Institute, Uzbekistan; Karshi Engineering-Economic Institute, Uzbekistan; Kazan National Research Technical University, Russian Federation; Lessius Mechelen, Belgium; Lutsk National Technical University, Ukraine; Ministry of education and science of Ukraine, Ukraine; Povolzhskiy State University of Telecommunications & Informatics, Russian Federation; Pryazovskiy State Technical University, Ukraine; Tashkent State Technical University, Uzbekistan; Technical Universities Association of CIS, Russian Federation; Vilniaus Gedimino Technicos Universitetas, Lithuania; Zaporizhzhya National Technical University, Ukraine. |
| Original Project Budget: | 1.214.498,15 |
| Maximum Grant Awarded: | 1.091.913,15 |
| Contract Duration: | 36 months |
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Approved Project budget: 1.214.498,15

Reference: 511092-TEMPUS-1-2010-1-UK-TEMPUS-JPCR

Title: Enhancement of Biotechnology (Pharmaceutical Engineering) curriculum at Master level in Russian universities.

Description: There was a severe shortage of personnel competent in the technological and managerial aspects of modern biotechnology in the pharmaceutical sector in the RF. This project addressed the issue by developing an internationally compatible and recognised Master Programme in Pharmaceutical Engineering. A strong partnership combined three leading universities in the field of Biotechnology from the EU (Cranfield University, Dublin City University and the Prague Institute of Chemical Technology) with the Moscow Academy of Fine Chemical technology, The Kubanskii State Medical University, and Altaiskaya State Medical Academy. Stakeholder involvement in the project was strong with partners from the regulatory bodies (Roszdravnadzor) and industrialists (Union of Professional Pharmaceutical Organisations) were involved. This strengthened the University- Labour market relationship. Experienced IT support for internet conferences and long distance seminars was provided by the European Quality Centre. Highly experienced management skills supplied by the staff of Cranfield University ensured the effective deployment of resources and delivery of results. The developers of educational programmes in the biotechnology sector faced three challenges: technology processes are innovative and rapidly developing; programmes need to meet the ESTC, EU Tuning and Third generation requirements; the safety, quality and efficacy issues in the sector are subject to increasing regulation. The project systematically addressed each of these issues. Sustainability of the new Programme combining traditional science elements such as chemistry, biology and microbiology with the engineering and regulatory competences expected of modern Pharmaceutical engineers was strengthened by its accreditation at government and industry level and by its adaption for vocational training.

The outcome of this project acts as a model for the development of other innovative programmes.

Coordinator: Cranfield University
Wharley End
Cranfield MK430AL, United Kingdom

Contractor: Cranfield University
Wharley End
Cranfield MK430AL, United Kingdom

Partners: Dublin City University, Ireland; European Quality Centre, Russian Federation; Institute of Chemical Technology Prague, Czech Republic; Kubanskii State Medical University, Russian Federation; Moscow Academy of Fine Chemical Technology,
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Russian Federation; St Petersburg Chemical Pharmaceutical Academy, Russian Federation; Union of Professional Pharmaceutical Organisations, Russian Federation.

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Reference: 511121-TEMPUS-1-2010-1-DE-TEMPUS-JPCR

Title: Engineering Curricula Design aligned with EQF and EUR-ACE Standards

Description:
The ECDEAST project objective was to ensure that Russian universities have advanced curricula for programmes in line with new development in the chosen engineering areas and according to the Bologna Process and European standards for the quality of engineering education (EUR-ACE). Three leading Russian engineering universities with the help of European partners jointly achieved following: developed a methodology for engineering curriculum design based on the alignment of EQF & EUR-ACE Standards with Federal educational standards requirements to structure of programmes and graduates' competencies; trained the PC universities' faculty to design engineering curricula according to EUR-ACE requirements with using of ECTS; developed/updated and implemented 3 Master engineering programmes and course modules materials at TPU, BMSTU and SPbSPU according to EUR-ACE requirements with using of ECTS and Dublin Descriptors; prepared the developed programmes for accreditation with awarding of the EUR-ACE label.

The main project outputs were: Guidelines on engineering programme designed; New curricula of 3 engineering programmes at TPU, BMSTU and SPbSPU (one in each); Updated syllabi and teaching materials of courses and modules with ECTS credits allocated to learning outcomes; Trained faculty of TPU (25), BMSTU(25) and SPbSPU (25) for curriculum design; Experience gained through teacher exchange (36), then shared; New programmes(3) implemented at TPU, BMSTU and SPbSPU (one in each); Programmes evaluated by peers against EUR-ACE Standards; Informative project website, promotional materials disseminated; Book on engineering curriculum designed.

 Coordinator: Hochschule Wismar Alter Holzhafen, 19 Wismar 23966, Germany

Contractor: Hochschule Wismar
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<td><strong>Partners:</strong> Bauman Moscow State Technical University, Russian Federation; European Network For Accreditation Of Engineering Education, Italy; Kaunas University of Technology, Lithuania; Saint-Petersburg State Polytechnic University, Russian Federation; European Society for Engineering Education, Belgium; Tomsk Polytechnic University, Russian Federation; The Lucian Blaga University of Sibiu, Romania.</td>
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<tr>
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<td><strong>Description:</strong> The project proposal was aimed at professionalising Higher Education and particularly environmental studies within three areas of specialisation through the implementation of the Bologna Process at all three levels, BA-MA and PhD. It fostered and established the cooperation between EU and Central Asia in the field of environmental studies and prepared future managers and specialists in Central Asia to protect in a more effective way their environment. The specific project objectives thus were: to implement the full Bologna process in environmental studies in at least three countries of Central Asia and Georgia with full info-kits towards Bologna implementation for Uzbekistan and Turkmenistan; to reform curricula in three distinctive areas at BA level (forestry, industrial safety and water and soil environmental science); to create a Master in environmental protection; to create 21 new doctoral schools in those three specialisation areas in Central Asia and Georgia; to improve the training skills of 120 teachers; to train 480 BA students and 150 MA students during the pilot project in the first year of the new courses; to improve the employability of the students; to prepare joint Master and PhD diplomas between EU and Central Asian partners in the field of environmental studies; to prepare 5 centers of accreditation in ISO 14000.</td>
</tr>
<tr>
<td><strong>Coordinator:</strong> Georg-August-Universität Göttingen Von-Siebold-Str. 4, 4 Göttingen 37075, Germany</td>
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<tr>
<td><strong>Contractor:</strong> Georg-August-Universität Göttingen Von-Siebold-Str. 4, 4</td>
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Study of the Achievements of Tempus IV projects in Curriculum development in Engineering and Environmental Sciences in Eastern Europe

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**Partners:**
Academician E.A.Buketov Karaganda State University, Kazakhstan; Bukhara State University, Uzbekistan; The Carl von Ossietzky University of Oldenburg, Germany; Chamber of Ecoauditors, Kyrgyzstan; University of Chemical Technology and Metallurgy, Bulgaria; Ghent University, Belgium; Iakob Gogebashvils Saxelobis Telavis Sakhelmtsifo Universiteit, Georgia; Ilia State University, Georgia; Issykkul State University named after K.Tynystanov, Kyrgyzstan; Kazakh-British Technical University, Kazakhstan; Khorog State University named after Moyonsho Nazarshoev, Tajikistan; Kokchetau State University named after Shokan Ualikhanov, Kazakhstan; Kostanai State Akhmet Baitursynov University, Kazakhstan; Kyrgyz National Agrarian University named after K.I. Skryabin, Kyrgyzstan; Kyrgyz State Technical University named after I.Razzakov, Kyrgyzstan; Ministry of Education and Science of Kyrgyz Republic, Kyrgyzstan; Ministry of Education & Science of the Republic of Kazakhstan, Kazakhstan; Ministry of Higher Education Tajikistan, Tajikistan; National Attestation Commission of Kyrgyz Republic, Kyrgyzstan; Nyugat-Magyarorszagi Egyetem, Hungary; Osh Technological University named after M.M. Adyshev, Kyrgyzstan; Physical-Technical Institute of Academy of Sciences of UZ, Uzbekistan; Polytechnic University of Turin, Italy; Samarkand Agricultural Institute, Uzbekistan; Solar Plus Ltd, Uzbekistan; S.Seifullin Kazakh Agro Technical University, Kazakhstan; State Agency on Environment Protection and Forestry, Kyrgyzstan; Warsaw University of Life Sciences, Poland; Tajik Agrarian University, Tajikistan; Tajik National University, Tajikistan; Talas State University, Kyrgyzstan; Tashkent Chemical-Technology Institute, Uzbekistan; TeachEx Academy for Teaching Excellence in Higher Education, Kyrgyzstan; The Kulob Branch of Technological University of Tajikistan, Tajikistan; Turkmen Agricultural University named after S.A.Niyazov, Turkmenistan; Turkmen State University named after Magtymguly, Turkmenistan; University of Alicante, Spain; University of L'Aquila, Italy; University of Udine, Italy; Urgench State University, Uzbekistan; Vrije Universiteit Brussel, Belgium.

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**Reference:** 511390-TEMPUS-1-2010-1-SK-TEMPUS-JPCR

**Title:** Environmental Governance for Environmental Curricula
### Description:
Issues of environmental policy (or rather environmental governance) were still considered unimportant in many universities in Belarus, Russia and Ukraine, or their presence in curricula is formal. This and weak integration in international research communities often lead to a situation when in new curricula novel developments were limited to adjusted terminology and new approaches of engineering nature. As a result, environmental graduates with robust natural science or engineering education had difficulties identifying environmental problems and suggesting balanced solutions / translating them into sound policies. A related problem was that environmental practitioners and educators do not cooperate; this affected the quality of training and employability of graduates. Evaluation and self-evaluation tools were also far from operational. To address this it was proposed (1) to revise BSc courses in environmental sciences in partner universities, upgrading them in general and introducing environmental governance context; (2) to set up at partner universities joint MSc and PhD programmes in Environmental Governance, (3) to create a set (five) of textbooks covering multidisciplinary issues of environmental studies, especially emerging and rapidly developing fields, (4) to set-up national permanent seminars of environmental educators and employers and a web-portal, (5) to introduce new mechanisms of evaluation and self-evaluation. Points (2) and (3) included development of curricula and syllabuses, re/training of teachers and short mobility periods for faculty and students, especially in support to international network-building.

### Coordinator:
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### Contractor:
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Bratislava 814 99, Slovakia

### Partners:
Belarusian State Technological University, Belarus;
Central Research Institute For Complex Use Of Water Resources, Belarus Ecoproject, Belarus;
Independent Environmental Chamber Of Krasnoyarsk Kray, Russian Federation;
Institute Of Carpathian Ecology, Ukraine;
International A. Sakharov State Environmental University, Belarus;
Joint University Of Belarus And Russia, Belarus;
Kharkiv State Academy Of Municipal Management, Ukraine;
Kozep-Eurpoei Egyetem, Hungary;
Median S.C.P, Spain;
Odessa State Environmental University, Ukraine;
Pskov State University, Russian Federation;
Siberian Federal University, Russian Federation;
Warsaw University of Life Sciences, Poland;
University of Klagenfurt, Austria;
Vrije Universiteit Amsterdam, Nederland.

### Original Project Budget:
1.624.337,36

### Maximum Grant Awarded:
1.138.322,93

### Contract Duration:
41 months

### Approved Project budget:
1.266.090,44
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**Original Budget:** 1.624.337,36
**Maximum Grant Awarded:** 1.138.322,93
**Contract Duration:** 41 months
**Approved budget:** 1.266.090,44
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