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**EDUCATION AND RESEARCH IN BIOSYSTEMS
ENGINEERING IN EUROPE; A THEMATIC NETWORK**

Final Report

Public Part

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Executive Summary

The thematic network ERABEE TN (<http://www.erabee.aua.gr>) was established in 2007 aimed at supporting the restructuring of the European Agricultural Engineering (AE) programs of studies in Europe towards the evolving discipline of Biosystems Engineering (BE). This inevitable transition followed the changes associated with the highly and dramatically transformed sector of the European Agriculture and the rapid developments in the field of the bio-engineering science and technology, requiring high level and internationally competitive knowledge and technical support. The current strong universal competition in the transformed high quality and low-input agriculture requires well-educated Biosystems engineers specialised in the application of engineering sciences to the broader area of all living organism applications, including agriculture. This aim constituted the long-term objective of the proposed project. The project also focused on catching-up with the corresponding developments already in an advanced stage in the USA and Canada. Finally, it indirectly supported industry seeking specialised experts to provide high level knowledge concerning specific subjects.

In that respect, the aforementioned objectives were addressed to the following main target audiences:

- European Universities offering, or in transition to offering, such or relevant graduate and postgraduate level studies
- Non-European Universities from USA, Central- and South-eastern Europe (i.e. Croatia, Serbia), South America, South Europe, Russia, Latin America, etc.
- Groups benefiting directly from teaching and research, namely students and students associations, scholars and researchers
- Related companies, industries and enterprises
- Professional societies
- European and National accreditation bodies in conjunction with policy makers, Ministries of Education and the Academic society of Higher Education in Europe in general
- Other related disciplines, associations and thematic networks
- Academics, stakeholders, decision-makers

The main objectives of ERABEE were to initiate and contribute to the **structural development and the assurance of the quality assessment of the emerging discipline of BE in Europe**. The need for such a development was established by the USAEE Thematic Network¹. To date, very few Biosystems Engineering programs exist in Europe and those that are initiated are at a very primitive stage of development. The innovative and novel goal of ERABEE-TN was the **promotion of this critical transition**, which requires major restructuring in Europe, exploiting along this direction the outcomes of USAEE-TN. It also aimed at **enhancing the compatibility** among the new programmes of BE, at aiding their recognition and accreditation at the European and International level and at facilitating greater mobility of skilled personnel, researchers and students.

These objectives were achieved by means of cooperation between Universities as well as synergies and links with other related Thematic Networks, academic/professional bodies, the private sector, stakeholders and decision makers.

The ERABEE partnership consisted of 35 participants from 27 Erasmus countries, out of which 33 were HEA Institutions offering programmes of studies in the areas of Agricultural / Biosystems Engineering and 2 were Student Associations (BEST, IAAS), namely one in the discipline of Engineering (European-wide level) and another one in the discipline of Life Sciences (International-wide level). Other Erasmus participants, namely TNs, Professional Associations, Accreditation bodies and HEInstitutions, were also involved through synergies. On the whole, a large percentage

¹ USAEE-TN: University Studies of Agricultural Engineering in Europe (<http://www.hostforce.co.uk/nondrup/usaaee/usaaee-tn.htm>)

of Institutions / Universities involved through their programs of studies and/or research activities in the evolving discipline of BE throughout Europe, participated in the network.

The project work **was structured** into eight WorkPackages (including management): (i) *Structural Developments*, (ii) *Teaching & Research*, (iii) *Quality Assessment and Accreditation*, (iv) *International Recognition and Attractiveness*, (v) *Quality and Evaluation Plan of ERABEE*, (vi) *Dissemination of Results achieved* and (vii) *Exploitation plan of ERABEE*. The work of the network was carried out by five subject-area Working Groups, each devoted to a specific WorkPackage and involving a small group of academics, drawn from each of the Network member institutions.

All **major results achieved and publications and dissemination materials produced** during the three-year lifetime of the project are presented in the project's web site (<http://www.erabee.aua.gr>). More explicitly among others, six volumes of Workshop Proceedings and several reports have been produced and published, a web-based database has been built and updated by the majority of partners, many articles have been posted in Journals/Conferences/University Publications/presented at University Briefings, ERABEE-TN members have participated and made presentations in conferences / plenary sessions / International global symposia / fora / events, three ERABEE-TN members have attended an Event of Education organised by the student association BEST, flyers and posters have been produced and circulated at a various events, surveys have been prepared and circulated to specific target groups (i.e. industry), e-newsletters have been an important dissemination tool, personal contacts and discussion groups have been made, etc. Interest on the project results has been expressed from academics, associations, students, policy makers and other stakeholders worldwide.

The project's main intention was the outputs achieved to be **widely disseminated and exploited** not only within the consortium but also beyond the participating organisations and countries, at the international level. Dissemination represented a critical issue for ERABEE-TN as it ensured visibility and sustainability of the accomplished activities and results. A strong dissemination and exploitation strategy had been followed from the beginning of the project and some very important results were achieved. Target groups were identified not only at the planning stage of the project but the consortium kept on exploiting and identifying groups and organizations that could potentially be interested in the project's products.

One major dissemination tool developed throughout the three years is the **ERABEE-TN web-site**. AUA is the host and intends to maintain and update it even beyond the project's eligibility period.

The following information is included:

- Introduction of BE in 27 partner languages
- Definition of the discipline as developed by ERABEE Network and [ASABE](#)
- General information concerning the TN, along with details about its objectives and target groups
- Information concerning the consortium (coordinator and partners)
- Synergies, meetings, publications, dissemination actions and materials, exploitation activities, announcements related with the ERABEE-TN
- An up-to-date web-based data base with details concerning the 3 cycle Agricultural / Biosystems Engineering studies offered by various European Institutions
- Links with related projects and networks (USAEETN, POMSEBES, TABE-NET) and a link to the LLP Call for Proposals 2010.
- A confidential area serving mainly for internal project communication and electronic coordination, management and evaluation activities. It supports the Networking of the partners, offering the possibility for a smooth flow of working and final documents, presentations and information for the ongoing work of Working Groups, Work Packages, etc.

Table of Contents

1. PROJECT OBJECTIVES	6
2. PROJECT APPROACH	9
3. PROJECT OUTCOMES & RESULTS.....	12
4. PARTNERSHIPS.....	17
5. PLANS FOR THE FUTURE	19
6. CONTRIBUTION TO EU POLICIES.....	22

1. Project Objectives

The **concrete objectives** of ERABEE-TN are summarised as follows:

- ✓ Promoting synergies between Education and Research: Promote the structured 3rd cycle programs of studies, also establishing linkage between education and research at all three cycles
- ✓ Supporting activities in the field of Accreditation and Quality Assurance: Develop advanced European degrees of studies (e.g. European doctorate) and enhance accreditation and quality assessment and assurance frameworks integrating the Biosystems Engineering TN activities to the corresponding major developments on the European accreditation and labelling of European Engineering studies (EUR-ACE-IMPLEMENTATION)
- ✓ Defining and upgrading Generic and Sectoral Competences: Implement TUNING Template
- ✓ Establishing international attractiveness of European programs of studies in Biosystems Engineering
- ✓ Expanding the Biosystems Engineering programs of studies to include emerging areas such as bio-fuels, biomaterials, useful waste, etc. as related to the new CAP developments and the European Knowledge based bio-economy framework
- ✓ Reinforcing the link between Education in the emerging field of Biosystems Engineering and Society introducing the new developments to the non-academic community and the public

The concrete aims of ERABEE-TN were to expand the initial USAEE-TN objectives developing new activities and promote the step-by-step critical transition and further structural development of the traditional Agricultural Engineering area to the emerging Biosystems Engineering area.

Impact regarding teaching and learning: the transition from the traditional field of Agricultural to Biosystems Engineering has a direct impact on programmes of study, student learning, information access and course advising and it contributes towards the harmonization of European Higher Education. When the networking activities of the ERABEE-TN were initiated, only two institutions were offering university studies in Biosystems Engineering: the University College Dublin and the Catholic University of Leuven. During the life-time of the ERABEE-TN project, some remarkable developments in the emerging field of Biosystems Engineering were experienced with the establishment of new programs of studies in Biosystems Engineering in Europe. The contribution of the ERABEE-TN was decisive in this direction. The new European programs of studies in Biosystems Engineering established are presented below: University College Dublin (Ireland), Universidad de León (Spain), Politechnic University of Cataluña (Spain), Universidade de Évora (Portugal), University of Maribor (Slovenia), Estonian University of Life Sciences (Estonia), Technical University of Cluj-Napoca (Romania), Aarhus University (Denmark), Katholieke Universiteit Leuven (Belgium-Flanders), Uludag University (Turkey).

Promotion of the Biosystems Engineering Studies Accreditation: the first programme of BE that scheduled to undergo the EUR-ACE accreditation procedure in the framework of ERABEE-TN is the BE programme offered by the University College of Dublin, Ireland. More specifically, the current accreditation of the 4-year BE degree by Engineers Ireland expires in 2010. UCD has recently applied for a 2-year extension of this accreditation. A site visit by the accreditation agency (Engineers Ireland) has been fixed for the 13-14 December 2010. It has been assured that a successful re-accreditation will result in the award of the EUR-ACE label. An extension of two years only was sought in accreditation (up to 2012), as on from this date, UCD Biosystems Engineering along with some other engineering disciplines in UCD, are considering the introduction of a 3-year BSc (Biosystems Engineering) degree followed by a 2-year accredited ME (Biosystems Engineering) degree, which would meet the requirements of chartered engineer registration by Engineers Ireland and the award of the EUR-ACE label.

Promotion of the Biosystems Engineering Studies Recognition trials: it was decided that the EurAgEng Recognition Process should be encouraged and that volunteer Institutions should undergo recognition trials, in order to accurately set up the whole process. Eventually, two Universities accepted to apply for a trial, namely the *Polytechnic University of Madrid, Spain* and the *Latvia University of Agriculture, Latvia*. In both cases, the process has been initiated and is in progress though EurAgEng. The trials will be carried out beyond the lifetime of the project and more recognition trials may be carried out that will ensure the project's sustainability beyond the eligibility period.

Impact regarding the sustainability of the ERABEE networking activities towards the pertaining academic society, the students and the professional environment context: at the last ERABEE workshop in September 2010 the Steering Committee decided to proceed with the formation of a Biosystems Engineering Network called **ERABEE Network**. This Network will function as a non-funded Network of European Universities / Departments offering programs of studies in the fields of Agricultural and Biosystems Engineering. It will be a European "networking basis", wherein the ERABEE consortium and new interested partners will stay in touch and will support the submission of new proposals and communicate new developments in Education and Research in Biosystems Engineering. This will also facilitate the interaction with EurAgEng and EUR-ACE concerning recognition and accreditation procedures and the organisation of working meetings.

Synergies with research projects about innovation in education: a) the ongoing project TABEL.NET (TransAtlantic Biosystems Engineering Curriculum and Mobility), within the EU-US ATLANTIS Programme, is targeted to advance in the internationalisation of ABE curricula and develop a global awareness within this discipline. This project is based on and is a follow-up of the ERABEE-TN and b) the data derived from the questionnaire on University-Enterprise cooperation developed by the ERABEE-TN has been used by the research project coordinated by University of Leon entitled "Análisis de los procedimientos y herramientas para la adaptación de los títulos de Ingeniería a las necesidades del mercado laboral nacional e internacional" (in en: *Analysis of the procedures and tools for the adaptation of the engineering studies to the international and national labour market*).

Enhancement scheme of student and staff mobility and improvement of inter-university communications and knowledge transfer: the schemes developed for promoting the mobility of students, graduates, PhD students and staff, both within and outside Europe, are illustrated below:

- web-based database on the European study programs in Biosystems Engineering, established within the framework of USAEE-TN and updated through the ERABEE TN activities: it was designed to make the European ABE programs of studies familiar and easily accessible to all over the world. This information facilitates students and staff mobility and provides useful information to the project target groups.
- twelve new bilateral agreements have been established and promoted, besides those existing before ERABEE.
- the ongoing mobility project TABEL.NET

Impact to the relevant Business/Industry/Society: business and industry seek specialised experts to provide high level knowledge concerning specific subjects. One of the objectives of ERABEE was to endorse synergies between Education and Research at all three cycles. A special survey was developed and distributed to the pertaining industry/enterprises, to map the current situation of the perspective employability of ABE graduates and the market needs. The most significant result of this survey was the importance given to the cooperation between Universities and enterprises specialised in Biosystems Engineering, as the majority of the enterprises were willing to employ highly specialised graduates (M.Sc.) and/or post-graduates (PhD). Moreover, almost all the enterprises aimed at a higher involvement in the development and restructuring of degree study programs and believed that the entrepreneurial spirit must be developed within the University itself. It was also made apparent that the enterprises aim at an easier and faster transfer of knowledge from University to industry and vice versa and at a permanent route of dialogue with the Universities. ERABEE-TN through its support to the restructuring of study programs, the

development of advanced accredited European degrees of studies and the impact on the international attractiveness of the discipline, indirectly, support industry by providing graduates with high level knowledge and technical capacities.

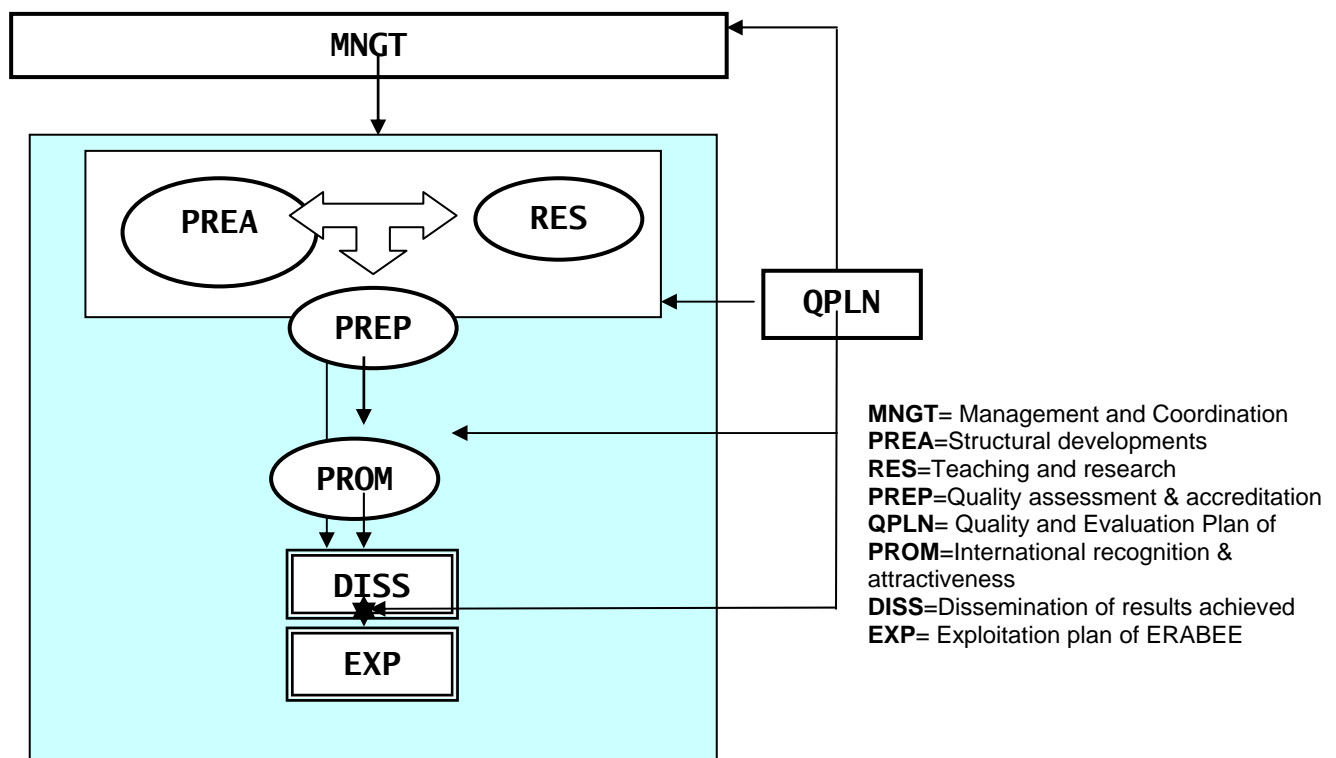
At an international level strong synergic activity was established with EurAgEng and with ASABE, so as to follow the international developments and coordinate the corresponding activities with the major professional organisations in Europe and the USA.

2. Project Approach

To achieve the objectives set the project work **was structured into eight WorkPackages**, including apart from management seven related WorkPackages on: Structural developments (support of the gradual expansion and further advancement of the structural developments of the European Agricultural Engineering programs of studies and their critical transition and structural development towards the Biosystems Engineering programs of studies); Teaching and research (promotion of the development of the 3rd cycle structured programs of studies in Biosystems Engineering in Europe, including advanced coursework in parallel to research towards the PhD); Quality assessment and accreditation (promoting the development of the Quality Assessment and Assurance Frameworks of European programs of studies in the emerging field of Biosystems Engineering and their incorporation into the European Engineering Quality Assessment scheme); International recognition and attractiveness (enhancing the international attractiveness of European programs of studies in Biosystems Engineering exploiting, among others, the EU/USA POMSEBES project outcomes and bringing together public-sector, scientific and professional players and contributing to the European innovation capacity); Dissemination of results achieved and Exploitation plan of ERABEE (wide dissemination and exploitation of the project results to the academic community, professional societies, enterprises, decision-makers in local, regional, national and European level etc).

The work was carried out by five **subject area Working Groups (WG)**, each devoted to a specific WorkPackage and involving a small group of academics, drawn from each one of the member institutions. The small size and the closely defined subject area of the working groups provided an ideal working environment. The networking activities were coordinated and monitored by the project coordinator and a Steering Committee (SC), which was responsible for detailed planning, project management and editing the main outputs as well as for the project's internal evaluation. SC Members were also involved in each of the Working Groups so as to ensure that the necessary two-way exchange of information can take place.

The Figure below shows graphically the work distribution and interaction between Workpackages



Cooperation and communication amongst partners was ensured by participation in project meetings/workshops, via electronic communication, through the web-site development (wherein all related information were posted for partners briefing), etc. The web-based database on the current status of the ABE programme of studies per university at a national level (developed by USAEE-TN) was maintained and updated by ERABEE-TN partners as well as a matrix to record the existing and the new bilateral agreements achieved under the project's framework was circulated. In addition, the active involvement of the European Society of Agricultural Engineers ensured the cooperation of the corresponding national societies. Furthermore, strong synergies have been established with other thematic networks and stakeholders (i.e. EUGENE, TUNING, TREE-TN, ARCHIPELAGOS, EUR-ACE-IMPLEMENTATION & EUR-ACE-Spread, FEANI, EUI-Net, SEFI, CIGR, etc.) and associations (e.g. ICA, BEST, IAAS) guarantying the compatibility of the relevant environment of higher engineering with Agricultural/Biosystems Sciences education in Europe.

Six workshops and three additional Working Groups and Steering Committee meetings in-between workshops were organised. Whichever WG was responsible to organise a Workshop, had the task to prepare the corresponding guidelines and paper format in order the consortium to be on time to prepare the paper-reports and presentations for the Workshop. Its responsibility was also to prepare a synopsis of all gathered paper-reports to be included in the Workshop proceedings. Agendas, minutes and any other administrative document were prepared by the coordination team. The workshops lasted two days, that is to say, the first one was mainly devoted to country-partner presentations and to briefings on the workshop's topic by invited speakers (i.e. industry, academics, students, policy makers, professional associations, etc) and the second day to Working Groups sessions and concluded with the Steering Committee meeting. After every workshop, the dates and venue of the next workshop were decided. Experts/academics to monitor and evaluate the progress of the work done were invited to all workshops. In order to better organise the progress of work done within WGs and the outputs achieved per WorkPackage, three (one-day) meetings took place as well. ERABEE-TN members attended (and had also been invited to attend) various conferences (at a national and even international and global level), events, fora, symposia and disseminated the project's results outside the consortium. Based on the objectives and the methodology used by each WG, surveys had been prepared and circulated as well as trial tests (i.e. two universities agreed to undergo the EurAgEng recognition process) were followed under specific tasks. Information on the above activities can be found at the project's web-site.

The main **added value** of the ERABEE-TN was the continuation and exploitation of the work done within the framework of USAEE-TN and POMSEBES. It represented a major challenge for Europe that is lagging behind the corresponding developments in the USA and Canada where the new field of studies has already been established. Meeting the challenge for this important new inter-disciplinary field and fulfilling the above described political goals set by CEC the ERABEE-TN supported the systematic, harmonised and coordinated at a European level development of the emerging discipline of Biosystems Engineering.

ERABEE-TN had set from the beginning of the project the tools and a specific **evaluation plan** so as to assess the quality of the work of the consortium as well as the progress of outcomes and products achieved. The Assessment criteria used were the following:

- Evaluation of the project by external evaluators (invitation to workshops/meetings) and professional bodies (e.g. EurAgEng council). Evaluation reports on the progress of the activities were provided afterwards (posted in the private area of project's web-site).
- Steering Commission meetings were organised at the end of each one of the six workshops as well in conjunction with the three additional WGs meetings taken place in-between workshops, ensuring that the project: met the set milestones, evaluated the organisational structure and other operational and management aspects of the project, monitored partner's active participation and contribution to conferences / workshops /

meetings as well as the quality and timing of deliverables preparation, the materialisation of synergic activities, the feedback received from parties outside the consortium. In addition to that, two self-assessment questionnaires were distributed to the consortium at the middle and at the final stage of the project (processed questionnaires are posted to the private area of project's web-site).

Dissemination activities that took place during the lifetime of ERABEE were among others: web-site, information on electronic platforms, references and links in other web-sites, articles in journals/University Publications/plenary lectures, participation in workshops and conferences, posters, flyers, proceedings, articles in journals, newsletters, participation in committees, surveys and personal contacts. **Exploitation activities** included the promotion of the Biosystems Engineering Studies through Recognition by EurAgEng and Accreditation by EUR-ACE, synergies with other Thematic Networks, promotion of new Degrees and Doctorates in Biosystems Engineering, synergies with research projects and transatlantic Educational projects about innovation in BE education, synergies with new teaching innovation groups and promotion of new scientific and teaching sectors.

The dissemination and exploitation plan was designed in a way to be flexible, taking account of the key stages of the project and information flows to and from external parties so as to help partners to tailor their products in such a way as to make them relevant beyond the life of the project. The projects web-site will be **sustained and updated as well after the lifetime of the project.**

3. Project Outcomes & Results

The major achievements and results accomplished during the whole period by the corresponding Working Group and linked to the project objectives are reported here below:

- **Working Group 1**

The operational objectives of WG1 were to support the gradual expansion and further advancement of the structural developments of the European Agricultural Engineering programs of studies and analysing to initiate and promote their step-by-step critical transition and structural development towards the Biosystems Engineering programs of studies; and to expand the Agricultural and Biological Engineering programs of studies to include the emerging areas of bio-fuels, bio-based materials and useful waste, as examples of applications of current and future societal needs, along with product quality as related to the new CAP developments.

WG1 was responsible for the organization of two workshops, one on the theme ***“Develop further the structure of the Biosystems Engineering discipline in Europe: definition of the emerging discipline, establishment of new modules in the core curricula and professional targets”*** that took place on 3-4.04.2008 in Madrid, Spain and another one on the theme: ***“Define the scope of Biosystems Engineering discipline placing special emphasis on the emerging areas of bio-fuels and biomaterials and quality of products, as they relate to the new CAP developments”*** that took place on 13-14.10.2008 in Dublin, Ireland. The two volumes of the Workshop proceedings can be found at <http://www.erabee.aua.gr/publications.htm>

Another outcome produced was on the ***“Investigation of the implementation of new European programs of studies in Biosystems Engineering based on the already developed and approved by FEANI-EMC core curricula of the first two cycles”***. This constitutes a paper-report of eight sections aiming at exploiting the results of the core curricula and ECTS table developed under the USAEE-TN and approved by FEANI, by adapting them to the broader area of Biosystems Engineering, addressed to a wider audience at a European level. Overall presentation of the programs of studies in Biosystems Engineering all over the world has been offered in six supplements because of the large volume of the relevant information. Through this major effort of ERABEE TN, the current developments in Europe and around the world in the Educational programs in Biosystems Engineering have been presented in a comprehensive way. Details can be found at the project's website (click on the globe shown at www.erabee.aua.gr).

Impact on target groups: cascaded among Universities, academic and professional associations, related thematic networks and projects, researchers.

- **Working Group 2**

The operational objectives of WG2 were to analyze the current 3rd cycle University studies schemes in Agricultural Engineering in Europe, to develop 3rd cycle structured programs of studies in Agricultural Engineering and in the emerging field of Agricultural and Biological Engineering, to promote advanced coursework in parallel to research, promoting also the establishment of the Doctorate in Agricultural and Biological Engineering (e.g. European doctorate), to develop synergies with TREE TN, SEFI and other parties to coordinate the relevant activities and analogous developments in the broader area of Engineering Education in Europe.

In this framework, WG 2 was in charge of the 3rd Workshop that tackled the theme on ***“3rd Cycle University studies in Europe and the current schemes in Agricultural Engineering, possible structured programs of studies in Agricultural Engineering”***

and the emerging field of Biosystems Engineering” held on 4-5.05.2009 in Uppsala, Sweden. Furthermore it was responsible for the organisation of 4th Workshop on **“Integration of education and research at the 1st and 2nd cycle regarding European Agricultural and Biological Engineering University studies and supported the research activities at the European level for the preservation of the rare knowledge in specialised relevant topics”** held on 16-17.11.2009 in Valetta, Malta. The two volumes of the Workshop proceedings can be found at <http://www.erabee.aua.gr/publications.htm>

To meet the objectives described above WG2 developed two other Outcomes, one concerning the **“Recommendations on the integration of research with Biosystems Engineering curriculum and development of synergies in the framework of thesis and other research projects carried out during the first two cycles of studies in Biosystems Engineering in Europe with the synergy of Socrates students and staff mobility”** and another one tackled the theme on **“A survey of the status (i.e. acceptance criteria, structure and organisation, quality, innovation, financing, etc.) of doctoral studies in Europe, and a scheme for promotion of cooperation and synergies in the framework of the 3rd cycle of studies and the European Doctorate in Biosystems (or Agricultural and Biological) Engineering in Europe”**. The conclusions derived from these two outcomes have been reported in the WG2 Final Report posted to the web. Several papers / articles / presentations have also been produced and published at <http://www.erabee.aua.gr/dissemination.htm>

Impact on target groups: cascaded among Universities (e.g. academic staff, students, managers/administrators), academic and professional associations, related thematic networks and projects, researchers, Ministries of Education, public sector, policy makers, companies involved in various aspects of agricultural production and processing, the industry and market in the field of the technical support of agriculture, etc.

- **Working Group 3**

The operational objectives of WG3 were to establish/Implement the recognition procedure of the European programmes of studies in AgEng with FEANI and EurAgEng, develop the process for recognition of the new Agricultural and Biological Engineering Programmes, develop an organizational scheme in close collaboration with EurAgEng, apply for the European Qualifications framework for Quality assessment and assurance to European programmes of studies in AgEng and Biosystems Engineering, promote the Eur-Ace Implementation and adoption of the European Quality Label. In order to meet those objectives it undertook the organization of the fifth workshop on the theme **“Quality Assurance and Assessment Frameworks of Biosystems Engineering studies”** held on 29-30 April 2010 in Prague, Czech Republic. The Workshop proceedings can be found at <http://www.erabee.aua.gr/publications.htm>

Another outcome on the **“Investigation of recognition procedure schemes” EurAgEng - ERABEE Recognition Process**” was prepared. ERABEE adopted the FEANI approved core curricula for Agricultural and Biosystems Engineering University studies in Europe originally designed by USAEE TN. This means that the benchmark core curriculum will serve the purpose of determining a set of minimum criteria / requirements against which any curriculum can be tested and decided whether or not it meets the criteria for its admission as a particular programme of Agricultural or Biosystems Engineering studies in Europe. If these criteria are met then the particular program of studies is consequently a) approved by FEANI, b) is recognized by European Association of Agricultural Engineers and c) can be accredited by EUR-ACE.

This approach permits countries wishing to eventually seek accreditation to Europe-wide engineering standards to do so through their national societies, provided that they are awarded the EUR-ACE labelling authorization. However it is considered by the USAEE and subsequently the ERABEE networks and by EurAgEng that an intermediate stage prior to seeking full accreditation would be valuable to many countries. Such a step, or recognition,

encourages the development of cooperation in education and in subsequent employment of qualified engineers across Europe. It would mainly allow the programs of studies under recognition to be better prepared for the EUR-ACE accreditation and offer an added value since their EurAgEng recognition will offer them a “recognised” status by the professional society and a complimentary to EUR-ACE approval of the Agricultural or Biosystems dimension of these programs of studies.

Two volunteer institutes have initiated the trial recognition: a) the Polytechnic University of Madrid, ETSI Agrónomos, Spain and b) the Latvia University of Agriculture, Latvia. These two Universities have prepared their application following a specific template developed by ERABEE (entitled *Draft Template for Departments Applying for Recognition of Programs of Studies by EurAgEng*) but the process is in progress since the remit of the committee is still to be prepared and particularly “volunteer” members for the Committee are still to be found. The trials will be carried out beyond the life of the project and more recognition trials may be carried out. This ensures the sustainability of the network beyond its lifetime.

Two other outcomes were developed under the auspices of this WG, one entitled “**Tools for Quality Assurance and Assessment Frameworks of Biosystems Engineering studies**” and another one entitled “**A scheme for the accreditation of new European programs of studies in Biosystems Engineering in synergy with EUR-ACE-Implementation**”. After the 5th workshop it was decided to combine P11 and P12. As a result a document describing SUBJECT-SPECIFIC CRITERIA, relating to the accreditation of Bachelor’s degree programs in Biosystems or Agricultural and Biological Engineering was compiled. The first programme of Biosystems Engineering scheduled to undergo the EUR-ACE accreditation procedure in the framework of ERABEE is the BE programme offered by the University College of Dublin, Ireland. More specifically, the current accreditation of the 4-year Biosystems Engineering degree by Engineers Ireland expires in 2010. UCD has recently applied for a 2-year extension of this accreditation. A site visit by the accreditation agency (Engineers Ireland) has been fixed for the 13-14 December 2010. It has been notified successful re-accreditation will result in the award of the EUR-ACE label. An extension of 2 years only was sought in accreditation (up to 2012), as on from this date, UCD Biosystems Engineering along with other some other engineering disciplines in UCD, are considering the introduction a 3 year BSc (Biosystems Engineering) degree followed by a 2 year accredited ME (Biosystems Engineering) degree which would meet the requirements of chartered engineer registration by Engineers Ireland and the award of the EUR-ACE label. Details for all outcomes and testing templates can be found at the project’s website.

- **Working Group 4**

WG4 worked on the international attractiveness of the European study programs in Biosystems Engineering, exploiting also the EU/US POMSEBES project outcomes and had the task to bring together public sector, scientific and professional stakeholders, contributing to the European innovation capacity, supported by the TUNING lines, aiming at implementing the TUNING Template, in order to promote the international image of these European University study programs; to develop further the web database about European study programs in Biosystems Engineering, established in the framework of USAEE-TN (University Studies of Agricultural Engineering in Europe; a Thematic Network), the predecessor of ERABEE-TN; to promote the multi-linguism in Biosystems Engineering University study programs.

For these reasons it undertook the organisation of the 6th Workshop held on the 9th-10th of September 2010 in Clermont-Ferrand. It tackled the theme on “**Enhancing the attractiveness of European study programs in Biosystems Engineering**”. The workshop proceedings can be found at the project’s website at the following link: <http://www.erabee.aua.gr/publications.htm>).

Another outcome achieved within WG4 has been the “**Implementation of TUNING Template**”, which is a template for a summary of TUNING subject area findings applied to

Biosystems Engineering discipline developed by ERABEE. TUNING has developed reference points for common curricula on the basis of agreed competences and learning outcomes, as well as cycle level descriptors for many subject areas, in order to enhance European recognition and integration of diplomas, taking into consideration the diversity of cultures. ERABEE findings will be also included in the TUNING web-site.

On more outcome developed concerned the topic on: “**The main enhancement scheme of student and staff mobility between EU universities & improvement of inter-university communications and knowledge transfer**”. The main conclusions of this outcome are that the existing schemes for promoting the mobility of students, graduates, PhD students and staff, both within and outside Europe, are: a) a web-based database on the European study programs in Biosystems Engineering, established within the framework of USAEE-TN and updated through the ERABEE TN activities; through this database the ABE program of studies can be disseminated throughout Europe (<http://sunfire.aua.gr:8080/ects/Welcome.do>); and b) new bilateral agreements have been established and promoted, besides those existing before the period of ERABEE. A matrix was prepared to report the existing and new Erasmus bilateral agreements established among ERABEE-TN partners (12 new agreements have been achieved under the ERABEE framework: effective since 2011/12).

The conclusions of this outcome will be communicated to: European and international academic (e.g. EurAgEng, ASABE, CIGR) and professional associations (e.g. CEDIA), related thematic networks and projects, public sector, policy makers and companies involved in agricultural production and processing. Details for all outcomes can be found at the project's website.

- **Working Group 5**

WG5 was involved in developing a Dissemination and Exploitation strategy from the very beginning. **Dissemination activities** included the: design and update of ERABEE web-site, information on electronic platforms, references and links in other web-sites, articles, plenary lectures, participation in workshops and conferences, posters, flyers, proceedings, newsletters, participation in committees, surveys and personal contacts.

More explicitly, the Thematic Network web-site (<http://www.erabee.aua.gr>) contains the following contents:

- Introduction of Biosystems Engineering (definition) in 27 partner languages
- Definition of the discipline as developed by ERABEE Network and ASABE
- General information concerning the Thematic Network, along with details about its objectives and target groups
- Coordinator and partners
- Synergies (related organisms, associations and networks)
- Meetings (information of ERABEE members attending various meetings/events/for a/international of global meetings/students events, etc)
- Publications (i.e. 6 workshops proceedings, articles in journals/conferences/plenary sessions/special events, etc.)
- Dissemination actions (activities that include newsletters, articles in the EurAgEng Newsletters, participations in the EUR-ACE Spread Project, articles in Conferences, presentations, questionnaires, participation in meetings, etc.)
- Exploitation activities (synergies, studies accreditation, new Biosystems Engineering studies, new teaching and research groups, research and education projects, etc.)
- Announcements related with the ERABEE Thematic Network
- An up-to-date web-based data base with details concerning the three cycle Agricultural/Biosystems Engineering studies offered by various European Institutions
- Links with related projects and networks (USAEE-TN, POMSEBES, TABE-NET)
- A link to the LLP Call for Proposals 2010.

- A confidential area for the internal communication. The confidential area of the website serves mainly internal project communication and dissemination and electronic coordination, management and evaluation activities. It supports the networking of the partners, offering the possibility for a smooth flow of working and final documents, presentations and information for the ongoing work of Working Groups, etc. In the Members area some of the following info has been posted: Administrative Documents; Meeting Minutes; Workshop Guidelines for Authors and Paper Format; Meeting Presentations (by ERABEE members and invited speakers); Agendas and arrangements info; Working Groups objectives, reports and presentations, etc.

For further details one may contact the members of the coordination team at <http://www.erabee.aua.gr/ERABEE%20CoOrdinator.htm>. Contact details of ERABEE partners and staff members are also included at <http://www.erabee.aua.gr/ERABEE%20partners.htm>.

Exploitation activities included the promotion of the implementation of the Biosystems Engineering Studies Recognition and Accreditation schemes, synergies with other Thematic Networks, promotion of new Degrees and Doctorates in Biosystems Engineering, synergies with research projects and transatlantic Education projects about innovation in education, synergies with new teaching innovation groups and promotion of new scientific and teaching sectors. Some results of the project have brought changes in the activities and structures of higher education. These changes show that the implementation of Biosystems Engineering in Europe is forthcoming, so that nowadays studies in this respect are of paramount importance. All activities affected by the project results have been considered in this perspective.

All exploitation activities undertaken during the three-year lifetime can be found at <http://www.erabee.aua.gr/Exploiatation.htm>.

4. Partnerships

The multi-country and specifically the European dimension of the ERABEE project is shown by the fact that its aims and objectives, methodology, effects, prospects and aspirations apply not only to a specific local or regional context, but to the European arena as a whole and beyond, considering also the established strong synergies with the US corresponding developments in the field of Biosystems Engineering.

Cooperation and communication amongst partners was ensured by the past experience and tradition in managing ERASMUS and other EU-funded projects. The TN has established a continuous cooperation scheme with most partners of the consortium as well as those outside it. Ever since ERABEE-TN originated, two parallel partnerships have been established between (European) ERABEE partners and US Universities in the framework of the POMSEBES project on "*Policy Oriented Measures in Support of the Evolving Biosystems Engineering Studies in USA – EU*" and in the framework of an Excellence Mobility Project on "*TransAtlantic Biosystems Engineering Curriculum and Mobility (TABE.NET)*".

In the framework of ERABEE-TN, a great deal of human force had been activated to work together in a trans-European educational environment and to interact in new cultural and linguistic contexts, fundamentally different from those they come from (e.g. speaking of teachers, researchers, students). Students accepted this challenge in order to understand, learn from and operate with citizens from other cultures. The geographical coverage of thirty five partners from twenty-seven countries from all over Europe links to the idea of the creation of a '*European cultural area*' and the ambiguous concept of a '*European cultural identity*', in connection of course with the imperative criteria of visibility. This concept refers to practical aspects in the project design such as the active participation of partners or the addressing of target groups of a wide scope from various parts of Europe.

One of the most important basic issues in a partnership building is the negotiation and contract formulation to agree on the targets and objectives of the partnership. Clearly, a partnership is intended to gain added value and usefulness as a consequence of agreed collaboration and joint activities. A well-functioning bilateral or multilateral partnership is based on the clear understanding regarding a number of partners involved. From the very beginning, the Steering Committee was responsible for the formation of WGs and the assignment of activities to the consortium. Therefore members were fostered to work side by side with each other and especially in the framework of their own WGs in this way to experience the benefits of language immersion, cultural orientation and ongoing program support. Participation in workshops/meetings was considered a great way to meet people and learn about the local culture. For that reason, the selection of meeting places was decided very carefully. Furthermore, when organizing workshops or meetings, strong efforts were made to invite outside speakers (individuals or bodies) of the local private sector as a way to bequeath their knowledge and experience inside the consortium.

ERABEE members had the opportunity to develop their professional skills in an international context, including written and oral presentations, social skills, interactive communications, personal and team management, and cultural awareness. Partnerships could thus be compensated through their staff involvement in curriculum development and in exchange mobility programs. This will consequently expand the mobility of students within Europe.

Bringing together Universities and Departments offering programs of studies in Agricultural and / or Biosystems Engineering with big diversity in the scope and the structure of those programs, represented a major challenge and had an important added value to the project. In addition, the interaction and synergies with stakeholders, industry, students/alumni associations and other professional associations enhanced the European dimension of the project. During the project's lifetime it was made apparent from all members that personal contacts with individuals/bodies outside the consortium (i.e. at national/regional and

international conferences and events) was a great opportunity for them on a personal basis and because they brought the gained experience and ideas back to their faculties/universities.

Cultural diversity is probably the most frequently cited concept in the debate on culture and cultural policy in Europe and is one of the main issues in the legal framework for culture in the EU. As a counterpart to the idea of a common European cultural identity, which is built on the assumption of a shared history and common “roots”, the diversity of cultures is generally perceived as one of the dominant and specific features of the EU and reflecting its wealth. The cultural diversity of the partnership contributed to the European added value of the ERABEE project. But at the same time the national identities of the member countries were respected. Cultural cooperation among the European partners is understood to have contributed substantially to a European added value and *‘to have formed an integral part of economic and social development as well to promoted social cohesion and to have fostered mutual understanding and a sense of possessing a common European citizenship’*.

One of project's objectives was the mapping of the diversity and the structure of the programs of studies in the traditional field of Agricultural Engineering in Europe. Therefore a European wide survey was initiated so as to investigate the current situation concerning the programme of studies and the research activities undertaken within European University Institutes. For this purpose, a continuously updated web-based data base had been developed. The previous USAEE-TN had also set the basis for the assessment of the state-of-art in the European programme of studies as well as the identification of the needs for the creation of a common core curriculum to be used as a benchmark around Europe. It had also set up the tools for the harmonization of studies in order to fit into the Bologna scheme (use of common ECTS credits, common modules, etc). Real collaboration among European actors was fostered and a great deal of human resources was mobilised around Europe in order to promote and activate other parties, such as professional bodies, academic organisations, policy makers, etc.

The European added value is clearly shown by the fact that it was decided in September 2010 to proceed with the formation of a Biosystems Engineering Network called **ERABEE Network**. This Network will function as a non-funded Network of EU Universities / Departments offering programs of studies in the fields of Agricultural and Biosystems Engineering and will support the submission of new proposals and communicate new developments in Education and Research in Biosystems Engineering.

The most comprehensive and thorough approach to assess added value involved a formal external evaluation, carried out by an external to the partnership expert. If this evaluation is started early enough, it can help to inform action rather than simply be a ‘looking back’ at what was or was not achieved. For that reason, ERABEE had invited various experts/academics to attend its workshops to monitor and evaluate the progress of the work done.

5. Plans for the Future

Some results of the project have brought changes in the activities and structures of higher education. These changes show that the implementation of Biosystems Engineering in Europe is forthcoming, so that nowadays studies in this respect are of paramount importance. All activities affected by the project results have been considered in this perspective.

Promotion of the Biosystems Engineering Studies accreditation: the active participation of ERABEE–TN members in the EUR-ACE project², aimed at strengthening the synergies with the major Engineering Thematic Networks, i.e. EUR-ACE IMPLEMENTATION, EUR-ACE-spread, and TREE, in order to promote the goal of implementation of the ‘EUR-ACE label’ accreditation of Biosystems Engineering, which will be a major exploitation step.

The first programme of Biosystems Engineering scheduled to undergo the EUR-ACE accreditation procedure in the framework of ERABEE is the BE programme offered by the *University College of Dublin, Ireland* (a site visit by the accreditation agency (Engineers Ireland) has been fixed for the 13-14 December 2010)

Along this direction it was decided that the EurAgEng recognition process should be encouraged and that volunteer Institutions should undergo trial cases. Two Universities, namely the *Polytechnic University of Madrid, Spain* and the *Latvia University of Agriculture, Latvia* have prepared their application. The process is in progress.

Promotion of new degrees and doctorates in Biosystems Engineering: new degrees have been launched, all of which have been promoted by members of the thematic network ERABEE. More specifically:

- ✓ University Master in Biosystems Engineering - University of Leon, Spain. University of Leon is one of the two participating Spanish institutions of the ERABEE-TN. In this University, the “Master Universitario de Investigación en Ingeniería de Biosistemas por la Universidad de León” (University Master in Biosystems Engineering by the University of León http://www.unileon.es/ficheros/acceso/master/triptico_master_in_biosistemas.pdf) and the “Doctorado en Ingeniería de Biosistemas” (Doctorate in Biosystems Engineering) have been recently verified by the Spanish Universities Council. Previously the proposals of program of studies were evaluated by a review panel, consisting of experts who use the protocols of ANECA (National Agency for Quality Assessment and Accreditation). The results of such evaluations were positive.

These Master and Doctorate degrees in Biosystems Engineering came from a previous doctorate in “Tecnologías Agrarias” (Agrarian Technologies). Both the information of the ERABEE-TN and the POMSEBES project were used to justify the interest of these new master and doctorate in the proposal. In addition such information was also used to develop the contents of the programs of studies. All this information was crucial for the approval of these new studies. This master was considered strategic by the regional government of “Castilla y León” according to the Regional Strategy for the technological development and innovation in Castilla y León.

- ✓ Second cycle on Biosystems Engineer - University of Evora (Portugal). University of Evora is the participating Portuguese institution of the ERABEE-TN. In 2010 the National Accreditation Agency has approved a new 2nd cycle on Biosystems Engineer in this University. This 2nd cycle will start in the 2010-2011 academic year. The duration of this programme is 120 ECTS credits distributed in four semesters. A common semester

² EUR-ACE “A decentralized European accreditation system of engineering study programmes” (http://www.feani.org/webfeani/EUR_ACE/EUR-ACE%202/EUR_ACE2_Main_Page.htm).

is followed by four branches: Bioenergy, Precision Agriculture, Irrigation, construction and equipment engineering and Biophysical engineering and the ecological systems.

- ✓ Master's Degree on Biosystems Engineering for Agriculture and Food Industry - Technical University of Cluj-Napoca, Romania. The Technical University of Cluj – Napoca (Romanian institution participating in the ERABEE-TN) promoted a Master's Degree (2nd cycle) on Biosystems Engineering for Agriculture and Food Industry in the academic year 2009–2010. It can be found in the list of Master's specializations of this University on the 47th position (<http://utcluj.ro/educatie/master.php>). This new Master had 21 students in the first academic year (2009–2010) and has 24 candidates for the course 2010/11. The Master's Core Curriculum was developed in accordance with the ERABEE studies proposal.
- ✓ Master's Degree on Technical and Economical Management of the Agricultural Engineering – Higher Educational Agronomic School of Dijon (France). Higher Educational Agronomic School of Dijon (AgroSup) in one of the French Institutions participating in ERABEE-TN. In Dijon a Master on “Technical and Economical Management of the Agricultural Engineering” was initiated in 2006 and this Master has been positively re-accredited in 2009 for 3 years. This Master is specially oriented to extend the education of Agricultural and Biosystems Engineers.
- ✓ Bachelor's Degree on Biosystems Engineering – Estonian University of Life Sciences (Estonia). Estonian University of Life Sciences is the participating Estonian institution of the ERABEE-TN. This project was initiated in 2009 to develop study programmes of applied education and Master in Biosystems Engineering. The objective of the project is to integrate the biological and engineering education to meet the expectations and requirements of agricultural producers for such professionals. In the development of the Biosystems Engineering study program a range of stakeholders were involved. The stakeholders represented managers of rural companies, agricultural growers, processors and others closely related to agriculture. Five joint workshops were held with stakeholders and university representatives, the conclusions and outcomes were used to improve the study programmes. The program is a professional higher education type with a duration of 4 years which equals to 240 ECTS.

Synergies with research projects about innovation in education: a) the ongoing project TABE.NET and b) ERABEE TN results have used by a Research Project implemented by the University of Leon.

Promotion of new teaching innovation groups: A new teaching innovation group called BETI (Biosystems Engineering Teaching Innovation) has been recently approved by the Politechnic University of Madrid. The two Spanish representatives of ERABEE-TN are members of this group. It aims at creating educational resources that promote the internationalization of studies in Biosystems Engineering.

Promotion of new scientific and teaching sectors: in Italy, the Agricultural Engineering scientific and teaching sector has been re-modulated and updated into the new sector “Agricultural, Forestry and Biosystems Engineering”, including the research and teaching subjects regarding also the following aspects related to Biosystems Engineering, distinguished in the 3 related Italian traditional sub-sectors: Hydraulics, Mechanics and Structures and Land. This is a result of the process promoted by the Italian representatives of ERABEE-TN. The new scientific and teaching sector was also approved by all the delegates of the American Society of Agricultural and Biological Engineers.

As mentioned before the *project's sustainability* will be ensured by the formation of a Biosystems Engineering Network called ERABEE Network which will support the submission of new proposals and communicate new developments in Education and Research in Biosystems Engineering.

The project's website will also be maintained and updated, on gratis, by the coordination staff. ERABEE members have promised to continue promoting and disseminating the important work done within the previous three years and address outcomes and results to new target user groups. They intend as well to support and promote the synergies and cooperation schemes already established.

6. Contribution to EU policies

LLP Key Competences:

The rising internationalisation, the rapid pace of change, and the continuous roll-out of new technologies introduced in various applications of the broader field of Biosystems Engineering mean that European Biosystems Engineering graduates must not only exploit their specific new jobs related skills, but also possess the generic competences that will enable them to adapt to the relevant rapid changes. These competences will also contribute to their motivation and job satisfaction in the workplace, thereby affecting the quality of their work in a challenging emerging area.

Four out of the eight key competences recommended by the European Commission and the Members States (e.g. mathematical competence and basic competences in science and technology, Digital competence, Entrepreneurship, Cultural expression) have been taken into consideration within the ERABEE project activities. The free access to project results on the website will also allow stimulation of discussions beyond the addressed target users, extending the impact of the project outcomes and thus its sustainability at the international level. The project not only promotes sustainable development but supports the recent enlargement of the Union (as it has invited countries from all the Europe-27) and includes in the partnership associated partners from non EU countries as well.

LLP Horizontal policies:

A lot should be done in the framework of promoting equality between men and women and contributing to combating all forms of discrimination based on sex, racial or ethnic origin, religion or belief, disability, age or sexual orientation contributing to combating all forms of discrimination based on sex, racial or ethnic origin, religion or belief, disability, age or sexual orientation and cultural-linguistic diversity. The methodologies and tools featuring within ERABEE allow a wide involvement of students and academics, regardless of age, gender, race, any other individual feature and/or geographical orientation.

Male students and male staff mainly colonize institutions and universities in the majority of Higher Engineering Education disciplines. Although a lot of men realise that technology should be a matter for women as well and are willing to contribute to actions to attract more women, the results are still very poor. In most European countries a very small percent of students that study (traditional Agricultural) and/or Biosystems Engineering or related programs are female students.

Complementarity with other policies:

Complementarity is intended to ensure that Community development policy 'shall be complementary to the policies pursued by the Member States'. This indicates that development co-operation is a shared competence between the Community and the Member States which can be jointly exercised.

- Cooperation with third countries and competent international organisations: In the context of the expected call for inviting third countries to join Thematic Networks, ERABEE TN intends to invite institutions from South America, Russia, Croatia and Serbia to join the remaining project activities. ERABEE seeks to create links with other continents on activities within its scope as well.
- Moreover promoting synergies between teaching and research by encouraging Universities to integrate research results in their teaching and link Socrates-Erasmus TNs with related research projects funded by the Research DG is a fundamental scope of ERABEE.
- Reinforcing the link between education and society, bringing together public sector, scientific and professional players will contribute to the European innovation capacity.

