EUROPEAN PROJECT ON HIGHER EDUCATION IN THE FIELDS RELATED TO GEOMATICS AS SUPPORT FOR MOBILITY OF STUDENTS AND TEACHERS

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ABSTRACT:

Technical development and globalisation, as a process and a condition of the space for higher education, dictate the guidelines for development of study programs all over the world. It is widely recognised that the adequate management of information on study programmes is crucial not only to the renovation of study programs but also to the future of international mobility of students, researchers and teachers in every profession. The professions such as surveying, geodesy, cartography, photogrammetry, remote sensing, GIS etc. are not the exception. In the European higher education area, the adoption of the Bologna Declaration brought additional challenges. The European Commission complements its policy work in the field of education and training with a variety of funding programmes. These are mechanisms that give financial and technical support to organisations, institutions or individuals to run or participate in projects all over the European Union and beyond, which can provide a helpful basis for creating European Area of Higher Education. In the paper the European project EEGECS (European Education in Geodetic Engineering, Cartography and Surveying) is presented, where the results of research on student and staff mobility are presented in more detail. As the conclusions, future prospects of the established network are presented and discussed.

1. INTRODUCTION

The new, fast developing technologies and methodological approaches in different professions are inevitably entering the everyday practice, which dictates the guidelines for study programmes in the higher education area all over the world. There is not only development in technology but also social-economic conditions in higher education, research and science are changing, which demands the renovation of the current curricula. For these reasons, the cooperation between educational institutions has become necessary, on the national as well as on the international level. It is widely recognised that the adequate management of information on study programmes is crucial to the future of international mobility of students, researchers and teachers in every profession. The professions such as photogrammetry, remote sensing, GIS are not the exception (Lisec and Kosmatin Fras, 2008).

In the future, a stronger co-operation between educational institutions has to take place and, more educational networks have to be formed consequently (Höhle, 2006). The European Union is being aware of importance of qualitative education. Education is a primary concern of government in all European countries, but the structures of education systems differ considerably, both within and between countries. For many years, the European countries have just followed its own way in professional training and education. The trend towards greater compatibility and mutual recognition got stronger with the Bologna Declaration.

In 1999 the European ministers of education started the Bologna Process with the idea to build up a European Area of Higher Education until 2010, in which students can choose from a wide and transparent range of high quality courses and benefit from smooth recognition procedures. There is a great variety of responsibilities in Europe for the funding, management and evaluation of education and training.

Every second year the Ministers meet to measure progress and set priorities for action. After Bologna (1999), they met in Prague (2001), Berlin (2003), Bergen (2005) and London (2007), and in reconvene Leuven/Louvain-La-Neuve (2009). Furthermore, the European Commission developed mechanisms that give financial and technical support to organisations, institutions or individuals to run or participate in projects all over the European Union and beyond in the fields of education and training. Each year, the Commission supports thousands of projects that contribute to the policy priorities agreed by the EU institutions and Member States. The Commission is assisted in this work by the Audiovisual, Education and Culture Executive Agency, and networks of National Agencies or National Offices situated in the participating countries (European Commission, 2008).

One of the project relating to higher education in the fields of GI sciences, supported by the European Commission, is the thematic network EEGECS (European Education in Geodetic Engineering, Cartography and Surveying). In the paper, the main ideas and achievements of the project are presented and future prospects are discussed. The main idea has been to support networking in order to provide information on international educational programmes, research, scientific projects – not only for higher educational level but also life-long.

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2. EUROPEAN HIGHER EDUCATION AREA

The past years have been a time for preparation and implementation for new curricula in the history of the European higher education. The main concern has been on the reformation of the structure of national higher education systems in a convergent way in accordance to the Bologna Declaration (Heine et al., 2006). The main goal of the Bologna Declaration has been to create a European space for higher education in order to enhance the employability and mobility of citizens and to increase the international competitiveness of European higher education. There are three main priorities of the Bologna process (European Commission, 2008):

- introduction of the three cycle system (bachelor, master and doctorate),
- quality assurance, and
- recognition of qualifications and periods of study.

The recognition of study programmes and diplomas is a prerequisite for the creation of an Open European area of education and training where students and teachers can move without obstacles. This is the main reason why the European Credit Transfer System (ECTS) was developed within the Erasmus programme as a means of improving academic recognition for study abroad. Erasmus programme of the European Community addresses the teaching and learning needs of all those in formal higher education, including trans-national student placements in enterprise, and the institutions and organisations providing or facilitating such education and training.

2.1 Higher education in the fields od GI in Europe

A special challenge for the renovation of the university study programmes has appeared in the fields depending on the fast developing information technology, including the spatial information technology. The geographic nature of information has become ever more apparent in the recent years and it has been estimated that over 90 % of data used by decision makers is related geographically, which was estimated already in the beginning of the nineties (Moloney et al., 1993). Therefore, the importance of geographical (spatial) oriented studies in the higher education has been increasing in the last decades.

The GI curricula have been usually developed in the framework of the higher education programmes of geodesy, surveying and cartography throughout Europe. Geodesy was developed in order to understand natural phenomena which are related to the size, shape, gravity field of the Earth. Terrestrial surveys and geodetic measurements have been the fundaments for determining size and shape of the Earth and position of spatial phenomena. On the other hand, the history of surveying goes back to the time when man settled permanently the land. The importance of this crucial natural resource forced the human to develop technical and methodological solution for land evidences and protection of rights on land. Surveying and geodesy were based on the same principles – the relative local and absolute positioning was performed with the same instruments (Figure 1). Furthermore, surveying and geodesy provided the basis for mapping. These three disciplines got a common higher educational curriculum in the most European countries. This is the main reason why the new methodology and technology for spatial data acquisition and analysis, such as photogrammetry, remote sensing and GIS, has been usually included in the higher education curricula of geodesy, surveying and cartography (Lisec and Kosmatin Fras, 2008).

The study objects in the geodetic, surveying, other spatial and land related studies have changed and broadened a lot during the last decades. As the consequence, the competences of classical geodetic, surveying and cartographic university study programmes are changing and new areas are developing very rapidly (Lisec and Kosmatin Fras, 2008). There have been several discussions on the topic of surveying and geodetic education in the last years (Konecny, 2002; Witte and Heck, 2002; Steinkeller and Heine, 2005; Heine et al., 2006).

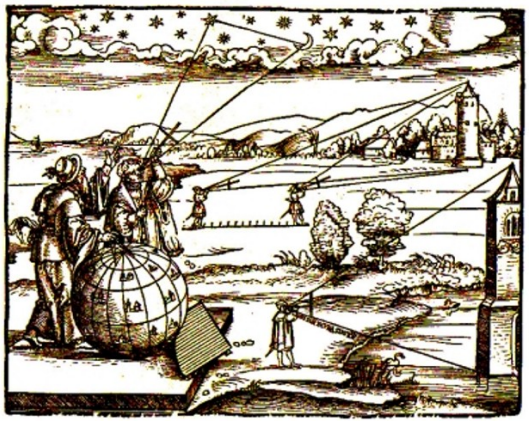

Figure 1. Peter Apian's Geographia from 1533, common measuring geodetic and surveying methodology (Beutler, 2004)

In Europe, the fields covered by the geodetic, surveying and cartographic study programmes are diverse among the countries. Geodetic engineers, surveyors in some countries provide professional services, which are provided by different professionals in other countries. However, the list of functions carried out by them is common to most countries: land and geodetic surveying, hydrography, photogrammetry and remote sensing, cadastral surveying, land and geographical information systems, mining surveying, engineering surveying and metrology, and cartography (Prendergast, 2001).

One of the most important and common issues of geodetic, surveying and GI higher education is to provide the theoretical and practical background on advanced technologies and methodologies for acquisition, integration, management, analysis and presentation spatial data, models and knowledge as support for applications for a number of uses (agriculture, geography, environmental science, forestry, geology, geophysics, civil engineering etc.). This embraces the knowledge on geodetic reference systems, global positioning systems, geographic information systems, photogrammetry, remote sensing and cartography, as well as traditional surveying, and relies on theories of mathematics, physics, astronomy, physical geodesy satellite technology etc. The term *geomatics* is used globally for this wide area of fields with varying connotations (Lisec and Kosmatin Fras, 2008).

The vision for the European Area of Higher Education builds up the background of the thematic network for higher education in geodesy, surveying and cartography and related fields. Under the Erasmus programme of the European Commission, the thematic network EEGECS (European Education in Geodetic Engineering, Cartography and Surveying) was established in 2002, which aims to facilitate trans-national access to educational resources in Europe and to enable the mobility of students and

graduates in geodetic engineering, cartography and surveying all over Europe.

3. THEMATIC NETWORK EEGECS

The European Commission complements its policy work in the field of education and training with a variety of funding programmes. The organizing scheme of funding programme for education and training has been changed in the last years (For more details see European Commission, 2008). As a part of the former European Socrates-Erasmus Programme, the Thematic Networks were launched officially in May 1996. The original purpose has been to help higher education institutions to create forums with the aim to analyse and study the state of development of various education and training fields in Europe in order to encourage the European dimension and improve the quality of education and training. Generally speaking, a Thematic Network presents a co-operation between departments of higher education institutions and other partners (e.g. academic organisations or professional bodies). All countries participating in the Socrates-Erasmus programmes (EU, EFTA and Candidate Countries) had possibility to be involved in a Thematic Network. The main aim of the programme was to enhance quality and to define and develop a European dimension within a given academic discipline or study area.

The EEGECS is a project originally created by Geodetic Engineering, Cartography and Surveying institutions whose main objective was to enhance collaboration and co-operation between the higher education institutions which offer these studies and studies from related fields (Steinkellner and Heine, 2005). As a Thematic Network, the community funding of the network was proposed for a three-year cycle followed by a dissemination year (Table 1).

Year	Eligible period
1	10/2002 – 10/2003
2	10/2003 – 10/2004
3	10/2004 – 03/2006
Dissemination period	10/2006 – 03/2008

Table 1. Eligible periods of the EEGECS Thematic Network (Ruiz Fernández and Tomás Estellés, 2008).

During the first three years, the network developed the objectives proposed through meetings, workshops, compilations, written materials and other kind of outcomes or structured information related to the topic of the network. The option of an additional year for dissemination has been important in order to disseminate and exploit project outcomes, within and beyond the group of institutions directly involved, as well as to ensure the sustainability even after Community budget funding ends (Ruiz Fernández and Tomás Estellés, 2008).

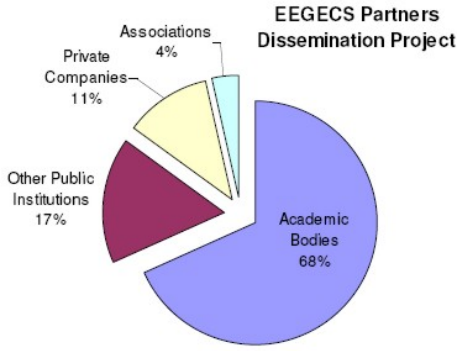

Figure 2. Partner institutions during the Dissemination period (Ruiz Fernández and Tomás Estellés, 2008).

The network has a partnership of over 100 institutions from 27 different European countries. The thematic network is composed of different types of partners and institutions (Figure 2): universities, public institutions, private companies and associations. The current distribution of partners is as follows (Ruiz Fernández and Tomás Estellés, 2008):

- 78 academic institutions (68.5%) and
- 36 non-academic institutions (31.6%): 19 public institutions, 13 private companies and 4 associations.

The institutions involved have been trying to create a transparent higher education in the fields of the EEGECS in order to provide the base not only for the mobility of students and teachers in Europe but also worldwide. The general aim of the project has been to make the achievements and essential results obtained by EEGECS available to the students, teachers and researchers, faculty managers, public and private sectors that are involved in professional activities related to Geomatics, through a number of permanently active and open Working Groups that use these results on everyday basis (EEGECS, 2007). The work has been organised in six working groups as it is evident from Table 2.

EEGECS WG	Objectives
WG1	Undergraduate education
WG2	Research
WG3	Continuous education, e-learning and the European dimension of studies
WG4	Enterprises-Private sector
WG5	Mobility, Language, Culture, Citizenship, Social cohesion
WG6	Quality Assurance

Table 2. EEGECS organising structure (EEGECS, 2005).

The EEGECS WG 1: Undergraduate Education, has focused on undergraduate education in the fields related to the EEGECS. The main objectives of the working group were (EEGECS, 2005):

- to develop the state-of-the art of the discipline in Europe and other countries, based on comparative analysis of the curricula in the European and non-European countries,
- to enhance dialogue between higher education institutions, exchange ideas and information etc.

- to adopt the ECTS and implement the Diploma Supplement;
- to promote transparency and facilitate mobility and recognition of study periods abroad;
- to elaborate a core curriculum of the discipline and keep diversity;

The EEGECS WG 2: Research, has focused on research in the fields of geoinformatics and related diciplines The main objectives of the working group were (EEGECS, 2005):
- to define the state-of-the art in research in Europe, including PhD programmes, the topics of thesis;
- to promote joint research programmes involving different countries, mobility of researchers;
- to promote the inclusion of the research results into undergraduate education and ensure quality of teaching as far as innovation and technology updating;

The EEGECS WG 3: Continuous Education, e-learning, has focused on continuous education, e-learning and the European dimension of studies in Geomatics and related disciplines. The main objectives of the working group were (EEGECS, 2005):
- to ensure a lasting employability of graduates and a knowledge-based community of professional in the discipline;
- to ensure that education reaches all individuals, promote the use of ICT and innovation in teaching methods;
- to develop collaboration between higher education institutions and create of joint-teaching programmes;
- to improve the attractiveness of the European Area of Higher Education in the discipline by means of creating international modules, courses, master programmes etc.

The EEGECS WG 4: Enterprises-Private sector, has focused on the situation of private sector in Geomatics. The main objectives of the working group were (EEGECS, 2005):
- to enhance the dialogue and strengthen links with enterprises and the private sector, promoting mobility of graduates, technology transfer, research;
- to analyse the needs of the private sector as far as graduates' skills are concerned;
- to analyse the types of industry in which the graduates can work;
- to create a network of enterprises willing to accept students to practical training.

The EEGECS WG 5: Mobility, Language, Culture, Citizenship, Social cohesion, has focused on the mobility of students, teachers and researchers. The main objectives of the working group were (EEGECS, 2005):
- to increase the mobility of undergraduate students, lecturers, researchers as well as administrative staff in Europe;
- to enhance social cohesion, promote ethics and respect for the diversity of cultures, equal opportunities for men-women, people with disabilities;
- to promote scientific studies among young people;
- to promote language learning among the whole academic community.

The EEGECS WG6: Quality assurance, has focused on the quality assurance in the education in the fields covered by the EEGECS. The main objectives of the working group were (EEGECS, 2005):
- to increase quality of teaching (methods and materials, best practices);
- to move towards a common accreditation system,
- to improve mutual trust and facilitate comparability and recognition of degrees;

The development of these objectives has been carried out through different types of activities (general assemblies, workshops, conferences, congresses), publications (proceedings, papers, reports, presentations, brochures), databases (PhD thesis, e-learning programmes, information on higher education study programmes in Europe etc.), further information can be found at the EEGECS official website (http://eegecs.webs.upv.es).

3.1 EEGECS research on student mobility

In order to support the mobility of student and teachers in Europe from the fields covered by the EEGECS, the WG 5 was established. The main objectives of the Working group 5 have been to increase the mobility of undergraduate students, lecturers, researchers and administrative staff in Europe, to promote scientific studies among young people.

In the framework of the EEGECS Working group 5 the motivation and interest of European students in international mobility was studied, and the student and staff mobility in the fields related to geomatics was discussed. The results of the research showed that students are aware of importance of international cooperation, exchange and mobility. The main obstacles for student mobility are financing, insufficiency of information on exchange programmes and study programmes abroad, and the extension of the study period because of the incongruity of study programmes.

Based on good experiences of the ISPRS association the idea on student networking and short-term education programme was presented and the information flow (also from the ISPRS WG VI/5 officers) was supported and well accepted. The idea on short-term educational programmes such as summer schools seems to be an adequate solution in order to provide the possibility to deepen the knowledge in the areas, not covered by contemporary study programmes, and of course in order to develop and strengthen the international cooperation among young professionals.

4. EEGECS – FUTURE PROSPECTS

Based on survey about self-evaluation and sustainability of the EEGECS and considering the potential benefits of maintaining contacts, support and strategic position to face European educational projects in the Geomatics area, there is a strong iniciative to continue with the activities of the EEGECS. However, there is also an interest to define specific goals, to apply some structural changes in order to increase the efficiency, and to establish links of collaboration to other associations in the same field (EEGECS, 2008).

Looking back over the past five years, the principal aspects that needed improvement are: the structure of the network and communication, the efficiency of the impact and links to other associations, the diversification of the activities. The main points that future activities should be focused on, according to members, are (EEGECS, 2008):
- the promotion and dissemination of Geomatics;
- the provision of efficient information and networking among members and professionals;
- the promotion and initiatives for joint educational projects and e-learning activities,

- the promotion of the mobility of students, researchers and teachers;
- the establishment of links between the university and professionals.

5. CONCLUSION

The new technologies and methodologies are inevitably entering the everyday practice. Regular reforms of higher educational programmes attempt to adjust curricula to the new conditions of science and society and GI-profession is not the exception. The nature of GI-profession, including surveying, geodesy and cartography, is changing and new areas are developing very rapidly. New technologies and the extension of the field of the profession require new concepts and structures in education. On the other side, scientific work and its connection with the teaching process have influenced the introduction of new cognitions into the teaching activity.

The important outcome of the EEGECS thematic network is the fact, that even some changes of the curricula, that has been introduced at some EEGECS partner institutions in the last decades, does not present a long-term solutions. The rapid development of science and technology demanded that the started process of renovation of study programmes on the level of higher education should rather be a cyclical one. The networking of the institutions that provide higher education is an important step towards the quality assurance of the higher education in this fast developing world. In addition such networking provides the base for international cooperation, promotion and development of the profession, consequently.

The European Commission tries to promote inter-university cooperation as a means of improving the quality of education for the benefit of students and higher education institutions through the funding programme in Education and Training provides an important support in order to build a qualitative and attractive higher education area. Unfortunately, the thematic network programme, such as EEGECS, has a time limited financing scheme. There is a huge interest to keep the network that has been developed during the thematic network project between 2002 and 2008, which present one of the most important outcomes of the community financing.

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