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HELLENIC REPUBLIC
H.Q.A.
HELLENIC QUALITY ASSURANCE AND ACCREDITATION AGENCY

EXTERNAL EVALUATION REPORT

SCHOOL OF RURAL AND SURVEYING ENGINEERING

NATIONAL TECHNICAL UNIVERISTY OF ATHENS

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External Evaluation Committee (EEC)

The Committee responsible for the External Evaluation of the School of Rural and Surveying Engineering of the National Technical University of Athens (NTUA) consisted of the following five (5) expert evaluators drawn from the Registry constituted by the HQAA in accordance with Law 3374/2005:

1. Associate Professor Costas Armenakis (Coordinator)
   (Title) (Name and Surname)

   Geomatics Engineering, Department of Earth and Space Science and Engineering, Lassonde School of Engineering, York University, Canada
   (Institution of origin)

2. Professor Peggy Agouris
   (Title) (Name and Surname)

   Dean, College of Science, George Mason University, USA
   (Institution of origin)

3. Professor Helen Couclelis
   (Title) (Name and Surname)

   Department of Geography, University of California -Santa Barbara, USA
   (Institution of origin)

4. Professor Lily Elefteriadou
   (Title) (Name and Surname)

   Director, University of Florida Transportation Institute (UFTI), Department of Civil and Coastal Engineering, University of Florida, USA
   (Institution of origin)

5. Expert Ioannis Machikas
   (Title) (Name and Surname)

   President of the Association of Rural and Surveying Engineers, Greece
   (Institution of origin)

Introduction

I. The External Evaluation Procedure

The dates of the visit were Monday, September 23, 2013 to Wednesday, September 25, 2013. During the week of the EEC's visit, the National Technical University of Athens was closed due to a labor dispute. Therefore, an on-site visit to the School of Rural and Surveying Engineering was not possible, and all meetings were held at the offices of ADIP. The EEC appreciates very much the efforts of Dean Siolas, faculty, staff, and students of the School to participate in this assessment under these difficult circumstances and expresses its sincere thanks to everyone who attended the meetings. Their enthusiastic participation clearly shows their exemplary professionalism and their willingness to seriously address the process of assessment for their School.

Schedule of the visit

Monday, September 25, 2013
- Meeting with Professor Siolas, Dean, School of Rural and Surveying Engineering
- Meeting with Professor Moropoulou, Vice-Rector, National Technical University of Athens
- Presentation and discussions of the School
- Meeting with the School's Administrative Secretary
- Meeting with staff (EEDIP, ETEP, IDAX)
- Meeting with the Professional Association of Rural and Surveying Engineers.

Tuesday, September24, 2013
- Presentations and discussions of Section I: Topography
- Meeting with Professor Ioannidis, Head, Topography Section
- Meeting with Professor Paradisis, Lab of Higher Geodesy and Dionysos Centre
- Meeting with Professor Stathas, Lab of General Geodesy
- Meeting with Professor Argialas, Remote Sensing Lab
- Meeting with Professor Georgopoulos, Laboratory of Photogrammetry
- Meeting with Professor Ioannidis, Cadastral Knowledge Area
- Meeting with Professor Nakos, Lab of Cartography
- Meeting with Professor Tsoulos, Geoinformation Centre
- Meeting with Professor Ioannidis, Geoinformation Graduate Program
- Meeting with students

Wednesday, September25, 2013
- Presentations and discussions of Sections II & III: Geography and Regional Planning and Infrastructure and Rural Development
- Meeting with Professor Vlastos, Head, Geography and Regional Planning
- Presentation of the Physical Geography and Environmental Impacts Lab, M.P. Papadopoulou
- Presentation of the Geography and Spatial Analysis Lab, Th. Vlastos and G. Fotis
- Presentation of the area Regional Planning and Regional Analysis, Unit of Regional Design and Regional Development, A. Stratigea
- Presentation of the Sustainable Mobility Unit, Th. Vlastos

- Presentation of the area Housing and Urban Planning Topics, A. Siolas
- Meeting with Professor Psarianos, Head, Infrastructure and Rural Development
- Meeting with Professor Nalbaldis, Land Reclamation Works and Water Resources Management
- Meeting with Professor Kattis, Structural Engineering and Elements of Structural Works Lab
- Meeting with Professor Aga, Architectural Design
- Meeting with Professors Psarianos and Spyropoulou, Transportation Engineering Lab
- Presentation of the Centre of Assessment of Natural Hazards and Preventive (Proactive/Mitigation) Planning

Presentation materials and a variety of additional documents were provided to the EEC, including the following rreference material:

- Presentations and discussions with faculty members and support personnel
- Discussions with students
- Internal assessment
- Curriculum guide
- Examples of lab assignments
- Example of photogrammetric field camp assignment
- White paper on the strategic objectives and character of the School

II. The Internal Evaluation Procedure

The EEC was given the 2010 internal evaluation report of the School of Rural and Surveying Engineering. This report is an extensive, well-documented, and well-written comprehensive document. It contains a wealth of useful information and data about the School, its programs, the curriculum, faculty, students, relations with external stakeholders, administration, services and infrastructure, as well as graduate programs and research. The report provides valuable information and addresses most major issues faced by the School. Through the report, the School has met the requirements of the internal evaluation process, although a more recent report would have been desirable.

A. Curriculum – Undergraduate programme

APPROACH

The School's curriculum aims to cover the scientific and technical activities of Rural and Surveying Engineers, Greece's production and development goals, as well as future prospects in those areas. It aims at providing students with the necessary scientific and technological education that will enable them to perform satisfactorily in a chosen (specific) area of Rural and Surveying Engineering. The curriculum covers the three Sections of the School:

- Section I: Topography (Spatial data acquisition, handling, processing and geovisualization);
- Section II: Geography and Regional Planning (spatial analysis, urban planning, regional planning, physical geography and environmental assessment); and
- Section III: Infrastructure Works and Rural Development (transportation and water

management).
The duration of studies is 5 years (i.e. 10 semesters, where the 10th semester is dedicated to the diploma thesis).

A total of 117 courses are offered. The total number of courses required for the completion of studies is 61 courses (about 7 courses per semester, 14 courses per academic year). Of those courses 47 are core (mandatory) courses and 14 are electives. Electives are chosen from a pool of 69 courses and represent 21% (1/5) of the available electives. In recent years, an average of 110-120 students is admitted annually to the program.

Students attending the 9th semester need to take a project course in the area of their major specialization, thus special project courses have been introduced in the curriculum, demanding collective/group work in one or more scientific areas. The practical experience of the students is further enriched through geodetic, photogrammetric and remote sensing field camps, as the students are exposed to realistic working conditions.

The objectives of the curriculum were decided based on the aims of the School as set by the legislature, the assessment of earlier curricula, and current scientific and technological standards and developments. Emphasis was given to the introduction of geoinformation science and technology courses in the curriculum. Both faculty members and students participated in the process. Also the professional association of Rural and Surveying Engineers and the sister School at the Aristotle University of Thessaloniki were consulted.

The last revision of the curriculum took place in 2001. Currently there is an initiative to reassess the strategic objectives and character of the School, leading also to the development of a new undergraduate curriculum.

IMPLEMENTATION

The curriculum reflects the current scientific and technological trends in the field of geomatics engineering, and includes courses related to photogrammetric computer vision, geographic information science and systems, remote sensing, cartography and Global Navigation Satellite Systems (GNSS). A curriculum that covers three Sections is unique relative to other similar programs in other countries. For example, in Canada and USA, the relevant undergraduate programs cover only the area of Geospatial/Geomatics Engineering. Although an on-site visit was not possible because the University was closed during the EEC's visit, the teaching infrastructure of the School was assessed as adequate and sufficient based on the presentations and discussions with the faculty members and the students.

Overall, the EEC has identified the following shortcomings with respect to the curriculum:

- Too many courses resulting in overlaps, including a very large number of elective courses;
- The undergraduate studies have been de facto extended from 5 to 7+ years;
- There is no actual enforcement of prerequisite courses;
- Insufficient number of core course in the area of geoinformation, one of the fastest growing fields internationally;
- Insufficient emphasis on developing computer programming skills in laboratory assignments;
- The course on cadastre, a main area of employment for the graduates of the program, appears to be "buried";

- It appears that new courses and course materials are added over time without the necessary pruning of obsolete material;
- Insufficient core and specialized courses for the Sectionss of Geography and Regional Planning, and Infrastructure Works and Rural Development;
- Insufficient communication and collaboration among the three Sections of the School ("three chimney stacks");
- Lack of courses linking academic materials with public organizations, market and industry;
- Lack of entrepreneurship-oriented courses to prepare the graduates for careers in the industry; and
- The unilateral recognition of the 5-year degree by the NTUA as an MScE/MEng, which does not confer much benefit to the graduates of the School as the degree is mostly viewed as an undergraduate degree externally.

The faculty members are very well qualified, have an excellent background and are very well prepared for the teaching and research needs of the School. Graduates of the program are regularly accepted for graduate studies at internationally known universities abroad.

Teaching is exclusively in Greek, which makes it very difficult to attract foreign undergraduate students through student exchange programs.

RESULTS

The goals and objectives of the School, the quality of the provided education and the job prospects of the graduates will be better served if the identified weaknesses stated above were considered in the design of the upcoming new undergraduate program curriculum.

Regarding the curriculum, the following were also noticed:

- It appears that Section I is much more substantial than Sections II and III.
- The collaboration among the Sections is limited to diploma theses.
- There are no links between courses and public organizations, market, and industry.
- The School must increase its emphasis on geoinformation, an area where it is becoming internationally known. Substantial introduction of geoinformation to all Sections should be considered.
- The School must formulate its program and courses so that a greater percentage of students attend the classes. Lectures should not be repeated during lab time.

Based on the meetings and the internal evaluation report, the EEC was pleased to see that the School is fully aware of the curriculum situation, and therefore, it is expected that measures will be taken soon to address the previously identified shortcomings, particularly through the planned redesigning of the undergraduate curriculum.

IMPROVEMENT

As previously mentioned, the School appears to be aware of the current strengths and weaknesses of the curriculum. Through the initiative on redefining the School's strategic positioning and its character, the School considers redesigning the curriculum of the undergraduate program. A white paper ('Profile of the School' /'Φυσιογνωμία της Σχολής')

has been prepared addressing many of the identified issues.

The following are general remarks and suggestions of the EEC for consideration during the redesigning process:

- The School can build its curriculum around a core program in Topography and Geoinformation. This can be implemented by including 3-4 courses of geographic information science, geographic analysis, and geographic information systems (currently there are only two courses).

- The three sections should be maintained and they should be developed upon a core Topography and Geoinformation program (Fig.1), where:

    - Section I: Topography and Geoinformation;
    - Section II: Environment, Cadastre and Regional Planning (renaming of Section II) and including cadastre, land information systems and environmental topics;
    - Section III: Infrastructure and Rural Development.

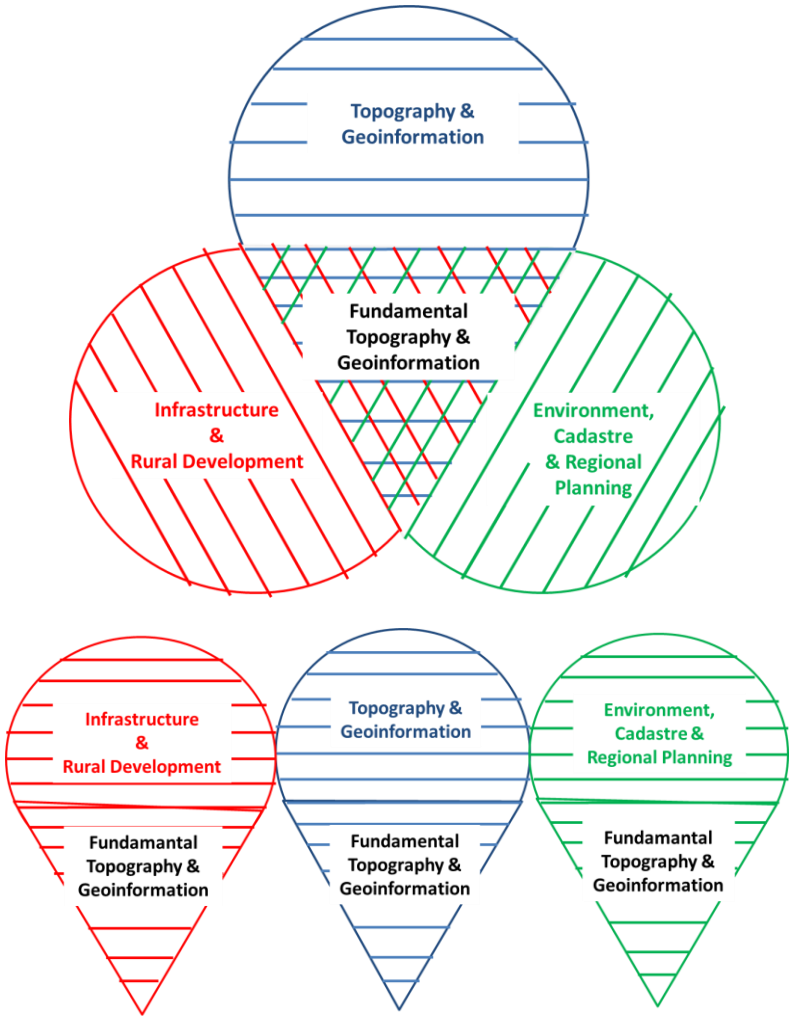

Figure 1: Suggested restructuring of the three Sections.

- Balance the number of courses among the three Sections and enhance the interaction among them.
- Introduce a minimum number of students for a course to be offered.
- Students' programming skills appear to be weak. They need to be improved by introducing programming tasks in the lab assignments. This will also contribute to the needed strengthening of the practical labs.
- Extend the use of open source software; train students to software used in practice such as AutoCAD.
- Establish seminars/presentations for the students, as was done for the assessment exercise. Introduce courses on entrepreneurship, writing technical papers and on conducting research.
- Establish connections between the School and its students with public organizations/market/production/industry. For example, introduce practicums and seminars with public organizations and industry.
- Encourage students to form clubs and forums around the objectives and subjects of the School.
- Involve undergraduate students in to research projects.

B. Teaching

APPROACH

The instructional staff is very knowledgeable and highly skilled. The students we met were very positive and complimentary of the instructors, and gave them high marks on capabilities, initiative, and enthusiasm.

The School provides information on several courses through http://mycourses.ntua.gr, which is a very good resource for students.

Existing teaching methods include both oral and written examinations, which allows for multiple types of in-depth assessment. There is also a very significant internship component (πρακτικη ασκηση) on Geodesy, Photogrammetry, and Remote Sensing. This internship is organized in cooperation with local authorities or other government institutions, and it helps students collaborate in groups, gain practical skills, and link academic work with practice.

To facilitate the use of information technologies, there should be an increase in the number of hours the laboratories and instructional facilities are open and available to the students.

Existing examination methods could be supplemented with the following strategies:

- Addition of a required minimum number of attendances for all courses that will be necessary for students to pass the class.
- Inclusion of additional class assessments through quizzes and mid-term exams.

IMPLEMENTATION

The results of the student evaluations provided by the School (Έκθεση Εσωτερικής Αποτίμησης 2010) demonstrate a high level of satisfaction with the instructional quality and particularly with the degree of student-instruction collaboration.

The following are recommended to enhance the curriculum implementation:

- *Enforcement of the existing course pre-requisites and program requirements*. Students should not be allowed to take a course if they have not passed the required pre-requisites. Also, students should be required to take the Project course (Μαθημα Θεμα) for their chosen specialty.
- *Increase of hands-on practical experience in addition to the existing emphasis on theory*. Students would greatly benefit by enhancing course materials with examples that connect theory to practice. They would also benefit by having practitioners conduct guest lectures on topics relevant to the course in order to familiarize students with the types of problems encountered in professional practice.
- *Enhancement of the linkage between research and the educational and classroom experience*. Students would benefit by increasing interactions with on-going research efforts conducted in other NTUA departments and institutions (in Greece and abroad), as well as by becoming exposed to international research through publications, repositories of papers, as well as web materials and webcasted seminars widely available for free on the internet.
- *Complete and standardize course web pages;*
- *Introduce attendance requirements, at least for the laboratory exercises*.
- *Introduce quizzes and midterm tests*, so the final grade is not determined only based on lab assignments and final exam).
- *Enhance the process for course evaluation by taking students' comments into account before offering the course again.*

In addition, it is recommended that closer connections of the instructional staff with the practitioners' community as well as with the international research community are established, to facilitate mobility of both staff and students. Staff and students could take advantage of funding opportunities from the European Community and other sources to conduct sabbaticals and internships abroad. There are also funding opportunities offered by various sources for traveling to conferences and other events, which would expand the School's network with the broader international community. Furthermore, converting the postgraduate curriculum to English would facilitate mobility to and from the School.

RESULTS

The School's 2010 Internal Assessment report indicates low percentages of student participation in final exams. Table 8 (2010 Internal Assessment) indicates that participation for required courses is 65.9%, while for electives it is 52.1%. Students should not be allowed to take more than a set maximum number of courses per semester and then drop those they are not able to pass easily.

The total number of registered students appears to be over 1250 (as shown in the provided "Table 4: academic year 2009-2010" of the Internal Assessment Report, 2010). This indicates an average number of 250 registered students per year. The admitted students in the same academic year were 111, indicating that 56% of the registered students in the School are students who have not graduated within the expected 5-year program duration. This obviously imposes a significant burden to the available resources, from teaching and teaching materials to labs to services and needs to be addressed sooner rather than later and in an efficient and decisive manner.

Furthermore, the average time to graduation (nearly 7 years for the undergraduate program for the past five years, and a similar amount of time for the Ph.D.) is too long.

IMPROVEMENT

The School is to be commended for conducting a very thorough Internal Assessment report in 2010 (Έκθεση Εσωτερικής Αποτίμησης 2010). This evaluation clearly shows that the staff has spent considerable resources assessing the program, outlining positives and negatives, and developing recommendations for future action by the School, as well as by the Ministry of Education. Several of the recommendations coincide with those of the EEC outlined above.

C. Research

APPROACH

It is clear that all constituencies of the School of Rural and Surveying Engineering (including its leadership, faculty, and students) realize the importance of research for the achievement of the School's internal and external academic goals. Research productivity is not only encouraged but expected, and the main objectives remain the improvement of quality of education and training that is provided to the future graduates of the School, and the betterment of the School's reputation and recognition, both nationally and internationally. While there are clear expectations of research activity at all levels, there is little evidence of clearly outlined internal standards for the assessment of research output.

IMPLEMENTATION

As previously mentioned, the School expects research activity from all faculty and requests that faculty list their work for consideration in promotion and tenure evaluations, thus promoting the importance of research within the School. Available internal funds are used to support some research-related activities of the faculty (including some student support and travel) but are not sufficient to provide internal support for all research activities. This lack of adequate internal funding for research turns out to be rather a positive thing, as it encourages the pursuit of external, more competitive, and more prestigious sources of support, as is common practice in academic institutions worldwide. Many (but not all) of the School's faculty do so, with varying levels of success.

Even though the EEC did not have the chance to perform an on-site visit and evaluation of the infrastructure of the School of Rural and Surveying Engineering (the university was closed due to a sit-in and staff strike), it was made clear through presentations, discussions with the Dean of the School, the faculty and students, as well as informal prior visits by individual EEC members, that the infrastructure for research is more than adequate. It should be noted that the infrastructure needs regular updating, maintenance and protection. As such, it falls within the responsibilities of the University's leaders and the State to provide funds for such support, which the EEC expects that it continues in the future.

Almost all faculty have been publishing their research work. The School indicated that the

number of publications and citations have been increasing (in the last 1.5 years the number of papers per staff member doubled and the number of citations increased 2.5 times based on Scopus). However, there is significant unevenness among the volume of the produced work, the quality of the outlets where it has been presented and published, and the impact of the published activities. Several faculty members have been steadily producing quality publications in international journals and well-regarded fully-refereed conference proceedings, and have contributed significantly to the improvement of the reputation of the School. However, even in the cases of some of the better-published faculty, the impact of the published work, as evidenced by the number of citations the published papers have received and the h-index of the faculty, seems to remain comparatively low. This should be viewed as an indication that publication outlets need to be chosen more carefully and using more selective criteria, and that the produced research work needs to be better aligned with the emerging research trends and priority areas that are being identified and pursued by the international scientific community. Furthermore, the faculty who haven't been as active in academic research or as productive, will need to refocus their research work, pursue activities with higher potential impact both for Greece and internationally, and increase the frequency and quality of their publications and the outlets where their work is presented and published.

As with publications, many faculty members are very active in pursuing external funding opportunities. Most of the larger awards have come from the European Union and have been collaborations with other groups and institutions, both Greek and international. There is still significant unevenness regarding funding levels among the faculty. Many faculty members pursue primarily smaller, applied grants from State sources, which has two negative implications. The first is that the level of funding is rather low, the scope is limited, and considering Greece's recent financial and economic difficulties, such opportunities have become scarce and are almost disappearing. And the second negative implication is that the work that is being performed through these grants (due to its specific and applied nature) is not really academic research per se. It is work more suited towards professional engineers, and as such, does not result in cited publications in selective outlets, or in scientific innovations, which should be the goals of academic research and which contribute towards the primary objectives of academic research. Overall, the level of external funding for the School should be improved and would definitely be higher if all faculty pursued larger-scale, multi-site, collaborative international projects, which usually bring high visibility for the participating faculty and students, as well as bigger budgets.

Regarding collaborations, it appears that internal collaborations among certain groups are adequate and frequently occurring. However, this does not apply to all groups and certainly not as much outside the School or the country. It seems that there are many international connections that have been (or can be) established through faculty connections or graduates who are now in other institutions, as well as with national and professional organizations. There are also opportunities for collaborations within the NTUA that the faculty could take advantage of. Such connections have the potential to not only enrich the academic experience of the involved faculty and students but also to result in challenging research pursuits, and success in securing larger interdisciplinary projects and substantial external funding. Such collaborations should be actively pursued and cultivated, with the support of the School's leadership and the initiative of faculty members and groups.

RESULTS

Undoubtedly, the School has made huge progress towards not only realizing and promoting the importance of research among faculty and students, but also towards significantly increasing research productivity and the impact of achieved results. During the previous discussion of the current implementation of the School's research objectives, specific remarks and suggestions were included regarding the shortcomings of the effectiveness of the School's research presence and activities. Moreover, there are some additional areas that can be further improved. First and foremost are the limitations that are imposed on research because of the interruptions that are frequently occurring in the School's operations, either due to legislative changes and abrupt modifications, or due to strikes and protests by faculty, staff and/or students. The impact of such interruptions is tremendous, as it affects funding, reputation, student progress and numerous other factors which are critical for the success of the School's research agenda. It is understood that many such interruptions are beyond the School's control, but it is of paramount importance for all constituents to understand the domino-like negative effects that such events have on the School on all levels.

Because of the importance of pursuing cutting-edge research topics and due to the constantly evolving (at tremendous speeds) scientific challenges and relevant technological progress, it is rather unfortunate that the average duration of PhD studies is about 7-8 years. Clearly, by the time a dissertation is completed, it is highly likely that the dissertation topic (which was defined on average eight years before) has become obsolete, or if the topic really is of value to the scientific community, it is almost sure that someone else has already addressed it by now.

It also seems that the School does not have any activities that can be classified as "translational research", meaning research that has evolved into prototypes or even products and/or processes that can be used by consumers, practitioners, or non-expert users. This is due to factors that range from the lack of State support for incentivising university/industry partnerships, to the absence of meaningful ties between the School and the industrial sector (or even with professional organizations and state agencies), to a lack of an entrepreneurial approach to research and the foresight to pursue "research of consequence".

IMPROVEMENT

Based on extensive discussions with the Dean of the School and numerous faculty members, as well as several students, it has become clear that the School understands the importance of research for its mission, identification and allocation of resources, and its reputation, as well as for the value of the degrees it awards its graduates. Therefore, the EEC feels that an important step towards improving the School's research performance has been made. Many specific suggestions and comments have been included in all sections of this report and the EEC recommends that the School's efforts towards enhancing their research profile and expand their research portfolio and external funding success remain strong and uninterrupted. It is recommended that all faculty (individually and collaboratively) is engaged in larger-scale, higher-risk (but also higher-impact) research of consequence. Furthermore, the EEC also urges that all students are educated within a culture of research, where global research problems and national and international scientific challenges influence the selection of PhD dissertation topics and the focus of research proposals.

D. Graduate Programs

APPROACH

The School offers and has the leading role in two interdisciplinary programmes for post graduate studies at specialization level (specialization post-graduate diploma). The two programmes are a) Geoinformation and b) Environment and Development. It also participates in four other interdisciplinary programmes within the NTUA. The duration of studies is usually 12 months but it can be extended to 24 months for the completion of the thesis.

The Geoinformation programme covers the systematic understanding of the geographical space and the collection, processing, analysis, interpretation, visualization and management of geographical data. Emphasis is based on information technologies. It has four areas of concentration: Spatial measurements and Modelling, Geoinformation, Spatial analysis and Design, and Spatial Infrastructure. Two other NTUA Schools are participating in this programme. The programme is unique in Greece as no other similar program is offered elsewhere. The curriculum consists of eight courses and a thesis. Four courses are to be selected from a total of six core courses and the other four courses from a list of 20 specialization courses. The courses are more or less consistent with the international norms. The program can accept annually between 20-40 students, however the average number of accepted students is usually around 25. There is a rigorous admission process in place and the acceptance rate is around 20-25%. The average graduation rate is quite high, around 92% (2005-2010). However in the last 2-3 years a significant drop in the number of graduating students has been observed, most probably due to the difficult economic conditions of the country.

The Environment and Development graduate program covers the multi-dimensional topics and issues of environment and development, such as land and environmental management, green development, renewable energy, waste management and regional planning. It has two streams: Environment and Development, and Environment and Development of Mountainous Regions. The latter was introduced in the 2008-09 academic year and it is offered at the NTUA's facility "Metsovo Center for Interdisciplinary Research (MEKDE)" which is located in Metsovo, in Northwestern Greece. Post-graduate students who so desire can stay at the Center for free. Six other NTUA Schools are participating in this programme. The programme is unique in Greece as it is the only graduate program on mountainous regions studies. The curriculum consists of ten courses and a thesis. For the first stream eight courses are selected from nine core courses and two from a list of seven specialization courses. For the second stream all ten core courses are to be taken. The program accepts annually an average number of 30-35 students, reaching 49 in 2009-2010 academic year. The number of applications is about double the number of those for the Geoinformation program. This is due to the large number of applicants from other disciplines. The average graduation rate is around 70% (2005-2010). The admission process is the same as for the Geoinformation programme.

Class attendance is required for both programmes (only two absences are allowed). There are no tuition fees for either graduate programme. However, the poor or even lacking funding for these programs endangers their existence.

IMPLEMENTATION

Both graduate programmes address current and future scientific and technological trends and provide much needed highly qualified personnel to the development projects of the country. The graduates of the programmes are hired by national and local government public organizations as well as by industry. The employment rate had reached levels of over 90% prior to the current economic crisis and recession of the country. The employers are also very satisfied with the level of knowledge, expertise and skill that the graduates have acquired during their studies. It is not very clear however as to why the two graduate programmes have different number of required courses (8 vs 10).

RESULTS

- The sustainability of the programs is threatened by the lack of appropriate legislative framework and the lack of steady funding. For the stream of Development of Mountainous Regions this may result in the termination of activities at the Center for Interdisciplinary Research (MEKDE) in Metsovo.
- While students of the program can receive course credits from foreign universities (e.g., similar to Erasmus), language is the impeding factor in attracting foreign students to attend either program courses or the program itself.

IMPROVEMENT

Some potential issues to be addressed are the following:

- It appears that there are overlaps with upper-level undergraduate courses.
- Stronger emphasis should be placed on computer programming and real-world applied research topics. The same applies to the theses produced by this program, which should be focused preferably on topics of importance to the community and with an application-oriented component that can provide useful hands-on experience to the graduates.

In addition to the proposed new concentration areas of coastal and marine geomatics and environmental geomatics, the following subjects should be addressed more extensively: GIS modelling, mobile GIS and location-based services, Internet GIS, collaborative GIS, geo-sensor networks, augmented reality, sensor integration, communication and information technology and robotic mapping. A necessary “pruning” of the existing courses should be performed, particularly those which overlap with relevant undergraduate courses.

The implementation of an English language stream, joint degrees in collaboration with foreign universities, greater mobility of students and the introduction of tuition fees to contribute to the operational cost of the programmes are also recommended.

The EEC also recommends stronger connections to industry, which can enhance curriculum development, identification of suitable real-world thesis topics, and may lead to internships and a smoother path to employment by graduates of these programs. In addition, the offering of graduate programs needs to be based on proper and stable legislation and the programs need to obtain national and international equivalency and recognition. Mechanisms for sustainable funding must be established.

Obviously the current economic situation of the country is taking its toll on the programs,

from the available resources to the number of applications and the number of graduating students. It is hoped that an improvement of the programs will result in new opportunities of resources (through tuition and foreign applicants, if the programs are offered in English) and improved marketability and better career placement for the graduates (through appropriate thesis topics and accumulated hands-on experience), which in turn will result into more applications and a higher reputation for the programs.

E. PhD Program

APPROACH

The School offers a PhD program as well. It is a research-based program and no courses are required. A PhD dissertation has to be submitted and successfully defended. If necessary, a candidate can attend courses from the post-graduate specialization programs. To enter the PhD program, a candidate must have a Master's degree or a post-graduate studies degree at specialization level. About 10 PhD positions may be offered per year. Currently there are 156 PhD candidates. PhD research constitutes the most significant component of the research output produced by the School. PhD candidates also contribute significantly to the teaching of leading scientific and technological topics.

IMPLEMENTATION

The program is mainly unstructured, requiring only the completion and subsequent successful defence of a PhD dissertation. Lack of funding forces PhD candidates to seek parallel employment elsewhere, and as a result, either it takes them much longer to complete their studies or they abandon them. As previously mentioned in this report, the average time to completion for a PhD degree is about 7-8 years.

RESULTS

A critical issue in the PhD program is the lack of steady funding for PhD candidates during their studies. Typical funding sources for PhD studies include teaching support, research programs, collaborative initiatives, and scholarships. However, there are not enough research funds to sponsor PhD students, and this leads to longer studies and attrition.
It is the recommendation of the EEC that significant efforts should be made to reduce the average time to complete a PhD degree to five years. Introducing some "benchmarks" (e.g., required seminars, publications and fully-refereed conference presentations) during the typical course of PhD studies could lead to a more structured and better managed PhD program. Efforts should also focus on obtaining funding through research and collaborative programs and projects, in order to attract, support, and retain qualified PhD students.

IMPROVEMENT

As discussed above, a major problem of the PhD program is the lack (or even absence) of adequate funding resources to support PhD candidates. When PhD students are involved with teaching duties, the large number of undergraduate students makes it extremely difficult for them to concentrate on their research. All available funding options should be pursued by both supervising faculty members and candidates, with emphasis given on research programs.

Collaboration with foreign and domestic universities will permit co-supervision of PhD candidates from external faculty members and will support the mobility of the PhD students. For example, spending some time visiting another university would be extremely beneficial. Having the ability (or even potentially the requirement) to write PhD dissertations in English will not only encourage this mobility and cooperation, but it will also make the produced dissertations accessible to a much larger audience among the international research community.

F. All Other Services

APPROACH

Services for students (undergraduate, post-graduate, and doctoral), instructors, and administrative personnel are provided in coordination with the central administration of NTUA, and are considered sufficient. While the evaluation process had to be completed without the benefit of a site visit to NTUA, visual presentations (photos and videos) and discussions with faculty and students indicated that, in general, the School's facilities and classrooms are sufficient in size and equipment.

Both instructional and administrative personnel appear happy to be working in the School and seem to have a positive collaborative relationship with the School's leadership, with whom they share a common vision with regard to the objectives to be pursued. Understandably, the Greek government's decision to substantially reduce administrative personnel numbers at NTUA, which was announced at the time of the EEC's visit, caused considerable anxiety among School members.

In all discussions with the EEC, students indicated that they are satisfied with the access they have to their instructors and to the School's administrative and technical support personnel.

The School's administrative and secretarial support appears to be satisfactory, with good access to databases and computing facilities. Student registration as well as communication with the School's administration is done online using each student's individual ID code. Many, if not most, administrative procedures are completed online and the School plans to digitize the remaining ones in the near future. The School has a satisfactory presence on the internet, providing a broad range of information and services to its students and the community at large (www.survey.ntua.gr/, http://ntua.gr/mycourses/).

There is no specific policy aimed at increasing student presence on the NTUA campus. The establishment of a required minimum number of presences per semester has been discussed, and this would likely help accelerate graduation rates.

RESULTS

The necessary student-oriented academic services and infrastructure are provided by the School in combination with the central NTUA administration. These include the library, a well-equipped geoinformation centre, health services, sports facilities, the organization of cultural events, food services, legal advising, etc. Government support for such services has recently been significantly reduced, raising concerns as to the possibility to sustain the

current level of services in the future.

In summary, it appears that current administrative services are sufficient and efficient, but grave concerns are raised by the continuing economic crisis in the country and the recent significant personnel reductions in both the School and NTUA as a whole.

IMPROVEMENTS

The School has identified a number of problems and issues that need improvement. A special committee has already been formed within the School to examine and seek solutions to these problems.

Issues that the EEC has identified for discussion and action include:

- Administrative aspects of the collaboration among the three Sections of the School.
- Weak interactions and limited collaboration of the School with the Surveying Engineering practitioners, including the Panhellenic Association of Rural and Surveying Engineers of the Technical Chamber of Greece and cognate companies and agencies of the private and public sectors (e.g. the Greek Cadastre).
- Insufficient information available to students regarding available scholarship opportunities.
- The lack of a student forum and office for facilitating connections between graduating students and the profession.

Collaboration with social, cultural and production organizations

By virtue of its curriculum and focus, the School collaborates significantly with various organizations at the local level. At the post-graduate level, and specifically in the second stream 'Environment and Development of Mountain Regions' of the post graduate programme 'Environment and Development', both classes and research projects take place at the NTUA facility in Metsovo known as the "Metsovo Center for Interdisciplinary Research". Post-graduate students who do not reside in the area may stay at the Center at no cost to them. This initiative contributes significantly to the program's interaction with the community in Metsovo.

The School also interacts with society and industry through their Center of Assessment of Natural Hazards. The school has established several memoranda of collaboration with the Mapping and Cadastral Agencies of Greece and Cyprus, as well as with local authorities.

Another aspect of such collaboration is the surveying work being conducted for local governments through provision of surveying diagrams. These internship courses on Geodesy, Photogrammetry and Remote Sensing are organized in cooperation with local authorities and government institutions. Such work not only contributes to the economic development of the region through the presence of a large number of students and researchers working on the project but links the academic work to the needs of public organizations and local authorities.

These collaborations could be expanded to include the National Panhellenic Association of

Rural and Surveying Engineers of the Technical Chamber of Greece, as well as the Greek Cadastre.

G. Strategic Planning, Perspectives for Improvement and Dealing with Potential Inhibiting Factors

The field of surveying and rural engineering has traditionally been an interdisciplinary area. It has become even more so in recent decades thanks to the explosive development of geoinformation and related digital technologies for positioning, sensing, image processing, mapping, and advanced spatial analysis. The School has successfully embraced the new technologies without abandoning the traditional ones. This has led to a well-rounded curriculum that covers a very broad spectrum of areas, sub-areas and specialties, some of which are intellectually and technically quite remote from each other, and which cover geographic scales from that of a single building to global representations.

That breadth comes with its own problems, both internal and external. Internally, there seems to be insufficient communication among the School's three academic Sectionss. For example, geoinformation is not part of the core for all Sections, even though it is nowadays a defining area of the discipline. Similarly, the cadaster, which is one of the most socially and economically important application areas of surveying engineering, is currently under Sections I and appears to be quite unrelated to the School's more applied areas. From hints from interviewed students, the EEC gathers that the limited communication and interaction among Sections and sub-fields is occasionally aggravated by personal frictions among faculty members.

The breadth of the School's offerings, as well as the interdisciplinary nature of the field itself, is leading to significant external overlaps with other NTUA schools and departments, in particular civil engineering, electrical engineering, and architectural engineering. Sometimes overlaps can give rise to fruitful interactions, as is the case with infrastructure projects at the architectural scale, but at larger scales, an overlap may be problematic, especially in the case of civil engineering (but also architecture). This can have delicate professional implications since engineers with different qualifications are licensed to undertake different kinds of projects. Thus, surveying engineers compete with civil engineers for surveying, transportation, and hydraulic projects, with architect engineers for architectural and urban planning projects, with civil and architect engineers for Environmental Impact Assessment studies, and with graduates from planning and regional development departments for regional development studies (Table 1).

This state of affairs inevitably raises identity issues and other dilemmas for the School and its graduates. In recent years the Ministry of Education's Athena plan has provided the impetus for broader discussions concerning the School's objectives and future organization. Thus far this process has resulted in a white paper titled the 'Profile of the School' ('Φυσιογνωμία της Σχολής') drafted by a group of faculty members. With it come thoughts concerning a possible renaming of the School, which could include combinations of the phrases 'surveying engineering', 'infrastructure development', 'geoinformation', 'geospatial engineering', and possibly others. These discussions reflect the tension between, on the one hand, the historic and established academic and professional present of the field as developed in Greece, and on the other, the heavily digital future of the discipline as it is taking shape internationally.

Which new name – if any – ends up being chosen will of course depend on what new structure is adopted for the School. It would not be appropriate for the EEC to address the content of the white paper, which had not yet been considered by the faculty as a whole at the time of the site visit. We are however very encouraged by the fact that these discussions are now beginning to take place. It is indeed quite evident that a thorough rethinking of the School's academic structure is indicated.

PROFESSIONAL LICENCE CATEGORY BY PROJECT TYPE	ENGINEERING SPECIALTY	A	B	C	TOTAL
Topographic	Surveying	-	-	-	1498
Topographic	Civil	-	-	-	272
Transportation	Surveying	531	195	229	955
Transportation	Civil	328	114	190	632
Hydraulic	Surveying	208	76	52	336
Hydraulic	Civil	400	140	234	774
Regional planning	Surveying	19	4	5	28
Regional planning	Architects	-	-	-	112
Regional planning	Regional & Urban planners	-	-	-	90
Urban planning	Surveying	165	32	32	229
Urban planning	Architects	-	-	-	315
Urban planning	Regional & Urban planners	-	-	-	113
Environmental Impact Assessment Studies	Surveying	-	-	-	120
Environmental Impact Assessment Studies	Civil	-	-	-	351
Environmental Impact Assessment Studies	Architects	-	-	-	112

Table 1. Distribution of licenses by professional affiliation and type of infrastructure projects. *(Courtesy of Mr. Machikas, External Evaluation Committee member)*

The EEC is aware of the professional interests that must be safeguarded or enhanced as well as of the legal, organizational, and budgetary constraints that the School is subject to. Still, the EEC believes that there is room for some earnest strategic planning and recommend that such planning be initiated as soon as possible. The overarching objective should be to position the School and its students more favorably vis-a-vis ongoing rapid developments in the discipline world-wide, while also being mindful of the mandates and special circumstances of Greek institutions of higher learning and of the country itself. The EEC members agree with practically all the principles laid out in the self-evaluation report (Section 7), and provide below a few additional suggestions and guiding principles in the hope that they will facilitate the School's internal deliberations.

1. The School's *identity* will be considerably strengthened by clarifying what makes it different from other departments and Schools that address similar objects of study and professional practice. Overlaps with areas from cognate departments are more likely to

be seen as complementary instead of competitive or redundant if the special contribution of the surveying engineer is highlighted in the curriculum and is well understood in the profession. In the EEC's view there are two main aspects that make up that identity:

a. The notion of *measurement of the earth* (or of the land) which closely corresponds to the scope of Section I of the current structure, as stated on the School's web site: "The development of measurement methods and techniques, and their application in topographic, photogrammetric, hydrographic, geodetic and geophysical surveys." (http://www.survey.ntua.gr/en/topo). This is the traditional understanding of the 'surveying engineer' – 'τοπογράφος', which means, in Greek, 'he who measures the land'. That name must remain because it literally describes the essence of the field and because it is tied to the identity of the profession in Greece.
b. The growing family of digital technologies known as geomatics or *geoinformatics* that are geared towards the study, representation and modification of terrestrial space at all scales. Professionally and academically, these are now the growth areas of the field. Surveying engineering departments around the world are increasingly emphasizing these aspects and changing their names accordingly. The School must keep up with these international developments and has already provided evidence that it is capable of competing at the cutting edge.

   Clearly these two personalities, those of the 'surveyor' and the 'geoinformation scientist', are in the process of being merged into one. Together they describe the new identity of the Greek surveying engineer, and should make up the defining elements of the School's academic program.

2. The techniques exist in order to support valuable *application areas*. Both Geography and Regional Planning (Section II) and Infrastructure and Rural Development (Section III) should draw heavily on the two key areas of 'surveying' and geoinformatics.
3. Internal *streamlining*: The EEC noticed a number of inconsistencies and overlaps in the distribution of areas within current Sections II and III that are probably due to historical and practical reasons. An obvious anomaly is the location of the cadaster under Section I even though it is an application area much more compatible with regional planning and rural development. The EEC recommends re-examining the internal allocation of the School's academic areas to the Sections and reallocating units where possible in order to achieve a more rational and efficient structure.
4. The EEC strongly recommends drafting a *rolling 5-year plan* aiming at the gradual implementation of the chosen long-term reorganization and renewal strategy for the School. This should include decisions to phase out areas that may have become obsolete or that no longer serve the School's new goals, as well as to re-orient faculty positions, as they become vacant, towards these goals.
5. It is very important to systematize and expand the School's *links with industry and the public sector* and to orient these towards growth areas internationally as well as domestically. This could be achieved through the existing laboratories and research centers and would help provide (paid or unpaid) internship opportunities for students and opportunities for technology commercialization and marketing for researchers. This objective is closely connected with that of expanding research collaborations with other countries, mentioned elsewhere in this report. As is the case with most other areas of knowledge, Greek surveying engineers should feel part of the global market of ideas and job opportunities, and need to be educated accordingly.

H. Final Conclusions and Recommendations of the EEC

The School of Rural and Surveying Engineering has already taken important steps in evaluating its curriculum and enhancing its operations. Its faculty and staff are well prepared and very capable, and the students are of very high calibre. Throughout this report and under the previous sections, the EEC has provided several suggestions and recommendations, as well as observations that are meant to provide motivation for the improvement of the School. These are summarized below.

The EEC recommends:

- Redesigning, restructuring and modernizing the undergraduate curriculum with fundamental topography and geoinformation as its core, along with enhancing computer programming instruction.
- Emphasizing practical applications to help provide context to the theoretical content of classes.
- Establishing strong connections with the profession in order to facilitate exchange of knowledge and experiences, and to enrich learning through seminars and presentations by practitioners and scientists.
- Enhancing and expanding the current evaluation and attendance requirements, and working toward reducing the overall graduation time, for both undergraduate and graduate programs, including the number of students who have exceeded by far the number of the required 5 years of studies
- Reconsidering the number of examination periods (currently three, which may be too high); the EEC recommends reducing these to two.
- Increasing the internal communication and collaboration between the School's Sections, both with respect to curriculum as well as research.
- Creating an effective framework to facilitate and promote e-learning and executive education, a major trend in international institutions world-wide, and a good way for the School to achieve external recognition and support.
- Revitalizing, protecting, utilizing, and supporting the Dionysos Research Centre, which is in serious danger of closing.
- Upgrading the post-graduate and PhD programmes.
- Maintaining, upgrading and enhancing of the Geoinformation Centre.
- Making every effort to improve the existing tremendous bureaucracy and the currently extremely time-consuming processes in the School and NTUA;
- Improving the appreciation of the faculty and students of the current international productivity gauges and indices and expand their research activities to include more substantial and competitive research proposals and the pursuit of external funding awards.
- Ensuring the School's presence in major prestigious and selective events world-wide and the publication of the produced research work in significant, high-impact international publication outlets.

Along the same lines, it is strongly recommended that the School's faculty and students increase their involvement with universities abroad through sabbaticals, fellowships, exchanges, workshop participation, invitations to external speakers to make presentations, etc. This way, the School can become more extroverted and an influential major international institution, which is entirely within the capabilities and potential of both faculty and students.