# ***Second Part***

Analysis of existing accreditation procedures, proposition of a methodology

# 2nd part: Analysis of existing accreditation procedures, proposition of a methodology

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## *1. Introduction*

During the follow-up conferences to Bologna, the Ministers recognized the important role that quality assurances systems play in ensuring high quality standards and in facilitating the comparability of qualifications throughout Europe. Universities and other institutions were encouraged to share information on best practice and to design scenarios for mutual acceptance of evaluation and accreditation processes. As a result national accreditation agencies have been established in many countries, but at present the accreditation process differs between the different countries. Building on the preliminary study that was undertaken in the THEIERE project, the EIE-Surveyor project collected information on the various processes and procedures of accreditation and evaluated the accreditation processes in the participating countries.

The EIE-Surveyor project also reviewed the results of the EUR-ACE project (European accreditation of European Engineering and graduates) [1], which was a consortium of 14 partners, supported by the European Commission. The objectives of the EUR-ACE project were (i) to ensure consistency between existing national engineering accreditation systems, (ii) establish a European "quality label" for accreditated programmes and (iii) assist with the establishment of accreditation in European countries where it does not yet exist, thus improving the quality of engineering education, facilitating transnational recognition and mobility of engineering graduates.

The EIE Surveyor task also considered how the EUR-ACE results could be applied to the field of electrical and communication engineering.

## *2. Main points to be considered*

The EUR-ACE project evaluated the various factors that should be taken into consideration when assessing an engineering programme. These have been used as the guideline for constructing the questionnaire. They are gathered into six domains.

### 2.1. General information and curriculum

The general points concerning the curriculum are:

- Identification of educational goals
- Profile of the programme
- Duration, workload, ECTS

  A difference must be made between the duration of courses, tutorials and practical works and the actual workload, which includes the personal unsupervised study time of the students.

- Teaching methods
- Programme structure
- Programme content
- Number and duration of internships or work placements

The internships may be in academic laboratories or in industry.

**2.2. Professors and academic staff**

- Teaching staff (number, specialisation, qualification)

  The ratio between professors and other academic staff is considered. Their area of specialisation must be close to the topic of the curriculum.
- Academic staff – student ratio
- Technical and support staff

  Qualifications of the technical and support staff are also important.
- Research activities of staff

  The research activity should inform the development of the curricula.
- Professional activities and consultancy

**2.3. Admission and educational standards**

- Admission requirements

  Students may be admitted to the programme on the basis of a general national or state examination or by a selective entrance examination.
- Assessments of demand for the programme
- Assessments of student performance

  This relates to the different ways of assessing the student performances (grading, oral assessment, practical results of a device).
- Student performance

  The performance must be evaluated according to ECTS criteria. The distributions of the results among the different grades may be evaluated.
- Graduate employment opportunities

**2.4. Quality assurance measures and development**

- Quality assurance measures
- Plans for the future development of the programme

**2.5. Institutional context**

- General requirements (organizing, management,…)

  This point relates to how the institution operates and is managed.
- Cooperation with Higher Educational Institutions
- Industry cooperation

  The industrial cooperation is important for technical fields. It can be at different levels (internships, Teaching engineers, facilities)
- Finances
- Facilities

  Many facilities are required for technical fields (laboratories, computers) but also for general needs (library, duplicated notes, …)

**2.6. Internationalisation**

- Study abroad opportunities

  Most of institutions propose studies abroad for their students. It can be a simple semester or a whole academic year with validation by the home institution. Many double diplomas are proposed.

- International co-operations
  The international co-operations between two institutions consist of student and teachers mobility. They generally precede the organisation of study abroad opportunities. They are often initiated by research activities.
- Foreign language requirements and education
  For non-English speaking people, a knowledge of the English language is very desirable.
- Subject or specific classes taught in foreign languages
  Many institutions propose some courses in English and a few have a full curriculum in English.

## *3. Questionnaire content*

It was considered important that the questionnaire evaluated how the EUR-ACE criteria are considered by the institutions during the accreditation process. The goal was to have some complementary information specific to EIE field.

The questionnaire was constructed so that it could be completed in a quick and straight forward manner. It was sent to one partner in each participating country. Where a country has several accreditation bodies, several questionnaires were sent. The questions were divided into four sections.

### 3.1. Accreditation body

- Is accreditation compulsory to deliver engineering degrees in EIE?
- Is the accreditation awarded by the government, the university, a professional body or some other agency?
- Is the accreditation awarded to a programme, a department or the whole institution?
- Does the accreditation body include faculty, employers, engineers in industry?
- Does the accreditation process include quality assurance measures?

### 3.2. Parameters Measured

A number of different parameters can be considered during the accreditation process. For each of them the questionnaire asked whether it is evaluated and if documentation is provided in advance or during the visit. The parameters listed in the questionnaire were:

- Curricula
- Examination papers
- Student examination scripts
- Projects reports and thesis
- Students' performance
- Employment of graduates
- Academic staff
- Recruitment
- Research activities
- Collaboration with industry
- Facilities

### 3.3. Evaluation visit

In general the accreditation body sends a visiting panel in the institution to be reviewed. In order evaluate the visiting process, the following questions were asked:

- What is the frequency of the visits?
- What is the size of the visiting panel?

- What is the composition of the visiting panel (academics, industrial, others)?
- What is the duration of the visit?
- Whom does the panel meet during the visit?
    - students
    - academic staff
    - technical staff
    - administrative staff
    - employers
    - graduates

**3.4. Conclusions**

On the completion of the visit, the visiting panel in general gives a verbal presentation of their findings to the staff in the institution visited. Subsequently a report is written which includes a recommendation on the accreditation. In order to evaluate how the conclusions are processed the followed questions were asked.

- To whom do the review panel report (government, university, professional body, agency)?
- Who makes the final decision (government, university, professional body, agency)?
- What are the different possible decisions?
- full accreditation
- accreditation for reduced period of time
- no accreditation
- additional non-compulsory recommendations

At the end of the questionnaire, the participants were also invited to add any further comments they may wish to make.

## *4. Results*

Twenty two completed questionnaires were received from partners in eighteen different countries. Some countries have several accreditation bodies – for example there are six different accreditation bodies in Germany and three in France. In the questionnaire many of the answers were not mutually exclusive so several answers were possible with the result that the total percentage may add to more than 100%.

64% of the respondents said that the accreditation is compulsory and in some cases accreditation can be given simultaneously by several entities. In 64% of the cases the government awards the accreditation while an independent agency does so in 45% of the cases. In the majority of cases (73%) the programme itself is accreditation and the whole institution is evaluated 56% of the time. The accreditation body is constituted by faculty (65%), member of specific accreditation bodies (59%) and employers (45%). Engineers in industry are present in only 14% of the accreditation bodies. The accreditation process includes quality assurance measures (77%).

The most important criteria that have been considered during the accreditation process are the curriculum (95%), the academic staff (91%), the collaboration with industry (86%), the facilities (86%), the research activities (82%) and the employment of graduates (77%). In most cases documentation related to these items was provided in advance. Other criteria evaluated include the projects reports and thesis (68%), the recruitment (59%) and the student examination scripts (45%). These items are generally evaluated during the visit. The examination papers are considered in only a minority of cases (32%).

On average, the frequency of the visits is 5 years and the size of the visiting panel is 4 persons. It

is mainly composed of academics (86%) and industrial representatives (55%). The visit lasts between 2 and 3 days. The panel meets mainly students (91%), academic staff (95%) and administrative staff (82%). Technical staff (50%), employers (36%) and graduates (41%) are interviewed less frequently.

The final report is sent to the government in (50%) of the cases, the university in (32%) and an independent agency in (41%). The final decision is made by the government (55%) of the time and an independent agency (36%) of the time. They decide on full accreditation or an accreditation for a reduced period of time or a non-accreditation. In 41% of the cases, additional non-compulsory recommendations can be given.

A first analysis shows that some countries have not yet introduced a formal accreditation process. These countries are generally in a transition situation in relation to introducing the Bologna process. The accreditation process, ECTS and the quality assurance measures will probably be introduced at the same time.

In some other countries several accreditation bodies exist depending on the region (in Germany according to the Länder) or the nature of the institution (in France between universities and Grandes Ecoles). It also appears that the accreditation for masters and PhD degrees is not yet compulsory everywhere.

Other issues regarding the accreditation process that are also being considered include the payment of the expenses in relation to the accreditation process. This point is important in the countries where the accreditation process is not paid by government. Also, the relation between the ECTS and the actual content and level of the courses is being considered. This issue is larger than the goal of this task, but it is a very important question for the mutual recognition of the curricula. Finally the issue of whether industrial placement is compulsory and for how long must it last is being reviewed.

## *5. Outcomes and dissemination*

The results have been presented at three conferences.

### 5.1. 18th European Association for Education in Electrical and Information Engineering (EAEEIE) annual conference (Prague, Czech Republic, July 2-4, 2008)

The introduction of the Bologna Process is leading to changes in the process of accrediting engineering programmes and also the quality control mechanisms associated with these programmes. The EIESurveyor project is examining the various accreditation processes currently in use in Europe and existing accreditation systems in Germany, Ireland and Portugal have been reviewed in this paper. Developments relating to mutual accreditation by the professional engineering bodies have also been presented

### 5.1. 19th European Association for Education in Electrical and Information Engineering (EAEEIE) annual conference (Tallinn, Estonia, June 29 - July 2, 2008)

A communication has shown that, according to the answers, the accreditation processes may be classified by a statistical approach into three groups (group I: Ireland, France (CTI), Latvia, Norway, United Kingdom; group II: Bulgaria, Czech Republic, Estonia, France (except CTI), Poland, Portugal, Slovakia; group III: Finland, Germany, Greece, Hungary, Lithuania, Spain).

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Classification into three groups might be a bit surprising. Indeed, differences between the accreditation processes are not as large as this classification suggests. However, to get objective criteria for assessing present differences, a "metric" had to be created. This metric was measuring the (weighted) deviations in the responses from the above mentioned questionnaires. Therefore, the formulation of the questions in the questionnaire and the decision what to answer had also an important influence on the outcome. This might be illustrated by an example.

One of the questions in the questionnaire was:
"Who makes the final decision? government □ university □ professional body □
independent agency □ international agency □ "

In case of the German accreditation agency ASIIN, more than 95% of the final decisions (as of autumn 2008) are made by ASIIN alone, which is an independent agency. However, in cases of course programmes for teachers, an additional permission of the state authorities must be given that confirms compliance with state laws and directives. As a policy by ASIIN, it is also carefully observed whether the latter are met. Therefore, in the questionnaire, the response "independent agency" was given, since this is closest to reality, while for the mentioned cases "government" would also be correct. However, differences like these might have been the reason to classify the German system into one group or into another.

Since accreditation systems are in a process of modification – in Germany, for example, it is planned to introduce "system accreditation" in addition to "programme accreditation" – differences and similarities between accreditation systems must be carefully observed in the future. It might even be necessary to refine classification into groups.

### 5.2. 36th Société Européenne pour la Formation des Ingénieurs (SEFI) annual conference (Aalborg, Denmark, July 2 – 5, 2008)

The main topics of this conference was quality, assessment, employability and innovation. The results shown above have been presented. This has been the opportunity to discuss with people involved in EUR-ACE and in French AERES (Research and Higher Education Evaluation Agency) who are interested in the final conclusions of the project.

## 6. Appendices

### Appendix 1

**18th European Association for Education in Electrical and Information Engineering (EAEEIE) annual conference (Prague, Czech Republic, July 2-4, 2007)**

# Accreditation of higher education in EIE in Europe

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## Abstract

*The introduction of the Bologna Process is leading to changes in the process of accrediting engineering programmes and also the quality control mechanisms associated with these programmes. The EIESurveyor project is examining the various accreditation processes currently in use in Europe and existing accreditation systems in Germany, Ireland and Portugal are reviewed in this paper. Developments relating to mutual accreditation by the professional engineering bodies are also presented.*

## 1. Introduction

During the Bologna follow-up-conference in Prague, "Ministers recognized the vital role that quality assurance systems play in ensuring high quality standards and in facilitating the comparability of qualifications throughout Europe. They encouraged universities and other higher education institutions to disseminate examples of best practice and to design scenarios for mutual acceptance of evaluation and accreditation/certification mechanisms."

Therefore, national accreditation agencies have been installed in many countries. Though the intention was (and still is) to achieve comparability of degrees, accreditation processes in different countries are different.

In the EIESurveyor project, one of the working groups is collecting available material on the processes and procedures of accreditation.

Using the accreditation agencies of Germany, Ireland, and Portugal as examples, it will be shown that accreditation procedures differ in Europe.

## 2. Accreditation in Germany

Education is in the responsibility of the individual States in Germany. Prior to the reforms that came into effect after the Bologna declaration, quality control of higher education was, therefore, a matter of the ministers in charge of higher education. The legal aspects were handled by themselves.

Functional control in the field of electrical and information engineering (EIE) was executed by the German Council of University Departments of Electrical and Information Engineering (FTEI). Only those departments, that met the requirements of the FTEI, were recognised by FTEI. Students with degrees awarded by FTEI recognized departments were preferred by German industry. Therefore, all university departments of electrical and information engineering aimed at meeting the requirements. Thus, a very effective and cost-efficient system of quality control was set up.

Since this system was completely outside of political control, ministers wanted to get rid of it. They took the opportunity of harmonization in the framework of the Bologna process to change the laws in such a way that the new degrees must now be accredited by accreditation agencies. This was based on the concept that competition between agencies would improve the quality of accreditation process. In order to control the accreditation agencies, they installed an Accreditation Council [1], [2] as a foundation under public law in North-Rhine Westphalia, the latter being one of the states of the Federal Republic of Germany.

To date, the Accreditation Council has accredited six accreditation agencies. These are in alphabetical order:

ACQUIN (www.acquin.org),
AHPGS (www.ahpgs.de),
AQAS (www.aqas.de),
ASIIN (www.asiin.de),
FIBAA (www.fibaa.de),
ZEVA (www.zeva.uni-hannover.de).

Each of these agencies is different from the others [2], either by its legal form, or by an existing or missing specialisation to certain subjects, or by its funding, or by its additional tasks and dependencies.

Presently, each new bachelor- and master-course programme must be accredited in Germany during the next three years. Accreditation should then be renewed every five years.

Programme accreditation is described using the procedures of ASIIN as an example. Initially, the programme team prepares a self-evaluation report, following guidelines prepared by the accreditation agency. A review team, consisting of three to seven peers, for formal correctness, then analyzes this report. Questions to be answered concern the content of a study course programme and its coherence, its level and quality, whether or not there is a need for graduates from this programme in the job market, the quality and quantity of lecturers, whether there is adequate supervision of students, whether there are sufficient lecture rooms, whether these are equipped adequately, whether there is appropriate access to literature, etc.

If these questions are answered satisfactorily, the team of peers visits the faculty offering the program. They review the management team of the faculty, the staff and the students. The latter are also interviewed in absence of staff.

At the conclusion of the visit, the team of peers gives a provisional summary to the management team of the faculty. They write a final report with recommendations. A board of experts, who may add to or even change the final report, then discusses this report. The final decision about accreditation is then made by another, independent group of experts.

Accreditation might either be awarded without any conditions, or with conditions or recommendations that ought to be followed within one year, or it might be denied. In the latter case, the state might even forbid the faculty to run that programme. Therefore, it is to be expected that the vast majority of programmes will be set up in a way that makes them likely to be accredited.

Since there are about 15000 course programmes in Germany (including all technical and non-technical subjects), about 3000 accreditation procedures must be executed each year. Since one of these procedures costs about € 25000, politicians are beginning to discover that they have produced gigantic additional costs. The previous system was more efficient and cheaper by some orders of magnitude.

Unfortunately, educational politicians in Germany find it difficult to admit that they have made mistakes. Therefore, the Bologna reforms will be reformed gradually over the next few years. In relation to accreditation this process has already begun.

Presently there is a discussion about replacing the program accreditation by what is called “system accreditation”. The idea is to install a quality assurance system at the Universities and Fachhochschulen. The new QA-system itself will be accredited every five years also. The QA-system will then accredit the individual programmes.

Again, this idea is flawed, since it is quite clear that the existence of a quality assurance system does not guarantee by itself that quality is maintained, let alone improved.

The umbrella organization of the four councils of schools of engineering and of computer technology at German Universities, 4ING, is, therefore, concerned about the future of engineering programmes at German Universities. They have started an intensive discussion with the sixteen state ministers and with the federal minister in charge of higher education in Germany. The experts of 4ING believe that the Bologna process in general, and accreditation of its programmes in particular must be reformed to maintain high-level higher education programmes.

## 3. Accreditation in Ireland

In Ireland each University is responsible for both the awarding and quality control of its own degrees. In addition engineering programmes have been subjected to external accreditation by the professional engineering bodies for many years. Engineers Ireland (EI) is responsible for setting up and maintaining proper standards of professional and general education for the formation of chartered engineers and has formally accredited engineering degree programmes in Ireland since 1982.

The accreditation process [3] involves a periodic audit of the engineering education provided by a particular programme. It is essentially a peer review process with an independent panel comprising both academic staff and professional engineers from industry. Detailed self-assessment reports and documentation are submitted to the panel several weeks in advance of the visit. During the 2-day visit the panel meet with academic and support staff members,

students, former students and employers. The panel also visits the various facilities (library, laboratories, etc.) and reviews student project work, examination papers and scripts and other assessed work. If the accreditation panel were satisfied completely with the standard of the programme, accreditation would be granted for a five-year period, at the end of which the programme would be invited to apply for re-accreditation. If the panel is not satisfied completely, accreditation for a reduced period, or, where there are serious deficiencies, no accreditation, is proposed.

In recent years, Engineers Ireland has revised its accreditation criteria, with the emphasis moving from inputs to outputs. Thus the new criteria are based on programme and learning outcomes [4].

## 4. Accreditation in Portugal

Prior to the introduction of the Bologna Process in Portugal, there were two accreditation and quality controls for the programmes at the Universities and Polytechnics with two different objectives.

The first was an accreditation process to control the scientific quality of the programmes and the adequacy of the staff, laboratories, programmes and the learning process quality. The responsibility for this process was a commission established by the Rectors of the Public Universities which was independent of the Government. The quality control was evaluated every five years, unless there were problems and in this case the period could be shortened to two or three years to check if the compulsory modifications had been introduced. The commission that evaluates the programmes is composed of academics, who prepare a report and propose a decision in relation to the programme quality, which is approved or not by the Quality Body.

The second was an accreditation process organized by the Professional Bodies to check if the standard of the programme was sufficiently high so that graduates from the programme would be able to practice as engineers and undertake the necessary responsibilities. The commission, which typically comprised three engineers and two academics, visited the institution offering the programme and undertook the evaluation. The Professional Body reviewed the report proposed by this commission.

For the two processes, which are independent, the Universities and Polytechnics prepare documentation on the administrative processes (information on teaching and administrative staff, subjects, programmes, laboratories, equipment, quality selection of students, student performance and subsequent employment information as well as questionnaires on the programme and teaching process.). During the visit, which generally lasts two days, the commission independently interviews the faculty, students, staff and alumni. After their visit, the commission writes a report, which is submitted to the board. The report makes a recommendation, and also gives guidelines for improving the quality of the programme

The implementation of the Bologna process started during the current academic year and is already being realized in most of the programmes being offered at the Universities and Polytechnics. The Portuguese Law, which defines the new structure of the programmes, was published in May 2006 and also defines the new accreditation quality control process. A new independent Accreditation Agency, which the Government will establish, taking into account the European Accreditation System guidelines, will be responsible for the overall quality control. This new Agency will include representatives from the European Agency or representatives from accreditation boards from other European countries. The Portuguese Law, which is going to define the accreditation process, has not yet been published.

## 5. The EUR-ACE Project

Under the auspices of FEANI, a group of national associations involved in accreditation [ASIIN (Germany), CTI (France), EC (UK), EI (Ireland), COPI (Italy), OE (Portugal), UAICR (Romania) and RAEE

(Russia)] submitted a proposal to the European Commission to set up the EUR-ACE project [5] with the objectives of (i) ensuring consistency between existing national engineering accreditation systems, (ii) establish a European "quality label" for accredited programmes, (iii) assisting with the establishment of accreditation in European countries where it does not yet exist, thus improving the quality of engineering education, facilitating trans-national recognition and mobility of engineering graduates. Following the successful completion of the EUR-ACE project, the partners established ENAEE (European Network for Accreditation of Engineering Education) to establish policies and procedures whereby the professional accreditation agencies in Europe will be authorized to add the EUR-ACE label to their accreditations.

## 6. Conclusions

Degree programmes in Universities and other Institutes are subject to various accreditation, evaluation and quality control processes, which vary from country to country. These processes can be managed by the Government, the State or by the Institutes themselves. Engineering programmes in addition may be subjected to external accreditation by the professional engineering bodies. The Bologna process, with its focus on mobility, credit transfer and quality control is resulting in a review of current accreditation processes. In addition the professional engineering bodies are increasingly considering mutual accreditation, which is also leading to changes in the process. The EIESurveyor project is reviewing existing processes and procedures for accreditation across Europe with a view to proposing best practice for accreditation and quality control of EIE engineering programmes in Europe.

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# Clustering Analysis on Questionnaire Data for Program Accreditation

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*Abstract*—**The aim of the SOCRATES EIE-Surveyor project is to be a reference point for Electrical and Information Engineering in Europe, bringing together representatives from 27 out of 31 eligible countries. One of the tasks of the project is the evaluation of the accreditation processes in the participating countries. A questionnaire about the accreditation process was developed and sent to project partners in each participating country. The main areas investigated the nature of the accreditation body, the criteria, which are evaluated, the structure of the visit and the decision formulation. The results of the questionnaire, will be analyzed using clustering analysis and more precisely hierarchical, in order to compare the answers in 17 European countries and to find similarities among them. As distance measures the Euclidian metric and the City block distance will be used. Average linkage, and Ward clustering algorithms will be utilized.**

*Index Terms*— **accreditation, evaluation, clustering**

## I. Introduction

The first moves towards formal engineering education in Europe began around the middle of the 18th century initially in France, but within a short space of time engineering schools were established in much of Europe [1]. In due course universities across the world established engineering programmes based on the European models. In mainland Europe, the duration and structure of engineering programmes were based on a programme of studies of four or five years duration and firmly grounded in mathematics and the sciences. Initially in the UK and Ireland programmes were generally of three years duration. The structure in the UK has evolved into a four years Masters of Engineering degree programme, while in Ireland, a four year Bachelor degree has been in place for nearly 50 years.

In June 1999 the Bologna Declaration [2] was published and its overall objective was the establishment of a European area of higher education in which student mobility would be facilitated and enabled. A follow-up conference in Prague [3] highlighted the important role that quality assurance systems play in ensuring high quality standards and in facilitating the comparability of qualifications throughout Europe. Prior to this the recognition or accreditation of qualifications was done largely on a national basis and, within individual countries, recognition or accreditation of programmes of study could take place at either institutional, national or the professional level. However, since the Bologna Declaration, the need for European wide recognition and accreditation of higher education programmes and their relationship to quality assurance are at present the subject of many discussions and

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activities in Europe [4].

Under the auspices of FEANI, the European Federation of National Engineering Associations, a group of national associations involved in accreditation submitted a proposal to the European Commission to set up the EUR-ACE (EURopean ACcredited Engineer) project with the objectives of ensuring consistency between existing national engineering accreditation systems and establishing a European "quality label" for accredited programmes [5]. Following the successful completion of the EUR-ACE project, the partners established ENAEE (European Network for Accreditation of Engineering Education) to develop policies and procedures whereby professional accreditation agencies in Europe will be authorised to add the EUR-ACE label to their accreditation [6].

An earlier Thematic Network project THEIERE [7], conducted a preliminary study of existing accreditation procedures in the field of electrical and information engineering across a range of universities in Europe. This work has been extended in the EIE Surveyor Thematic Network project [8], which by means of a questionnaire has collected material on the existing accreditation processes and procedures in Europe. Some early results of this work have already been presented [9] and this paper presents a detailed analysis of the Questionnaire Data obtained.

## II. QUESTIONNAIRE

### A. Context of the questionnaire

The starting point of the accreditation task in Surveyor project was the EUR-ACE project (European accreditation of European Engineering and graduates) [5], which was a consortium of 14 partners, supported by the European Commission. The objectives of the EUR-ACE project were (i) to ensure consistency between existing national engineering accreditation systems, (ii) establish a European "quality label" for accreditated programmes and (iii) assist with the establishment of accreditation in European countries where it does not yet exist, thus improving the quality of engineering education, facilitating transnational recognition and mobility of engineering graduates.

The aim of the EIE Surveyor task was to see how the EUR-ACE results could apply to the field of electrical and communication engineering.

The EUR-ACE project evaluated the various factors that should be taken into consideration when assessing an engineering programme. These have been used as the guideline for constructing the questionnaire. They are gathered into six domains.

*1) General information and curriculum*

The general points concerning the curriculum are:

- Identification of educational goals
- Profile of the programme
- Duration, workload, ECTS

A difference must be made between the duration of courses, tutorials and practical works and the actual workload which includes the personal unsupervised study time of the students.

- Teaching methods
- Programme structure
- Programme content
- Number and duration of internships or workplacements

The internships may be in academic laboratories or in industry.

*2) Professors and academic staff*

- Teaching staff (number, specialisation, qualification)

The ratio between professors and other academic staff is considered.

- Academic staff – student ratio
- Technical and support staff
- Research activities of staff
- Professional activities and consultancy

*3) Admission and educational standards*

- Admission requirements

Students may be admitted to the programme on the basis of a general national or state examination or by a selective entrance examination.

- Assessments of demand for the programme
- Assessments of student performance
- Student performance

The performance must be evaluated according to ECTS criteria. The distributions of the results among the different grades may be evaluated.

- Graduate employment opportunities

*4) Quality assurance measures and development*

- Quality assurance measures
- Plans for the future development of the programme

*5) Institutional context*

- General requirements (organizing, management,…)
- Cooperation with Higher Educational Institutions
- Industry cooperation
- Finances
- Facilities

*6) Internationalisation*

- Study abroad opportunities
- International co-operations

The international co-operations between two institutions consist of student and teachers mobility.

- Foreign language requirements and education
- Subject or specific classes taught in foreign languages

Many institutions propose some courses in English and a few have a full curriculum in English.

### B. Questionnaire content

It was considered important that the questionnaire evaluated how the EUR-ACE criteria are considered by the institutions during the accreditation process. The goal was to have some complementary information specific to EIE field.

The questionnaire was constructed so that it could be completed in a quick and straight forward manner. It was sent to one partner in each participating country. Where a country has several accreditation bodies, several questionnaires were sent. The questions were divided into four sections.

*1) Accreditation body*

- Is accreditation compulsory to deliver engineering degrees in EIE?
- Is the accreditation awarded by the government, the university, a professional body or some other agency?
- Is the accreditation awarded to a programme, a department or the whole institution?
- Does the accreditation body include faculty, employers, engineers in industry?
- Does the accreditation process include quality assurance measures?

*2) Parameters measured*

A number of different parameters can be considered during the accreditation process. For each of them the questionnaire asked whether it is evaluated and if documentation is provided in advance or during the visit. The parameters listed in the questionnaire were:

- Curricula
- Examination papers
- Student examination scripts
- Projects reports and thesis
- Students' performance
- Employment of graduates
- Academic staff
- Recruitment
- Research activities
- Collaboration with industry
- Facilities

*3) Evaluation visit*

In general the accreditation body sends a visiting panel in the institution to be reviewed. In order evaluate the visiting process, the following questions were asked:

- What is the frequency of the visits?
- What is the size of the visiting panel?
- What is the composition of the visiting panel (academics, industrial, others)?
- What is the duration of the visit?
- Whom does the panel meet during the visit?
  - students
  - academic staff
  - technical staff
  - administrative staff
  - employers
  - graduates

*4) Conclusions*

On the completion of the visit, the visiting panel in general gives a verbal presentation of their findings to the staff in the institution visited. Subsequently a report is written which includes a recommendation on the accreditation. In order to evaluate how the conclusions are processed the followed questions were asked.

- To whom do the review panel report (government, university, professional body, agency)?
- Who makes the final decision (government, university, professional body, agency)?
- What are the different possible decisions?
  - full accreditation
  - accreditation for reduced period of time
  - no accreditation
  - additional non-compulsory recommendations

At the end of the questionnaire, the participants were also invited to add any further comments they may wish to make.

### *C. First analysis*

A first analysis shows that some countries have not yet introduced a formal accreditation process. These countries are generally in a transition situation in relation to introducing the Bologna process. The accreditation process, ECTS and the quality assurance measures will probably be introduced at the same time.

In some other countries several accreditation bodies exist depending on the region (in Germany according to the Länder) or the nature of the institution (in France between universities and Grandes Ecoles). It also appears that the accreditation for masters and PhD degrees is not yet compulsory everywhere.

Other issues regarding the accreditation process that are also being considered include the payment of the expenses in relation to the accreditation process. This point is important in the countries where the accreditation process is not paid by government. Finally the issue of whether industrial placement is compulsory and for how long must it last is being reviewed.

## III. Clustering and Data Encoding

Cluster analysis or clustering is the classification of objects (patterns) into different groups, or more precisely, the partitioning of a data set into subsets (clusters), so that the data in each subset are similar according to some defined distance measure. Central to all of the goals of cluster analysis is the notion of degree of similarity (or dissimilarity) between the individual patterns being clustered. Data clustering is a common technique for statistical data analysis. The patterns are given in the form of feature vectors containing elements that describe in numeric form objects or events.

In this study the objective is to discover similarities among countries so each questionnaire answered is a distinct pattern. The feature vector for each questionnaire is formed by encoding numerically the answers to the questionnaire using various techniques.

TABLE 1
ENCODING OF QUESTIONNAIRE

| | | Desciption | Encoding | | | | | Inputs |
|---|---|---|---|---|---|---|---|---|
| 1 | | **The accreditation body** | | | | | | |
| | a | yes | 1 | | | | | 1 |
| | | no | 0 | | | | | |
| | b | Government | 1 | 0 | 0 | 0 | 0 | 5 |
| | | University | 0 | 1 | 0 | 0 | 0 | |
| | | Professional body | 0 | 0 | 1 | 0 | 0 | |
| | | Independent body | 0 | 0 | 0 | 1 | 0 | |
| | | International agency | 0 | 0 | 0 | 0 | 1 | |
| | c | a programme | 0,2 | | | | | 1 |
| | | a department | 0,5 | | | | | |
| | | the whole institution | 1 | | | | | |
| | d | | | | | | | |
| | e | faculty | 1 | 0 | 0 | 0 | 0 | 5 |
| | | employers | 0 | 1 | 0 | 0 | 0 | |
| | | engineers in industry | 0 | 0 | 1 | 0 | 0 | |
| | | accreditation body | 0 | 0 | 0 | 1 | 0 | |
| | | Others | 0 | 0 | 0 | 0 | 1 | |
| | f | yes | 1 | | | | | 1 |
| | | no | 0 | | | | | |
| | g | International | 1 | 0 | 0 | | | 3 |
| | | European | 0 | 1 | 0 | | | |
| | | EUR-ACE | 0 | 0 | 1 | | | |
| | h | Yes | 1 | | | | | 1 |
| | | No | 0 | | | | | |
| 2 | | **The Criteria** | | | | | | |
| | a | 11 choices accumulated In 3 columns (0-1) | | | | | | 3 |
| 3 | | **The evaluation visit** | | | | | | |
| | a | 2 years | 0.25 | | | | | 1 |
| | | 5 years | 0.63 | | | | | |
| | | Other (normalized 8 y=1) | | | | | | |
| | b | 1 | 0.14 | | | | | 1 |
| | | 2 | 0.29 | | | | | |
| | | 3 | 0.43 | | | | | |
| | | Other (normalized 7=1) | | | | | | |
| | c | Academics | 1 | 0 | 0 | | | 3 |
| | | Industrial | 0 | 1 | 0 | | | |
| | | Other | 0 | 0 | 1 | | | |
| | d | 1 day | 0.25 | | | | | 1 |
| | | 2 days | 0.50 | | | | | |
| | | 3 days | 0.75 | | | | | |
| | | longer | 1.00 | | | | | |
| | e | 6 choices accumulated(0-1) | | | | | | 1 |
| 4 | | **The conclusion** | | | | | | |
| | a | Government | 1 | 0 | 0 | 0 | 0 | 5 |
| | | University | 0 | 1 | 0 | 0 | 0 | |
| | | Professional body | 0 | 0 | 1 | 0 | 0 | |
| | | Independent body | 0 | 0 | 0 | 1 | 0 | |
| | | International agency | 0 | 0 | 0 | 0 | 1 | |
| | b | Government | 1 | 0 | 0 | 0 | 0 | 5 |
| | | University | 0 | 1 | 0 | 0 | 0 | |
| | | Professional body | 0 | 0 | 1 | 0 | 0 | |
| | | Independent body | 0 | 0 | 0 | 1 | 0 | |
| | | International agency | 0 | 0 | 0 | 0 | 1 | |
| | c | full accreditation | 1.00 | | | | | 1 |
| | | reduced accreditation | 0.50 | | | | | |
| | | no accreditation | 0.00 | | | | | |
| | | additional non-compulsory recommendations | 0.70 | | | | | |

Table 1 illustrates the encoding utilized. Each multiple choice question is encoded as a binary input or a real number between 0-1. In most cases, for example questions 1b), 1g) etc, the use 1-of-C coding is utilized. The number of input is determined by the possible choices of a question. Each choice is given the value zero except for the one corresponding to the correct one, which is given the value one. In other cases, such as questions 1c), 3a), 3b) a real number between 0-1 can represent the answer, and only 1 input is needed. Finally, in multiple choice questions, where the answers could be several categories, such as questions 2a) and 3 e) the total number of the selected categories is accumulated and normalized between 0-1. There was one question 1d) where the encoding was not possible and it was not used as input. In total, as shown in Table 1, 38 inputs formed the feature vector for each questionnaire.

Using the above encoding scheme the feature vector of each questionnaire was formed. However, there were several problems encountered with missing answers in the questionnaires. According to the nature of the question different strategies were used to resolve the problem. One of the most common problems encountered was the missing answers to a yes, no question, such as 1a), 1f), etc. In this case the value 0.5 was used. In questions such as 1c), 3a), 3b) where a real number between 0-1 can represent the answer, and only 1 input is needed, the value 0 is reserved for no answer.

Finally, analyzing the answers to al the questionnaires, in question 4a) nobody choose "international agency", so this input was eliminated. Similarly, in question 4b) the inputs for choices "University" and "International Agency" were eliminated.

Data clustering algorithms can be hierarchical or partitional [10]. Hierarchical algorithms find successive clusters using previously established clusters, whereas partitional algorithms determine all clusters at once. Hierarchical algorithms can be agglomerative ("bottom-up") or divisive ("top-down"). Agglomerative algorithms begin with each element as a separate cluster and merge them into successively larger clusters. Divisive algorithms begin with the whole set and proceed to divide it into successively smaller clusters. Hierarchical clustering may be represented by a two dimensional diagram known as dendrogram which illustrates the fusions or divisions made at each successive stage of analysis. An example of such a dendrogram is shown in Fig. 1.

An important step in any clustering is to select a distance measure, which will determine how the similarity of two elements is calculated. The most common distance measure, which will be used in this paper, is the Euclidean distance. The Euclidean distance between feature vectors $\underline{x}$ and $\underline{y}$ is given by:

$$d_E\left(\underline{x},\underline{y}\right)=\sqrt{\sum_i\left(x_i-y_i\right)^2} \qquad (1)$$

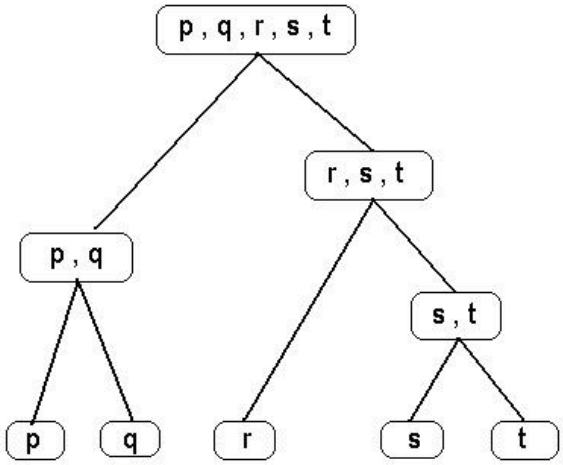


Fig. 1. Example of dendogram

Another popular distance measure, which is utilized on integer values, and suitable to the data presented in this paper, is the City block distance also known as Manhatan distance or Taxi distance. The City block distance between feature vectors $\underline{x}$ and $\underline{y}$ is given by:

$$D_C\left(\underline{x},\underline{y}\right)=\sum_i |x_i-y_i| \tag{2}$$

In this paper agglomerative hierarchical clustering is utilized using the Euclidean and City block distance. At each particular stage the method joins together the two clusters which are closest together (most similar). Differences between methods arise because of the different ways of defining distance (or similarity) between clusters.

One of the most common agglomerative hierarchical clustering methods is **Average linkage**. The distance between two clusters is defined as the average distances between a point in one cluster and a point in the other cluster.

**Ward's** hierarchical clustering method minimizes the loss associated with each cluster. At each step in the analysis, among all pairs of clusters, it merges the pair that produces the smallest **squared error** for the resulting set of clusters, resulting in minimum increase in information loss. Information loss is defined by Ward in terms of an error squared error criterion. The squared error for a cluster is the sum of the squared distances in each element from the cluster mean. The squared error is thus equal to the total variance of the cluster times the number of elements in the cluster. The squared error for a set of clusters is defined to be the sum of squared errors for the individual clusters.

Each agglomeration occurs at a greater distance between clusters than the previous agglomeration, and one can decide to stop clustering either when the clusters are too far apart to be merged (distance criterion) or when there is a sufficiently small number of clusters (number criterion).

## IV. CLUSTERING RESULTS

Hierarchical clustering was performed on the encoded data of the questionnaires in order to discover similarities among countries concerning accreditation procedures. The best results, in the Mean Square Error Sense, were the average linkage algorithm and the Ward's algorithm utilizing either Euclidean or City block distance.

The results of clustering using the average linkage algorithm and City block distance are shown in Fig. 2.

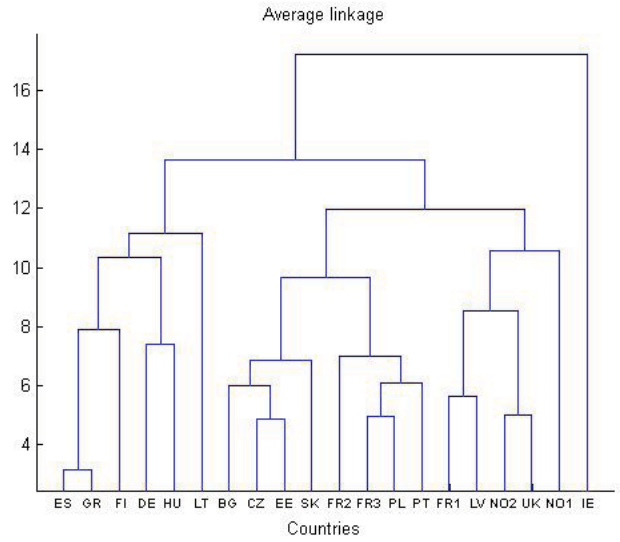


Fig. 2. Results of average linkage algorithm using City block distance

The results of clustering using the average linkage algorithm and Euclidean distance are shown in Fig. 3.

The results of clustering using Ward's algorithm and City block distance are shown in Fig. 4.

The results of clustering using Ward's algorithm and Euclidean distance are shown in Fig. 5.

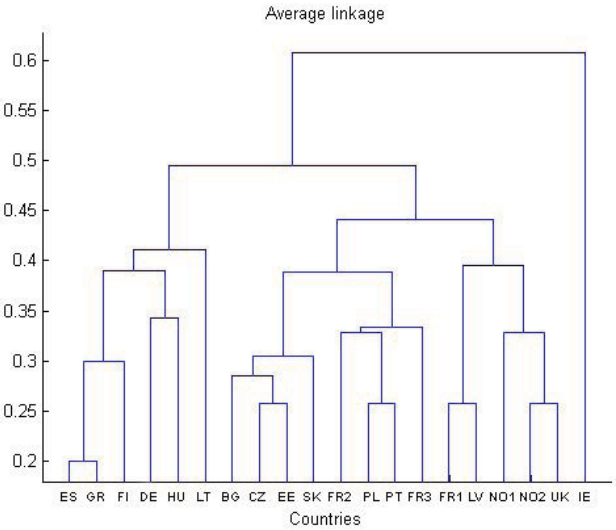


Fig. 3. Results of average linkage algorithm using Euclidean distance.

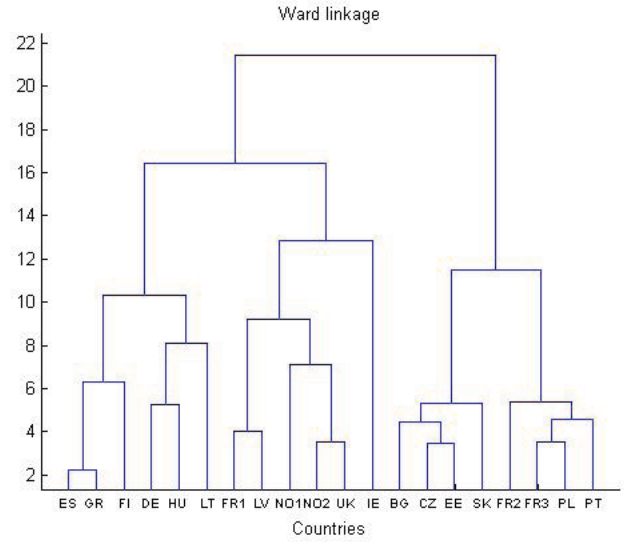


Fig. 4. Results of Ward's algorithm using City block distance.

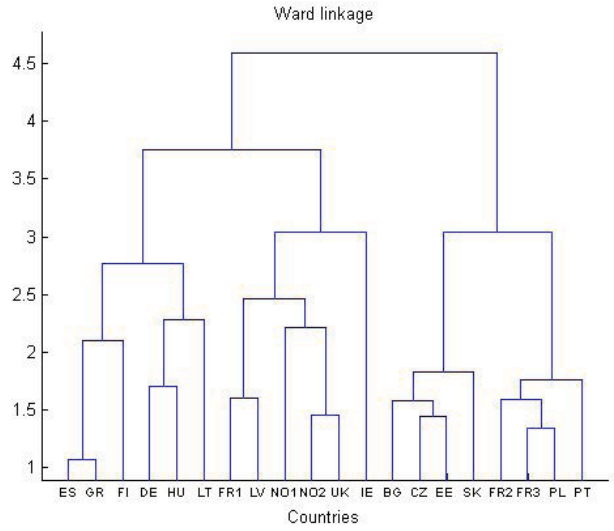


Fig. 5. Results of Ward's algorithm using Euclidean distance.

Analyzing the results we can see that results were similar in all cases and we note the formation of three clusters:

- Spain, Greece, Finland, Germany, Hungary and Lithuania.
- Bulgaria, Czech Republic, Estonia, Slovakia, France(2 and 3), Poland and Portugal.
- France(1), Latvia, Norway(1 and 2), United Kingdom and Ireland.

The algorithms utilized, Average and Ward's, gave the same results for both distance measures, City block and Euclidean. The only difference between the two algorithms is the assignment of Ireland. The average algorithm shows that Ireland is different from all the other countries while Ward's algorithm assigns Ireland to cluster 3. One final notice is that the clustering results show the questionnaires in France to belong to two different clusters. This result can be explained by the fact that accreditation in France is done by different agencies and the results reflect the different approach to accreditation among these agencies.

## V. Conclusion

In this paper the analysis of a survey about the accreditation process in 17 European countries was performed.

A first analysis shows that some countries have not yet introduced a formal accreditation process. These countries are generally in a transition situation in relation to introducing the Bologna process. The accreditation process, ECTS and the quality assurance measures will probably be introduced at the same time.

In some other countries several accreditation bodies exist depending on the region (in Germany according to the Länder) or the nature of the institution (in France between universities and Grandes Ecoles).

Cluster analysis showed the formation of three groups:

- Spain, Greece, Finland, Germany, Hungary and Lithuania.
- Bulgaria, Czech Republic, Estonia, Slovakia, France(2 and 3), Poland and Portugal.
- France(1), Latvia, Norway(1 and 2), United Kingdom and Ireland.

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# Appendix 3

**36th Société Européenne pour la Formation des Ingénieurs (SEFI) annual conference (Aalborg, Denmark, July 2 – 5, 2008)**

# Accreditation processes in Electronic and Information Engineering

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**Abstract**
The aim of the SOCRATES EIE-Surveyor project is to be a reference point for Electrical and Information Engineering in Europe. The project brings together representatives from 27 out of 31 eligible countries. One of the tasks of the project is the evaluation of the accreditation processes in the participating countries. A questionnaire about the accreditation process was developed and sent to project partners in each participating country. The main areas investigated the nature of the accreditation body, the criteria, which are evaluated, the structure of the visit and the decision formulation.

A first analysis shows that some countries have not yet introduced a formal accreditation process. These countries are generally in a transition situation in relation to introducing the Bologna process. In some other countries several accreditation bodies exist depending on the region or the nature of the institution. It also appears that the accreditation for masters degrees is not yet compulsory everywhere.

Other issues regarding the accreditation process that are also being considered relate to who pays the expenses in relation to the accreditation process, what is the relationship between the ECTS and the actual content and level of the courses and whether or not industrial placement is a compulsory component of the programme.

*Keywords:* accreditation, evaluation, electrical engineering

## 1. INTRODUCTION

EIE-Surveyor is a SOCRATES project whose objectives are:
- Identification of the generic competences and subject-specific competences in Electrical and Information Engineering (EIE).
- Implementation of quality assessment methodologies on some educational resources available in EIE.
- Evaluation of the existing accreditation processes and the proposition of a standard methodology for accreditation, in order to enhance comparability and common certification procedures.
- Compilation of the existing curricula in EIE in Europe, the multinational degrees, and the situation of the implementation of Bologna process in EIE, at the bachelor, master and PhD levels.

The main activities of the project are:
- The application of the tuning methodology to EIE to identify competences.
- The compilation of a list of the degrees available in EIE in Europe, and the state of the implementation of the Bologna process.
- The quality assessment of some resources in EIE available through the Internet.
- The analysis of existing accreditation procedures and the proposition of a standard accreditation methodology.

The expected outputs are:
- The update of a monograph on the degrees and international degrees in EIE in Europe that was published in a previous project (THEIERE project).
- Guidelines for the generic competences and subject specific competences content in EIE programmes
- Proposal for a standard accreditation methodology, together with a census on existing accreditation boards and methodologies.

- Library of selected pedagogical resources available in EIE with a quality assessment.

The project involves 94 partners from 27 countries (out of 31 eligible countries). This reports on the accreditation task of the project.

The starting point of the accreditation task in Surveyor project was the EUR-ACE project (European accreditation of European Engineering and graduates) [1], which was a consortium of 14 partners, supported by the European Commission. The objectives of the EUR-ACE project were (i) to ensure consistency between existing national engineering accreditation systems, (ii) establish a European "quality label" for accreditated programmes and (iii) assist with the establishment of accreditation in European countries where it does not yet exist, thus improving the quality of engineering education, facilitating transnational recognition and mobility of engineering graduates.

The aim of the EIE Surveyor task was to see how the EUR-ACE results could apply to the field of electrical and communication engineering.

## 2. MAIN POINTS TO BE CONSIDERED

The EUR-ACE project evaluated the various factors that should be taken into consideration when assessing an engineering programme. These have been used as the guideline for constructing the questionnaire. They are gathered into six domains.

### 2.1. General information and curriculum

The general points concerning the curriculum are:
- Identification of educational goals
- Profile of the programme
- Duration, workload, ECTS
  A difference must be made between the duration of courses, tutorials and practical works and the actual workload which includes the personal unsupervised study time of the students.
- Teaching methods
- Programme structure
- Programme content
- Number and duration of internships or workplacements
  The internships may be in academic laboratories or in industry.

### 2.2. Professors and academic staff

- Teaching staff (number, specialisation, qualification)
  The ratio between professors and other academic staff is considered. Their area of specialisation must be close to the topic of the curriculum.
- Academic staff – student ratio
- Technical and support staff
  Qualifications of the technical and support staff are also important.
- Research activities of staff
  The research activity should inform the development of the curricula.
- Professional activities and consultancy

### 2.3. Admission and educational standards

- Admission requirements
  Students may be admitted to the programme on the basis of a general national or state examination or by a selective entrance examination.
- Assessments of demand for the programme
- Assessments of student performance
  This relates to the different ways of assessing the student performances (grading, oral assessment, practical results of a device).
- Student performance
  The performance must be evaluated according to ECTS criteria. The distributions of the results among the different grades may be evaluated.

- Graduate employment opportunities

**2.4. Quality assurance measures and development**
- Quality assurance measures
- Plans for the future development of the programme

**2.5. Institutional context**
- General requirements (organizing, management,…)
  This point relates to how the institution operates and is managed.
- Cooperation with Higher Educational Institutions
- Industry cooperation
  The industrial cooperation is important for technical fields. It can be at different levels (internships, Teaching engineers, facilities)
- Finances
- Facilities
  Many facilities are required for technical fields (laboratories, computers) but also for general needs (library, duplicated notes,…)

**2.6. Internationalisation**
- Study abroad opportunities
  Most of institutions propose studies abroad for their students. It can be a simple semester or a whole academic year with validation by the home institution. Many double diplomas are proposed.
- International co-operations
  The international co-operations between two institutions consist of student and teachers mobility. They generally precede the organisation of study abroad opportunities. They are often initiated by research activities.
- Foreign language requirements and education
  For non-English speaking people, a knowledge of the English language is very desirable.
- Subject or specific classes taught in foreign languages
  Many institutions propose some courses in English and a few have a full curriculum in English.

## 3. QUESTIONNAIRE

It was considered important that the questionnaire evaluated how the EUR-ACE criteria are considered by the institutions during the accreditation process. The goal was to have some complementary information specific to EIE field.

The questionnaire was constructed so that it could be completed in a quick and straight forward manner. It was sent to one partner in each participating country. Where a country has several accreditation bodies, several questionnaires were sent. The questions were divided into four sections.

**3.1. Accreditation body**
- Is accreditation compulsory to deliver engineering degrees in EIE?
- Is the accreditation awarded by the government, the university, a professional body or some other agency?
- Is the accreditation awarded to a programme, a department or the whole institution?
- Does the accreditation body include faculty, employers, engineers in industry?
- Does the accreditation process include quality assurance measures?

**3.2. Parameters Measured**

A number of different parameters can be considered during the accreditation process. For each of them the questionnaire asked whether it is evaluated and if documentation is provided in advance or during the visit. The parameters listed in the questionnaire were:
- Curricula
- Examination papers
- Student examination scripts
- Projects reports and thesis

- Students' performance
- Employment of graduates
- Academic staff
- Recruitment
- Research activities
- Collaboration with industry
- Facilities

### 3.3. Evaluation visit

In general the accreditation body sends a visiting panel in the institution to be reviewed. In order evaluate the visiting process, the following questions were asked:

- What is the frequency of the visits?
- What is the size of the visiting panel?
- What is the composition of the visiting panel (academics, industrial, others)?
- What is the duration of the visit?
- Whom does the panel meet during the visit?
    - students
    - academic staff
    - technical staff
    - administrative staff
    - employers
    - graduates

### 3.4. Conclusions

On the completion of the visit, the visiting panel in general gives a verbal presentation of their findings to the staff in the institution visited. Subsequently a report is written which includes a recommendation on the accreditation. In order to evaluate how the conclusions are processed the followed questions were asked.

- To whom do the review panel report (government, university, professional body, agency)?
- Who makes the final decision (government, university, professional body, agency)?
- What are the different possible decisions?
    - full accreditation
    - accreditation for reduced period of time
    - no accreditation
    - additional non-compulsory recommendations

At the end of the questionnaire, the participants were also invited to add any further comments they may wish to make.

## 4. RESULTS

Twenty two completed questionnaires were received from partners in eighteen different countries. Some countries have several accreditation bodies – for example there are six different accreditation bodies in Germany and three in France. In the questionnaire many of the answers were not mutually exclusive so several answers were possible with the result that the total percentage may add to more than 100%.

64% of the respondents said that the accreditation is compulsory and in some cases accreditation can be given simultaneously by several entities. In 64% of the cases the government awards the accreditation while an independent agency does so in 45% of the cases. In the majority of cases (73%) the programme itself is accreditation and the whole institution is evaluated 56% of the time. The accreditation body is constituted by faculty (65%), member of specific accreditation bodies (59%) and employers (45%). Engineers in industry are present in only 14% of the accreditation bodies. The accreditation process includes quality assurance measures (77%).

The most important criteria that have been considered during the accreditation process are the curriculum (95%), the academic staff (91%), the collaboration with industry (86%), the facilities (86%), the research activities (82%) and the employment of graduates (77%). In most cases documentation related to these items was provided in advance. Other criteria evaluated include the projects reports and thesis (68%), the recruitment (59%) and the student examination scripts (45%). These items are generally evaluated during the visit. The examination papers are considered in only a minority of cases (32%).

On average, the frequency of the visits is 5 years and the size of the visiting panel is 4 persons. It is mainly composed of academics (86%) and industrial representatives (55%). The visit lasts between 2 and 3 days. The panel meets mainly students (91%), academic staff (95%) and administrative staff (82%). Technical staff (50%), employers (36%) and graduates (41%) are interviewed less frequently.

The final report is sent to the government in (50%) of the cases, the university in (32%) and an independent agency in (41%). The final decision is made by the government (55%) of the time and an independent agency (36%) of the time. They decide on full accreditation or an accreditation for a reduced period of time or a non-accreditation. In 41% of the cases, additional non-compulsory recommendations can be given.

## 5. CONCLUSION

A first analysis shows that some countries have not yet introduced a formal accreditation process. These countries are generally in a transition situation in relation to introducing the Bologna process. The accreditation process, ECTS and the quality assurance measures will probably be introduced at the same time.

In some other countries several accreditation bodies exist depending on the region (in Germany according to the Länder) or the nature of the institution (in France between universities and Grandes Ecoles). It also appears that the accreditation for masters and PhD degrees is not yet compulsory everywhere.

Other issues regarding the accreditation process that are also being considered include the payment of the expenses in relation to the accreditation process. This point is important in the countries where the accreditation process is not paid by government. Also, the relation between the ECTS and the actual content and level of the courses is being considered. This issue is larger than the goal of this task, but it is a very important question for the mutual recognition of the curricula. Finally the issue of whether industrial placement is compulsory and for how long must it last is being reviewed.

**Reference**

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