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

EXTERNAL EVALUATION REPORT

DEPARTMENT OF PRODUCTION ENGINEERING AND MANAGEMENT

TECHNICAL UNIVERSITY OF CRETE

According to Version 2.0 of the Template

September 2012

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External Evaluation Committee

The Committee responsible for the External Evaluation of the **Department of Production Engineering and Management of the Technical University of Crete,** consisted of the following five (5) expert evaluators drawn from the Registry constituted by the HQA in accordance with Law 3374/2005 :

1. ***Prof. Paul Maropoulos***
   University of Bath, UK

2. ***Prof. Dimos Poulikakos***
   ETHZ, Switzerland

3. ***Prof. Christos Spitas***
   Delft University of Technology, The Netherlands

4. ***Prof. Kimon Valavanis***
   University of Denver, USA

5. ***Prof. George Yadigaroglu*** (Coordinator)
   ETHZ, Switzerland

Introduction

I. The External Evaluation Procedure

- **Dates and brief account of the site visit.**
- **Whom did the Committee meet ?**
- **List of Reports, documents, other data examined by the Committee.**
- **Groups of teaching and administrative staff and students interviewed**
- **Facilities visited by the External Evaluation Committee.**

HQA made available to the Evaluation Committee (the *Committee*) information about the Department of Production Engineering and Management (*DPEM*, the *Department*) for early preparation of the Evaluation. Unfortunately the Internal Evaluation report of the Department provided was dated 2009. Upon arrival on site, the latest version of the Internal Evaluation report dated August 2011 was given to the Committee; DPEM stated that this report was made available to the HQA on time.

The Committee visited DPEM of the Technical University of Crete (TUC) from Monday 18/6/2012 to Wednesday 20/6/2012. Upon arrival in Chania, on Monday afternoon, the Committee members were met by DPEM faculty members. The Committee met with the Department Chair and former Department Chair (Profs. Stavroulakis and Matsatsinis) at their hotel and discussed visit details and schedule with them. Later the same night, Profs. Stavroulakis, Kouikoglou and Matsatsinis hosted a dinner for the Committee making first exchanges of information possible.

On Tuesday, 19/6/2012, the Committee met briefly with the TUC Rector, Prof. Yannis Phillis, who presented an overview of TUC, its departments, its general directions and problems/issues the TUC Administration faces. Following this meeting, the Committee was escorted to the Department Conference room on campus, where DPEM faculty gave extensive presentations that went into considerable details on the Internal Evaluation process and results, curriculum issues, educational programs at the undergraduate and graduate levels, research activities, and metrics for performance evaluation, policies and procedures. The presentations continued until 7 PM and the discussions were very open, transparent, candid and conducted in an atmosphere of mutual trust. Then, the Committee members met briefly and had a first discussion related to the evaluation. Later that night, there was a joint dinner for the Committee in which several DPEM Faculty were present, as well as the Secretary of the Department, Ms. Havre.

On Wednesday, 20/6/2012, the Committee toured the Department facilities (administration offices, infrastructure, laboratories, registrar's office, etc.). During the visits in laboratories, faculty and support staff gave short presentations related to their activities. The Committee also had the opportunity to talk to undergraduate and graduate students who were present in the labs. Conversations with this student body were helpful and constructive. After that, the Committee met separately with representatives of the different constituencies of the Department (administrative staff, and other specialized supporting personnel like ΕΤΕΠ, ΕΕΔΙΠ, ΙΔΑΧ). These meetings were fully attended, cordial, candid, informative and lively. The Committee did not meet with elected official student representatives, as the Chair of the DPEM informed the Committee that the students had a negative reaction to the Evaluation.

Following the meetings, the Committee met in executive session, collected its major findings, and then met with the members of the OMEA, Profs. Stavroulakis, Kouikoglou and Matsatsinis for an initial debriefing. Following that, the Committee was transported to the Airport for their return trip to Athens.

The visit took place in a highly professional but equally cordial and collegial atmosphere. The Committee members are unanimous in wishing to express in writing their gratitude and appreciation to all the Faculty and Staff of the Department for their excellent hospitality and help with all aspect of the evaluation visit and to HQA for the logistical support.

II. The Internal Evaluation Procedure

- **Appropriateness of sources and documentation used**
- **Quality and completeness of evidence reviewed and provided**
- **To what extent have the objectives of the internal evaluation process been met by the Department?**

The Committee was provided with very extensive documentation, copies of presentations, and complete data on all relevant aspects of the Department's operations. In addition, the Committee was provided with a copy of the most recent Department's Internal Evaluation Report that was thorough, detailed, comprehensive, and informative.

The Committee responsible for preparing the Internal Evaluation (OMEA) had done an excellent job in collecting the available data, organizing it in very useful forms for the Committee and summarily presenting it. The Internal Evaluation report was complete and generally covered the topics adequately.

A. Curriculum

Undergraduate curriculum

APPROACH and IMPLEMENTATION

- **What are the goals and objectives of the Curriculum? What is the plan for achieving them?**
- **How were the objectives decided? Which factors were taken into account? Were they set against appropriate standards? Did the unit consult other stakeholders?**
- **Is the curriculum consistent with the objectives of the Curriculum and the requirements of the society?**
- **How was the curriculum decided? Were all constituents of the Department, including students and other stakeholders, consulted?**
- **Has the unit set a procedure for the revision of the curriculum?**
- **How effectively is the Department's goal implemented by the curriculum?**
- **How does the curriculum compare with appropriate, universally accepted standards for the specific area of study?**
- **Is the structure of the curriculum rational and clearly articulated?**
- **Is the curriculum coherent and functional?**
- **Is the material for each course appropriate and the time offered sufficient?**
- **Does the Department have the necessary resources and appropriately qualified and trained staff to implement the curriculum?**

The mission statement of the curriculum is 'to prepare, through teaching and research, engineers with skills necessary for the dynamic design of production systems and services, while in parallel cultivating the ability to follow the developments in their scientific domain'

(Ref. Οδηγός Σπουδών & ΠΠΣ 2011-12, Section 1.1). This is embodied in the following curriculum:

A 1st cycle (undergraduate) programme of five years, organized in ten semesters (300 credits of the ECTS), resulting in the award of a diploma in Production Engineering and Management (ref. Οδηγός Σπουδών & ΠΠΣ 2011-12).

A 2nd cycle (postgraduate) programme of 1 ½ years (90 credits of the ECTS), resulting in the award of a Master of Science degree in one of the three specializations: Organisation and Management, Operations Research, and Production Systems.

A 3rd cycle (doctoral) programme of three years (minimum), with the duration of study extensible up to six years.

The curricular objectives are defined implicitly by the two presidential decrees 71/1995 and 372/1997 (ref. Έκθεση Εσωτερικής Αξιολόγησης ΜΠΔ - 20-11-2011, section 2.3.1). At the next level of resolution, the Committee reviewed the list of courses, each with a brief description of topics covered. The Department has clustered the courses into seven thematic groups, which are reasonably consistent and constitute a meaningful structuring in the curriculum.

Recommendation A1*: An explicit document showing how the curricular objectives are translated into competency-based learning goals, and those in turn clustered into courses serving a meaningful whole is missing and is advisable.* The study guides do not provide such information.

The objectives of the curriculum are set by presidential decree (ref. Οδηγός Σπουδών & ΠΠΣ 2011-12, section 2.2).

Seen as a sum of topics and of acquired skills, the undergraduate curriculum can be considered as satisfactory in training engineers, with good adherence to the mission statement and the corresponding societal needs. Its component "electromechanical systems", added in the last decade, dictated by the need to give professional rights of Mechanical Engineers in this area to the graduates, gives also an engineering accent that can potentially contribute to the same goals. However, *it is felt that it can still be better integrated into a meaningful whole to support the mission statement, with a focus on production processes and installations*. As it stands, it is more of a supplement on generic mechanical engineering skills that dilutes rather than strengthens the curriculum profile and its consistency.

The introduction of the group of several "electromechanical systems" engineering courses, (Ref. Οδηγός Σπουδών & ΠΠΣ 2011-12, Section 3.2) was a necessary step to strengthening the "production engineering" part of the mission statement, which clearly demands a strong technological background, akin to that of a mechanical engineer.

Recommendation A2: *The Committee recommends strengthening the departmental identity as a Production Engineering Department, driven directly from the mission statement.* In fact, statistical information presented to the Committee regarding the employment of its graduates supports this recommendation.

Upon graduation, students are well received by industry, as the statistics shown to the Committee reveal. The major criterion of their success in getting hired is their adequate training and specialization.

The Committee learned from the Department that the curriculum has been first developed by a departmental committee back in 1984, taking into account the opinions of the Technical

Chamber of Greece (TEE) and Faculty members of other relevant departments in Greece and abroad. A major revision took place in 2003, taking into account new developments in scientific and professional activities, the feedback of the alumni and suggestions by TEE concerning the inclusion of additional mechanical engineering courses. Another major revision in 2008 resulted in a reduction of the number of courses from 65 to 56, taking into account the results of the previous external evaluation and the opinions of alumni, TEE and the industry, which where summarized in two panhellenic conferences that were organized. The Curriculum is approved by the General Assembly of the Department where students participate. Furthermore, the Committee was told that minor revisions are done almost every year, mainly concerning the inclusion or modification of elective courses.

The Committee was presented with information about a thorough study of the curriculum in comparison with curricula of Production Engineering and similar departments that had been performed. The results showed that, on average, the various components of the curriculum (groups of courses or scientific fields) are represented in similar proportions.

Recommendation A3: *The number of courses may be comparable to those offered in equivalent five-year programs in Greece, it is still larger than in the average universally accepted curricula and the Committee feels that it can be reduced.*

RESULTS

- **How well is the implementation achieving the Department's predefined goals and objectives?**
- **If not, why is it so? How is this problem dealt with?**
- **Does the Department understand why and how it achieved or failed to achieve these results?**

The department displayed good awareness of the causes for its decisions with regard to the curriculum, and the results thereof.

IMPROVEMENT

- **Does the Department know how the Curriculum should be improved?**
- **Which improvements does the Department plan to introduce?**

The department reported as its goal to expand the curriculum into the domain of energy (i.e. renewable energy generation). However, it does not seem that this contributes to the mission statement of the Department and is not encouraged.

Recommendation A4: *It is suggested to consolidate and better integrate the existing courses of the 1st cycle (undergraduate curriculum) towards the mission statement.*

Postgraduate curriculum

There are no special remarks for the postgraduate and doctoral programs that appear to be delivering appropriate content in the respective areas of specialisation. At the same time, given this Committee's recommendation to reconsider the sectorial distribution of courses in the Department, the graduate and doctoral programmes may need to be realigned to the resulting themes.

B.1 Teaching—Undergraduate level

APPROACH

Does the Department have a defined pedagogic policy with regard to teaching approach and methodology?

- **Teaching methods used**
- **Teaching staff/ student ratio**
- **Teacher/student collaboration**
- **Adequacy of means and resources**
- **Use of information technologies**
- **Examination system**

The comments below should be considered within the general environment of the Greek educational system that imposes its characteristics on all institutions.

The pedagogical policy of the Department is based on the combination of applied theoretical and technical education. The teaching methods are consistent with the classical Greek approach in Technical Universities. A variety of teaching and learning methods is used, including non-compulsive-attendance lectures, compulsory-attendance laboratory sessions, coursework and a mandatory six-month Diploma Thesis (Διπλωματική Εργασία). The Committee applauds the policy of the Department to keep the Diploma Thesis mandatory within the curriculum. The Department has an elected Student Advisor (Σύμβουλος Σπουδών) for all undergraduate students, a good practice that should be reinforced.

Most of the Faculty post their teaching materials (e.g., lecture Notes, lecture slides, problem sheets, assignments, etc.) on the e-learning site offered by the TUC. The good practice of providing all students living near the Campus with remote access to the TUC Information Technology (IT) infrastructure is noted. Although considered a good practice, the availability of the teaching materials electronically could have well eroded attendance in classes.

The examination system is commonplace, based either on a single final exam, or a combination of a final exam and coursework. Several Faculty give access to the students to their written examination papers after grading, something considered as good practice.

The teaching staff / student ratio can be interpreted in quite different ways. The DPEM has 23 faculty members and additional support staff. If one considers the total number of all registered undergraduate students, 997 in March 2012, the ratio of students per faculty is rather high at about 43. However, considering only the students within the regular length of study, estimated as 572, this ratio drops to about 25. Considering the actual number of students attending classes the ratio is significantly lower.

The average failure-rate of the students per course appears to be rather high, too high in some courses, compared to the international norm; the students interviewed considered, however, their performance as fairly graded.

IMPLEMENTATION

- **Quality of teaching procedures**
- **Quality and adequacy of teaching materials and resources.**
- **Quality of course material. Is it brought up to date?**
- **Linking of research with teaching**
- **Mobility of academic staff and students**

- **Evaluation by the students of (a) the teaching and (b) the course content and study material/resources**

The Committee got the impression that there is good collaboration in general between *interested* students and Faculty. The availability of IT resources was good, but severe lack of funding for laboratory equipment exists.

The Committee visited all the laboratories that generally serve both for instruction and faculty/student research, *a good practice*. Many activities need only a computer infrastructure and no needs or deficiencies were mentioned or noted. The situation is rather diverse regarding hardware- or specialized-equipment oriented activities and laboratories where there is no homogeneity regarding the age and quality of the equipment, methods, etc.

Recommendation B1: *The Committee recommends that the DPEM reviews the state of its laboratories, optimizes the use of resources, (e.g. by joining forces of laboratories where IT is the main activity), replacing or abolishing antiquated equipment and in general selectively reinforcing the most promising activities.*

In order to form an opinion about the teaching partnership between teachers and students, the Committee visited various parts of the Department and interviewed small random groups of undergraduate and graduate students who were present in the labs. This helped the Committee in understanding that, overall, there is good teacher/student collaboration. However, despite the considerable commitment to teaching by the Department, some students expressed concerns about the link between lectures, laboratory sessions and assessment procedures (examinations) in some courses. *This is an issue that the Department has to address, as it appears that there may be in certain cases a 'disconnect' between theory and applications.*

Resources deployed for the teaching process can always be improved, upgraded and modernized if needed. The capacity of the teaching rooms and laboratories appears to be adequate for the number of students who actually attend courses. However, if all students were attending courses, the Committee was told that the available size of the classrooms in DEPM would have been inadequate. Lack of space in general would have been eliminated or mitigated with the new buildings promised to the Department whose construction was interrupted for reasons totally out of the control of the Department.

It is commendable that, at the undergraduate level, the students are given the opportunity in their diploma thesis to participate in the Department's research activities.

The industrial experience project (Πρακτική άσκηση, 2 to 4 months) has been very successful and also provides to the students future employment opportunities. *The Committee recommends that the practice be encouraged.*

The Department follows the good practice of conducting systematically course evaluations. It is important for the evaluated faculty member to receive not only the results of his/her course evaluation but also the statistical average scores across the whole Department. *It appears that the feedback loop to students can be further strengthened.* It is important for faculty to discuss comments with the students and try to rectify issues when possible to improve lecture delivery engaging and motivating the students further.

RESULTS

- **Efficacy of teaching.**
- **Discrepancies in the success/failure percentage between courses and how they are justified.**
- **Differences between students in (a) the time to graduation, and (b) final degree grades.**

- **Whether the Department understands the reasons of such positive or negative results?**

There is a large number of students that extend their studies well beyond the minimum necessary time and have the right to repeat the courses and examinations without limits, overloading and burdening the system. The Committee learned that the average time to graduation is 7.3 years. The longer the students stay, the less academically active they become. The new 2011 Law would have provided a remedy to this situation, but has not been implemented.

The average grade during studies is 6.5/10 (not including failing grades and the diploma work)

Low attendance in the Lectures was brought to the attention of the Committee and this considerably reduces the efficacy of the teaching. *The Department should address this issue and devise strategies for promoting attendance.*

The DPEM suffers like other regional Greek educational institutions from well-known shortcomings such as:

Lack of qualification (poor mathematics and language skills preparation of the entering class). TUC and of DPEM suffer to some extent from geographic isolation (that in times of financial difficulties is given more weight). The system of Greek national-level entrance examinations (Πανελλήνιες) and of the choices declared result in DPEM not getting the best students who are also not always particularly motivated for the curriculum offered.

The lack of proper preparation of the students, apparently coupled in certain cases with insufficient attention given to a more "pedagogical" teaching approach, may result in absenteeism and create a vicious circle.

Recommendation B2: *The Committee recommends that DPEM examines ways of remedying, when needed, pedagogical obstacles. For example, student evaluations of teaching should not only be systematically conducted but the results discussed (in class trying to find the root causes), even possibly made public.*

Recommendation B3: *The Committee also recommends that entering students that have deficiencies in certain areas be offered tutorial remedies*, (e.g., lacking additional instruction staff, tutorials could be taught by older students that could be given laboratory credit units for this extra activity)

The Committee learned that students are optimizing the use of their time to obtain the passing grade in the course rather than master the course material.

Recommendation B4: *The Committee recommends considering integral "design" courses where small teams work closely with Faculty and teaching support staff to better involve the students.* Such projects could be considered as alternatives to taking certain courses or could be given credit in some other innovative way.

The implementation of required prerequisite courses is essential for the more effective teaching. A prerequisite course should be passed before having access to the follow-up courses.

Recommendation B5: *The Committee recommends that the common practice of uniformly high grades for the Diploma Thesis be avoided, and instead a more objective and wider grading scale range be used.*

Within the ERASMUS programme, there is a good number of agreements with foreign

universities for a balanced exchange of students (slight excess towards TUC) in a number of specializations. The Faculty profits also in a minor way from such exchanges.

The new practice allowing faculty members to spend up to six months per year in other domestic or foreign universities is a good one for the Department.

IMPROVEMENT

- **Does the Department propose methods and ways for improvement?**
- **What initiatives does it take in this direction?**

The DPEM has tried ways of improving teaching efficiency in the past and there were extensive, open and candid discussion in this matter with Faculty, support staff, and samples of undergraduate and graduate students. Most of the difficulties may be endemic in the Greek educational system.

B.2 Teaching—Postgraduate and doctoral levels

Postgraduate studies have started at DPEM in 1991. They have to be conducted **ac**cording to the general Greek regulations.

The Committee was pleased to learn that 70% of the participants are not Department graduates, although this is not true for the Production Engineering direction (sector) of the program. Postgraduate students enrich the department student body when they come from other specialties.

The number of applicants is very good; the admissions success ratio is about 20-30 % (14-21 persons per sector) ensuring good quality of the participants.

There is a set of good candidate selection criteria and a good selection procedure based on these.

Doctoral program

The doctoral program follows also the Greek legal framework. The Department imposes a maximum duration of the program (six years) that the Committee considers a good practice.

C. Research

APPROACH

- **What is the Department's policy and main objective in research?**
- **Has the Department set internal standards for assessing research?**

The Department is active in research at multiple levels and in very diverse areas. There exist competitively funded international projects involving collaborations with European partners, competitively funded national projects, and services to the domestic public and private sector. To conduct research, the faculty members of the Department are organised into 12 Research Laboratories that also involve doctoral candidates, postgraduate and, sometimes, undergraduate students (mainly through diploma theses), something that the Committee considers as good practice.

The Department does not appear to have a clearly articulated policy and main objective in

terms of research. The Committee assumes that the overall Departmental philosophy, as included in the Internal Evaluation report (page 7), is providing the overarching research strategy that is then executed by faculty members. There are effective best practice guidelines in terms of research execution and management and these are built into the process of tenure and promotion of individual faculty members. The Committee noted that there is a clear emphasis on publications in SCOPUS and ISI listed Journals as the bibliographical information used by the Department is based on SCOPUS.

Recommendation C1: *The Committee recommends that the Department should formally define its research strategy to provide clarity to its members in terms of its research direction and priorities.*

An examination of the Department's research outputs clearly indicated that the Department's research focuses on both fundamental and applied type of research, at national and international levels. Departmental research has resulted in archive publications in top Journals and in top referred Conferences. A very *positive practice* is that undergraduate, graduate students, researchers and postdoctoral students are included in research projects and publications.

Recommendation C2: *This generates a positive research attitude within the Department and the Committee would like to see this good practice continued and enhanced.*

According to information provided to the Committee, the Department does not appear to have a formal policy or standards in terms of the evaluation of internally conducted research. However, it can be argued that the Departmental policy in terms of research evaluation can be directly inferred from the Departmental practice and requirements in terms of publishing papers in international learned Journals and other peer-reviewed Conferences and Symposia. Indeed, the Internal Evaluation Report includes evidence that some research laboratories are internationally recognized due to their research activities, publications and awards. Further, there is evidence that some faculty members are very well-respected by their peers. The Departmental standards in electing new faculty members and in promoting faculty to the next level are not always consistent.

Recommendation C3: *The Committee recommends that the Annual Activity Reports of the Department and the under development software tool by ΜΟΔΙΠ of TUC could be used towards establishing internal research evaluation benchmarks and the identification and dissemination of best practice. Ideally, this should include the peer review of research outputs in order to establish a shared understanding of research impact and quality.*

IMPLEMENTATION

- **How does the Department promote and support research?**
- **Quality and adequacy of research infrastructure and support.**
- **Scientific publications.**
- **Research projects.**
- **Research collaborations.**

In the opinion of the Committee, the Department promotes research primarily via the following mechanisms:

(i) The generation and operation of the Research Laboratories, 12 of which are operating or are being created at present.

(ii) The operation of the postgraduate degree programmes that have three specialisations.

(iii) The creation of an inclusive research ethos within the Department that involves faculty, doctoral candidates as well as postgraduate and undergraduate students.

The Committee notes that dedicated staff for research support are available in each of the Laboratories and this is welcomed. The research infrastructure in terms of equipment is variable across the various Research Laboratories. In terms of equipment there are some clear differences between the Research Laboratories, especially as some areas require software and others hardware. In certain cases equipment appeared to be outdated and we note that the maintenance and repair of expensive pieces of equipment can be problematic.

Recommendation C4*: The recommendation of the Committee is that the Department would need to consider improving the quality of equipment in a number of Research Laboratories and to ensure that all Laboratories have access to state-of-the-art hardware and software.*

The Department is very active in terms of publications with around five Journal papers and three refereed Conference papers per member of faculty, per annum. These are competitive publication figures, notwithstanding that they include papers with multiple faculty members as authors. The Department also produced six patents as a result of its activities that are close to research exploitation.

The Department executes a range of research projects from EU and national sources. The Internal Evaluation Report (page 72) gives the research income per member of faculty over a number of years. Since 2005, these income figures are highly variable, year on year, with a minimum of 24,868 € in 2007 and a maximum of 407,743 € in 2010. It is unclear as to why there has been such a high variability and it will be important for the Department to evaluate this aspect and make efforts to ensure that research planning can be based on a more stable income basis.

In terms of research collaborations, the Department appears to have many active collaborations with Greek and International Universities.

Recommendation C5*: The Committee notes that the level of collaboration with industry is not as well developed and recommends that this is an area that requires further effort and attention from the Department.*

RESULTS

- **How successfully were the Department's research objectives implemented?**
- **Scientific publications.**
- **Research projects.**
- **Research collaborations.**
- **Efficacy of research work. Applied results. Patents etc.**
- **Is the Department's research acknowledged and visible outside the Department? Rewards and awards.**

The section above has included extended commentary regarding the overall performance of the Department in terms of research. In addition to the above, the Committee would like to highlight the following;

(i) Many faculty members have publication records ranging from respectable to outstanding. Faculty members are professional society members, and some have

received research awards. One Professor is an IEEE Fellow and another is an AAAS Fellow. Several faculty members have Editorial Board appointments and others serve as Editors, Senior Editors or Editors-in-Chief of prestigious Journals.

(ii) Some of the research projects undertaken in the Department involve external research partners, including other EU countries.

(iii) The doctoral program is well established. The average duration of study is 5 years, which is within international norms. The Committee was pleased to hear that the process for evaluating doctoral students includes the requirement of original research publications (on average two papers in ISI Journals plus conference papers), as well as research maturity and ability to conduct independent research. Doctoral students are required to take two graduate courses, selected with help from their supervisor to support their thesis research.

(iv) There is no formal process of advertising positions and selecting candidates. Also, there is no uniform funding policy for doctoral students. Some doctoral students are funded by projects or service contracts when available, but typically not in their first year of study. Such projects are typically related to the student's doctoral thesis. Some doctoral students mentioned that they have almost daily contact with their supervisors. The scientific output of doctoral students is excellent on average, and compares favourably with the average in good North American or European doctoral programs.

IMPROVEMENT

- **Improvements in research proposed by the Department, if necessary.**
- **Initiatives in this direction undertaken by the Department.**

Strategic Planning of Research. Overall, the faculty produces research of good quality and quantity. Some faculty members collaborate internationally producing well-cited publications. However, the Committee notes that research in the Department is very widely spread, covering a large number of themes and it appears that there is little synergy in research activities between Research Laboratories and each faculty member conducts research in his/her own area of expertise. The other point is to ensure the critical mass of the Research Laboratories, as the Department maintains 12 Research Laboratories with 22 faculty members.

Recommendation C6: *The Committee strongly recommends that the Department, in the context of n on-going Strategic Plan review, identifies a small number (three to four) of major Research Themes and focuses and reclassifies its research activities in these thematic areas. This will allow the Department to gain recognition in selected areas growing in importance internationally, by building on its current strengths. This recommendation does not mean that Research Laboratories would need to be abolished, but rather that an appropriate and thematically coherent integration of Research Laboratories would need to be considered by the Department to better manage research and enhance its international impact.*

At present the Department has three Divisions that are responsible for a number of Research Laboratories (Labs) as follows; the Production Systems (PS) Division with five Labs, the Operations Research (OR) Division with three Labs and the Organisations and Management

(OM) Division with four Labs. The PS Division is important in terms of maintaining and strengthening the engineering and technological scientific areas within the Department that are vital to ensure that the Department has an appropriate selection of Mechanical and Manufacturing Engineering capabilities. The Committee noted that the Computational Mechanics Lab is currently in the OR Division and this appears to be out of place thematically. Further, this Lab could strengthen the technological and engineering orientation of the PS Division. The Committee also notes that the Safety and Ergonomics Lab may best fit thematically in the OR Division.

Recommendation C7: *While understanding the legal limitations involved, the Committee recommends that the Department continues its efforts to update the mission of its laboratories and re-evaluate their alignment with its objectives, to ensure thematic consistency, also in the context of supporting the definition of major Research Themes as proposed in Recommendation C6. Such a re-alignment will make it easier for the Department to address major research areas such as applications in Energy, with a clear definition of the technological and management aspects that will be addressed.*

Hiring of new faculty members in modern strategic areas, strategically selected/identified by the Department will also help the Department's growth and reputation. The Department must establish a transparent, effective and realistic way of accomplishing this objective, when upcoming retirements get replaced, for example. The current economic uncertainty should not discourage forward thinking and strategic planning for the future of research in the Department.

Recommendation C8: *The Committee recommends that the Department develops a Strategic Plan for the development of its staffing policy, considering both the research planning and the needs arising from the development of the teaching programmes, undergraduate and postgraduate.*

Structure of doctoral research programme. A significant part of the research in the Department is carried out by doctoral students under the supervision of and in collaboration with the faculty members. Consideration should be given by the Department to the following aspects and observations of the Committee:

(i) A qualifying examination, which could take the form of a publishable research result within the first 12-18 months of the doctoral program. Failure to pass the qualifying exam is a mechanism to dismiss students who do not make satisfactory progress.

(ii) There is no funding policy for doctoral students, so that they can devote themselves to, and be more effective in, their research. The availability and amount of funding for doctoral students depends on their supervisors.

(iii) Doctoral theses written in English and published in a technical report series would facilitate the promotion of the Department's research outside Greece.

(iv) A course on research methods, and tutorials on how to give presentations, write successful research papers, and apply for research funding, are also helpful components of a doctoral program, which the Department would benefit from introducing.

Research funding. The amount of research funding could be augmented. The Committee feels that the faculty has the potential to obtain additional research funding, which in return should be used to provide support for doctoral students, technical support staff, and postdoctoral researchers.

Recommendation C9: *Infrastructure and procedures would need to be put in place to provide internal peer review and mentoring for research proposal writing, and post-award administration of projects, in order to diffuse and share the available experience within the Department, especially for junior faculty members.*

Promotion of research. The research activities of the Department, especially those that involve industry, need to be better advertised both within and outside the University. Particular emphasis should be placed on disseminating successful research activities to the undergraduate students. This would stimulate student interest in research early on, and raise the profile of applied research in the Department. The Committee was told that one serious potential impediment to such promotion may be student factions that actively oppose the involvement of industry in University research and are driven by non-academic interests. If this is a true reflection of reality in TUC and other Greek Universities, it is a lamentable state of affairs that goes against the educational and career interests of the large majority of students and is also at odds with what is common practice in Engineering Schools around the world.

D. All Other Services

APPROACH

- **How does the Department view the various services provided to the members of the academic community (teaching staff, students).**
- **Does the Department have a policy to simplify administrative procedures? Are most procedures processed electronically?**
- **Does the Department have a policy to increase student presence on Campus?**

The Department is taking initiatives, within the constraints of the highly centralized and outdated systems and procedures imposed by the State, to maintain and improve services to the academic community, the community at large and the profession.

The Department and its technical and administrative leadership try to simplify and optimize administrative procedures in order to facilitate and promote student and faculty/staff participation in the Department and general Campus academic activities. However, such efforts are limited due to bureaucratic issues that complicate unnecessarily even the simplest issues.

The administrative infrastructure is very satisfactory and the services it provides to students and faculty are of high quality, expediting timely access to the Department's administrative processing of paperwork. The communication between the Department and the University administration units could be improved.

At the graduate level, and, most importantly, at the doctoral level, the candidates are in contact with their advisors almost on a daily basis. This facilitates and expedites focused

academic activities and promotes an atmosphere of collaboration as evidenced by the dissertation work, awards, attendance to scientific conferences and publications.

The Department tries to improve student presence on campus through a series of activities but also by promoting and encouraging cordial and collegiate relationships between student groups and between students and faculty members. The general weaknesses, identified elsewhere in this evaluation, prevent the expansion of these academic and cultural activities. Nevertheless, the Department has undertaken major and significant steps to overcome current difficulties.

Emphasis must be placed on increased collaboration with the productive sectors and organizations in the Community, which, especially for Engineering, must include Industry. Students, both graduate and undergraduate, must be brought closer to such organizations, as well as government agencies, and the civil sector that need and request technical assistance. It is noteworthy that the faculty involves a good number of students in such external project work, as noted elsewhere, and its members must be encouraged and assisted to increase these interactions.

The narrow bounds of the Department's main academic activities (courses, laboratories, tutoring, etc.) must be expanded and supported to provide students with a wider understanding of the impact of their own discipline to other academic and research activities.

Staff Development, appraisals and feedback mechanisms could be considered for the improvement of staff morale and productivity.

IMPLEMENTATION

- **Organization and infrastructure of the Department's administration (e.g. secretariat of the Department).**
- **Form and function of academic services and infrastructure for students (e.g. library, PCs and free internet access, student counseling, athletic- cultural activity etc.).**

The secretarial and technical services of the Department are operating well and effectively, making a major contribution to the operation of the Department. There are five secretarial members of staff; three supporting the Departmental Committees and providing various certificates to graduates and two supporting the interactions of incoming and current students. The technical services are provided by 13 members of staff that are mainly deployed in the Research Laboratories of the Department. Other types of services are supported by central elements of TUC's administration.

The Committee understands that the administrative services are implemented either through traditional channels and mechanisms or by the sheer commitment and devotion of individuals that frequently goes beyond the call of duty.

RESULTS

- **Are administrative and other services adequate and functional?**
- **How does the Department view the particular results?**

The Committee finds that the overall results of the Department's administrative and technical services are adequate, functional and of good quality. The Department seems to be

very supportive of the staff involved in administrative and technical services.

In some areas of the secretarial administration, such as in aspects related to student-facing services, there is a gradual introduction of web-based systems and working practices. These have been introduced in a successful manner and have improved the effectiveness and speed of the provided services. However, there remain a large proportion of administrative functions that are still paper based.

Recommendation D1: *The Department should consider methods for simplifying its business processes and automating appropriate elements via the introduction of suitable systems and methods.*

The technical members of staff noted that apart from their educational and research support duties, they are involved in a range of additional tasks that are especially time consuming, such as equipment procurement and acceptance. The Committee also understands that the Department cannot easily adjust for peaks in workload by recruiting fixed-time staff as all appointments need to be centrally approved and advertised and the time required for these approvals frequently exceeds the time over which extra staff are required. The Committee notes these facts that primarily stem from outdated and inefficient methods imposed by the State in relation to procurement and temporary staff appointment.

IMPROVEMENTS

- **Has the Department identified ways and methods to improve the services provided?**
- **Initiatives undertaken in this direction.**

The Department seems interested in assessing, improving and expanding these services. A few areas might be improved by limited investment and change of working methods that are in the power of the Department to enact. However, major improvements are highly unlikely as the Department and TUC are currently faced with serious shortage of resources. In addition, several problems arise as a consequence of State regulations and procedures that would need to be reviewed and changed to benefit not only TUC but also the whole University system in Greece.

Collaboration with social, cultural and production organizations

Please, comment on quality, originality and significance of the Department's initiatives.

Efforts by the Department to be involved, and collaborate, with social, cultural, and production organizations in the Community, the Country as a whole, and internationally must be enhanced. However, collaboration with production organisations is somehow restricted due to the opposition of politically motivated minorities that may make involvement with Industry problematic.

The Department should also be more proactive in promoting and advertising its activities without unnecessary modesty.

Several laboratories have been accredited by the State as national examination or service centres (e.g., air control training simulations, IT accreditation, etc). The Committee

considers this as *good practice* as making use of available resources and keeping in touch with external partners.

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

- **Potential inhibiting factors at State, Institutional and Departmental level, and proposals on ways to overcome them.**
- **Short-, medium- and long-term goals.**
- **Plan and actions for improvement by the Department/Academic Unit**
- **Long-term actions proposed by the Department.**

The Committee feels that the uncertainty, extensive bureaucracy and interventional nature of the control mechanisms imposed by the State on the University and the Department result in delays that impact both the strategic and operational practice in the Department. Despite these issues, there are domains within which the Department can exploit opportunities and, at least partially, satisfy its objectives.

The Department has already taken steps towards developing a strategic plan within the currently very uncertain realities at State, Institutional and Departmental levels.

The Department took the very positive initiative to start a process of external evaluation about 10 years ago. The resulting recommendations were taken into account and have helped to make a first step toward the development of the Department according to internationally competitive standards. Important overlying inhibiting factors in developing and implementing a strategy which would break away from routine developments are:

• There appears to be a general feeling of lack of trust between the Department / Institution and the State. This results in the application of extensive bureaucracy that is wasteful as it causes lengthy and largely unnecessary procedures. For example, there are large delays in ordering equipment for research and for the Institution, even when the respective funding is available.

• In the very recent past, due to the bad economic situation in Greece, there is lack of governmental funds for growth of any kind. Of course, the situation before 2008 was significantly better and good growth was possible.

• There appears to be a lack of a positive climate for research and education marked by continuous interruptions through student strikes and building occupations. Here, the State, but also the Institution, do not take effective measures to deal with this phenomenon.

Affected by factors such as the above, the Department tends to operate driven by solving short term problems or by taking advantage of opportunities that may appear, rather than taking a step back and developing a long term strategic vision and a detailed plan of how to reach it. Also, it appears to be difficult for the Department to define clear priorities and posteriorities, aligning the development of the Department along these lines. The tendency is more one of replacement of what exists rather than supporting a consistent strategy based on a commonly shared vision. Hence, some groups seem to be smaller than what is needed for an effective Department of Production Engineering and Management. More specifically, the Engineering component of the Department, which is of good quality, has not grown in terms of numbers of faculty as required to satisfy the Production / Manufacturing Engineering

needs such as, Factory Design, Engineering Economy, Lean Production, Green Manufacturing, and Manufacturing Processes. Note that growth does not always require "new money" from the State. It can be achieved by reassigning retiring positions to new areas as dictated by a clear strategic vision and the corresponding planning.

It is also worth noting that the Departmental strategy must be aligned with the University operating environment as defined by the State. Hence, it is reasonable and necessary to organize the Departmental strategy in four-year implementation packages, or whatever the State approves, at the end of which a clear accounting and assessment of what has been achieved can be carried out and the next phase can be planned.

Recommendation E1: *The Department must define a few clear goals on how they see themselves in the Greek-European-World landscape in the focused area of Production Engineering and Management. What are the scientific areas in which the Department wants to be one of the best? Where does the Department want to simply be competitive? What are the posteriorities where the Department does not wish to have a competitive presence beyond fulfilment of teaching requirements? The Department needs to focus its activities and thinking in that respect. A philosophy of "less in more" is recommended here.*

Recommendation E2: *A few major Research Themes (see Recommendation C6) and strategic research directions must be defined with a short/medium (approx. four years) and a longer (eight years) implementation plan. These directions will lead to reaching the aforementioned goals. It is the opinion of the Committee that explicit in the definition of these directions and goals should be a strengthening of the "engineering" component of the department, through a combination of replacements of retirements and new positions.*

Recommendation E3: *The major Departmental activities (research and teaching) must be streamlined within these strategic directions and the connections must be clearly identified in terms of the teaching and research output metrics.*

The new degrees of freedom that the recently passed Law for Higher Education provides, namely the opportunity to develop internal plans of organization, can be exploited to accomplish worthy goals and objectives that the previous legal framework did not allow. It is especially important for the Department to be ready to implement the new framework for Higher Education, if and when this is implemented.

F. Final Conclusions and recommendations of the EEC

Conclusions and recommendations of the EEC (Committtee) on:

- **the development of the Department to this date and its present situation, including explicit comments on good practices and weaknesses identified through the External Evaluation process and recommendations for improvement**
- **the Department's readiness and capability to change/improve**
- **the Department's quality assurance.**

This evaluation took place at a very difficult time for the country as a whole. Funding to the Department and any resources needed for implementing improvements have been drastically reduced or eliminated; decisions regarding, e.g., staff appointments, have been frozen or rejected and there is little room for implementing any large-scale future plans, at least in the short term.

The Committee understands that the Department is weathering this testing situation (e.g. the

loss of contractually funded positions -- *συμβασιούχοι*) as well as may be possible. This however, should be remedied as soon as possible.

The Greek educational institutions are operating within strict rules imposed by the State and depend strongly on decisions that are taken or approved at Ministerial level. Although the recent 2011 Law attempted to remedy this, it has not been de facto implemented yet. Moreover, the 2011-2012 academic year started with a two-month long "occupation" of the TUC campus that has paralyzed all activities and then damaged or delayed the academic year activities significantly.

The observations and conclusions of this Evaluation should be seen in this light.

Overall, the Committee thinks that the Department is doing a very good job in terms of its core tasks, teaching and research. Human resources are good and generally very motivated and the Department occupies a nationally important niche area.

The Committee has made numerous recommendations in the previous sections above. All these would need to be considered by the Department. Herein, the Committee wishes to restate a selected number of key recommendations as follows:

Recommendation A2: *The Committee recommends strengthening the departmental identity as a Production Engineering Department, driven directly from the mission statement.*

Recommendation A4: It is suggested to consolidate and better integrate the existing courses of the 1st cycle (undergraduate curriculum) towards the mission statement.

Recommendation B2: *The Committee recommends that DPEM examines ways of remedying, when needed, pedagogical obstacles. For example, student evaluations of teaching should not only be systematically conducted but the results discussed (in class trying to find the root causes), even possibly made public.*

Recommendation C5: *The Committee notes that the level of collaboration with industry is not as well developed and recommends that this is an area that requires further effort and attention from the Department.*

Recommendation C7: *While understanding the legal limitations involved, the Committee recommends that the Department continues its efforts to update the mission of its laboratories and re-evaluate their alignment with its objectives, to ensure thematic consistency, also in the context of supporting the definition of major Research Themes as proposed in Recommendation C6. Such a re-alignment will make it easier for the Department to address major research areas such as applications in Energy, with a clear definition of the technological and management aspects that will be addressed.*

Recommendation E1: *The Department must define a few clear goals on how they see themselves in the Greek-European-World landscape in the focused area of Production Engineering and Management. What are the scientific areas in which the Department wants to be one of the best? Where does the Department want to simply be competitive? What are the posteriorities where the Department does not wish to have a competitive presence beyond fulfilment of teaching requirements? The Department needs to focus its activities and thinking in that respect. A philosophy of "less in more" is recommended here.*

Recommendation E2: *A few major Research Themes (see Recommendation C6) and*

strategic research directions must be defined with a short/medium (approx. four years) and a longer (eight years) implementation plan. These directions will lead to reaching the aforementioned goals. It is the opinion of the Committee that explicit in the definition of these directions and goals should be a strengthening of the "engineering" component of the department, through a combination of replacements of retirements and new positions.

The Department has the general tendency of egalitarian and even distribution of resources regardless of their potential usefulness, impact and compliance with the Department's strategy. This is further hampered by a general lack of internal quality evaluation processes for teaching and research.

Recommendation F1*: The Committee recommends that in the future internal self- and peer-assessment procedures be implemented and resources allocated according to well established quality and cost/benefit criteria and in compliance with the Department's strategic planning.*