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HELLENIC QUALITY ASSURANCE AGENCY
FOR HIGHER EDUCATION

EXTERNAL EVALUATION REPORT

COMPUTER SCIENCE DEPARTMENT (CSD)

(a.k.a. DEPARTMENT OF INFORMATICS)

ARISTOTLE UNIVERSITY OF THESSALONIKI (AUTH)

October 17, 2011

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External Evaluation Committee

The Committee responsible for the External Evaluation of the Department of Informatics of the Aristotle University of Thessaloniki consisted of the following five (5) expert evaluators drawn from the Registry constituted by the HQAA in accordance with Law 3374/2005 :

1. Prof. **Georgios B. Giannakis** (Coordinator)

    University of Minnesota, Minneapolis, MN, USA

2. Dr. **Alexander Berler**

    Director Consulting Services, Gnomon Informatics S.A., Athens, Greece

3. Prof. **Nikolaos Bourbakis**

    Wright State University, Dayton, OH, USA

4. Prof. **Dimitris Samaras**

    Stony Brook University, NY, USA

5. Prof. **Lefteris Tsoukalas**

    Purdue University, West Lafayette, IN, USA

N.B. The structure of the "Template" proposed for the External Evaluation Report mirrors the requirements of Law 3374/2005 and corresponds overall to the structure of the Internal Evaluation Report submitted by the Department.

The length of text in each box is free. Questions included in each box are not exclusive nor should they always be answered separately; they are meant to provide a general outline of matters that should be addressed by the Committee when formulating its comments.

Introduction

I. The External Evaluation Procedure

The external evaluation committee (EEC), consisting of :

1. Prof. **Georgios B. Giannakis** (Coordinator)

    University of Minnesota, Minneapolis, MN, USA
2. Dr. **Alexander Berler**

    Director Consulting Services, Gnomon Informatics S.A., Athens, Greece
3. Prof. **Nikolaos Bourbakis**

    Wright State University, Dayton, OH, USA
4. Prof. **Dimitris Samaras**

    Stony Brook University, NY, USA
5. Prof. **Lefteris Tsoukalas**

    Purdue University, West Lafayette, IN, USA

visited the Computer Science Department (CSD) of the Aristotle University of Thessaloniki (AUTH) on the 26th, 27th and 28th of September 2011. During the first day, the committee met with the Vice Rector for Academic Affairs (Prof. Lialiou), representatives from the OMEA team, and key faculty members of CSD who presented a high-level overview of the department (including thorough statistical metrics). The EEC visited the main CSD site at the AUTH Campus ("Faculty of Science" building) in the second day. EEC members had the opportunity to exchange views with key administrative staff of the department (Secretariat and the 4 assistants), and form a clear view of the main premises (classrooms, computer labs, etc). In addition, extensive presentations were delivered by leading faculty members highlighting the key entries of the internal CSD evaluation (on teaching, research tracks/labs, curricula and services). The 28th was reserved for a site visit at the AUTH premises located at the Kalamaria District, where postgraduate CSD research and teaching activities take place. There, EEC members had informative discussions with junior faculty members as well as undergraduate and graduate students.

In addition, the Department had made available to the committee, a large volume of data, including samples of final year project reports, doctoral theses, curriculum vitae (CVs) of faculty members, statistics on student performance, entering and graduating student numbers, statistics on duration of studies, reports on strategic plans, as well as plans for curriculum improvement currently under discussion. Specifically, the following documents were made available to the committee:

➢ Electronic copies of slides of all presentations delivered.
➢ Extensive statistical analysis on human resources, teaching, curriculum, research, funding and distinctions/awards.
➢ Management and reporting/forecasting of departmental activities.
➢ Description of the Department and its 5 laboratories.
➢ Research and development (R&D) highlights of CSD during 2000-07 and 2008-11.
  o   List of publications
  o   List of R&D projects

- ➢ B.Sc. program in Computer Science offered by CSD/AUTH.
    - o Timetable of courses offered and classroom assignment.
    - o Course regulations.
- ➢ M.Sc. program in Informatics offered by the CSD at AUTH.
- ➢ Inter-departmental M.Sc. program on "Informatics and Management" offered jointly by the CSD, the Department of Economic Sciences, Faculty of Law, Economic and Political Sciences at AUTH.
- ➢ Sample performance of student theses and papers (more than 65 documents).
    - o B.Sc. Diploma, M.Sc., and Ph.D. theses.
    - o Conference and journal publications.
- ➢ CVs of CSD faculty members.
- ➢ Assessment of CSD activities in 2000-2007 and 2008-2011.
- ➢ List of distinctions of CSD faculty members and students.
- ➢ List of Ph.D. graduates and their placement.
- ➢ University of Macedonia report on CSD rankings within Greece.
- ➢ Student mobility activities (Erasmus program).
- ➢ Internal CSD evaluation performed in 2008.
- ➢ External evaluations performed in 2005 and 2008.

All in all, the EEC felt confident in gaining a thorough understanding of the CSD curricula, performance in teaching, research and funding efforts, as well as the overall ambience, morale and interactions among faculty, staff and students.

II. The Internal Evaluation Procedure

The committee felt that all resources made available to them for the execution of their work were very helpful and informative. EEC members had the opportunity to personally meet most faculty members (about 20 out of 27), and most of them were present during most of he evaluation process, willing to address questions and inquiries from the committee. The whole process was perceived as a valuable and long-overdue exercise, which proved beneficial to the department, the EEC, and the overall evaluation process.

Occasionally, the EEC felt that the material was perhaps over detailed and less geared toward forming the needed high-level understanding of the key factors involved in the evaluation process. This was alleviated through the additional material provided on the spot which resolved the vast majority of issues raised.

The supporting evidence provided was thorough, and albeit lengthy at times, the presentations delivered succeeded in providing a clear picture of the major issues touched upon in the present evaluation report.

It was felt that the goals and vision set by the Department in their Internal Report were largely concrete and supported by the evidence gathered. Overall, the committee felt that this is an excellent Department, one of the best in the country that deserves support and encouragement by the Greek State and the AUTH. Major issues reported (further elaborated in the ensuing paragraphs) pertain to infrastructure needs, disparity of premises into three locations, streamlining and enriching the curricula, transfer of knowledge and cooperation with Industry, alignment with modern research trends, and CSD benchmarks worldwide.

A1. Curriculum (undergraduate program)

APPROACH

• *What are the goals and objectives of the Curriculum? What is the plan for achieving them?*

The goal and objectives of the curriculum are to offer a program at the cross-roads of Informatics (Computer Science), Computer Engineering, and Electrical Engineering (Signal and Image Processing) aiming to :

➤ *prepare & train* students with theoretical foundations supplemented with substantial practical training (via intensive course projects) and a final bachelor (B.Sc.) level thesis;

➤ *update & innovate* through specialization tracks in the areas of communications and networks, digital media, information systems, and information technology in education;

➤ *inspire & guide* students to follow either graduate studies (M.Sc. and Ph.D.) or join the workforce in industry, government, and commercial sectors.

The curriculum comprises two main sections, the first including 30 *core* obligatory courses offered during the first five (5) semesters, and the second consisting of 15 *specialization* courses offered in the last three (3) semesters, during which students select one of the four available tracks: Communication, Networks and Systems Architecture; Information Systems; Digital Media; and Information and Communication Technologies in Education. In *each track,* students attend core courses and a number of electives (either from the same or from a different track). A Diploma *thesis* is required to be performed in the last year of studies (at the 7th semester).

* *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?*

The Department was established in 1992 to offer to the northern part of Greece the opportunity of a competitive program with international standards. As per the internal report presented to the EEC, the curriculum in its current revision meets the benchmarks of:

➤ *International practice:* reports by the ACM/IEEE curricula in Computer Science, Computer Engineering, Information Systems and Software Engineering;

➤ *National practice*: Greek curricula in Informatics, and part of Electrical and Computer Engineering Departments;

➤ *Faculty expertise*: background and expertise covers topics in Computer Science, Electrical Engineering, Physics, and Mathematics;

➤ *Trends & outlook*: awareness of local, national and international demands in academia and industry.

Although the curriculum process takes into account students' feedback, it will be useful if more systematic input is solicited from alumni and potential employers of CSD graduates.

* *Has the unit set a procedure for the revision of the curriculum?*

The recently revised curriculum includes the following modifications and updates.

➤ Extra projects and tutoring (administered by M.Sc. and Ph.D. students) have been added in the first 4 semesters to courses with programming and lab content;

➤ Courses evaluation and reporting processes have been streamlined;

> ➢ Diploma thesis presentations and evaluation by a 3-member committee will be initiated in the next academic year.

Outcomes of recent revision : increased success rates and improved grades in Mathematics.

In a future revision, the provision of prerequisites will be considered to improve the overall structure of the program.

IMPLEMENTATION

• *How effectively is the Department's goal implemented by the curriculum?*

The curriculum was designed to meet its goals. The separation of courses into core and specialization (tracks) offers a solid foundation on the Computer Science, Computer Engineering, and Signal/Image Processing, while at the same time providing deeper knowledge in each of the four areas of specialization. However, the high volume of the core and specialization courses leads to an average graduation time exceeding 5.5 years. In addition, a large number of students (40%) stay longer than 6 years due to the inflexibility of the Greek University system to drop them out from the program. Part of this problem is the transfer students that negatively contribute to this issue due to the uncontrollable timing of their admission to the program. A recent provision of the State will synchronize the timing of regular admissions and transfers into undergraduate programs, which will markedly reduce the excessive number of stagnating students.

The 8 elective courses offered by each specialization track complement nicely the 7 core courses of the curriculum. However, there are contemporary fields that are not covered adequately (e.g., cyber security). In addition, with little agility in elective courses it appears that breadth is somewhat sacrificed especially after the first half of the program.

• *How does the curriculum compare with appropriate, universally accepted standards for the specific area of study?*

This CSD curriculum bears similarities with the Computer Science and Engineering curricula offered by ECE and CS Departments in EU and the US. However, its implementation presents major differences with respect to universally accepted standards. For instance, many EU and US curricula are based on prerequisite courses and do not allow students to enroll from one year to the next unless they have passed all requirements of the predefined sequence of courses. In contrast, students in CSD at AUTH can be admitted to the final year without having completed prerequisite classes. In addition, students are eligible to register in elective courses after successfully completing 80% of the core courses. Another unclear aspect of the presented curriculum is its adherence to the EU-mandated Bologna Agreement, according to which basic (B.Sc.-level) CS must be completed in 3 years. A final comment pertains to the European Credit Transfer system to which the CSD curriculum must be aligned with – an adjustment that will also facilitate the exchange of students through the Erasmus Programme.

• *Is the structure of the curriculum rational and clearly articulated?*

The choice of core courses is well structured to provide the necessary CS and EE-Signals background for students to follow the elective courses per specialization track.

• *Is the curriculum coherent and functional?*

The current version of the curriculum shows reasonable structure and functionality. There is certainly room for improvement in the coverage of contemporary courses and enhanced cohesiveness. The EEC felt that the CSD objectives cover ground from several disciplines

(informatics, communication networks, opto-electronics, signal and image processing). Thus, meeting these objectives satisfactorily in four years is a challenging task, and may be partly responsible for the large number of stagnating students. This is however, a problem common to most departments in Greek Universities.

• Is the material for each course appropriate and the time offered sufficient?

The content of courses offered is appropriate, but as mentioned earlier the amount of material and effort required is not commensurate to the required level of learning and timely graduation (in 4 years).

• Does the Department have the necessary resources and appropriately qualified and trained staff to implement the curriculum?

The CSD at AUTH has well qualified faculty members to teach the courses and labs, and to some degree adequate resources and facilities to implement the curriculum. Areas of improvement include hiring or training of staff on IT-based issues, increasing the number of paid teaching assistants (for lab exercises), and well-equipped, co-located facilities.

RESULTS

• How well is the implementation achieving the Department's predefined goals and objectives?

The current implementation of the undergraduate program produces results that satisfy up to a certain extent the current and future needs of the students, faculty, and staff. Improved implementation hinges upon how well the challenges of stagnating students, the optimum balance between breadth and depth in coursework, and the sub-optimum facilities of CSD at AUTH will be addressed in the future.

• Does the Department understand why and how it achieved or failed to achieve these results?

The department is well aware of the aforementioned challenges, has taken preliminary steps and looks forward to updating the undergraduate curriculum in accordance with the new law from the Ministry of Education.

IMPROVEMENT

• Does the Department know how the Curriculum should be improved?

The department is aware of the problems; one possible challenge is the existing culture and the ownership of courses and labs.

• Which improvements does the Department plan to introduce?

The department plans within the new undergraduate curriculum to reduce the course load while preserving the strength and diversity of courses offered.

A2. Curriculum (Graduate programs)

APPROACH

• What are the goals and objectives of the Curriculum? What is the plan for achieving them?

The goals and objectives of the graduate programs are to:

> ➢ *prepare & train* specialized computer scientists building upon their capacities, via intensive course projects, literature surveys and a final M.Sc.-level thesis.

> ➢ *produce groundbreaking research* through the Ph.D. program, pursuing worldwide excellence in computer science.

The plan to achieve these goals and objectives is the development of a 3-semester M.Sc. program in Informatics (2 semester coursework and 1 semester for the M.Sc. thesis) following the same tracks of the undergraduate program. Each track offers at least six (6) *core* courses and a number of elective courses. Students must complete 8 courses (at least 6 from track's core courses and 2 elective courses from other tracks). An obligatory <u>*master thesis*</u> is performed during the third semester, and can be written in English.

An evaluation process is in place for admission to the M.Sc. program. Students coming from informatics-related departments, with an average score of 7.5 or higher, are directly admitted to the M.Sc. program, while those coming from other disciplines are admitted after successfully completing a number of courses determined by the graduate committee. M.Sc. students can serve as teaching assistants (TAs) to have the 500Euros tuition fee per semester waived. In addition to the regular M.Sc. Program of the CSD, an inter-departmental M.Sc. Program is available on "Informatics and Management" in collaboration with the Department of Economics at AUTH. It is a 3-semester program (2 semesters with 7 courses plus 1 thesis course). A 7-member committee (Master Studies Coordination Board, consisting of one representative from each track and the Director of the M.Sc. Program) manages this joint M.Sc. program, which trains an average of 45 students per year.

For the Ph.D. Program, a Coordination Board decides the admission of students; Ph.D. students may serve as TAs, while receiving research assistantships (RAs) coming either from national or international funding sources, if available.

The graduate plan also includes seminars from expert speakers, student awards in the form of waving TA responsibilities, recently instituted yearly progress reports, mechanisms for evaluating student performance, student advisors (for both M.Sc. and Ph.D. students), and graduate thesis committees (3 members for M.Sc. and 5 internal members and 2 external members for the Ph.D. defense). The minimum requirement for PhD defense is 2 papers published in peer-reviewed journals. With the current regulations of the Ministry of Education, each faculty member (Full, Associate and Assistant Professors) has a maximum of 5 PhD students under their direct supervision.

• *How were the objectives decided? Which factors were taken into account? Were they set against appropriate standards? Did the unit consult other stakeholders?*

The objectives were decided on the basis of the following factors.

➢ *Based on International practice:* reports by the ACM/IEEE curricula in Computer Science, Computer Engineering, Information Systems and Software Engineering;

➢ *National practice*: Greek curricula in Informatics, Electrical Engineering and Computer Engineering Departments;

➢ *Faculty expertise*: background and faculty expertise falls primarily in Computer Science and Informatics, Electrical Engineering, and Mathematics;

➢ *Trends & outlook*: awareness of local, national, and international demands in academic and industry sectors;

➢ The graduate program rules and regulations mandated by the Ministry of Education.

• *Is the curriculum consistent with the objectives of the Curriculum and the requirements of the society?*

The objectives of the graduate programs are similar with international benchmarks, with the

requirements of society, and with the rules and regulations imposed by the Ministry of Education.

• *How was the curriculum decided? Were all constituents of the Department, including students and other stakeholders, consulted?*

Like all the graduate programs in Greece, the M.Sc. and Ph.D. curricula at CSD were decided based on several factors (regulations from the Ministry of Education, University regulations, etc), and from all stakeholders who had the opportunity to offer input toward this decision.

• *Has the unit set a procedure for the revision of the curriculum?*

Both M.Sc. and Ph.D. programs have been revised and updated (twice) by the graduate committee. A new update and revision is on the works, waiting for the upcoming new regulations from the Ministry of Education to be in effect.

IMPLEMENTATION

• *How effectively is the Department's goal implemented by the curriculum?*

The CSD relies on various bibliographic metrics to assess the effectiveness of implementing its graduate programs. These metrics are based on: (i) quantity and quality of publications as well as standard citation indices; (ii) effectiveness of the graduate program in research and funding; and, (iii) graduate student awards and student placement in the market. Although CSD has introduced several metrics, its implementation efforts have faced various difficulties in assessing the duration of graduation time, the fit of graduates with the already tight job market, and the perceived rigidity of the national University system.

• *How does the curriculum compare with appropriate, universally accepted standards for the specific area of study?*

Although the CSD graduate programs are relatively new (initiated in 2003) they are competitive and well-known to the academic communities. In particular, the Ph.D. Program of CSD ranks at the top 2-3 spots among 4-year programs in Greece and around 160-180 of their peer institutions internationally.

• *Is the structure of the curriculum rational and clearly articulated? Coherent? Functional? Is the material for each course appropriate and the time offered sufficient?*

The structure of the graduate curricula appeared rational, coherent, functional, and clearly articulated. The material and the courses are well prepared and appropriate for the time frame offered by the faculty. The feedback received from a small number of graduate students was favorable. The average time for graduation from the Ph.D. program is currently 5.5 years, while recently developed mechanisms aim at reducing it to 4-5 years.

• *Does the Department have the necessary resources and appropriately qualified and trained staff to implement the curriculum?*

The available resources, recent difficulties in funding, the large volume of teaching and limited space are inhibiting factors rendering the implementation of the graduate programs marginally adequate and limiting their visibility and potential for well-deserved recognition. On the other hand, the faculty members are well qualified and internationally recognized. Increasing the number of government-funded teaching assistants is a must, in view of the

fact that this graduate curriculum can truly benefit from additional laboratories and design projects.

RESULTS

• *How well is the implementation achieving the Department's predefined goals and objectives?*

After the due updates in the graduate programs, the implementation of the predefined goals scored high according to the reformed admission requirements at the M.Sc. and Ph.D. programs (yearly progress reports; external EU funding to support graduate students; maintaining a high average of research productivity per faculty member (3.5 refereed journals and 4 refereed conference papers, 8 PhDs per year).

• *If not, why is it so? How is this problem dealt with?*

The number of excessively delayed graduation time is an area of concern, common to all undergraduate and graduate curricula throughout the country. This delay will be reduced as the application of the 5-Ph.D.–students-per-faculty rule is expected to lower the number of stale cases or motivate faster graduation (to open up slots for newcomers). A second area pertains to monitoring and feedback from M.Sc. and Ph.D. graduates, which has been partly dealt with by collecting limited data sets from an alumni portal.

• *Does the Department understand why and how it achieved or failed to achieve these results?*

Limitations and weak links have been understood and identified, but for the most part have been justifiably attributed to the constraints, rules and regulations stemming from the lack of efficiency, agility, and prevention of University self-governance by the Ministry of Education.

IMPROVEMENT

• *Does the Department know how the Curriculum should be improved?*

Most of the means for improving the curriculum have been correctly identified.

• *Which improvements does the Department plan to introduce?*

Areas to improve the graduate curriculum could include:

  ➢ Increase the percentage of student evaluation responders, and utilize feedback from alumni in updating and streamlining the curricula;
  ➢ Revamp M.Sc. areas of specialization in response to current trends in research and market demands;
  ➢ Develop mechanisms to fund and increase the number of teaching assistants, create departmental scholarships and fellowships;
  ➢ Consider developing a worldwide competitive graduate program in English;
  ➢ Institute means to increase the probability of securing jobs for CSD graduates; and
  ➢ Re-negotiate with the AUTH administration the percentage of overhead returned to the department.

B. Teaching

APPROACH

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

The Department's policy integrates conventional classroom-based instruction with web-based tools and learning methodologies for content delivery as well as for facilitating improvements on conventional teaching. The policy envelops a curriculum architecture which is developed in accordance with international practices, and reflects an effort for continuous improvement and modernization, which is based on faculty initiatives, student feedback and, more recently, alumni and industry input to a certain extent. The teaching philosophy of CSD places high priority on being modern and flexible while meeting student needs through a "***students first***" pedagogic approach.

In general terms, the Department's 27 faculty members offer lectures, labs, exams and projects in nearly 80 courses in several curriculum and area categories to the approximately 900 students; 49 of these courses are obligatory for graduation (out of which 4 courses are devoted to foreign-language training). Additionally, graduation requires a Diploma Thesis to be developed and successfully presented by the student. A group of core courses must be taken during the first 5 semesters of undergraduate studies. Additional courses taken beyond the 5th semester are drawn from one of the following 4 scientific tracks (covered by 5 Labs):

- Communication, Networks and Systems Architecture
- Information Systems
- Digital Media
- Information and Communication Technologies in Education

In each track, students attend core courses and a number of electives (either from the same or from different tracks). The Diploma Thesis is done during the 7th semester of their studies and counts as one course. Hence, the total number of courses required for the B.Sc. Degree, including the Diploma Thesis, is 50.

During the first 5 semesters, an unusually high number of students populate some of the core courses making it rather cumbersome to effectively deliver content due to limitations of space and infrastructure. Conventional large-classroom and amphitheater lectures and high student-to-faculty ratios are observed. Yet innovative teaching approaches (e.g., use of software environment such as "Blackboard") find a growing role in addressing issues of size and infrastructure. Students voice concerns about the efficacy of rather large classes and the limited number of teaching resources available including the number of professors and teaching assistants.

The student to staff ratio is above international norms. The undergraduate student-to-staff ratio is 900 students to 27 members of the staff (approximately 33:1).

The Department's laboratory infrastructure includes, but is not limited to, laboratory space and facilities which could benefit from additional resources and modernization. Overall, a serious effort is made to provide appropriate lab experiences and prepare the students with high-quality programming environments and tools. The Department has 5 computing labs

accessible to students and uses (typically unpaid) M.Sc. and Ph.D. students to assist with labs (as well as in grading lab reports, proctoring exams or assisting with lab assignments). When interviewed, the students indicated a desire to have more laboratory experiences. Current infrastructure and staffing levels make it difficult to deliver on such expectations, but the need is evident.

Overall, there is a positive ambiance and good relations between faculty and students in the Department. Although improvements and more systematic approach would be welcome, the Department makes earnest and commendable efforts to build life-long relations with alumni.

IMPLEMENTATION

The students expressed satisfaction with most of the followed teaching procedures, the teaching material and available resources, while some concern was voiced with the limited resources and incentives for continuous student engagement with the learning process.

Diverse and varying views were expressed to the committee especially on limited faculty-student interactions. The students look for a good balance between fundamentals (physics and mathematics) and more specialized computer science content. It is rather apparent that a limited number of prerequisites could improve organization and streamlining of coursework, but there is some resistance to what the committee felt is a step in the right direction.

The Department offers a series of seminars by prominent researchers and industry professionals, which is helpful in developing a broader view of the discipline and the CS profession. Such activities need to be strengthened and may need to take the form of "required to attend" weekly undergraduate and graduate seminars.

While there is a reasonable level of mobility of students and staff, there are considerable margins for improvement in taking advantage of student European mobility programs such as the Erasmus exchanges. The faculty however seems to be active in visiting international programs through sabbatical leaves and research collaborative activities. While the language of instruction is Greek, students are well-versed in English-based material and capable of following up well the international bibliography. Students who have been abroad have clearly felt the benefits of the exchange and they could help the Department increase the incoming the relatively low number of international students by translating the lecture presentations and notes into English.

The Department has three successful M.Sc. programs in Informatics, including an inter-departmental one in applied business informatics. These programs could be expanded and possibly include more international students if the Ministry of Education allows English as the language of instruction, thus increasing the flow of students from international and regional sources.

The Department has a portal of alumni to receive feedback on teaching and curriculum, and implements an on-line anonymous system of course evaluation with nearly 30% of the students responding. Means to improve student participation are actively sought, while ensuring confidentiality and mining meaningful input for improving teaching at all levels.

RESULTS

The teaching practices of the Department are characterized by sincere efforts to improve efficacy, and maintain quality up to the highest international standards and practices. Information technology is used efficiently to streamline and facilitate improvements. The students felt that their courses were somewhat heavy on basic mathematics and physics at the core level while more laboratory experiences would have been welcome. The Department, however, has limited resources for laboratory infrastructure, including space and staff, while the student numbers are large, and include a rather large number of stagnating students.

IMPROVEMENT

The Department is seeking continuous improvements in pedagogic approaches and effective feedback from students and alumni so that it is up to the best international standards and practices. More flexibility and effective faculty control of prerequisites, greater student and staff mobility, as well as more resources for space and lab infrastructure could contribute to sustainable growth in teaching aspects at all levels of instruction. Additional areas with room for improvement include effective means of raising funds for teaching assistantships (TAs) and research assistantships (RAs); advertising of job opportunities and successful placement of graduates on the CSD website; and streamlining of the curriculum to reduce the relatively high number of credit units, which appears to be partly responsible for the number of stagnating students nationwide.

C. Research

For each particular matter, please distinguish between under- and post-graduate level, if necessary.

APPROACH

- *What is the Department's policy and main objective in research?*

The department has a well-defined research policy striking the desirable balance between fundamentals, analytical and applied subjects. Such an effort is well organized thanks to the creation of research tracks, and within the corresponding areas, research teams which entail more than one faculty working in connected fields. This is mostly guided from the curriculum structure organized into five main Labs, each comprising elective courses. Such a clustering of research activities parallels the ongoing research activities of individual faculty. The main objective is high-quality research supported by external funding sources through a peer-reviewed, competitive process.

- *Has the Department set internal standards for assessing research?*

Somewhat rigid standards for students (such as requiring instead of encouraging and fostering research resulting in a number of journal and conference publications) have been placed in the graduate programme (M.Sc. and Ph.D.), as well as for faculty members in their (re-) appointment and promotion process.

IMPLEMENTATION

- *How does the Department promote and support research?*

During the visit, it was felt that the department strives to be a productive, collegial, high-quality research unit, as evidenced by close interactions between faculty members (especially within each Lab), Ph.D. students, and the high publication standards that the department encourages. CSD has recently refurbished a large space away from the main AUTH campus, which has allowed housing about a third of the CSD operation in research-conducive facilities. It was perceived as a shortcoming to have a remotely located satellite unit which could potentially hurt departmental cohesiveness, but at the same time as an advantage of upgrading the substandard on-campus facilities which add to the challenges of carrying out state-of-the-art research emerging from the current socially tense situation in Greek universities. Faculty are keenly aware of the limitations to research that the current financial situation and legal uncertainties impose on their research, and exert their outmost efforts to protect their Ph.D. students to the best of their ability. For a variety of reasons, the department has grown in a somewhat "organic," "esoteric" and thus "self-evolving" manner by hiring over the last dozen years mostly its own graduates, or graduates of other Greek Universities but has not been as successful in attracting talent from the international academic market (only 10% approximately of the faculty has Ph.D.s granted by institutions outside the country, lower than other top-ranked Greek departments). This perceived homogeneity in background contributes to a collegial environment but might limit the department's diversity of perspectives, approaches and international connections that are necessary to help CSD overcome robustly the often debilitating limitations to research imposed by the current economic and administrative meltdown of Greece.

- *Quality and adequacy of research infrastructure and support*

There seems to be limited infrastructure support for research in the department. This was observed in a couple of instances. For example, there are no dedicated personnel helping with grant preparation, negotiation, signing and follow-up of projects. This is rather unusual

for a research and funding programme of this magnitude and limits the time faculty can spend on proposal writing and the research itself. Faculty should be highly commended for conducting research under such adverse conditions.

- *Scientific publications*

The Department has consistently maintained a high-quality and high-impact publication record in most established areas of theoretical/applied Informatics and ECE-Signals, in numbers commensurate with the department's standing and goals of excellence.

- *Research projects*

The research projects are diverse. The historically first projects were mainly on infrastructure, mostly funded by the Greek government from the beginning to the middle of the last decade towards standardizing practices in the IT sector in Greece. Subsequently, most projects were funded from Greek Research and EU Programmes. Part of the EU funding comes from projects with less basic research components, which are not conducive to high-quality Ph.D. research.

- *Research collaborations*

There are three types of research collaborations observed in the department. The first pertains to intra-lab research; the second involves collaborations between individual faculty and their past advisees participating in EU projects. The last type consists of formal collaborations between CSD at AUTH and other national and international institutions.

RESULTS

- *How successfully were the Department's research objectives implemented?*

Research areas are well-clustered and poles of excellence are present in the department, some labs seem to have larger cohesion and synergy between teams whereas in others research success is mostly due to the ambition of the individuals rather than the synergies between them (which eventually could have even greater impact). Due to the evolution of research interests of faculty there is a certain amount of overlap in research interests across teams and it is not clear that they lead to collaboration. Overall, inter-sector collaborations are limited, but do exist.

- *Scientific publications*

Albeit non-uniform across faculty members, the average number and quality of the publications is of high quality. The faculty publishes in good conferences and journals of the corresponding domains, and occasionally in the top ones. Furthermore, the impact of the department is considerably high across areas as demonstrated from the number of citations. There is certain variation in terms of quantity across research areas mostly due to the nature of domains. It will be nice if in the future more CSD faculty members are elevated to the ACM, IEEE, or AAAI Fellow rank, and receive awards from prestigious journals, which will certainly contribute to boosting the CSD visibility worldwide.

- *Research projects*

The department has been successful in securing funds for infrastructure, national and EU-research. The source of funding for infrastructure comprises support for network and e-services. The second source of funding, which has gradually grown to become the most sizeable one, comes from the EU. The department has been very active in this direction and was able to replace the infrastructure source - that was the dominant one at the beginning of its existence - with EU funding, and almost all teams appear to have secured significant parts

in large EU projects in FP6 and FP7. However, the department does not seem as successful in securing Future Emerging Technologies (FET) projects, which are highly selective and desirable (over those putting emphasis on mundane deliverables) because they can support quality Ph.D. theses. The last funding source consists of research support for PhD candidates and Post-doctoral associates through competitive Greek programs (PENED/HERAKLETUS). Here too, the department performs very well. On the other hand, such programs impose constraints on the duration of the PhD studies, which in certain cases compromises the quality of the doctoral work.

- *Research collaborations*

Through the individual professors' motivation and portfolio, the department has a solid track record in scientific collaborations. The department belongs to the largest single academic institution in Greece, with departments in almost all disciplines; however, the amount of interdisciplinary collaboration is not as high as one would expect, especially in areas that are currently attracting a lot of attention globally, such as biomedicine. Research labs appear to have funding for bilateral collaboration with many countries in Eastern Europe and the Middle East.

- *Efficacy of research work. Applied results. Patents etc.*

The faculty members have no patents. The committee observed a number of technologies with strong potential for commercialization. The research in e-Learning has resulted in a platform that is being distributed free and gaining acceptance nationwide.

- *Is the Department's research acknowledged and visible outside the Department? Rewards and awards.*

The department has good visibility world-wide. It is ranked highly within AUTH and is at the 2-3 spots among all 4-year programs in Informatics nationally. This is due to the academic record and reputation of its faculty members, their professional activities, and their distinctions (IEEE Fellow, etc). It is able to attract excellent graduate students from many other departments. It will be desirable for CSD to attract future ERC-starting grant laureates (considered to be the most prestigious individual grant at the EU level), which is an outstanding achievement that will feature CSD among the top in Europe.

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

The Department is in the process of having yearly progress reports of Ph.D. students, and introducing a form of examination at the end of the first year of their research.

The Department realizes the challenges posed by the economic situation and outlook in Greece, which makes national funding very unlikely for the foreseeable future and gas redoubled its efforts in achieving international funding.

D. All Other Services

For each particular matter, please distinguish between under- and post-graduate level, if necessary.

APPROACH

- *How does the Department view the various services provided to the members of the academic community (teaching staff, students).*

The administrative services, including secretarial and technical support are offered with professionalism covering the needs of both the academic staff and the students. Also, the number of employees in support of these duties seemed appropriate. The CSD administrative office has 5 members, 1 serving as director, 2 for the undergraduate and 2 for the postgraduate programs. In addition, 3 members of the administrative staff are designated for various tasks within CSD, 2 for the labs' technical support, and 1 for the general responsibilities, which include physical plant and accounting at the Kalamaria facility.

The department relies on an online document management system (PILEAS) used for teaching purposes, and regularly used by students and staff. CSD has also implemented a portal to maintain networking amongst its alumni. In addition, AUTH offers a series of central services available to all departments, which include:

1. A centralized information system (IS) for student management that covers administrative tasks as well as teaching- and research-related statistics and reports;
2. A web facility for students to select courses and register online;
3. A network operation centre supporting faculty premises with broadband access, network security, and data privacy;
4. A central IS support facility (KYTP);
5. A university-wide research office for administrative, legal and accounting support in R&D projects;
6. A central library facility with extensive onsite and online services; and,
7. A central e-learning platform (Blackboard) used extensively by the department.

Finally, the Greek government is centrally providing textbook distribution (EUDOXOS web system), and public transport card (PASSO) via the web, and external distribution channels.

- *Does the Department have a policy to simplify administrative procedures? Are most procedures processed electronically?*

Steps have been taken, centrally by the Ministry of Education, for the e-distribution of textbooks and the issuing of reduced-cost transportation cards. Updated information systems are put in place by AUTH making extensive use of web technologies (DMS, e-learning, alumni portal) to reduce unnecessary burden on administrative staff, students and academic staff. Administrative procedures though remain in paper due to the bureaucracy and legal regulations that Greek Universities (and thus CSD) must adhere to. These procedures induce undue hassle, delays, misinterpretations, and wasted manpower in the administrative processes of the department, which in turn renders decision making processes tedious and ineffective as reported uniformly by the academic staff interviewed (examples include distribution of funds, budget allocation, accounting regulations, and bureaucracy overheads).
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- *Does the Department have a policy to increase student presence on Campus?*

Certain actions were foreseen in the latest meeting of the general assembly of CSD to increase the success rate in core topics where students massively failed in specific periods. Tutors, mini-projects, and progress reports were introduced in the teaching process that increased student onsite presence, and reduced failure tolls.

In postgraduate courses, student attendance is basically obligatory (absence exceeding 30% implies automatic FAIL in the class).

IMPLEMENTATION

- *Organization and infrastructure of the Department's administration (e.g., secretariat of the Department).*

The organization and infrastructure of the Department's administration - secretariat of the Department - seemed to be working smoothly and effectively. The personnel have a clear understanding of the services, and are willing to take additional responsibilities as needed.

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

Students and academic staff came across as being satisfied with the quality of the premises; however, it was brought to the EEC's attention that the department's operation being split into 2-3 locations renders day-to-day operation difficult, student–faculty interaction challenging, and the overall cohesiveness across labs increasingly hard to achieve.

The department has two well-equipped classrooms in the "Faculty of Science" building of the main campus, and 4 new classrooms in the "Kalamaria" facility mostly used for postgraduate teaching, seminars, and research offices.
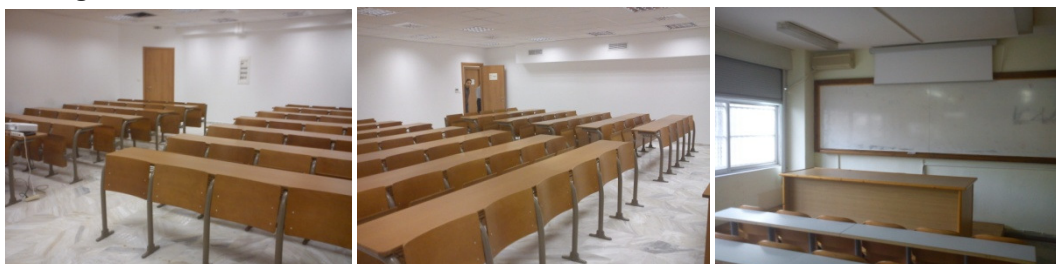
There are three PC labs in the central premises (each with 20-30 stations) with one of them underutilized since it also serves as a computer room with rather noisy network and server installation.

Support from the KYTP (http://web.itc.auth.gr) and the University Network Operation Centre (www.noc.auth.gr) of AUTH appears to meet expectations and serves both faculty members and students adequately and promptly. No major issues were reported or noticed. Wireless access is provided to registered students and faculty members and those guests with access to the eduroam protocol.

It is worth mentioning that both of these university-wide services are supported by CSD undergraduate and graduate students on a part time (and often voluntary) basis.

The AUTH library is supported by an extensive information system with many online services, e-learning facilities, manuscript scanning services, extensive indexing, storage, and information retrieval infrastructure, subscription to all major magazines and journals; see www.lib.auth.gr .

CSD students and faculty members have access to more that 20,000 journals, 50 search engines, 368,000 titles in the library, and an online e-learning facility with 73 courses from CSD faculty members. The library has stored 71 PhD theses from CSD, 423 Diploma and M.Sc. theses, and 446 papers produced from 2003 onwards.

RESULTS

- *Are administrative and other services adequate and functional?*

Administrative and technical services are adequate, functional, and offered by well-qualified personnel as elaborated earlier.

- *How does the Department view the particular results.*

The Department is doing its best to realize its mission under the stringent constraints of State-mandated reforms in the higher education laws and regulations, the times of reduced resources for Universities worldwide, and the legacy of bureaucratic central management at the local scale.

IMPROVEMENTS

- *Has the Department identified ways and methods to improve the services provided?*

Improvements will be welcome in collecting, aggregating, and analyzing statistical data from the administrative information system serving the secretariat. It was observed during the relevant presentations that figures reported from those systems did not match the real figures provided by each lab director.

Additional improvements were requested by the academic staff concerning the extensive bureaucratic procedures related to R&D participation and the percentage of overhead retained by the central R&D office of AUTH.

Other areas of improvement include the creation of alumni support mechanisms (e.g., via social media), effective marketing and advertising of "points of CSD pride," and the built-up of CSD-Industry partnerships.

- *Initiatives undertaken in this direction.*

Web tools are extensively used to better streamline the teaching and research processes, and facilitate student-related administrative tasks.

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

For each particular matter, please distinguish between under- and post-graduate level, if necessary.

Given its youth (established about 20 years ago), and remarkable accomplishments in its relatively short history (among the top four-year programs in Informatics nationwide), the department has ample room for improvement, and a bright future ahead of it. It can clearly benefit from a much needed strategic plan in refocusing the curriculum as well as balancing and growing its research and funding horizons to face the challenges arising from the tough economic times in academia and the nation as a whole. All these clearly call for a synergistic effort of the State (Greek Ministry of Education), the University (AUTH), and the Computer Science Department (CSD) itself, to overcome the inhibiting factors identified in this section, streamline expenditures, optimize the allocation of resources, and advance the CSD to the next level.

The major ***inhibiting factors*** identified by the committee fall under three categories:

a) *sub-optimum infrastructure* (lack of a single building to host CSD and the need to modernize the software/hardware laboratories and computer rooms);

b) somewhat ad *hoc organization of research and teaching areas* (into 4 tracks and 5 corresponding Labs) not covering a few critical areas in Informatics cohesively, with "vague" distinctions and "loosely" connected ties across labs, less in par with modern trends in the highly-competitive funding arena, and somewhat disconnected from the Greek Industry, and EU competitive private market; and,

c) *Non-diverse academic pedigree of faculty hires leading to a self-perpetuating growth* (considerable percentage of faculty with Ph.D.s from AUTH and other Greek Universities), which compromises efforts toward heterogeneity and plurality, curtails the influx of fresh ideas, but also limits the visibility and vision necessary to succeed at the global stage worldwide.

Correspondingly, the committee's ***perspectives for improvement*** and recommended courses of action comprising the ***strategic plan*** are as follows.

A) Highlight and publicize the instrumental role of CSD as a unit of paramount importance for the University and the Nation, and persuade AUTH to allocate in the next cycle of State funding a single building or a major part of it (3-4 floors) to host the Department, and equip it with state-of-the-art laboratories. Albeit at a very high cost (monthly rent of 19,000 Euros), the current section of CSD in the facility of "Kalamaria" hosting about 1/3 of CSD, is adequate; but being far from the main campus renders communication among faculty and students as well as teaching and research efforts challenging, inadequate and fragmented. As a short-term objective, re-negotiate with renter to achieve a lower rent in Kalamaria, while at the same time vigorously pursue the medium-range goal to reach an agreement with AUTH and the Ministry of Education to allocate funds for a new building (to be completed in the next 3-5 years).

B) Initiate CSD faculty meetings (plus possibly an annual retreat) to develop a strategic plan for growth and re-shaping of the curriculum and the current organization of teaching, research and funding efforts. To this end, develop a *mission statement*, identify peer institutions in Greece, EU and the US, and make sure that the *content of coursework* at the undergraduate and graduate levels is in par with the Bologna agreement, the *needs of the information technology (IT) market*, and the *niche areas* were CSD at AUTH can truly make a difference. It was felt that specific areas not fully covered in the CSD curricula include:

B1) Theoretical computer science (algorithms, complexity, and optimization) as well as mobility-focused background, applications, and research themes;

B2) Security at all levels (host-computer, information, network, and Cyber); and

B3) Bio-, health- and environmental informatics, the latter emphasizing power, energy, intelligent energy-efficient buildings and the Smart Grid, as well as renewable sources (including solar and wind sources for which Greece can play a prominent role in the international research and development forum).

C) Actively recruit future hires needed to strengthen the aforementioned areas B1)-B3), but select outstanding candidates who have earned their Ph.D. degrees from Universities abroad. Among comparable quality candidates, weigh heavier external ones. Further, encourage postgraduate students and faculty to visit for a substantial time (1-2 years) top-caliber foreign institutions to broaden their

perspectives in teaching, research, and funding efforts. Explore innovative means of advertising the Departmental strengths by not keeping CSD's top-notch graduates (to possibly aid in fulfilling deliverables in the next EU projects), but instead placing them in other institutions abroad to excel and enrich their horizons away from AUTH, serve as ambassadors of the excellent work done at CSD, and possibly return after a proven stellar career to give back to their alma mater.

The Department was clearly put together by former faculty members from the Sciences (primarily Mathematics and Physics) and Engineering (mainly Electrical) at AUTH about 20 years ago, and these roots show still today in the curriculum, self perception of the faculty teaching and research efforts, as well as in their scientific and technological predispositions. Although CSD offers arguably one of the best four-year programs in the country, it does not resemble modern departments in research universities across the globe, because it represents a hybrid outgrowth comprising an amalgam of Electrical and Computer Engineering (ECE in Signal and Image Processing Theory and Algorithms), and Informatics (Computer Science – CS), with an added slant on IT Education tailored for graduates seeking teaching positions in Greek secondary education.

It was felt that the demand for IT educators has saturated; hence, this thrust should not grow further. On the other hand, the need for IT graduates in the government and private companies is only expected to grow; and for this reason, it is imperative to strengthen the ties with the State, Industry and the private sector in general, especially those involved in the aforementioned areas B1)-B3). Toward this objective, it is highly recommended to consider having an *Industry Advisory Board* (IAB) with members from Greek and EU company representatives, and seek regular feedback (through an annual meeting at the Department) on curriculum updates, and evolving research topics investigated, as well as encourage *student internships*, an "*Industry Career Day*" per year (where recruiters and future graduates interact), and foster Industry-University *collaborative, and cross-disciplinary funding* efforts.

Although mentioned in previous sections, the committee's perspectives for improving the *undergraduate* curriculum were centered around:

u1) reducing the number of courses to align with the Bologna mandates for the number of credit units required for the B.Sc. degree;

u2) lowering the number of required courses (perhaps increase CS over ECE obligatory ones);

u3) enhancing agility with more elective ones taking advantage of the comprehensive set of courses offered throughout AUTH;

u4) introducing prerequisites, which will also help lowering the number of stagnating or non-graduating students;

u5) considering replacement of the obligatory undergraduate thesis with a senior design project course for all, while retaining the thesis option for students with excellent grade point average (GPA); and,

u6) exploring avenues to increase the number of responders to teaching evaluations.

At the *graduate and postgraduate* levels, the committee recommendations focused on:

g1) consideration of the additional option of a "courses-only" M.Sc. degree (without thesis);

g2) the possibility of supplementing the annual reports with the Ph.D. Thesis Proposal about a year prior to defending the Ph.D. Thesis; and

g3) development of ways to increase the currently low percentage of funded Ph.D. students

through fellowships and research assistantships (currently standing at less than a third of the total number of Ph.D. students).

In addition to the State and AUTH-based efforts, the latter responsibility of securing funds for research assistants (RAs) is yet another inhibiting factor to be also addressed by the Department, intertwined with the modest funding coming to CSD (less than 40,000 Euros per faculty per year); notwithstanding, CSD ranks highly within AUTH as far as incoming funds are concerned. The latter means that CSD is subsidizing a large number of other departments while receiving less-than-what-deserved part of the AUTH resources. By increasing the amount of the overhead funds that AUTH returns to CSD, the Department may be able to enhance the quality of teaching by increasing substantially the number of laboratories needed in the core courses, and also boost a bit the number of RAs available. In addition, the Research Office at AUTH should establish mechanisms to aid CSD faculty during the proposal preparation phase – a due expectation expressed to the committee especially by junior faculty members. Furthermore, the Department should facilitate, encourage, and also reward faculty putting efforts in major proposal writing and securing external funds (those could include reduced teaching and increased administrative support, which appears feasible since the administrative assistants' time seems to be freeing-up as student registration, grades, and related certificates have all gone electronic and Internet-based.

F. Final Conclusions and recommendations of the EEC
For each particular matter, please distinguish between under- and post-graduate level, if necessary.

The ensuing conclusions and recommendations of the EEC pertain to:

- 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 suggestions for improvement;

- the Department's readiness and capability to change/improve; and,

- the Department's quality assurance.

Recommendations for the Curriculum – *Undergraduate Programme*

1. Reduce the number of courses to align with the Bologna mandates for the number of credit units required for the B.Sc. degree.
2. Lower the number of required courses (perhaps increase CS over ECE obligatory ones).
3. Enhance agility with more elective courses taking advantage of the comprehensive set of courses offered throughout AUTH.
4. Introduce prerequisites to improve the academic level in the courses and the overall structure of the program.
5. Solicit more systematic input from alumni and potential employers of CSD graduates.
6. Possibly consolidate the high volume of courses by 10% to reduce average graduation times.
7. Control the timing of transfer-student admissions.
8. Add new courses that are missing such as cyber-security and bioinformatics.

9. Introduce a senior design team project.
10. Align with the European Credit Transfer system.

Recommendations for the Curriculum – *Graduate Programme*

1. Increase the number of paid teaching assistants.
2. Create departmental scholarships and fellowships.
3. Introduce additional labs and design projects.
4. Consider an M.Sc. course- or project-only option for non-research oriented students.
5. Revamp M.Sc. areas of specialization in response to current trends in research and market demands.
6. Introduce a Business Plan course or thesis for the interdisciplinary MS, focusing in teamwork between CSD and Economics students.
7. Consider a Thesis Proposal requirement for PhD students.
8. Consider developing a worldwide competitive graduate program in English, with a balanced core-specialization curriculum.
9. Re-negotiate with the AUTH administration the percentage of overhead returned to the department, and invest that to the PhD students.

Recommendations for Teaching

1. Hire senior students to help with grading, and tutoring students in the introductory programming courses.
2. Reduce the student to faculty ratio.
3. Increase laboratory experience.
4. Better inform students on the needs of the labor market; create forums to meet employers; and help secure internships internationally.
5. Increase the percentage of student evaluation responses and solicit more systematic input from alumni and potential employers of CSD graduates.
6. Hire additional members or train existing administrative staff on IT-related issues.
7. Provide more administrative support to free-up CSD faculty time for teaching and research.
8. Build contemporary well-equipped co-located facilities.
9. Limit the number of incoming students.

Recommendations for Research

1. Aggressively hire in strategic areas with an emphasis on candidates with significant experience (Ph.D./postdoctoral) outside the country.
2. Update Department organization to reflect today's research field configuration.
3. Focus on:
   a. Theoretical computer science (algorithms, complexity, and optimization)
   b. Wireless/Sensor networks/Mobility-focused background, applications, and research themes;
   c. Security at all levels (host-computer, information, network, and Cyber); and
   d. Bio-, health- and environmental informatics.
4. Create mechanisms to promote collaborative research among faculty across different research tracks.
5. Strengthen mobility to top-quality research groups world-wide and for PhD students to top industrial internships.
6. Strengthen efforts towards technology transfer and commercialisation, for example through an incubator.
7. Provide more administrative support to free-up academics time for teaching and research.
8. Focus on higher quality EU funding that produces research as a deliverable.

9. Take advantage of AUTH size for interdisciplinary collaborations.
10. Insist on securing publications at the highest quality journals and conference proceedings, even if that means a slightly smaller number of papers

Recommendations for Other Services

1. Make administrative services (including the distribution of funds, budget allocation, and accounting regulations) fully electronic.

2. Upgrade computer rooms with state-of-the-art PCs, servers, networking, and AC.

3. Improve collection, aggregation, and analysis of statistical data from the administrative information system serving the secretariat.

4. Streamline and reduce bureaucratic procedures related to R&D participation and the percentage of overhead retained by the central R&D office of AUTH.

5. Strengthen alumni support mechanisms (e.g., via social media, effective marketing and advertising of CSD distinctions), and the built-up of CSD-Industry partnerships.

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