

EXTERNAL EVALUATION REPORT
for
UNIVERSITY OF PETROŞANI (UPET)

DOCTORAL FIELD
Engineering and Management

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I. Introduction

This report summarizes the findings from the external evaluation of doctoral field of Engineering and Management (E&M) at University of Petroșani (UPET). First, some background information is given as context, then the resources and methods used to prepare this report are listed. Next, an analysis of the performance indicators is given, followed by a SWOT analysis and the recommendations. Finally, conclusions are made.

General Background

Since its foundation in 1948, the University of Petroșani had the mission to train specialists for the mining industry, as well as for other industrial branches. Currently, the mission of the University includes three components, training, scientific research and contribution to the development of the Romanian society as an EU member. The strategic objectives for the development of scientific research include continual advancing and sharing of research knowledge, adapting priority domains and directions, developing multi-disciplinary research through innovation and transfer activities, and the reaching of performance indicators required for the institutional classification of the University in the education and research category.

The campus of the university includes education facilities, research labs, and sports grounds, as well as dormitories, a cafeteria, and a students' club.

The operation of the University of Petroșani is supported by a complex managerial structure, which includes the academic component: faculty; departments; research centers, and the administration component with well-defined functional and operational roles. UPET also has several organizational subdivisions that have been constituted to support the education and research processes. These include the Department of Research, Development and Innovation Management, The Doctoral School and the Department for Cooperation and European Programs.

The Doctoral School

The Doctoral school at the University of Petroșani was established in 2009 being headed by the Director of the Doctoral School and the Board of the Doctoral School. Within the University of Petroșani, the Doctoral school has the status of a department, with its own income and expenses budget, complying with the internal norms of the University and the decisions of the Managing Board. The University of Petroșani is acknowledged as Institution Organizing Doctoral Studies in the branch of Engineering Sciences, in the following fields: Mines, Oil and Gases; Industrial Engineering; Systems Engineering and Engineering and Management, under the supervision of 23 doctoral advisors. There is a combined total of 162 doctoral students in these fields.

The Doctoral field of Engineering and Management

The doctoral field Engineering and Management operates within the Doctoral School of the University of Petroșani (SD-UP), its objective being the continuous reconsideration of the research directions within the limits established by ARACIS, in order to ensure the skills that define the career of a specialist in this field in compliance with the requirements of the industry. The field is coordinated by the Director of the Doctoral School and the Doctoral School Board.

The doctoral students in E&M focus on applying science, mathematics, and engineering methods to integrate the operations of complex industrial and social-technical systems. They use their knowledge and skills to improve the systematic use of statistical analysis, interpersonal communication, design, planning, quality control, operations management, risk assessment and management, occupational health and safety, computer modeling and problem solving. The doctoral students must have knowledge and abilities in a wide range of disciplines, as well as the

capacity to work with people and attain a wide, systemic view. The curriculum is periodically updated in keeping up with the specific developments in the research area. The doctoral program of engineering and Management at UPET has a number of quality assurance procedures and systems to ensure quality of the academic program in all aspects. These are detailed in the Self Assessment report.

PhD Advisors/Coordinators:

Within the field of Engineering and Management, there are three SD-UP affiliated Ph.D. supervisors/coordinators. The field of expertise of the doctoral supervisors is based on the following fields: strategic management, human resource management, project management, marketing, logistics, small and medium enterprise management, investment management, quality management and sustainable development. The doctoral studies are carried out in the fundamental field of Engineering Sciences, specifically in the doctoral field of Engineering and Management, covering a variety of research areas in multidisciplinary topics.

Doctoral Students:

Doctoral students come from local industries and from international sources. They may be engineers or supervisors working full time. The number of doctoral students during the last five years (from 2016 to 2021) ranged from two to thirteen, totaling 33 students. Within the same period, three doctoral students successfully defended their theses and two graduated with their PhD degrees in Engineering and Management. Currently there are 15 doctoral students in the E&M program. Doctoral students must publish at least two articles in indexed publications before they can defend their theses. This practice raises the standards and prepares the students for academic employment.

Research Directions:

E&M involve multidisciplinary integration of a mix of disciplines. This multidisciplinary nature enables the EM program to address the research and development needs of local and international companies. The doctoral program in E&M at UPET attracts students from local industries and multinational companies. Doctoral theses address multiple research areas. These areas include;

- Research on technical-economic optimizations in the energy sector,
- Innovative tools for competitiveness and skills in entrepreneurship,
- Analysis of sustainable solutions for environmental protection and conservation, development of innovative management tools useful for sustainable resource management and economic reconversion of post-industrial areas,
- Research on the integration of quality tools in the management of innovative projects
- Engineering and project management and Agile project management, and,
- Aspects of industrial organizations management.

These research directions are common and appropriate for many national and international engineering and management graduate programs. They cover a wide variety of multidisciplinary fields. These research areas also place UPET in an excellent position to help with the challenges faced by the local economy.

II. Methods Used

This report is based on the information supplied by UPET Self-Assessment Report of the Doctoral Field of Engineering and Management and several Zoom meetings/discussions with program administrators, research centers, program coordinator, faculty advisors, doctoral students, doctoral graduates and their employers. On site visit was not possible due to the COVID virus pandemic (see references section for resources used).

III. Analysis of Performance Indicators

Standards and Performance/Field Indicators

Evaluation Criteria for doctoral programs at UPT are grouped under parts A, B and C and their multiple sections are listed in the self-study report. The following conclusions are based on the Engineering and Management Doctoral Field's internal evaluation report of the field of engineering management and the meetings/discussions listed in References. The internal evaluation report was thorough and very well prepared. The information needed for the analysis was available in detail.

To avoid repetitions, only assessment results and sections thought to be significant are discussed (see the internal-evaluation report for details).

A. Institutional Capacity Indicators

A.1. Institutional, administrative and managerial structures and financial resources

A.1.1. The Organizing Institution of the Doctoral Studies (IOSUD) implemented the mechanisms for an effective performance as provided in the specific legislation on the organization of doctoral studies.

All criteria for performance sub indicators under A.1.1.1 were met

All criteria for performance sub indicators under A.1.1.2 were met

A.1.2. IOSUD has the logistics necessary for accomplishing the mission of doctoral studies.

All criteria for performance sub indicators under A.1.2.1 were met

All criteria for performance sub indicators under A.1.2.2 were met

A.1.3. IOSUD ensures the optimal use of financial resources and the revenue from doctoral studies are completed by supplementary funding besides the one granted by the Government.

All criteria for performance sub indicators under A.1.3.1 were met

All criteria for performance sub indicators under A.1.3.2 were met

All criteria for performance sub indicators under A.1.3.3 were met.

At least 10% of the total amount of sums corresponding to the doctoral grants obtained by the university by means of institutional contracts and by means of tuition fees collected from self-funded doctoral students are used in order to fund the doctoral students' professional training expenses.

A.2. Research Infrastructure

A.2.1. IODS has a modern research infrastructure that enables the implementation of specific doctoral studies activities.

All criteria for performance sub indicators under A.2.1.1 were met

A.3. Quality of human resources

A.3.1. In each doctoral field there is qualified personnel, with adequate expertise necessary for the development of the doctoral studies program

All criteria for performance sub indicators under A.3.1.1 were met

All criteria for performance sub indicators under A.3.1.2 were met

At least 50% of the doctoral advisors in the evaluated doctoral area of study are tenured professors within the IOSUD-UPET. There are two tenured professors at UPET, therefore the percentage is 66.67%.

All criteria for performance sub indicators under A.3.1.3 were met

All criteria for performance sub indicators under A.3.1.4 were met

In the doctoral field Engineering and Management there is one doctoral adviser (Prof. Dr.Habil.Ing. Edelhauser Eduard) who coordinates more than 8 doctoral students at the same time, but not more than 12.

A.3.2. The doctoral advisors in the area of study conduct internationally visible scientific activity.

All criteria for performance sub indicators under A.3.2.1 were met

All criteria for performance sub indicators under A.3.2.2 were met..

All the doctoral advisers in the doctoral studies field continue to be scientifically active, obtaining more than 25% of the score required.

B. Educational Efficiency

B.1. The number, quality and diversity of the candidates who attended the entrance exam

B.1.1. The institution which organizes doctoral studies displays the capacity to attract candidates outside the higher education institution or a higher number of candidates than the number of state funded places.

All criteria for performance sub indicators under B.1.1.1 were met.

B.1.2. The candidates admitted to the doctoral studies display professional and research academic performance

All criteria for performance sub indicators under B.1.2.1 were met

A language proficiency exam and an oral exam (interview) with the applicant is a compulsory part of the admission procedure.

All criteria for performance sub indicators under B.1.2.2 were met

The average abandonment rate during the 5 years under analysis is 19.69% – a percentage of 0,1969, without exceeding the 0.3 value – *the percentage of 30%*.

B.2. The contents of the doctoral studies program

B.2.1. The advanced academic training programme is suitable for the development of doctoral students' research abilities and the consolidation of their ethical scientific behavior

All criteria for performance sub indicators under B.2.1.1 were met

All criteria for performance sub indicators under B.2.1.2 were met

All criteria for performance sub indicators under B.2.1.3 were met

All criteria for performance sub indicators under B.2.1.4 were met

All criteria for performance sub indicators under B.2.1.5 were met

B.3.1. Research is capitalized by doctoral students through conference presentations, scientific papers, technological transfer, patents, products, orders of services.

All criteria for performance sub indicators under B.3.1.1 were met

All criteria for performance sub indicators under B.3.1.2 were met

B.3.2. The doctoral school is supported by a significant number of external scientific specialists within the committees for the public defense of doctoral theses in the evaluated domain.

All criteria for Performance sub indicators under B.3.2.1 were met

The criteria for Performance sub indicators under B.3.2.2 were not analyzed because in the field of E&M during the period 2016-2020, only one doctoral thesis was defended and confirmed. Currently the program has 20 students, including 3 theses defended and two inactive students. There are only 3 doctoral supervisors in the program.

C.1. The existence and regular operation of the system of internal quality assurance

C.1.1. There is an institutional framework and policies and procedures are applied for the internal assurance of relevant quality

All criteria for performance sub indicators under C.1.1.1 were met

All criteria for performance sub indicators under C.1.1.2 were met

C.2. Data transparency and the availability of learning resources

C.2.1. Significant information for doctoral students, future candidates, general interest data respectively, are available in an electronic format

All criteria for performance sub indicators under C.2.1.1 were met

C.2.2 IOSUD/Doctoral School assures students' access to the necessary resources to carry out doctoral studies

C.2.2.1. All doctoral students have free access to a platform with academic data bases relevant for the domain under consideration.

All criteria for performance sub indicators under C.2.2.1 were met

All criteria for performance sub indicators under C.2.2.2 were met

All criteria for performance sub indicators under C.2.2.3 were met.

C.3. The degree of internationalization

C.3.1. There is an applied strategy to enhance the degree of internationalization of doctoral studies.

All criteria for performance sub indicators under C.3.1.1 were met

The Doctoral School, via IOSUD, has signed mobility agreements with foreign universities, research institutes, companies which carry out activities within the evaluated domain, to perform mobilities for doctoral students and academic staff. There were five Erasmus+ mobility scholarships from which benefited three PhD students in the field of Engineering and Management and six students participated in at least one international conference. Thus, nine students out of the 20, ie 45% of doctoral students have completed a training period abroad or another form of mobility such as participation in international scientific conferences.

All criteria for performance sub indicators under C.3.1.2 were met

All criteria for performance sub indicators under C.3.1.3 were met

The IOSUD-UP representatives participated in numerous education fairs to attract new international doctoral students.

Conclusion for A, B, and C: All criteria for performance indicators A, B, and C appear fulfilled in all areas (*see details in the self-assessment report, Part 2 - The degree of fulfilling performance criteria, standards and indicators*).

Overall, a review and analysis of all criteria for Standards and Performance/Field Indicators at the level of Engineering Management Doctoral Field were met. This is a major accomplishment.

IV. SWOT Analysis and Recommendations

The doctoral program of Engineering and Management at UPET has many strengths and opportunities. Some of the strengths and opportunities are:

The doctoral program of E&M is one of the four doctoral fields in the Doctoral School, established in its current form in 2015, only about 6 years ago. There are a total 23 doctoral supervisors/coordinators in the Doctoral School with only three of them being in Engineering and Management. Mines, Oil and Gas program is the largest with 13 coordinators. Given its small size, the doctoral program of Engineering and Management has been successful with 15 doctoral students and two graduates, with another expected in near future.

Petrosani's local industry has primarily been based on mining. A quarter of Romania's coal comes from local mines as mentioned in a meeting by former students. However, there is now a push for transitioning from fossil fuels to alternative green energy production. In ten years, most of these mines are expected to close. The workforce will have to be trained, reallocated and socio-economic concerns need to be addressed. The doctoral program in Engineering and Management is uniquely positioned to facilitate this transition and address resulting concerns due to its multidisciplinary nature and its research focus on technological entrepreneurship, innovation, new start-ups, system integration, project management and risk management. A recent thesis focused on innovation and facilitating start-ups using project management tools. Another thesis is focused on utilizing/converting former mines to tourism opportunities. It is expected that the doctoral program in E&M will be attracting new doctoral students, given the opportunities with organizational culture and resistance to change emerging as new research areas of focus.

Research labs in Engineering and Management are not necessarily for hardware but labs are needed in project management, statistical analysis software, big-data and digital systems engineering. The doctoral program at UPET has two dedicated Engineering and Management labs. One in computerized simulation, natural gas transportation, 3-D printing and impact analyses. Another lab is on a multidisciplinary research. These labs were established through the efforts of the doctoral program supervisors/coordinators with cooperation and partial funding secured from industry sources. The labs provide great value for the program. These efforts are to be commended.

Current and former students were very complementary of the doctoral program supervisors. They are personally involved in student progress starting from admission to graduation. They

make sure students collaborate with each other in research ideas and use of research tools. Another strength mentioned was the curriculum. First year focus on research methods, ethics, writing papers and advanced statistics, a necessary subject often not included. Statistical analysis in research has acquired greater role at UPET. Advanced statistics and its uses in fields such as risk, safety and resilience research are emphasized. Second year courses focused on the thesis topics determined by the student and the doctoral guidance committee. A proposal is submitted and presented by the student. Committees are put together by the students and the supervisor together. This student-centered approach is a strength.

Student research has been leading to significant publications. A recent thesis on technological entrepreneurship was published in an indexed journal has resulted in 50 citations, a sign of quality.

Doctoral graduates emphasized the interdisciplinary aspects of Engineering and Management doctoral program. One former student is employed in launching successful new start-ups. Education in agile project management, quality engineering innovation, entrepreneurship and simulation has been key to another graduate who teaches technological innovation at high schools helping to train tomorrow's business leaders. Her thesis placed the former student in a unique position for this role. The student developed an e-learning platform for simulation and applications for industry, a major contribution. A former student and employer also mentioned that the doctoral education in E&M at UPET has helped him develop not only technically but also as a human-being personally, he would not be where he is without it.

One can make some recommendations in terms of opportunities for improvement that may be seen as *weaknesses*: The time to graduation is expected to be three years. This may not be enough, as some students asked for extension to 4th year. The requirement for publishing, one proceeding and one indexed journal article, before defending theses may be challenging. There is financial support, both internal and external. These scholarships are available, though they have been limited. Scholarship for Romanians Everywhere, financed by the state has attracted international students. Increasing funding and its duration by seeking additional sources of funds other than governmental/university ones may be helpful. An opportunity here may be to offer certificate programs to the industry with short courses for profit. The proceedings from such efforts can increase both the availability of student funds and industrial cooperation.

V. Conclusions and general recommendations

Internationally, Engineering and Management programs at graduate level are both popular and serve an essential need from industry, academia, and applied research. The popularity seems to stem from the multidisciplinary nature of the curricula and research and cooperation with the industry. Students, practicing engineering professionals and administrators of technical organizations with diverse backgrounds are attracted to the field of Engineering and Management as they all find themselves operating in a project management environment.

The Doctoral Field in Engineering and Management at UPET has clear and well-defined objectives and well thought out curricula, fulfilling a unique need for a multidisciplinary doctoral program addressing critical issues in transitioning from fossil fuels to green energy. The program produces quality theses and attracts international students. The doctoral program has been fulfilling all quality assurance measures in meeting standards imposed given its small size and resources (see section III). The doctoral theses and student research are leading to scholarly publications, research proposals and industry/government partnerships.

The doctoral program has also been seeking International cooperation and experience and an entrepreneurial dimension in research and education. The program seems to be a major inspiration that enables creation of innovation, creation of new small businesses and start-ups by its graduates.

Some students may like to see more provisions in enabling collaborations with other students in exchanging ideas and experiences. Perhaps a research forum, held once or twice a year to enable collaborations with masters and doctoral students and other domains (such as with Industrial Engineering) in exchanging ideas and experiences may be very helpful where each doctoral student presents an outline of their research/methodology to other doctoral students and the faculty of the interested programs. We do this annually and invite industry and government representatives also. It is also a good recruiting tool to increase PhD enrollments.

Overall, the doctoral program of Engineering and Management at UPET is a successful program with a significant potential to grow rapidly, with many opportunities. Indications show that the

doctoral field in Engineering and Management is well managed by its faculty and administrators, with dedicated advisors going out of their way in advising students in challenging research areas.

E&M at UPET has the opportunity to grow significantly in terms of faculty and students due to a unique socio-economic position and support from upper university administration. The rector clearly seems to support the E&M program due to its research focus transition to green energy. It seems like new faculty will be added, growing the program and its resources. Cooperation with other EM programs in Romania is encouraged.

The doctoral students, graduates and employers are very complementary of the doctoral program. It seems to be an ideal environment where students and their advisors are working in harmony to make the program a success. The program also contributes significantly to the local development challenges. All indications are there that the E&M doctoral program will grow significantly in the near future.

As an external evaluator, I give my high approval of the Doctoral field in Engineering and Management at UPET.

VI. References and resources:

- Doctoral field of Engineering and Management at University of Petroșani (UPET), Self-Assessment Report (2021).
- 11.10.2021 ZOOM meeting: 12:15 pm. EM Contact person and Self-Assessment Report Team.
- 11.10.2021 ZOOM meeting: 14:00 pm. EM Doctoral Supervisors.
- 11.10.2021 ZOOM meeting: 15:15 pm. Research Centers.
- 12.10.2021 ZOOM meeting: 12:30 pm. EM Doctoral Students.
- 12.10.2021 ZOOM meeting: 15:15 pm. EM Doctoral Graduates.
- 12.10.2021 ZOOM meeting: 16:30 pm. Employers of Doctoral Graduates, EM.