TECHNICAL UNIVERSITY OF CLUJ-NAPOKA

DOCTORAL FIELD

Engineering and Management

EXTERNAL EVALUATOR REPORT

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Contents

I. Introduction

This report summarizes the findings from the external evaluation of Doctoral Field of Engineering and Management at the Technical University of Cluj-Napoka (TUCN). First, some background information is given as context, then the resources and methods used to prepare this report is listed. Next, an analysis of the performance indicators is given, followed by a SWOT analysis and recommendations. Finally, conclusions are made.

General Background: The Technical University of Cluj-Napoca is one of the 12 universities of "*advanced research and education*" in Romania. TUCN's major objective is the involvement in advanced scientific research and gaining of significant scientific results through interdisciplinary and multidisciplinary topics.

Human resources

Within the doctoral field of Engineering and management, currently there are11 PhD supervisors (coordinators) responsible for advising doctoral students. The PhD supervisors are listed in the internal evaluation report. Out of the total of 11 supervisors, 2 are from outside IOSUD and one is retired.

Financial Resources Funding comes from, governmental funds allocated, the University's own revenues for internal competitions, support grants for research, awarding research results and/or awarding monthly research grants.

Doctoral field of Engineering and Management:

The first admission for the field of doctoral studies Engineering and Management took place in 2008. Engineering and Management is an interdisciplinary field that brings together disciplines of engineering, management and economics. The field was born as a response to the needs of the industry. TUCN ranks among the best schools in engineering and management in the country (TUCN Internal Evaluation Report, 2021).

Course work for the doctoral program is determined by the doctoral coordinator and the student depending on the research and thesis area. An ethics course is compulsory that must be taken during the first semester of study. In six months, students submit a project/research proposal. The students must publish at least three articles within three years (One must be in an indexed journal).

The eleven doctoral coordinators have a wide range of multidisciplinary expertise, such as quality management, innovation, engineering economics, marketing and digitalization. The enrollments and completed theses have been increasing over time. 20 to 30 doctoral students are admitted each year.

Mission: "Mission for the field of doctoral studies engineering and management is to generate an educational framework associated with the Socratic of framing in truth, good and utility". Emphasis is on multidisciplinary application of engineering, science and management in solving real world problems.

Objectives: Objectives are materialized in:
1. Development of research, innovation and creativity initiated from a broader professional thematic framework that capitalizes on knowledge and procedures mainly engineering to be conducted in a managerial paradigm, from idea to application. Promoting entrepreneurship in line with the EU's Europe 2020 strategy.

2. Increasing the level of professional and general culture of those who complete these forms of improvement and the transfer to the community of the personal model of activism and ethical conduct, with an impact on the development of the community and human society as a whole, incentive to overcome for each individual and increase respect for any personal effort that contributes to the social good (TUCN Internal Evaluation Report, 2021)

The Doctoral Program: The cycle of doctoral studies in the doctoral field *Engineering and management* has two compulsory components:

a) Training program based on advanced university studies (PPUA), within the doctoral school;
b) Individual Scientific Research Program (PCS).

The Training Program based on advanced university studies is supported by teachers from the Technical University of Cluj-Napoca and by invited professors from other universities. The scientific training program of the doctoral student is carried out under the guidance of the PhD supervisor and consists of the Scientific Research Project and Scientific Research Reports. Their role is to prepare the doctoral student, to help and evaluate him in order to elaborate the doctoral thesis.

Research: In the period 2016-2020 in the field of *Engineering and management*, 32 doctoral theses were completed. published a total of 110 scientific papers, of which 45 in ISI-listed journals and ISI Proceedings, 55 in BDI publications and 10 in non-indexed publications. During the same period, PhD supervisors also published 36 books, 351 articles, of which 51 in ISI-listed journals, 122 in ISI Proceedings, 164 in BDI publications and 14 in non-indexed publications.

Within the training program based on advanced university studies, the doctoral student participates in the first year of doctoral studies in the activities within 3-4 subjects of doctoral studies. These subjects are chosen in such a way that they are all offered in the first year of the doctoral internship, and the cumulative duration of the training program based on advanced university studies cannot exceed 3 months. The subjects in the training program based on

advanced university studies of a doctoral student are agreed and proposed by the doctoral supervisor together with the doctoral student

In the first 6 months from the signing of the study agreement, the doctoral student must present the Scientific Research Project proposal for the doctoral thesis. The theme of the scientific research project is established by the doctoral supervisor together with the doctoral student.

The doctoral studies are completed by defending the doctoral thesis in public session. The duration of the doctoral program is usually 3 years. For good reasons, the duration of the doctoral program can be extended by 1-2 years, with the approval of the University Senate, at the proposal of the doctoral supervisor.

II. Methods Used

This report is based on the information supplied by IOSUD-TUCN Internal-Evaluation report of the Doctoral Field of Engineering & Management and several Zoom meetings/discussions with program administrators, program coordinator, faculty advisors, doctoral students, doctoral graduates and several 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 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 Zoom meetings/discussions listed in References. The internal evaluation report was not easy to read but the information needed for the analysis was available.

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.1.1. Institutional, administrative, managerial structures and financial resources.

All performance sub indicators under A.1.1.1

All performance sub indicators under A.1.1.2 were accomplished

A.1.2. IOSUD has the logistical resources necessary to accomplish the mission of doctoral studies

All performance sub indicators under A.1.2.1 were accomplished

All performance sub indicators under A.1.2.2 were accomplished

A.1.3. IOSUD ensures that financial resources are used optimally, and revenues from doctoral studies are supplemented by funding in addition to that provided by the government

All performance sub indicators under A.1.3.1 were accomplished

All performance sub indicators under A.1.3.2 were partially accomplished.

> Proportion of doctoral students in the field of Engineering and Management, existing at the time of elaboration of the evaluation, who benefit for a minimum of six months from other sources of funding than government funding, through scholarships granted by individuals or legal entities or are financially supported by research or development grants institutional/human resources, is 2%. This is lower than the expected indicator percentage. This may be due to the uncertain times due to the pandemic where external resources are extremely limited.

All performance sub indicators under A.1.3.3 were accomplished

A.2.1. IOSUD have a research infrastructure to support the development of activities specific to doctoral studies

All performance sub indicators under A.2.1.1 were accomplished

A.3.1. At the level of each field there are qualified staff with the necessary experience to carry out the doctoral study program

All performance sub indicators under A.3.1.1 were accomplished

All performance sub indicators under A.3.1.2 were accomplished

All performance sub indicators under A.3.1.3 were accomplished

All performance sub indicators under A.3.1.4 were accomplished

A.3.2. PhD Supervisors from the Doctoral field carry out an internationally visible scientific activity

All performance sub indicators under A.3.2.1 were accomplished

All performance sub indicators under A.3.2.2 were accomplished

B. EDUCATIONAL EFFECTIVENESS

B.1.1. The institution organizing doctoral studies has the capacity to attract candidates from outside the higher education institution or in greater numbers than the number of places financed from the state budget.

All performance sub indicators under B.1.1.1 were accomplished

B.1.2. Candidates admitted to doctoral studies demonstrates academic, research and professional performance.

All performance sub indicators under B.1.2.1 were accomplished

All performance sub indicators under B.1.2.2 were accomplished

B.2.1. The training program based on advanced university studies is appropriate to improve the research skills of doctoral students and to strengthen ethical behavior in science.

All performance sub indicators under B.2.1.1 were accomplished

All performance sub indicators under B.2.1.2 were accomplished

All performance sub indicators under B.2.1.3 were accomplished

All performance sub indicators under B.2.1.4 were accomplished

All performance sub indicators under B.2.1.5 were accomplished

B.3.1. The research is capitalized by doctoral students through presentations at scientific conferences, scientific publications, technology transfer, patents, products, service orders

All performance sub indicators under B.3.1.1 were accomplished

All performance sub indicators under B.3.1.2 were accomplished

B.3.2. The Doctoral School calls a significant number of external scientific references in the commissions for public defense of doctoral theses for the evaluated field.

Performance sub indicators under B.3.2.1 were partially accomplished

> In the period 2016-2020, within this field, 32 doctoral theses were defended. The internal analysis report shows two case exceedances to 3 theses coordinated by the same PhD Supervisor, in a year. This performance in my opinion is commendable. With such high number of theses defended, load on a couple of advisors were slightly higher. These advisors went out of their way in helping their students to graduate. This may indicate a need for additional advisors appointed for this domain.

Performance sub indicators under B.3.2.2 were partially accomplished

The same reasoning for this indicator as above (B.3.2.1) may be made.

C. QUALITY MANAGEMENT

C.1.1. The institutional framework exist and policies and procedures are applied for the relevant internal quality assurance.

All performance sub indicators under C.1.1.1 were accomplished

All performance sub indicators under C.1.1.2 were accomplished

C.2.1. The information of interest for doctoral students, future candidates, respectively the information of public interest is available for consultation in electronic format.

All performance sub indicators under C.2.1.1 were accomplished

C.2.2. IOSUD/Doctoral School provides doctoral students access to the resources needed to conduct doctoral studies

All performance sub indicators under C.2.2.1 were accomplished

All performance sub indicators under C.2.2.2 were accomplished

All performance sub indicators under C.2.2.3 were accomplished

C.3.1. There is a strategy and it is applied to increase the degree of internationalization of doctoral studies

All performance sub indicators under C.3.1.1 were accomplished

All performance sub indicators under C.3.1.2 were accomplished

All performance sub indicators under C.3.1.3 were accomplished.

Overall, Quality Assurance measures/indicators in meeting standards on the level of Engineering Management Doctoral Field is accomplished.

CONCLUSION FOR A, B, C: The indicators A, B, and C are met in most significant areas for all quality, practical and operational purposes.

IV. SWOT Analysis and Recommendations

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

The doctoral program has dedicated advisors (coordinators), students and administration. The program has been and continues to be successful as evidenced by increasing graduates and theses defended over time.

Current students enrolled were very complementary of the doctoral program in engineering and management at TUCN. The multidisciplinary nature of the program and how it addresses the research and development needs of big companies in planning, communications, scheduling and overall, in project management is a major strength.

Contributions to the industry: The program is valuable in complementing work experience and contributing to industry and companies in accomplishing project and new product development

tasks. Meeting with the employers of engineering and management students and graduates showed that the employers are complimentary of the research, development, communication, and project management skills acquired from the doctoral program. Such experience has led to establishment of partnerships with the university. They praised the multidisciplinary nature of the program. An employer of a current student mentioned improved communication and problem-solving skills with upper management, project teams and the customers. All employers praised the systemic thinking and leadership skills obtained through the education received at TUCN's doctoral program in Engineering and Management.

Students seem to be mostly working professionals or have significant engineering experience. Some of them seem to have high positions in their organizations. They bring industrial experience and potential resources and research ideas/themes for the doctoral program.

The advisors are willing to meet with the students at least weekly, including weekends, going out of their way. This was mentioned by all students as a strength. The students were highly complementary of their doctoral advisors.

TUCN has a solid IT platform that enables the students and the coordinators to communicate frequently and easily. Online availability of classes and meetings, especially during the pandemic has been a strength.

The program enables students/graduates to advance in their careers: Even though there may not be direct financial rewards from industry for the graduates, they were able to advance their careers and positions due to their education at TUCN, thereby receiving financial gains indirectly.

Opportunities provided for teaching is a strength that were also mentioned by the graduates. Graduates value this opportunity as class discussions lead to new ideas and cooperation.

The program promotes industry and academic cooperation to encourage doctoral research and development of new products/processes with local companies.

Doctoral Research is leading to getting new patents and increased number of publications as an indicator of success. Publications are expected to increase as number of students and advisors increase. Students are educated in writing proposals and publishing papers as one of the competencies.

A strength and also an ***opportunity*** is the effort in promoting international cooperation for the doctoral field. The doctoral program has been successfully seeking International co-operation in research, education, and student exchange. These activities can attract new students.
Another one is the introduction of the entrepreneurial and organizational dimension. This was mentioned by the graduates and employers. These two are major opportunities for advancing the program and serving industry needs.

One can make some recommendations in terms of opportunities for improvement that may be seen as *weaknesses*:

Several students thought that the three years for completion of the doctoral program is not enough to publish three papers and complete the thesis. Even though there is a provision for extending the time for a year or two, the provision seems hard to get as it has to go through the university Senate. Recommend flexibility in completion time which preferably will be determined by the student, the coordinator and the department chair (due to funding issues), perhaps extending it to 4 years.

Some students would like to see more provisions in enabling collaborations with other students in exchanging ideas and experiences. Perhaps a research forum may be held twice a year where each doctoral student presents an outline of their research/methodology to all other doctoral students and the faculty of the department. We do this twice a year and invite industry representatives also.

One student mentioned that there is more appreciation of engineering management program and research in other members of the European Union than there is locally. The above suggestion may be extended in inviting faculty and coordinators from other disciplines/doctoral programs at TUCN to student presentations on research.

There may be some issues with doctoral student funding in terms of university funded compensation and availability of scholarships. They seem to be limited and not enough to attract new students. Recommend increasing funding by seeking additional sources of funds other than governmental/university ones. 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. It may also be a part of the important entrepreneurial dimension mentioned above.

Considering that some of the coordinators advise more than the desired 8 students, additional resources and increasing the number of coordinators is recommended.

The doctoral school seems to impose strict (mostly numerical) standards in the operation of doctoral fields. Some of this is understandable and desirable. However, there may be differences in the operation and management of each field. Some flexibility in each doctoral field establishing their own standards and criteria, especially in relevant qualitative measures may be helpful.

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. 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.

Overall, the Doctoral Field in Engineering and Management at TUCN has a clear and well-defined mission statement, objectives and well thought out curricula, fulfilling a unique need for a multidisciplinary doctoral program addressing industry demands and meeting the expectations. The doctoral program has been fulfilling Quality Assurance measures in meeting standards imposed (see section III). The doctoral theses and student research are leading to patents, scholarly publications and research proposals.

Students have access to the library, software, multidisciplinary labs and financial resources. The doctoral program has been successfully seeking International experience and an entrepreneurial dimension in research and education.

This is a successful doctoral program growing rapidly. Indications are there that the doctoral field in Engineering and Management is well managed by its administrators, with dedicated advisors going out of their way in advising students and being available any time. Doctoral students are highly complementary of their advisors. It seems to be an ideal environment where student advisors are working in harmony to make the program a continued success. As an external evaluator, I give my high approval of the Doctoral field in Engineering and Management at TUCN.

VI. References and resources:

TUCN Internal Evaluation Report of the Field of Doctoral studies in Engineering and Management (2021).

12.7.2021 ZOOM meeting, 15:15 pm. With Doctoral Supervisors.

13.7.2021 ZOOM meeting: 16:00 pm. With Doctoral students TUCN.

13.7.2021 ZOOM meeting: 18:30 pm. With Doctoral graduates.

14.7.2021 ZOOM meeting: 16:15 pm. With employers of doctoral graduates.