



The External Evaluation Report of a Doctoral Study Domain

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I. Introduction¹

In this chapter, the following shall be summarized:

- the context in which this external evaluation report was drafted (**the type of evaluation, the period of the evaluation visit, the composition of the Experts Committee** etc.);
- details about the doctoral school(s) of which the doctoral domain under review is part (number of doctoral advisors, number of students, institutional context, short history etc.);
- details about the doctoral study domain under review (number of students, institutional context, short history etc.).

The evaluation was carried out for the Energy Engineering doctoral domain in the period from 14.6.-25.6.2021. The panel members were prof. I. Felea, prof. K. Miličević and student member T. Lupu.

Introduction according to the self-assessment document:

The School of Engineering - Polytechnic University of Bucharest, through the efforts of professors and students, has consolidated its academic status and prestige in 200 years, being the most prestigious school of engineers in Romania. You come from all sides and all the state! was the call of Gheorghe Lazăr from Înștiințarea, through which, through the princely Opis, in 1818 the first higher technical school with teaching in Romanian and the first engineering courses were opened, at the Sfântul Sava monastery in Bucharest, which, in 1832, was reorganized into the College of at St. Sava. On October 1, 1864, the "School of Bridges and Roads, Mines and Architecture" was established, which, on October 30, 1867, became the "School of Bridges, Roads and Mines", with a duration of studies of 5 years. Under the leadership of Gheorghe Duca, on April 1, 1881, the institution was restructured and became the "National School of Bridges and Roads".

¹ Each time when applicable the information shall be presented gender-wise.



On June 10, 1920, the Polytechnic School of Bucharest was established, with four sections: Electromechanics, Constructions, Mines and Metallurgy, Industrial Section. Since November 1920, the name is changed to POLITEHNICA in Bucharest. On August 3, 1948, the Polytechnic Institute of Bucharest was established, which initially included four faculties and in which, since 1950, most of the current faculties have appeared. Based on the resolution of the University Senate of November 1992, the Polytechnic Institute of Bucharest became, by OM 7195 / 19.12.1992, the University POLITEHNICA of Bucharest (UPB). As a recognition of the achievements of the entire academic community, in terms of excellence of study programs, quality and visibility of scientific research, through its administrative and institutional capacity, POLITEHNICA University of Bucharest has been classified as advanced research and education universities, being the only university in Romania which is in all areas of ranking in the first category (A) for all study programs. In 2015, following the evaluation of the Romanian Agency for Quality Assurance in Higher Education, UPB obtained the reconfirmation of accreditation, with a high degree of trust.

II. Methods used

This chapter will contain the methods and tools used in the external evaluation process, before and during the evaluation visit, including at least:

- The analysis of the internal evaluation report of the doctoral study domain under review and its Annexes;
- The analysis of documents made available by the IOSUD, in physical format, during the evaluation visit (if such documents have been requested);
- The analysis of documents, data and information available on the IOSUD/Doctoral School(s) website, in electronic format;
- Visiting the buildings included in the institution's property, comprising (indicative and non- exhaustive list, which shall be changed according to the context):
 - classrooms;
 - laboratories;
 - the institution's library;
 - research centers;
 - the Career Counselling and Guidance Center;
 - lecture halls for students;
 - the student residences;
 - the student cafeteria;
 - sports ground etc.;
- Meeting/discussions with doctoral students in the doctoral study domain under review;
- Meeting/Discussions with the graduates of the doctoral study domain under review;
- Meeting/Discussions with employers of the graduates in the doctoral study domain under review;
- Meeting/Discussions with the school officials of the Doctoral School(s) in which the doctoral study domain under review is operating;
- Meeting/Discussions with the doctoral advisors in the doctoral study domain under review;
- Meeting/discussions with the representatives of the various structures of the IOSUD/Doctoral School(s) in which the doctoral study domain under review is operating;



- The Council of the Doctoral School, the University Senate, the Board of Directors, the Quality Assessment and Assurance Commission, the Quality Assurance Department, the Ethics Commission (including with the student representatives of these structures);
- the Career Counselling and Guidance Center;
- student organizations;
- secretariats;
- various departments/administrative offices (Social/Student residences-Cafeterias etc.);
- Application of questionnaires to doctoral students or academic staff in the doctoral study domain under review.

The methods and tools used in the external evaluation process included:

- The analysis of the internal evaluation report of the doctoral study domain under review and its Annexes;
- The analysis of documents, data and information available on the IOSUD/Doctoral School(s) website, in electronic format;
- Online preliminary meeting for the preparation and harmonization of evaluation steps, in hybrid mode, of doctoral study domains and IOSUD;
- Online meeting with representatives of the institution and of the Council for Academic Doctoral Studies (CSUD);
- Online meeting with the contact person for the doctoral study domain under review and the team who drafted the internal evaluation report;
- Online meeting with Doctoral Schools Council (CSD members);
- Online meeting with PhD students;
- Online meeting with the academic staff corresponding to the doctoral study domain;
- Online meeting with the members of the Ethics Commission;
- Online meeting with the Directors/ persons in charge of the research centers/laboratories within the doctoral study domain;
- Online meeting with employers of Doctoral graduates in the domain;
- Online meeting with graduates for the respective doctoral study domain;
- Internal domain evaluation panel meetings;

III. Analysis of ARACIS's performance indicators

Domain A. INSTITUTIONAL CAPACITY

**general description of domain analysis.*

Criterion A.1. The administrative, managerial institutional structures and the financial resources

**general description of the criterion analysis.*

Standard A.1.1. The institution organizing doctoral studies (IOSUD) has implemented



the effective functioning mechanisms provided for in the specific legislation on the organization of doctoral studies.

**general description of the standard analysis.*

Performance Indicator A.1.1.1. *The existence of specific regulations and their application at the level of the Doctoral School of the respective university doctoral study domain:*

(a) the internal regulations of the Doctoral School;

(b) the Methodology for conducting elections for the position of director of the Council of doctoral school (CSD), as well as elections by the students of their representative in CSD and the evidence of their conduct;

c) the Methodologies for organizing and conducting doctoral studies (for the admission of doctoral students, for the completion of doctoral studies);

d) the existence of mechanisms for recognizing the status of a Doctoral advisor and the equivalence of the doctoral degree obtained abroad;

e) functional management structures (Council of the doctoral school), giving as well proof of the regularity of meetings;

f) the contract for doctoral studies;

g) internal procedures for the analysis and approval of proposals regarding the training for doctoral study programs based on advanced academic studies.

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

The institution organizing doctoral studies (IOSUD) has implemented the effective functioning mechanisms provided for in the specific legislation on the organization of doctoral studies. It has provided as annexes of self-assessment document all needed documents:

- Annex A.1.1.1.a

- Annex A.1.1.1.b

- Annex A.1.1.1.c

- Annex A.1.1.1.d

- Annex A.1.1.1.e

- Annex A.1.1.1.f

- Annex A.1.1.1.g

There is a slight mismatch between the order of documents in this report template and in the self-assessment document, but it seems that the Annexes cover all relevant procedures.

Additionally, the meetings did not raise any doubts about effective functioning mechanisms.

Performance Indicator A.1.1.2. *The doctoral school' Regulation includes mandatory criteria, procedures and standards binding on the aspects specified in Article 17, paragraph (5) of the Government Decision No. 681/2011 on the approval of the Code of Doctoral Studies with subsequent amendments and additions.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself



- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled

The Doctoral School Regulations include criteria, procedures and standards required for the aspects specified in art.17, par. 5 of the Code of doctoral university studies, approved by Government Decision no. 681/2011, with subsequent amendments and completions.
The meetings did not raise any doubts about the indicator.

Standard A.1.2. The IOSUD has the logistical resources necessary to carry out the doctoral studies' mission.

**general description of the standard analysis.*

Performance Indicator A.1.2.1. *The existence and effectiveness of an appropriate IT system to keep track of doctoral students and their academic background.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

Student management system <http://studenti.pub.ro/> implements general functions such as administrative data acquisition and processing for the supervision of the activities of all students enrolled at University POLITEHNICA of Bucharest for Doctoral studies. The database contains all the information required in the "Unique Matriculation Register" for each study cycle.

The Energy Doctoral School of UPB provides an integrated information system of PhD students and their activity during their doctoral study program, based on advanced academic studies (PPA) and scientific research program (PCS), managed by the secretary of the doctoral school restricted to its competency.

The meetings did not raise any doubts about the indicator.

Performance Indicator A.1.2.2. *The existence and use of an appropriate software program and evidence of its use to verify the percentage of similarity in all doctoral theses.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

Turnitin provides instructors with the tools they need to interact with students in the process of writing, providing feedback and evaluating the documents they send.

Within the Polytechnic University of Bucharest, all the leading doctoral professors have individual accounts on the Turnitin platform received from CSUD through the Doctoral Schools of the University.



Students, in turn, have access to Turnitin through doctoral supervisors.
The meetings did not raise any doubts about the indicator.

Standard A.1.3. The IOSUD makes sure that financial resources are used optimally, and the revenues obtained from doctoral studies are supplemented through additional funding besides governmental funding.

**general description of the standard analysis.*

Performance Indicator A.1.3.1. Existence of at least one research or institutional / human resources development grant under implementation at the time of submission of the internal evaluation file, per doctoral study domain under evaluation, or existence of at least 2 research or institutional development / human resources grant for the doctoral study domain, obtained by doctoral thesis advisors operating in the evaluated domain within the past 5 years. The grants address relevant themes for the respective domain and, as a rule, are engaging doctoral students.

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled

In the last 5 years, 42 research-development-innovation grants coordinated by DS members have been
The meetings did not raise any doubts about the indicator. Nevertheless, it is recommended to develop a strategy to increase the number and amount of project funds. For example, UPB and/or doctoral i.e. some kind of "start-up" to initiate research activities and prepare it for a carried out.

Performance Indicator *A.1.3.2. The percentage of doctoral students active at the time of the evaluation, who for at least six months receive additional funding sources besides government funding, through scholarships awarded by individual persons or by legal entities, or who are financially supported through research or institutional / human resources development grants is not less than 20%.

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

Within the field of doctoral studies in Energy Engineering there are a total number of 162 doctoral students receiving funding from the state budget. Of these, a number of 42 doctoral students received / benefit from complementary funding of at least 6 months (table 11 in the self-assessment document) representing a percentage of 25.93% of the total number of students enrolled at the time of sending the self-assessment report.

Performance Indicator *A.1.3.3.2 At least 10% of the total amount of doctoral grants



obtained by the university through institutional contracts and of tuition fees collected from the doctoral students enrolled in the paid tuition system is used to reimburse professional training expenses of doctoral students (attending conferences, summer schools, training, programs abroad, publication of specialty papers or other specific forms of dissemination etc.).

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is partially fulfilled.

In the self-assessment document, there was no data about this indicator. Upon additional enquiry the DD contact person provided percentages (e.g. 22,12% for year 2020). Furthermore, also upon additional enquiry, the information was provided that each PhD student has allocated an annual amount for research activities, which in 2020 was 1440 Euro.

However, it is not completely clear how this percentage/amount was calculated/determined. Thus, it is recommended to check these numbers/percentages/amounts and define them precisely in the future (and check if it is sufficient for students!) to be prepared for future evaluation procedures and have it internally as one of the relevant indicators.

Additionally, at the meetings seemed that the criteria for the financing of conferences is not completely clear to the students. Thus, it is recommended to define criteria more precisely and to communicate them to the students.

Criterion A.2. Research infrastructure

**general description of the criterion analysis.*

Standard A.2.1. The IOSUD has a modern research infrastructure to support the conduct of doctoral studies' specific activities.

**general description of the standard analysis.*

Performance Indicator A.2.1.1. The venues and the material equipment available to the doctoral school enable the research activities in the evaluated domain to be carried out, in line with the assumed mission and objectives (computers, specific software, equipment, laboratory equipment, library, access to international databases etc.). The research infrastructure and the provision of research services are presented to the public through a specific platform. The research infrastructure described above, which was purchased and developed within the past 5 years will be presented distinctly.

² The indicators marked with an asterisk (*) hold a special status, referring exclusively to the evaluation of doctoral studies domains, as per Article 12 from the annex No.1 of the Order of the minister of education No. 3651/12.04.2021 approving the Methodology for evaluating university doctoral studies and the system of criteria, standards and performance indicators used in the evaluation. In case they are not met, the Agency extends a period of maximum 3 years to IOSUD to correct the respective deficiencies.



- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

The research assets of the Energy Doctoral School are constituted by laboratories and research facilities of the departments within the Faculty of Power Engineering and of the research centers. The research assets are presented in the Annex A.2.1.1. The research infrastructure of each laboratory within the Energy Doctoral School, posted on the ERRIS platform, are presented in table 7 of the self-assessment

In general, the meetings:

- Online meeting with PhD students;
 - Online meeting with the Directors/ persons in charge of the research centers/laboratories within the doctoral study domain;
 - Online meeting with employers of Doctoral graduates in the domain;
 - Online meeting with graduates for the respective doctoral study domain;
- have confirmed the satisfaction with the equipment and the resources in general.

Criterion A.3. Quality of Human Resources

**general description of the criterion analysis.*

Standard A.3.1. At the level of each domain there are sufficient qualified staff to ensure the conduct of doctoral study program.

**general description of the standard analysis.*

Performance Indicator A.3.1.1. *Minimum three doctoral thesis advisors within that doctoral domain, and at least 50% of them (but no less than three) meet the minimum standards of the National Council for Attestation of University Degrees, Diplomas and Certificates (CNATDCU) in force at the time when the evaluation is carried out, which standards are required and mandatory for obtaining the enabling certification.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

All 29 PhD supervisors fulfill the CNATDCU criteria for the professor degree (see Table 13 of the self-assessment document), which represents 100% percent.

The meetings did not raise any doubts about the indicator.

Performance Indicator *A.3.1.2. *At least 50% of all doctoral advisors have a full-time employment contract for an indefinite period with the IOSUD.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents



and the evaluation visit itself

Recommendations:

The indicator is fulfilled

The percentage of doctoral supervisors that are full members in UPB is: 75,86% (see Table 14 of the self-assessment document).

The meetings did not raise any doubts about the indicator.

Performance Indicator A.3.1.3. *The study subjects in the education program based on advanced higher education studies pertaining to the doctoral domain are taught by teaching staff or researchers who are doctoral thesis advisors / certified doctoral thesis advisors, professors / CS I or lecturer / CS II, with proved expertise in the field of the study subjects they teach, or other specialists in the field who meet the standards established by the institution in relation with the aforementioned teaching and research functions, as provided by the law.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

The training program based on advanced university studies related to the field of Energy Engineering includes specialized disciplines and disciplines that develop transversal skills (Ethics, Research Methodology and scientific authorship, project management), totaling 30 credit points.

The meetings did not raise any doubts about the indicator.

Performance Indicator *A.3.1.4. *The percentage of doctoral thesis advisors who concomitantly coordinate more than 8 doctoral students, but no more than 12, who are themselves studying in doctoral programs³ does not exceed 20%.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is partially fulfilled.

In the self-assessment document there was data that the share of PhD supervisors who simultaneously coordinate more than 8 doctoral students, but not more than 12, is 24.14%. However, there were in addition three supervisors with more than 12 doctoral students. Upon additional enquiry the percentage was corrected to 17,24% (after writing the self-assessment document some students were expelled), but it remained unclear how many supervisors have more than 12 doctoral students. Hence, it is recommended to clarify these data.

Standard A.3.2. *The Doctoral advisors within the domain are carrying out a scientific activity visible at international level.*

*general description of the standard analysis.

Performance Indicator A.3.2.1. *At least 50% of the doctoral thesis advisors in the evaluated domain have at least 5 Web of Science- or ERIH-indexed publications in magazines of impact, or other achievements of relevant significance for that domain, including international-level contributions that indicate progress in scientific research - development - innovation for the evaluated domain. The aforementioned doctoral thesis advisors enjoy international awareness within the past five years, consisting of: membership on scientific boards of international publications and conferences; membership on boards of international professional associations; guests in conferences or expert groups working abroad, or membership on doctoral defense commissions at universities abroad or co-leading with universities abroad. For Arts and Sports and Physical Education Sciences, doctoral thesis advisors shall prove their international visibility within the past five years by their membership on the boards of professional associations, membership in organizing committees of arts events and international competitions, membership on juries or umpire teams in artistic events or international competitions.*

- *description of the facts, the findings from the assessed institution's documents and the evaluation visit itself*

- *analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself*

Recommendations:

The indicator is fulfilled

The list of five representative publications for each scientific PhD supervisor and complementary international visibility (membership in the scientific committees of international publications and mentions highlighting their the boards of international professional associations; the quality of a invited speake at conferences or at groups of experts held abroad or the quality of a member of commissions for the defense of doctoral theses at foreign universities or in co-supervision with a foreign university) is presented in Table 17 of the self- assesment document.

The meetings did not raise any doubts about the indicator. However, to increase the visibility even more, it is recommended to define measures of promoting and rewarding the scientific excellence of doctoral thesis advisors.

Performance Indicator *A.3.2.2. *At least 50% of the doctoral thesis advisors in a specific doctoral study domain continue to be active in their scientific field, and acquire at least 25% of the score requested by the minimal CNATDCU standards in force at the time of the evaluation, which are required and mandatory for acquiring their enabling certificate, based on their scientific results within the past five years.*

- *description of the facts, the findings from the assessed institution's documents and the evaluation visit itself*

- *analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself*

³ 3 years for the doctoral university studies with the duration stipulated at Article 159, paragraph (3), respectively 4 years for the doctoral university studies with the duration stipulated at Article 174, paragraph (3) of the Law of national education No.1/2011 with subsequent amendments and additions, with additional extension periods approved as per Article 39, paragraph (3) of the Code of doctoral studies approved by the GD No. 681/2011 with subsequent amendments and additions.



Recommendations:

The indicator is fulfilled

The summarizing table with doctoral supervisors and 25% of the score required by the minimum CNATDCU standards in force at the date of evaluation, necessary and mandatory for obtaining the habilitation certificate based on scientific results from the last 5 years, are reported in table 18 of the self-assessment document. Out of 29 supervisors only 4 do percentage.

The meetings did not raise any doubts about the indicator.

Domain B. EDUCATIONAL EFFECTIVENESS

**general description of domain analysis.*

Criterion B.1. The number, quality and diversity of candidates enrolled for the admission contest

**general description of the criterion analysis.*

Standard B.1.1. The institution organizing doctoral studies has the capacity to attract candidates from outside the higher education institution or a number of candidates exceeding the number of seats available.

**general description of the standard analysis.*

Performance Indicator *B.1.1.1. *The ratio between the number of graduates of masters' programs of other higher education institutions, national or foreign, who have enrolled for the doctoral admission contest within the past five years and the number of seats funded by the state budget, put out through contest within the doctoral domain is at least 0.2 or the ratio between the number of candidates within the past five years and the number of seats funded by the state budget put out through contest within the doctoral studies domain is at least 1,2.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is not fulfilled.

The result is an average ratio of 0.148, with an upward trend in the last 4 years. It is recommended to develop a strategy how to attract students from other educational institutions.

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

**general description of the standard analysis.*

Performance Indicator *B.1.2.1. *Admission to doctoral study programs is based on selection criteria including: previous academic, research and professional*



performance, their interest for scientific or arts/sports research, publications in the domain and a proposal for a research subject. Interviewing the candidate is compulsory, as part of the admission procedure.

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled

There was no information about this indicator in the self-assessment document. However, based on the meetings it seems that the EE complies with these requirements; each year the admission methodology is approved by UPB Senate.

Performance Indicator B.1.2.2. *The expelling rate, including renouncement / dropping out of doctoral students 3, respectively 4, years after admission⁴ does not exceed 30%.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled

As it can be seen in Table 30, the share of dropout/abandon of PhD students 2 years from admission is 0.5%. The meetings did not raise any doubts about the indicator.

Criterion B.2. The content of doctoral programs

**general description of the criterion analysis.*

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

**general description of the standard analysis.*

Performance Indicator B.2.1.1. *The training program based on advanced academic studies includes at least 3 disciplines relevant to the scientific research training of doctoral students; at least one of these disciplines is intended to study in-depth the research methodology and/or the statistical data processing.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

⁴ 3 years for the doctoral university studies with the duration stipulated at Article 159, paragraph (3), respectively 4 years for the doctoral university studies with the duration stipulated at Article 174, paragraph (3) of the Law of national education No. 1/2011 with subsequent amendments and additions.



Recommendations:

The indicator is fulfilled.

The training program based on advanced university studies in IOSUD-UPB includes 5 compulsory disciplines, of which 2 are specialized disciplines:

- Power system dynamics
- Artificial intelligence in power systems
- Smart grids
- Modeling and simulation of power systems
- Power quality
- Optimization of power system operation
- Electricity markets
- Smart cities
- Energy efficiency
- Heat and mass transfer
- Power plants and CO2 reduction
- Renewable energy sources
- Wastewater treatment plant
- Hydro power plants

established by the doctoral supervisor and 3 are disciplines that provide transversal competencies, which were approved by the Rector's Decision no.41 /30.10.2018, at the proposal of CSUD. This decision is presented in the Annex, as well as the State of functions, at CSUD level, which certifies the programming of the disciplines, as can be seen in the figure in the self-assessment document. The subject sheets (relevant for the training in scientific research of doctoral students, of which at least one discipline is intended for the in-depth study of the research methodology and / or statistical data processing) are presented in the self-assessment document and in

The meetings did not raise any doubts about the indicator.

Performance Indicator B.2.1.2. *At least one discipline is dedicated to Ethics and Intellectual Property in scientific research or there are well-defined topics on these subjects within a discipline taught in the doctoral program.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled

The discipline of Ethics is provided in the training program based on advanced university studies as a compulsory discipline for all PhD students in the first year.

The meetings did not raise any doubts about the indicator.

Performance Indicator B.2.1.3. *The IOSUD has mechanisms to ensure that the academic training program based on advanced university studies addresses „the learning outcomes”, specifying the knowledge, skills, responsibility and autonomy that doctoral students should acquire after completing each discipline or through the research activities⁵.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself



- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled

The doctoral study programs ensure the formation of professional competencies (content, cognitive and research) in specialized fields, as well as transversal competencies. The training program based on advanced university studies is a tool for enriching the knowledge of the doctoral student and that serves him for the development in good condition of the scientific research program and for the acquisition of advanced competencies specific to the doctoral university cycle, being specified by the code doctoral studies. At the Doctoral Schools level, an analysis is made regarding the evaluation of doctoral supervisors taking into account the result of their evaluation at the department level and the evaluation by students and the necessary measures are established which are variable according to the provisions of the Doctoral School Regulations.

The meetings did not raise any doubts about the indicator.

Performance Indicator B.2.1.4. All along the duration of the doctoral training, doctoral students in the domain receive counselling/guidance from functional guidance commissions, which is reflected in written guidance and feedback or regular meeting.

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

In the period 2016-2020, 46 PhD students defended their thesis. Table 21 reports, for example, some publications elaborated by the PhD students with members of their guidance committee. All papers reported in table 21 of the self-assessment document are visible in **Scopus**.

The meetings did not raise any doubts about the indicator. Furthermore, the students are very positive towards their relationship with their supervisors in general. For example, defining the PhD area also based on the student's interests at the beginning of the study/research is very beneficial for the success of the research.

Nevertheless, it is recommended to open a communication channel for students to report discretely possible problems

(technical, scientific, personal, ...) with their advisor.

Performance Indicator B.2.1.5. For a doctoral study domain, the ratio between the number of doctoral students and the number of teaching staff/researchers providing doctoral guidance must not exceed 3:1.

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

⁵ Or by what the graduate should know, understand and to be able to do, according to the provisions of the Methodology of 17 March 2017 regarding inscription and registration of higher education qualifications in the National Register of Qualifications in Higher Education (RNCIS) approved by the Order No.3475/2017 with subsequent amendments and additions.



- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is not fulfilled

The average of the reported years indicates an average coefficient of approx. 3,11. Hence it is recommended to decrease the number of students by enrolling only the students of the highest quality, and/or to increase the number of teaching staff/researchers, e.g. through projects.

Criterion B.3. The results of doctoral studies and procedures for their evaluation.

**general description of the criterion analysis.*

Standard B.3.1. Doctoral students capitalize on the research through presentations at scientific conferences, scientific publications, technological transfer, patents, products and service orders.

**general description of the standard analysis.*

Performance Indicator B.3.1.1. *For the evaluated domain, the evaluation commission will be provided with at least one paper or some other relevant contribution per doctoral student who has obtained a doctor's title within the past 5 years. From this list, the members of the evaluation commission shall randomly select 5 such papers / relevant contributions per doctoral study domain for review. At least 3 selected papers must contain significant original contributions in the respective domain.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

There are over 50 papers written by 12 students who has obtained a doctor's title within the past 5 years. In agreement with the DD panel coordinator (prof. Felea), I have randomly chosen two papers:

In the paper:

Passive house analysis in terms of energy performance; Mirela Mihai, Vladimir Tanasiev, Cristian Dinca, Adrian Badea,, Ruxandra Vidu

photovoltaic panels were analyzed in terms of energy production and economic investment. The energy demand of the house was simulated using the EnergyPlus software in order to understand the house performance during cold and hot seasons using various occupancy scenarios. This study brings essential information that can be used in the future for all the buildings that will be built in Romania, because most of the buildings are residential and represent 80% of the buildings, with a large energy consumption for heating (i.e. 56% of the total energy consumption). Although important within Romania, these results can not be taken as significant original contribution, i.e. they lack universal applicability.

The paper:

Comparison of PI and PR Current Controllers applied on Two-Level VSC-HVDC Transmission System; Alisa Manoloiu,

Heverton A. Pereira,, Remus Teodorescu, Massimo Bongiorno, Mircea Eremia, Selenio R. Silva analyzes differences between alpha-beta and dq reference frames regarding the control of two-level VSC-HVDC current loop and dc-link voltage outer loop. The results show that that PR can work without voltage feedforward with better results than PI controller. The proportional gain for the PR controller was modified in order to improve the system response without relying on voltage feedforward path. Thus, the stability performance was kept as in case with voltage feedforward. These results can be taken as significant original contributions.

Performance Indicator *B.3.1.2. *The ratio between the number of presentations of doctoral students who completed their doctoral studies within the evaluated period (past 5 years), including posters, exhibitions made at prestigious international events (organized in the country or abroad) and the number of doctoral students who have completed their doctoral studies within the evaluated period (past 5 years) is at least 1.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

According to the self-assessment document, the ratio between the number of presentations of PhD students who completed their doctoral studies in the evaluated period (last 5 years), including posters, exhibitions, held at prestigious international events (held in the country or abroad) and the number of doctoral students who have completed their doctoral studies in the evaluated period (last five years) is greater than 1. Upon additional enquiry, the exact ratio is provided (3,57).

The meetings did not raise any doubts about the indicator.

Standard B.3.2. *The Doctoral School engages a significant number of external scientific specialists in the commissions for public defense of doctoral theses in the analyzed domain.*

**general description of the standard analysis.*

Performance Indicator *B.3.2.1. *The number of doctoral theses allocated to one specialist coming from a higher education institution, other than the evaluated IOSUD should not exceed two (2) in a year for the theses coordinated by the same doctoral thesis advisor.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is not fulfilled.

According to the Table 24 of the self-assessment document, there are supervisors who participated in



more than 2 theses coordinated by the same doctoral supervisor, in a year. Hence, there is as a recommendation to increase the number of PhD supervisors in corresponding fields (e.g. the nuclear field).

Performance Indicator *B.3.2.2. *The ratio between the doctoral theses allocated to one scientific specialist coming from a higher education institution, other than the institution where the defense on the doctoral thesis is organized, and the number of doctoral theses presented in the same doctoral study domain in the doctoral school should not exceed 0.3, considering the past five years. Only those doctoral study domains in which minimum ten doctoral theses have been presented within the past five years should be analyzed.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

Based on Table 24 of the self-assessment document and on an additional enquiry, the exact ratio is 0,148. The meetings did not raise any doubts about the indicator.

Domain C. QUALITY MANAGEMENT

**general description of domain analysis.*

Criterion C.1. Existence and periodic implementation of the internal quality assurance system

**general description of the criterion analysis.*

Standard C.1.1. There are an institutional framework and procedures in place and relevant internal quality assurance policies, applied for monitoring the internal quality assurance.

**general description of the standard analysis.*

Performance Indicator C.1.1.1. *The Doctoral school in the respective university study domain shall demonstrate the continuous development of the evaluation process and its internal quality assurance following a procedure developed and applied at the level of the IOSUD, the following assessed criteria being mandatory:*

(a) the scientific work of Doctoral advisors;

(b) the infrastructure and logistics necessary to carry out the research activity;

(c) the procedures and subsequent rules based on which doctoral studies are organized;

d) the scientific activity of doctoral students;

e) the training program based on advanced academic studies of doctoral students;

f) social and academic services (including for participation at different events,



publishing papers etc.) and counselling made available to doctoral students.

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled

In accordance with the provisions of the National Education Law no. 1/2011 in the University POLITEHNICA of Bucharest, the self-evaluation and evaluation of the teachers is performed annually, using the procedure approved annually by the UPB Senate. Each teacher has the obligation to complete the self-assessment form, with the concrete specification of the activities carried out for a calendar year. The department council analyses the Self-evaluation Form and based on it and the data known

in the department, based on the evaluation questionnaires completed by the students, it elaborates the Form. The peer evaluation also refers to the involvement in the activities of the department / faculty / included in the teaching norms, the quality of forming and working in a team, the contribution to the university that are not

department and the guidance of students. The data are centralized at the level of the Department and are discussed individually with each teacher. If measures are imposed, they are established at the level of the Department Council.

The meetings did not raise any doubts about the data. There is also a strategy document given on additional enquiry, but it is missing measurable indicators. Thus, it is recommended to have such a document in order to have more clearly defined goals and a path how to reach them.

Performance Indicator *C.1.1.2. Mechanisms are implemented during the stage of the doctoral study program to enable feedback from doctoral students allowing to identify their needs, as well as their overall level of satisfaction with the doctoral study program in order to ensure continuous improvement of the academic and administrative processes. Following the analysis of the results, there is evidence that an action plan was drafted and implemented.

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is partially fulfilled

The Energy Doctoral School has implemented feedback mechanisms from PhD students:

- questionnaires to assess the satisfaction of doctoral students;

- needs analysis

However, there is no evidence for actions taken based on the results of the feedback. Hence, it is recommended to use the feedback as the basis for needed changes and improvements.

Criterion C.2. Transparency of information and accessibility of learning resources

**general description of the criterion analysis.*

Standard C.2.1. Information of interest to doctoral students, future candidates and



public interest information is available for electronic format consultation.

**general description of the standard analysis.*

Performance Indicator C.2.1.1. *The IOSUD publishes on the website of the organizing institution, in compliance with the general regulations on data protection, information such as:*

- (a) the Doctoral School regulation;*
- (b) the admission regulation;*
- (c) the doctoral studies contract;*
- (d) the study completion regulation including the procedure for the public presentation of the thesis*
- (e) the content of training program based on advanced academic studies;*
- (f) the academic and scientific profile, thematic areas/research themes of the Doctoral advisor within the domain, as well as their institutional contact data within the domain, as well as their institutional contact data*
- (g) the list of doctoral students within the domain with necessary information (year of registration; advisor);*
- (h) information on the standards for developing the doctoral thesis;*
- (i) links to the doctoral theses' summaries to be publicly presented and the date, time, place where they will be presented; this information will be communicated at least twenty days before the presentation.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled

The Energy Doctoral School has a dedicated website, through which all the information regarding the is

Energy Doctoral School

The meetings did not raise any doubts about the indicator.

Standard C.2.2. *The IOSUD/The Doctoral School provides doctoral students with access to the resources needed for conducting doctoral studies.*

**general description of the standard analysis.*

Performance Indicator C.2.2.1. *All doctoral students have free access to one platform providing academic databases relevant to the doctoral studies domain of their thesis.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled

All doctoral students from UPB have access to the scientific literature to sustain the Romanian research and education system

– ANELIS PLUS 2020. A copy of the contract for the provision of this access between ANELIS PLUS and UPB is presented in the Annex. Within University POLITEHNICA of Bucharest, all doctoral students from the Energy Doctoral School benefit, through the national project ANELIS Plus 2020, from online access to electronic scientific resources (databases / scientific journal platforms with full text and bibliographic and bibliometric databases) in order to support and stimulation of scientific production at national level. The meetings did not raise any doubts about the indicator.

Performance Indicator C.2.2.2. *Each doctoral student shall have access, upon request, to an electronic system for verifying the degree of similarity with other existing scientific or artistic works.*

- *description of the facts, the findings from the assessed institution's documents and the evaluation visit itself*

- *analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself*

Recommendations:

The indicator is fulfilled.

After completing the doctoral thesis developed in the Energy Doctoral School, the thesis and abstracts will go through an analysis of similarities with the Turnitin program, provided by IOSUD-UPB. The similarity analysis is done by the doctoral supervisor, in the presence of the doctoral student. The duration of the verification may not exceed 30 days from the submission.

It is recommended to encourage students to use the system for their work in general (scientific papers and similar), not only for the doctoral thesis.

Performance Indicator C.2.2.3. *All doctoral students have access to scientific research laboratories or other facilities depending on the specific domain/domains within the Doctoral School, according to internal order procedures.*

- *description of the facts, the findings from the assessed institution's documents and the evaluation visit itself*

- *analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself*

Recommendations:

The indicator is fulfilled.

The material base of the Energy Doctoral School consists of the laboratories and research facilities of the departments and research centers of the faculty. All doctoral students have free access to the entire material base of the doctoral school based on a prior appointment to the head of the laboratory. The meetings did not raise any doubts about the indicator.



Criterion C.3. Internationalization

**general description of the criterion analysis.*

Standard C.3.1. There is a strategy in place and it is applied to enhance the internationalization of doctoral studies.

**general description of the standard analysis.*

Performance Indicator *C.3.1.1. *IOSUD, for every evaluated domain, has concluded mobility agreements with universities abroad, with research institutes, with companies working in the field of study, aimed at the mobility of doctoral students and academic staff (e.g., ERASMUS agreements for the doctoral studies). At least 35% of the doctoral students have completed a training course abroad or other mobility forms such as attending international scientific conferences. IOSUD drafts and applies policies and measures aiming at increasing the number of doctoral students participating at mobility periods abroad, up to at least 20%, which is the target at the level of the European Higher Education Area.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled

The table 27 shows the share of doctoral students who have done internships abroad or participated in conferences abroad, which is 38,27%. Thereby, 23 students went to the internship or mobility in Universities from Europe for a period of at least 3 months up to 6 months (this data was given upon additional enquiry).

The meetings did not raise any doubts about the data.

Performance Indicator C.3.1.2. *In the evaluated doctoral study domain, support is granted, including financial support, to the organization of doctoral studies in international co-tutelage or invitation of leading experts to deliver courses/lectures for doctoral students.*

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled

There was 7 co-supervisions since 2014 and only 2 reported given lectures. Hence, it is recommended to increase the numbers, especially one of courses/lectures delivered by leading international experts.

Performance Indicator C.3.1.3. *The internationalization of activities carried out during the doctoral studies is supported by IOSUD through concrete measures (e.g., by participating in educational fairs to attract international doctoral students; by*



including international experts in guidance committees or doctoral committees etc.).

- description of the facts, the findings from the assessed institution's documents and the evaluation visit itself

- analysis of the facts, the findings from the assessed institution's documents and the evaluation visit itself

Recommendations:

The indicator is fulfilled.

UPB participated in 2016-2020 in 38 educational fairs to attract international doctoral students. The meetings did not raise any doubts about the indicator.

IV.SWOT Analysis

<p><u>Strengths:</u></p> <p>- the strengths identified throughout the report will be resumed as part of the indicators' analysis. Other general strengths that do not fall within a particular indicator may be formulated.</p> <p>- laboratories are well-equipped</p> <p>- students are satisfied with their advisors and the PhD study in general</p> <p>- participation in projects, including cooperation with the industry and other doctoral schools (and/or universities)</p>	<p><u>Weaknesses:</u></p> <p>- the weaknesses identified throughout the report will be resumed as part of the indicators' analysis. Other general weaknesses that do not fall within a particular indicator may be formulated.</p> <p>- unclear financial support for students and research teams in the starting phase of research</p>
<p><u>Opportunities:</u></p> <p>- possible lines of action for the development of the institution under review shall be identified;</p> <p>- examples of opportunities: a favorable economic environment in the proximity of the assessed institution, the uniqueness of the study programs and their relevance to the local/national market, the overall attractiveness of the study programs etc.</p> <p>- possible stronger cooperation with the industry based on existing agreements with the largest companies in Romania (Transelectrica, Engie, Enel) and research institutes for research (COMOTI, ICSI Rm. Valcea, ICPE-CA, ICEMENERG) and collaborations</p> <p>- stronger internationalization based on existing agreements with universities from Europe (Politecnico di Milano, Politecnico di Madrid, INSA</p>	<p><u>Threats:</u></p> <p>- the possible causes of the deficient aspects (the causes of the identified weaknesses), which are practically the threats to the proper functioning of the institution, shall be identified;</p> <p>- besides, there may be external threats, such as: the inopportune economic environment in the proximity of the assessed institution, the conduct of low attractiveness study programs for both candidates and the labor market etc.</p> <p>- PhD study seems to be too hard for students employed outside the University, i.e. it is hard for them to balance work and studying. This could result with a lower interest to enroll the PhD study.</p> <p>- the research area "energy" is really broad. Hence, it is really challenging to follow the newest development and to ensure resources for balanced</p>



Lyon etc.)	development within all aspects of energy research
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V. Overview of judgments awarded and of the recommendations

No.	Type of indicator (*, C)	Performance indicator	Judgment	Recommendations

The recommendations contained in the report shall be resumed in the indicators' analysis. Other general recommendations may be made that do not fit within a particular indicator.

VERY IMPORTANT!!! – *Each identified weakness must be correlated with at least one recommendation to improve the situation!*

VI. Conclusions and general recommendations

Several important issues raised during the evaluation are resumed and some general conclusions are drawn on the quality of the education provided within the doctoral study domain under review; the Experts' Panel also presents general assessments about the institution. Other general recommendation may also be presented, which cannot be related to a specific indicator and have not been presented at point V.

A decision is proposed, together with the reasons for granting it (if the Experts' Panel members do not reach a consensus, each of them can propose and argue his/her own decision).

VII. Annexes

The following types of documents shall be attached:

- *The detailed schedule of the evaluation visit – MANDATORY.*
- *The survey questionnaire applied to doctoral students or academic staff in the doctoral study domain under review, the results - optional (e.g., in graphic form) and their interpretation - if applicable.*
- *Scanned documents – any document requested from the IOSUD during the evaluation visit and received, which is not found in the internal evaluation file received before the visit and referred to in the report.*
- *Pictures – if relevant issues are raised regarding the condition of the student residences, cafeterias, premises for teaching and learning activities, library etc.*
- *Screenshots/Print screens of the Doctoral School/IOSUD website proving specific claims in the report, accompanied by the date when they were accessed and*



saved.

- *Any other documents relevant to the evaluation process referred to in the report.*

Prof. Kruno Milicevic