

## **The External Evaluation Report of a Doctoral Study Domain**

### Contents

- I. Introduction
- II. Methods used
- III. Analysis of performance indicators
- IV. SWOT Analysis
- V. Overview of judgments awarded and of the recommendations
- VI. Conclusions and general recommendations
- VII. Annexes

### **I. Introduction<sup>1</sup>**

This report was drafted during the evaluation of the doctoral studies field SYSTEMS ENGINEERING within the POLYTECHNIC UNIVERSITY OF BUCHAREST. The audiences took place between 14 and 25 June 2021, and the composition of the commission of evaluators was:

- Prof.dr.ing. Marian Barbu – Universitatea „Dunărea de Jos” din Galați;
- Prof.dr.ing. Ramon Vilanova Arbos – Universitat Autònoma de Barcelona;
- Drd.ing. Florina-Luminița Besnea – Universitatea din Craiova.

The field of Systems Engineering is part of the Doctoral School of Automation and Computers. The Doctoral School of Automation and Computers was established in 2012, in accordance with the Regulation on the organization of Doctoral Schools in the Polytechnic University of Bucharest. The Doctoral School of Automation and Computers is one of the 14 existing doctoral schools within IOSUD from the Polytechnic University of Bucharest. This doctoral school manages two doctoral fields: Systems Engineering and Computer Engineering and Information Technology, comprising a number of 44 scientific leaders, of which:

- in the field of Systems Engineering there are 24 doctoral supervisors, 18 holders within the institution, and 6 are associates;
- in the field of Computers and Information Technology there are 20 doctoral supervisors, 16 holders within the institution, and 4 are associates.

Within the Doctoral School of Automation and Computers there are a number of 271 PhD students in internship, of which:

- in the field of Systems Engineering there are 105 doctoral students;
- in the field of Computers and Information Technology there are 166 PhD students.

According to the provided report, the research mission of the Doctoral School of Automation and Computers is in accordance with the mission of the Polytechnic University of Bucharest on training through scientific research and research, development and innovation, as well as national and international priorities on scientific research in the fields of study in which he organizes doctoral studies: Systems and Computer Engineering and Information Technology:

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<sup>1</sup> Each time when applicable the information shall be presented gender-wise.



- 1) Increasing scientific performance in doctoral programs in Systems and Computer Engineering and Information Technology;
- 2) Development of interdisciplinary collaborations between the scientific research groups within the Doctoral School of Automation and Computers;
- 3) Development of the research infrastructure from the Doctoral School of Automation and Computers as a premise for the realization of some internationally competitive doctoral theses;
- 4) Promoting doctoral studies in the Doctoral School of Automation and Computers at various international events and attracting as many foreign doctoral students as possible;
- 5) Attracting an important number of European projects dedicated to doctoral and postdoctoral research in the fields of Systems and Computer Engineering and Information Technology

According to the report, the research in the field of Systems Engineering is based on the concepts of Systems Theory corroborated with tools offered by Mathematics, Computer Science and the Basics of Electronics and Electrical Engineering. Within the field of PhD Systems Engineering there are thematic approaches such as:

- modeling, simulation and testing of technical processes;
- development of advanced production strategies: Industry 4.0 and Industry 5.0;
- advanced management systems: theoretical paradigms and implementation paradigms;
- the smart concept in engineering practice;
- analysis of computer systems;
- synthesis and management of advanced management systems;
- development of IoT solutions and Cyber-physical systems;
- development of service science and integration of solutions;
- intelligent robotics, cognitive and holonic manufacturing systems;
- intelligent production networks, energy distribution and supply chains.

Within the doctoral field of Systems Engineering, in the evaluated period 2016 - 2020, a number of 28 doctoral theses were publicly defended.

## II. Methods used

In the external evaluation process, before, and during the evaluation visit, the following methods and tools were used:

- Analysis of the Report of internal evaluation of the field of doctoral university studies evaluated and its annexes;
- Analysis of documents, data and information available on the IOSUD / School / Schools website Doctorates, in electronic format;
- Visit to buildings from the institution's patrimony, which include:
  - classrooms;
  - laboratories;
  - the institution's library;
  - research centers;
  - reading rooms for students;
- Meeting / online discussions with doctoral students in the field of evaluated doctoral university studies;
- Meeting / online discussions with employers of graduates in the field of doctoral studies evaluated;
- Online meeting / discussions with the management of the Doctoral School in which the field of evaluated doctoral university studies operates;
- Online meeting / discussions with doctoral supervisors in the field of evaluated doctoral university studies;
- Online meeting / discussions with the person in charge of the evaluated doctoral university field and with the team that made the internal evaluation report;
- Online meeting / discussions with directors / managers / research laboratories related to the field of doctoral studies;
- Meeting / discussions with representatives of the various structures of IOSUD / School / Schools Doctoral degrees in which the evaluated doctoral university field of work operates;



- The Doctoral School Council, the University Senate, the Board of Directors, the Evaluation and Quality Assurance Commission, the Quality Assurance Department, the Ethics Commission (including with the students representing these structures);
- Career Counseling and Guidance Center;
- student organizations;
- Application of questionnaires to doctoral students in the field of evaluated doctoral university studies.

### III. Analysis of ARACIS's performance indicators

#### **Domain A. INSTITUTIONAL CAPACITY**

IOSUD from the Polytechnic University of Bucharest and the Doctoral School of Automation and Computers included in this IOSUD, prove a good institutional capacity, which allows the development of doctoral studies in appropriate quality conditions.

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

*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.*

IOSUD within the Polytechnic University of Bucharest has approved and implemented the regulations provided in the specific legislation regarding the organization of doctoral studies.

**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.*

The implementation of internal regulations is accomplished satisfactorily. The institution provided the necessary documents and proofs of such implementation. The organisation has reached an appropriate level of maturity.

Recommendations: Some pages of the site devoted to doctoral studies are found only in Romanian. No English version. Should be translated (for example, site dedicated for the internal regulations at CSUD level, elections director of the Council of doctoral school (CSD)). Also, the one for the mechanisms for the recognition of the quality of PhD supervisor, but this one depends on the ministry.



The indicator is fulfilled

**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.*

Documentary proof is provided of the criteria, procedures and standards.

Recommendations: The SD\_AC regulation is in rumanian. English translation is recommended to be made available.

The indicator is fulfilled

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

IOSUD within the Polytechnic University of Bucharest has availability of the necessary software resources to support and carry out the doctoral studies in appropriate conditions

**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.*

Electronic platforms provided by UPB are used. The system is observed as complete and effective

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled.

**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.*

All PhD supervisors from SD\_AC have an account and use the Turnitin. Turnitin is an acknowledged platform for plagiarism detection. No evidences of its use are provided. However, a posteriori claim for more information has provided such evidences.

Recommendations: It has not found if it is established for PhD supervisors the obligation to provide plagiarism analysis as part of the reporting strategy. It is recommended to analyze if this should be established or just left at the discretion of the PhD supervisor.

The indicator is fulfilled.

**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.*

IOSUD from the Polytechnic University of Bucharest ensures that globally the financial resources are used optimally, and the revenues obtained from doctoral studies are supplemented by additional funding to that provided by the government.

**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.*

A total of 9 research grants were identified. Complete information regarding its use, field of application and owner of the grant is provided.

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled.

**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%.*

A total of 37 students are currently under project grants. Full list of projects with identification with grants provided are listed. The proportion of additional funding is  $(37/115) \cdot 100 = 32.17\%$ . Therefore above the 20% threshold

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled

**Performance Indicator \*A.1.3.3.<sup>2</sup>** *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.).*

The list of initiatives that support reimbursement is provided. These initiatives confirm the support of about 40%. Therefore above the 10% threshold

Recommendations: Even it seems that quantity is quite large, some additional information regarding how it spreads over the total doctoral students could provide a more global idea.

The indicator is fulfilled

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<sup>2</sup> 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.



## Criterion A.2. Research infrastructure

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

The Doctoral School of Automation and Computers from the Polytechnic University of Bucharest has a very good quality research infrastructure that can properly support the activities specific to doctoral university studies.

**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.*

Material and work spaces are aligned with the objectives of the doctoral domain. Web sites for research groups with lists of equipment are provided that allow to explore the available equipment. However, it has not been possible to find the equipment acquired during the last 5 years.

Recommendations: Annexes provided with the description of material and infrastructure equipment is provide din rumanian. So it ha sbeen difficult to locate material thatwas purchased and developed within the past 5 years . For next occasions, those critiral aspects should be better provided also in english

**The indicator is fulfilled**

## Criterion A.3. Quality of Human Resources

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

The Doctoral School of Automation and Computers from the Polytechnic University of Bucharest has qualified staff to conduct the doctoral university studies.

**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.*

A total of 20 out of 24 PhD supervisors meet the criteria. This represents a percentage clearly above the thresholds

Recommendations: Indicator accomplished satisfactorily. No reccomendations are issued

**The indicator is fulfilled**

**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.*

Employee certificates are presented for all full-time PhD supervisors. At the IS domain, there are 24 advisors, 6 of them are associated advisors. This provides a percentage of 75% of advisors with full-time employment



Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled

**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.*

It is verified that 100% of the studies of the doctoral domain are taught by experts of the required level.

Recommendations: No documentary proof is provided. Even a letter of statement issued by the programme coordinator or any academic governance with authority to state this would result beneficial

The indicator is fulfilled

**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 programs<sup>3</sup> does not exceed 20%.*

There are actually Two PhD supervisors currently coordinate more than 8 PhD students but less than 12. This results in a percentage of 8.33%. Clearly under the stated threshold

Recommendations: The information is provided as a PDF file. In order to facilitate the analysis, this kind of tables is better to provide them as excel files

The indicator is fulfilled

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

The Doctoral School of Automation and Computers from the Polytechnic University of Bucharest has doctoral advisors with an internationally visible scientific activity

**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*

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<sup>3</sup> 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.





*professional associations, membership in organizing committees of arts events and international competitions, membership on juries or umpire teams in artistic events or international competitions.*

PhD supervisors in the field show an excellent record of publications and international research recognition. Just one out of 24 does not meet the threshold

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled

**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.*

A total of 4 out of 20 can not provide the required level. However, the minimum percentage of 50% required is accomplished.

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled





## **Domain B. EDUCATIONAL EFFECTIVENESS**

IOSUD from the Polytechnic University of Bucharest and the Doctoral School of Automation and Computers included in this IOSUD, prove a good educational effectiveness, which allows the development of doctoral studies in appropriate quality conditions.

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

*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.*

IOSUD from the Polytechnic University of Bucharest and the Doctoral School of Automation and Computers included in this IOSUD prove, in the Systems engineering domain, they can attract doctoral candidates from outside the institutions.

**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.*

Apart from the first year in the set of 5 analysed, every year the application/admittance ratio is above the 0,2 threshold. Global average is 0,25.

Recommendations: Even the threshold is reached, it is passed on a quite adjusted level. So the programme is encouraged to increase the efectivity of the call effect and to increase attractiveness. Also taking into account that for every new admission you need 5 extra applicants to be on the level.

The indicator is fulfilled

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

IOSUD from the Polytechnic University of Bucharest and the Doctoral School of Automation and Computers prove the Systems Engineerig admitted candidates demonstrate goodacademic and professional level.

**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.*

This performance indicator information is not provided in the report. However from the interviews condicted it became clear the asmission procedure includes the stated criteria and procedures

Recommendations: Indicator accomplished satisfactorily. No reccomendations are issued

The indicator is fulfilled.

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

Even from the provided data at the report it is not clear the way the abandon / dropout rate for PhD students is computed, the accomplishment rate is really high, so PhD students finish their studies and (also from the interviews with PhD students) they are satisfied with the study programme.

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled.

## **Criterion B.2. The content of doctoral programs**

*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.*

The training program based on advanced university studies in the field of Systems Engineering is adequate to improve the research skills of doctoral students and to strengthen ethical behavior in science.

**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.*

5 courses are offered: Specialized discipline 1 (8 ECTS) Specialized discipline 2 (8 ECTS) Research methodology and scientific authorship (4 ECTS) Ethics of scientific research and intellectual property (6 ECTS) Project management (4 ECTS). They cover the stated domains in an explicit way.

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled

**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.*

The course Ethics of scientific research and intellectual property (6 ECTS) is offered. The discipline is explicitly covered.

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled

**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 activities<sup>5</sup>.*

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<sup>4</sup> 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.

<sup>5</sup> 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.



The requested mechanisms to ensure the academic programme addresses the stated academic objectives are in place. They are based on the existing SD\_AC quality assurance / feedback mechanism.

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled

**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.*

The information provided is in terms of joint publications joint publications of the doctoral student with at least one of the members of the guiding commission was chosen. This can not be considered as a proof of counselling/guidance

Recommendations: It is requested that guidance feedback in forms of PhD student report should be provided. Joint publications just reflect one of the aspects of the PhD activity. In addition, just to appear as co-author in one paper does not reflect the role of counselling nor the aspects PhD student needed

The indicator is fulfilled.

**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.*

The number of students used as admitted students is not coherent with the numbers listed in B.1.1.1. IN any case, due to the number of members of the steering committees the threshold is not exceeded in any case.

Recommendations: You should better show the number of PhD students each tutor is tutoring/guiding

The indicator is fulfilled.

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

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

In the case of the field of Systems Engineering within the Polytechnic University of Bucharest, the research is capitalized by doctoral students through presentations at scientific conferences and scientific publications.

**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.*

For each of the 28 PhD students who have obtained the title of doctor in the field of doctoral studies in Systems Engineering in the last five years and whose title has been validated by CNATDCU, 1-2 articles or other relevant contributions have been selected. Complete information is accessed at the provided IPB website.

Recommendations: Research that is reflected in the papers can be considered relevant as well as the corresponding journals where they are published. As a recommendation, it is seen that in quite a few papers, the PhD student is not the first author. This should be in case PhD student is the main driver of the conducted work, and this is what is supposed to be when the publication reflects findings relevant to the PhD

The indicator is fulfilled.



**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.*

The provided list of presentations conducted by PhD students during the period of evaluation shows the ratio is at least 1 for each student and clearly above 1 in global average. A total of about 70 presentations are listed, for the 28 doctoral students who completed their doctoral studies in the period 2016-2020.

Recommendations: Please, complete the information by showing the complementary set, This is, students that do not have any presentation.

The indicator is fulfilled.

**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.*

The Doctoral School of Automation and Computers appeals for the field of Systems Engineering to a significant number of external scientific references in the commissions for public defense of doctoral theses for the analyzed field.

**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.*

The list of 28 theses defended by PhD students in the field of Systems Engineering in the period 2016-2020 is provided. This is a quite complete information regarding all the conducted PhDs, however, it is not highlighted in any way when a member is not from IPB. Therefore it is not possible to make the validation check from the stated document. Additional information has been requested to and the indicator has been validated.

Recommendations: In the self-assessment report, it is stated that the analysis of this table shows that 10 of the references from other IOSUDs have more than 2 participations in the public support commissions. The criteria state that this should not exceed 2 in a year. So even the period is of 5 years, the average of 2 can not be considered as the value to be computed to reach the criteria. It should be the number by specialist

The indicator is fulfilled.

**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.*

As per the previous performance indicator, the list of 28 theses defended by PhD students in the field of Systems Engineering in the period 2016-2020 is provided. This is a quite complete information regarding all the conducted PhDs, however, it is not highlighted in any way when a member is not from UPB.

In the self-assessment report, the ratio between the number of doctoral theses assigned to a certain scientific referent from a higher education institution than UPB and the number of doctoral theses defended in the doctoral field Systems Engineering within SD\_AC is not higher of 0.3.

Recommendations: Please, highlight or allow easy differentiation of specialist form outside UPB

The indicator is fulfilled



## **Domain C. QUALITY MANAGEMENT**

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

IOSUD from the Polytechnic University of Bucharest and the Doctoral School of Automation and Computers included in this IOSUD, generally prove a good quality management, which allows the development of doctoral studies in appropriate quality conditions. An improvement in the degree of internationalization is needed.

*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.*

The Doctoral School of Automation and Computers has the institutional framework created for internal quality assurance, but measures are needed for its effective application.

**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.*

The operational procedure "Evaluation and internal monitoring of the evolution of doctoral schools" (PO-SC) was elaborated by the Quality Service of IOSUD UPB. It covers all required axes of analysis: a) the scientific activity of PhD supervisors; b) the infrastructure and logistics necessary to the research activity; c) the subsequent procedures and norms on the basis of which the doctoral studies are organized; d) the scientific activity of PhD students; e) the training program is based on advanced university studies of PhD students.

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled.

**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.*

As per the previous performance indicator, the operational procedure "Evaluation and internal monitoring of the evolution of doctoral schools" (PO-SC) was elaborated by the Quality Service of IOSUD UPB. Feedback mechanisms are implemented to get feedback from doctoral students are implemented in terms of two types of questionnaires: a) Questionnaire for assessing the satisfaction of doctoral students regarding the scientific research program, b) The questionnaire for assessing the satisfaction of doctoral students regarding the advanced training program.



Recommendations: The implemented forms are provided. However, no analysis of the results nor evidence that an action plan was drafted and implemented is provided. How often feedback is received? Evolution of the results from the questionnaire during the last years? This information is needed in order to have the complete quality evaluation mechanism

The indicator is partially fulfilled.

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

The Doctoral School of Automation and Computers proves transparency in the presentation of information and accessibility to learning resources.

*Standard C.2.1. Information of interest to doctoral students, future candidates and public interest information is available for electronic format consultation.*

In the case of Systems Engineering within the Doctoral School of Automation and Computers, the information of interest for doctoral students, future candidates, respectively the information of public interest are available for consultation in electronic format.

**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 advisors 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.*

Links to websites as well as to PDF documents with the information published are provided. Two issues are detected: 1) Some pages are only in Romanian and 2) Links to <https://upb.ro/wpcontent/uploads/2020/03/Regulament-organizare-sidesfasurare-studiiuniversitare-de-doctorat.pdf> and <https://upb.ro/wpcontent/uploads/2019/11/Regulament-Studii-POSTUNIVERSITARE-31.10.2019.pdf> are broken links. Pages can not be found (error 404)

Recommendations: Ensure all relevant pages can also be found in English. If they are supposed to also attract students from abroad, potential candidates should find the information in English. Also review provided information can be accessed

The indicator is fulfilled

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





In the case of Systems Engineering, within the Doctoral School of Automation and Computers, provides the necessary resources for conducting the doctoral studies.

**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.*

Different platforms are provided for accessing academic databases. 1) The "Politehnica" University of Bucharest benefits through the national ANELIS Plus 2020 Project from online access to electronic scientific resources. 2) In 2020, UPB concluded a free access agreement for teachers and students to specialized courses through the CourseEra platform.

No comments on access to other platforms such as IEEEExplore, ScienceDirect, etc

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled.

**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.*

PhD students have access to Turnitin with the consent of their doctoral supervisors.

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled.

**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.*

All PhD students have permanent access to the research laboratories available to SD\_AC. In the case of shared resources (e.g., Cloud platforms) or limited, access is planned by prior appointment.

Recommendations: Indicator accomplished satisfactorily. No recommendations are issued

The indicator is fulfilled.

### **Criterion C.3. Internationalization**

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

Within the Doctoral School of Automation and Computers, it is necessary to adopt an internationalization plan with clear and specific measures that will be part of the mission of doctoral studies.

**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.*





Two different kinds of mobilities are identified: a) internship or stays at other institutions, and b) stages abroad because of attending scientific events. Whereas for the second case there are over 100 presentations, just 2 of them in the field of IS accomplished training internships abroad. Therefore, taking together the 20% threshold is reached. However there is a clear need for increasing the internships abroad.

**Recommendations:** It is recommended to increase the opportunities for funding training internships abroad. Just 2 students can not be considered a success. A higher percentage of students (if not all) should at some time, conduct such internship.

**The indicator is fulfilled**

**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.*

The programme includes co-supervised theses in the field of Systems Engineering defended in the period 2016-2020. However, no documentary proof is found of other internationalisation actions such as the invitation of first-rate experts to give courses / lectures for doctoral students. Also, the financial support for promoting them is not shown.

**Recommendations:** It is recommended to establish a plan for promotion of visits/lectures/seminars from renowned international experts. This would also help internationalisation, establish contacts and promote co-supervised PhDs

**The indicator is fulfilled.**

**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.).*

Concrete measures for internationalisation are not clear. Even there is provided a list of international experts from prestigious universities in Europe, who were members in the commissions for public support of doctoral theses in the field of Systems Engineering, the list is so short for the dimension of the doctoral studies under evaluation

**Recommendations:** There is the need for a clear and specific internationalisation plan. Concrete measures should be established. They should be part of the doctoral studies mission and not be left to particular contacts of PhD supervisors

**The indicator is fulfilled.**



## IV. SWOT Analysis

<p><b><u>Strengths:</u></b></p> <ul style="list-style-type: none"> <li>▪ PhD supervisors prove a high level research activity;</li> <li>▪ The research infrastructure is corresponding to the assumed mission and objectives, avoiding the PRECIS research infrastructure;</li> <li>▪ Quality and quantity of doctoral students' dissemination activities.</li> </ul>	<p><b><u>Weaknesses:</u></b></p> <ul style="list-style-type: none"> <li>▪ Lack of clear evidence of the activity of the steering commissions;</li> <li>▪ Lack of application of evaluation mechanisms regarding the general level of satisfaction with the doctoral university study program;</li> <li>▪ Lack of existence and follow-up of an internationalization plan with clear and specific measures.</li> </ul>
<p><b><u>Opportunities:</u></b></p> <ul style="list-style-type: none"> <li>▪ The existence of some economic partners that express their interest for collaboration within the doctoral field of Systems Engineering;</li> <li>▪ The quality of doctoral supervisors allows obtaining a high degree of internationalization;</li> <li>▪ The topicality of the doctoral field allows attracting a significant number of candidates.</li> </ul>	<p><b><u>Threats:</u></b></p> <ul style="list-style-type: none"> <li>▪ Lack of establishing a budget for each doctoral student and / or Doctoral School with possible implications on the access to the endowments necessary for the adopted doctoral thesis, especially in a top field such as Systems Engineering;</li> <li>▪ Lack of close connection with the graduates of doctoral studies, in order to ensure an adequate feedback, aspect resulting from their non-participation in the scheduled meeting.</li> </ul>

## V. Overview of judgments awarded and of the recommendations

No.	Type of indicator (*, C)	Performance indicator	Judgment	Recommendations
1	*	A.1.1.1	Fulfilled	Some pages of the site devoted to doctoral studies are found only in Romanian. No English version. Should be translated (for example, site dedicated for the internal regulations at CSUD level, elections director of the Council of doctoral school (CSD)). Also, the one for the mechanisms for the recognition of the quality of PhD supervisor, but this one depends on the ministry.
2	*	A.1.1.2	Fulfilled	The SD_AC regulation is in rumanian.
3	*	A.1.2.1	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
4	*	A.1.2.2	Fulfilled	It has not found if it is established for PhD supervisors the obligation to provide plagiarism analisys as part of the reporting strategy. It is reccomended to analyze if this should be established or just left at the discretion of the PhD supervisor. No evidences of it suse are provided.
5	*	A.1.3.2	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
6	*	A.1.3.1	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
7	*	A.1.3.3	Fulfilled	Even it seems that quantity is quite large, some additional information regarding how it soreads over the total doctoral students could provide a more global idea.
8	C	A.2.1.1	Fulfilled	Annexes provided with the description of material and infrstructure equipment is provide din rumanian. So it ha sbeen difficult to locate material thatwas purchased and developed within the past 5 years . For next occasions, those critial aspects should be better prvided also in english
9	C	A.3.1.1	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
10	C	A.3.1.2	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
11	*	A.3.1.3	Fulfilled	No documentary proof is provided. Even a letter of stement issued by the programme coordinator or any academic governance with authority to state this would result beneficial
12	*	A.3.1.4	Fulfilled	The information is provided as a PDF file. In orderto facilitate the analysis, this kind of tables is better to provide them as excel files
13	C	A.3.2.1	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
14	*	A.3.2.2	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
15	*	B.1.1.1	Fulfilled	ven the threshold is reached, it is passed on a quite adjusted level. So the programme is encouraged to increase the efeitvity of the call effect and to increase attractiveness. Also taking into account that for every new admission you need 5 extra applicants to be on the level.
16	*	B.1.2.1	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
17	*	B.1.2.2	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
18	*	B.2.1.1	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
19	*	B.2.1.2	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
20	*	B.2.1.3	Fulfilled	Indicator accomplished satisfactorily. No reccomendations are issued
21	*	B.2.1.4	Fulfilled	It is requested that guidance feedback in forms of PhD student report should be provided. Joint publications just reflekt one of the aspects of the PhD activity. In addition, just to appear as co-author in one paper does not reflekt the vele of counsellng nor the aspects PhD student needed

22	C	B.2.1.5	Fulfilled	You should better show the number of PhD students each tutor is tutoring/guiding
23	C	B.3.1.1	Fulfilled	Research that is reflected in the papers can be considered relevant as well as the corresponding journals whether they are published. As a recommendation, it is seen that in quite a few papers, the PhD student is not the first author. This should be in case PhD student is the main driver of the conducted work, and this is what is supposed to be when the publication reflects findings relevant to the PhD
24	*	B.3.1.2	Fulfilled	Please, complete the information by showing the complementary set, This is, students that do not have any presentation
25	*	B.3.2.1	Fulfilled	IN the self-assessment report, it is stated that the analysis of this table shows that 10 of the references from other IOSUDs have more than 2 participations in the public support commissions. The criteria state that this should not exceed 2 in a year. So even the period is of 5 years, the average of 2 can not be considered as the value to be computed to reach the criteria. It should be the number by specialist
26	*	B.3.2.2	Fulfilled	Indicator accomplished satisfactorily. No recommendations are issued
27	*	C.1.1.1	Fulfilled	Indicator accomplished satisfactorily. No recommendations are issued
28	*	C.1.1.2	Partially Fulfilled	The implemented forms are provided. However, no analysis of the results nor evidence that an action plan was drafted and implemented is provided. How often feedback is received? Evolution of the results from the questionnaire during the last years? This information is needed in order to have the complete quality evaluation mechanism
29	*	C.2.1.1	Fulfilled	Ensure all relevant pages can also be found in english. If they are supposed to also attract students from abroad, potential candidates should find the information in english. Also review provided information can be accessed
30	*	C.2.2.1	Fulfilled	Indicator accomplished satisfactorily. No recommendations are issued
31	*	C.2.2.2	Fulfilled	Indicator accomplished satisfactorily. No recommendations are issued
32	*	C.2.2.3	Fulfilled	Indicator accomplished satisfactorily. No recommendations are issued
33	*	C.3.1.1	Fulfilled	It is recommended to increase the opportunities for funding training internships abroad. Just 2 students can not be considered a success. A higher percentage of students (if not all) should at some time, conduct such internship.
34	*	C.3.1.2	Fulfilled	It is recommended to establish a plan for promotion of visits/lectures/seminars from renowned international experts. This would also help internationalisation, establish contacts and promote co-supervised PhDs
35	*	C.3.1.3	Fulfilled	There is the need for a clear and specific internationalisation plan. Concrete measures should be established. They should be part of the doctoral studies mission and not be left to particular contacts of PhD supervisors

*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**

Doctoral school of Automation and Computers (SD\_AC) is part of IOSUD – Polytechnic University of Bucharest (UPB). From the analysis of the materials made available at institutional level it can be seen that all the criteria have been met with. Just in one case, (criteria C.1.1.2) there is a partial fulfillment. We present the general conclusions derived from the analysis within the field of Systems Engineering.

The doctoral studies have proven to be of high level according to other International doctoral study programmes. This level of excellence is achieved thanks to the high-level research activity of UPB academics that, also, act as PhD supervisors. In addition, doctoral students, in turn, do have the appropriated research infrastructure to conductt heir research activity.

There is identified great potential for internationalisation and netowrking with other institutions oustide Romania, those are emerging from high level supervisors. However that potential is not developped as it could. This fact could represent a great attraction of international doctoral students and more oppourtunities for academic relationship with international experts.

Even the generated and completes PhD thesis are of quality, there is a chance of improvement on the methodological part. Efficient feedbak mechanisms are to be implemented on order to get closer to the doctoral student activity. By improving the guidance the generated PhD thesis by sure will be able to enrich generating more research results.



## 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.*