Annex No. 3

The External Evaluation Report of a Doctoral Study Domain

Contents

I. Introduction[1]

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.).

Due to the restrictions of the pandemic crisis, the evaluation was mainly conducted online. Meetings were organized through the platform Zoom in Romanian but with a simultaneous translator service.

In 2017, the previous 10 doctoral schools were reorganized into a single Doctoral School, the IOSUD-TUCN doctoral school, being Computers and information technology one of the doctoral fields. At the level of doctoral fields, the doctoral university studies are organized in the Coordination Councils of the doctoral programs, which are subordinated to the TUCN Doctoral School. In particular, there is a Coordinating Council of the doctoral programs in Automation and Computers, with the fields of Systems Engineering and Computers and information technology.

Currently, the doctoral field of Computers and Information Technology has 12 supervisors. Currently, there are 77 doctoral students and 20 candidates have completed their studies in the last 5 years, by publicly defending their doctoral thesis.

The main research topics cover the following areas: Artificial Vision, Artificial View Mobile Robots, Virtual Reality, Distributed Systems, Computer Networks, Statistics and Probability, Service Oriented Distributed Computing, Business Process Modeling, Interactive Systems, Programming Engineering, Intelligent Agent Systems, Probabilities, Research Methodology, Web Semantics and Agents, Transactional Systems, Program Reliability, Algorithms and Calculability, Context Sensitive Software

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

Systems, Wireless and Mobile Communications, Industrial Informatics, Information Security, Digital Communications Systems, Ethics and Academic Integrity, Mathematical Models of Machine Learning..

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.

During the evaluation, the self- assessment report and provided annexes were used as the main elements for the evaluation. This information was complemented with additional documentation, such as

the presentations displayed during the online meetings and the physical visit to the educational and research infrastructure.

The online meetings proceeded as scheduled with the different stakeholders: representatives of the institution and of the Council for Academic Doctoral Studies (CSUD), responsible of doctoral domain and the team who drafted the internal evaluation report, doctoral coordinators, PhD students, members of the Ethics Commission, members of the Commission for Quality Evaluation and Assurance, the Directors and persons in charge of the research centers/laboratories, Doctoral Studies Council, employers of doctoral graduates and graduates. The meetings were moderated by the evaluation team, and attendants answered to the question raised by the members of the evaluation panel. In general, all the meeting were satisfactorily carried out and the discussion with attendants helped to clarify the different issues raised by the evaluation members.

III. Analysis of ARACIS's performance indicators

Domain A. INSTITUTIONAL CAPACITY

From the institutional and managerial point of view, the doctoral school covered satisfactorily all the issues related to the adoption and implementation of specific regulations for doctorate schools and enough financial and logistics resources are allocated to carry out the doctoral studies' mission. Infrastructure and human resources are adequate. Supervisors are scientfically active and productive, although it is suggested to increase the quality of publications.

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

The doctoral field of has demonstrated that that the administrative and managerial structures have been implemented according to the general legal framework and the specific regulations of the doctoral school. Moreover, advisors have proved their capacity to obtain research projects and grants that help to engage doctoral students. Finally, an appropriate percentage of external incomes are reinvested to support students' activities.

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.

The doctoral school has adequately designed and implemented a specific regulation to cover all the aspects of the doctoral studies. There is evidence that confirm the application of specific regulations, being this information accessible to all students both in Romanian and English.

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 TUCN Doctoral School has implemented a specific regulation that covers procedures for conducting the elections for the position of director of Doctoral School Council (CSD) and student elections of their representative in CSD, procedures for organizing and conducting doctoral studies, mechanisms for the recognition of the quality of PhD supervisor and procedures for analysis and approval of proposals on the subject of doctoral study programs.

Supplementary documentation provides evidence about elections procedures and results, internal regulations, functional management structures and minutes of the meetings and the doctoral study agreement. There is also a mechanism for analysing and approving the topic of each doctoral student.

There are no specific recommendations.

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.*

The regulations of the doctoral school covers the organization of the training program,the attendance obligations of doctoral students and the procedures for accepting new doctoral supervisors, for changing the doctoral supervisor of a certain PhD student and conflict mediation, for interrupting the doctoral program and for preventing fraud in scientific research.

Supplementary documentation provides TUCN Doctoral School Regulations.

There are no specific recommendations.

The indicator is fulfilled.

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

The IT system at the level of doctorate schools is fully implemented and keeps the records of students' admissions and progress. Additionally, all PhD supervisors and students are guaranteed the access to anti-plagiarism software, so they can freely use it to check the similarity index of their publications and thesis prior to the review process.

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.*

The application "Management of doctoral students" from the Technical University of Cluj-Napoca is a specific module within the Integrated University System (SINU designed to cover the necessities of

doctoral students. The system keeps record of both personal data, identification data, and specific data related to their status during studies: form of funding, year of enrolment, status in internship, previous studies, internal/external TUCN, doctoral topic and PhD Supervisor. The Doctoral School Digitization Platform (https://doctorat.utcluj.ro/) is a web application consisting of 10 modules that provides electronic management of information flows in the doctoral school and currently manages admission data, guidance committee, contracted subjects, research topic and other information for over 200 doctoral students.

Supplementary documentation provides more details about the information system and during the meetings with students and supervisors it was confirmed that the system is working properly.

There are no specific recommendations.

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 have access to Turnitin anti-plagiarism software and doctoral students have access through their supervisors. The procedure regarding the completion of doctoral studies within IOSUD-TUC-N regulates how to develop the similarity report that should be used by the instructor to identify plagiarism.

In the case of the Computers and Information Technology domain, when the level of similarity reported by Turnitin is greater than 15%, the doctoral student is invited to give explanations and/or to review the work. Supplementary documentation reports that the level of similarity of the theses from 2019-2020 was between 1% and 6%.

There are no specific recommendations.

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.

The doctoral field reveals the participation in research projects and grants that engage doctoral students and help to support their training program, publications and participation in conferences.

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.*

8 of 12 PhD supervisors in this field have won at least one research/institutional development contract obtained through competition in the last 5 years and the number of research contracts obtained through competition by PhD supervisors is 33, out of a total number of 34 agreements. The number of grants under implementation Is 8.

Supplementary documentation provides the complete list of agreements by supervisor, with the status finished or not of the agreement, the period and a web link. The topics of the agreements are relevant in the field of Computers and Information Technology and it is accredited the participation of doctoral students.

There are no specific recommendations.

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%.*

The percentage of scholarship students in training who benefit from other sources of funding is 32%. Supplementary documentation provides evidence of the participation of doctoral students in research scholarships for a period longer than 6 months.

There are no specific recommendations.

The indicator is fulfilled.

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.).*

The funding of training costs considers institutional expenses for access to specialized information (books, licenses), for the salary of people involved in the professional training of the doctoral students and for mobilities and participation in conferences. The percentage used to reimburse professional training expenses of doctoral students is 28.58%, over the required limit of 10%

In the supplementary documentation it can found the list of doctoral students in the field of Computers and information technology who benefited from international mobility in the period 2016-2020 and the amount of money aimed at reimbursing professional training expenses.

There are no specific recommendations.

The indicator is fulfilled.

Criterion A.2. Research infrastructure

The doctoral field has proved to have an adequeate research infrastructure to support the research work of doctoral students. Students have also access to the most relecant electronic resources in the field of Computer Science and Information Technology.

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

The doctoral field has proved to have an adequeate research infrastructure to support the research work of doctoral students. Students have also access to the most relecant electronic resources in the field of Computer Science and Information Technology.

[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.

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.*

The available infrastructure where students can carry out their scientific work includes the Distributed Systems Research Laboratory, the Image Processing and Shape Recognition Research Center, the Research Laboratory in Networks and Communication Protocols, the Computer Graphics and Interactive Systems Research Laboratory, the Knowledge Engineering Group, the Dedicated and Embedded Computing Systems Laboratory and the IoT Computational Intelligence Lab. Additionally, the platform Anelis Plus enables permanent access of doctoral students to online databases with publications relevant to the field.

The availability of the research infrastructure and the adequacy of the lab equipment was confirmed during the meeting with the persons in charge of the research centers and laboratories. During the online, session, the research lines and projects associated to the different research teams were also presented. The described works were aligned with the main topics of the doctoral domain. Thanks to the high number of finalized and ongoing projects in which the research staff is involved, the research infrastructure is continuously improved.

There are no specific recommendations.

The indicator is fulfilled.

Criterion A.3. Quality of Human Resources

All the indicators are accomplished although it is suggested to it is suggested to distribute students among supervisors more evenly and to increase the impact factor of the targeted journals.

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

All the indicators under this standard are accomplished: the majority of supervisors reach the minimum CNATDCU standards, and the training program is adequate and supported by full time lecturers with expertise within the domain of the disciplines. The number of supervisors that coordinate more than 8 doctoral students, but no more than 12, is below the required limit. However, students should be more evenly distributed among supervisors.

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.*

11 out of the 12 supervisors meet the minimum CNATDCU standards at the time of the evaluation, which represents a percentage of 91.67%. The accomplishment of the required standards is proved in the supplementary documentation.

There are no specific recommendations.

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.*

The 12 PhD supervisors of the doctoral domain are holders within IOSUD. Annexes contain the status and the holder certificates of the PhD supervisors of the field.

There are no specific recommendations.

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.*

All the disciplines in the training program of the Computers and Information Technology field are supported by teachers or researchers who have the quality of doctoral/qualified supervisor, professor/CS I or associate professor/CS II with proven expertise in the field of taught subjects, or industry specialists with doctorate, who have special skills in the discipline which they teach. Supplementary documentation provides the list of disciplines and the CV of the teachers/researchers responsible for each discipline.

There are no specific recommendations.

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[3] does not exceed 20%.*

According to the provided information, the number of supervisors that currently coordinate more than 8 doctoral students, but no more than 12 is 8.33%. However, there are 3 supervisors with only 1 o 0 students. Given that new supervisors have recently gained this condition, it is expected that in a short period of time the doctoral students will be more evenly distributed among supervisors. This point was confirmed during the meetings with supervisors.

As a recommendation, students should be more evenly distributed among supervisors.

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 two subsequent indicators are accomplished. However, it is suggested to increase the impact factor of the targeted journals.

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*

[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.

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.

The scientific production of PhD advisors shows that at least 50% have papers in journals with impact factors or conferences relevant in the field of Computers and Information Technology. Likewise, they show an active participation in editorial boards of journals and conferences. However, they should try to increase the number of papers in the Q1-Q2 rank. Supplementary documentation lists the five most relevant publications for each advisor in the last five years as well as their international activity in journals and conferences.

As a recommendation, supervisors should target journals with higher impact factors, within Q1-Q2 rank.

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.*

All the PhD supervisors have proven to be scientifically active, obtaining more than 25% from the score required by the minimum standards CNATDCU. Supplementary documentation provides data relative to the accomplishment of the CNATDCU minimum standards for the last 5 years by the PhD supervisors

There are no specific recommendations.

The indicator is fulfilled.

Domain B. EDUCATIONAL EFFECTIVENESS

The educational effectiveness of the doctoral domain is demonstrated by the number of enrolled students each year, with a low dropout rate, and the scientific production. Students receive a adequate guidance from advisory committees and there is enough human resources to support the required guidance. However, it is advised to include explicitly the learning outcomes as part of disciplines' curricula and to target at least one journal paper with impact factor per student.

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

The capacity of attraction of external students is above the required limit. The selection process is carefully implemented according to the established regulations, and the dropout ratio is clearly below the limit.

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.

The capacity of attraction of external students that belong to other higher education institutions is above the required threshold. However, the doctoral fields should increase its capacity to attract student from institutions different to TUCN.

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.*

The ratio between the number of master's degree graduates from other higher education institutions in the country or abroad who have registered for the doctoral admission competition in the last five years and the number of places funded from the state budget competition at the doctoral school is 0.262, close but higher than the required limit of 0.2.

As a recommendation, it is suggested to increase the promotion of the doctoral field in other Higher Education Institutions different to TUCN, so that the indicator can be easily accomplished.

The indicator is fulfilled.

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

The admission to the doctoral study program is clearly defined by the Doctoral School Regulations. The evaluation criteria for the interview considers the academic, research and professional performance of the candidates, their interest in scientific research, publications in the field and a research topic proposal. The procedures are adequately implemented and help to reduce the dropout rate below the required limit.

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.*

The evaluation of the candidates consists of two steps: an interview and an examination of linguistic competence. The evaluation criteria for the interview considers the academic, research and professional performance of the candidates, their interest in scientific research, publications in the field and a research topic proposal. Supplementary documentation provides the doctoral admission regulations.

There are no specific recommendations.

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[4] does not exceed 30%.*

The dropout/abandon rate for doctoral students 3 years after admission is 7.79%, which is clearly below the limit of 30%. Provided documentation shows the status of all the doctoral students in the period 2016 – 2020.

There are no specific recommendations.

The indicator is fulfilled.

Criterion B.2. The content of doctoral programs

The training program is adequate and includes the compulsory subject about Ethics. However, the specific subjects' program should explicitly include the learning outcomes. Students receive a adequate guidance from advisory committees and there is enough human resources to support the required guidance.

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 is adequate and includes the compulsory subject about Ethics y. However, the specific subjects' program should explicitly include the learning outcomes. Students receive a adequate guidance from the advisory committee.

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.*

A wide variety if disciplines is offered to doctoral students, being all of them related to the field of Computers and Information Technology. More than three disciplines are offered and one of them is related to Research methodology. Supplementary documentation provides a complete list of the disciplines and the studied disciplines per student.

There are no specific recommendations.

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 discipline dedicated to ethics in scientific research and intellectual property is compulsory and included in the subject Agreement. The sheet of the discipline is provided in the supplementary documentation.

There are no specific recommendations.

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*

[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.

knowledge, skills, responsibility and autonomy that doctoral students should acquire after completing each discipline or through the research activities[5].

The internal regulations of the doctoral school define the procedures for the evaluation of the quality of the doctoral study program. More specifically, there is a specific procedure for colleting the level of satisfaction of the doctoral students using a questionnaire. Collected results are analysed and discussed at the CSUD meeting.

The disciplines' curricula details the competencies, skills and abilities that doctoral students should acquire after completing the subjects. The curricula of some specific subjects are provided in the supplementary documentation.

As a recommendation, the disciplines' curricula should explicitly address the learning outcomes that students are expected to achieve. Currently, the include the competences. But while competences generally describe the desirable knowledge, learning outcomes are a more specific description of what students will be able to do in some measurable way.

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.*

During the meetings with doctoral students and graduates it was confirmed they receive an adequate counselling from the guidance commissions. Doctoral students keep regular meetings with their supervisors. Joint publications with supervisors demonstrates the collaboration among students and supervisors

There are no specific recommendations.

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.*

In the period 2016-2020, a total of 77 students carries out their doctoral activity and 20 doctoral students defended their doctoral thesis. The resulting 97 students were guided by 44 researchers, which gives a ratio of 2.20, below the limit 3:1.

There are no specific recommendations.

The indicator is fulfilled.

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

Productivity of doctoral students that finished their PhD over the last 5 years is adequate, but it is recommended to target al least one paper in journal with higher impact factor per student. External researchers regularly participate in the evaluation commissions with no over-representation of a specific researcher.

[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.

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

Provided documentation proves that there are joint publications in journals and conferences between students and supervisors, and they are related to the topic of the doctoral field. However, it is recommended to target at least one journal paper with impact factor per student.

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.*

Provided documentation proves that there are joint publications in journals and conferences between the 20 graduates and their supervisors. The analysis of a sample of publications reveals that the topics of the papers fall within the scope of the field of Computers and Information Technology. Although the publications are adequate, they mix journal and conferences papers and it would be better to have al least one journal paper with higher impact factor per student.

However, it is recommended to target al least one paper in journal with higher impact factor per student.

As a recommendation, contributions should target at least one journal paper with impact factor per student.

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 20 graduates in the last 5 years participated in a total of 57 international research events, so the ratio is 2.85 over the minimum of 1.

There are no specific recommendations.

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 keeps contact with other national research groups that regularly participates in the public defense of doctoral theses. Additionally, they are distributed over the defended doctoral thesis so that there no over representation of a specific researcher.

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.*

A total of 20 doctoral theses have been defended in the last 5 years and no more than 2 thesis have been allocated to the same specialist coming from a higher education institution, other than the evaluated IOSUD, for the theses coordinated by the same doctoral thesis advisor. Provided documentation lists all the external evaluators and proves that the indicator is accomplished.

There are no specific recommendations.

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.*

The ratio between the number of doctoral theses assigned to a scientific referee from a higher education institution than TUCN and the total number of doctoral theses is 0.25, below the limit of 0.3. Supplementary documentation provides the name of each external specialist and the number of thesis in which they have participated.

There are no specific recommendations.

The indicator is fulfilled.

Domain C. QUALITY MANAGEMENT

The Quality Assurance System is designed and implemented satisfactorily, although tha action plan should include more details about the actions to be implemented. All the relevant information regarding the doctoral field is available through the website. Students have access to the electronic resources relevant for the doctoral field and all the research facilities. The international visibility of the doctoral school is guaranteed by the participation of international experts in local courses and classes and by the promotion of the educational offer at international events.

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

The Quality Assurance System is designed and implemented. There are procedures to monitor the activity of all the actors of the doctoral domain and to collect feedback information. However, it is suggested to improve the format of the action plan.

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.

There is a defined framework for Quality Assurance, with procedures that have been implemented. The framework includes procedures for collecting information about students and advisors, the training program and the infrastructure. There are also specific procedures to measure the students' satisfaction and some actions have been implemented. However, it is suggested to improve the action plan with more details about the person responsible of the counter measure, a deadline, and the indicators that measure the evolution of the detected problem.

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 internal quality assurance procedures at the level of the IOSUD monitor the scientific activity of PhD supervisors and students, the infrastructure and logistics necessary to carry out the research activity, the regulations and procedures that organize the doctoral studies, the training program and the social and academic support services. The Quality Assurance structure is organized at several levels: first the Commission for Quality Assessment and Assurance (CEAC), then the Office for Quality Assurance and finally,the Quality managers at the level of faculties and Doctoral School. Evaluation is taken periodically, and some reports are included in the supplementary documentation. Feedback from students is quantitatively analyzed so that detected deficiencies are addressed through a specific action plan. Supplementary documentaion includes the doctoral school regulations, the quality assurance procedures, the doctoral students' feedback report and the self-assessment reports. There is also an action plan to address the detected deficiencies.

As a recommendation, the action plan should include the remedy actions are proposed along with a deadline, a responsible person and the indicators to measure the evolution of the detected problem.

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.*

There is a procedure of the Quality Assurance system for collecting information from students, including aspects related to their satisfaction, their main challenges and needs and their feedback about the competences acquired during the training program. Data collected is analyzed by the IOSUD-TUCN Secretariat, so that a annual report on the satisfaction degree of doctoral students is generated. The report is discussed at the CSUD meeting and then published on the IOSUD website. Depending on the results, an action plan is activated to solve the detected issues.

Supplementary documentation include the questionnaires templates and the doctoral students' feedback report.

There are no specific recommendations.

The indicator is fulfilled.

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

All the relevant information regarding the doctoral field is available through the website. Students have access to the electronic resources relevant for the doctoral field and all the research facilities.

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

The links for the doctoral school regulations, admission regulations, doctoral studies contract, information for public defence of the thesis and required standards, the content of training programs, the academic and scientific profile of supervisors, list of PhD students and links to abstracts of doctoral theses to be defended publicly are provided and they contain the expected information

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.

The IOSUD website http://iosud.utcluj.ro/ and the doctoral school website http://iosud.utcluj.ro/scoli-doctorale-146.html contain all the information of interest for doctoral students both in Romanian and English: the doctoral school and institutional regulations, the admission regulations and the doctoral study contract, and information on the elaboration standards of the doctoral thesis. Additionally, the doctoral school website contains all the information about the content of study programs, the academic and scientific profile of supervisors and the list of doctoral students with basic information. The date, time and place of the thesis to be defended publicly are published on the platform https://doctorat.utcluj.ro/ 20 days in advance of the public defense. Browsing the provided links it was confirmed that all the addressed information is available.

There are no specific recommendations.

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.

Students have access to the electronic resources though international databases, and to anti-plagiarism software and labs and equipments required for their research.

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.*

All the doctoral students within IOSUD-UTCN benefit from free electronic access to the scientific and research literature through the Anelis Plus portal using their account and password. During the meetings with students and supervisors it was confirmed the availability of electronic resources relevant to the field of Computers and Information technology.

There are no specific recommendations.

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.*

All PhD Supervisors have access to Turnitin anti plagiarism software and doctoral students have access through their supervisors. All doctoral theses are verified using this platform. The availability of this tool was confirmed during the meetings with students and supervisors.

There are no specific recommendations.

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.*

The access of doctoral students to the research infrastructure is regulated by the doctoral study contract and the specific regulations of the doctoral school. In the case of the Computers and Information Technology field, and depending on the specific area, students have access to the Research Center Image Processing and Shape Recognition, the Distributed Systems Research Laboratories, the Computer Graphics and Interactive Systems Laboratory, the Intelligent Systems Laboratory, the Dedicated and Embedded Computing Systems Laboratory, the Knowledge Engineering Laboratory, the Research Laboratory in Networks and Communication Protocols and the IoT Computational Intelligence Lab.

During the meetings with students and graduates it was confirmed the availability of labs and research infrastructure.

There are no specific recommendations.

The indicator is fulfilled.

Criterion C.3. Internationalization

The international visibility of the doctoral school is guaranteed by the participation of international experts in local courses and classes and by the promotion of the educational offer at international events.

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

Students have participated in mobilities for attending conferences or courses. The doctoral field keeps contact with international experts that regularly deliver classes or courses, and it is also active in the promotion of the educational offer at a international level.

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.*

The number of doctoral students who have completed a training or mobility internship abroad or another form of mobility in the last 5 years is 62. Given that currently there are 77 doctoral students, the percentage specified by the indicator is 80.52%, clearly above the required limit.

There are no specific recommendations.

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.*

During the last 5 years, a total of 16 international experts were invited to give courses/lectures for doctoral students. The self assesment report details the name and affiliation of nternational experts. Supplementary documentation also details the title of the presentations as well as the date/location at which the lectures were given.

There are no specific recommendations.

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.).*

The main activities carried out to increase the visibility of the doctoral field al the international level are three: invitation of international experts to participate in the commissions for guiding or defending the doctoral theses, the participation of doctoral supervisors as members of international commissions and the presentation of the educational offer at international events. The self-assessment report details the list of international events where the doctoral studies were promoted as well as the brochures and flyers used for the promotion. The supplementary documentation provides the details about the participation of international experts in the commissions of doctoral thesis and the participation of doctoral supervisors in commissions abroad.

There are no specific recommendations.

The indicator is fulfilled.

IV. SWOT Analysis

Strengths:	**Weaknesses:**
- The supervisors of the doctoral field are quite active in terms of their participation in European projects - The research infrastructure includes many labs and equipment that have been improved using the funding from research projects	- Students should be more evenly distributed among supervisors. - PhD advisors should target journals with higher impact factors, within Q1-Q2 rank
Opportunities:	**Threats:**

- There is an emergent IT industry that can support future doctoral students and research lines - The doctoral field keeps links with Universities abroad that can be used to increase its visibility and internationalization - The field of Computers and Information Technology is now an emergent field due to the topic of Artificial Intelligence. Many students are willing to learn about AI and many companies are interested in developing AI applications.	- The number of supervisors should be increased in the next years

V. Overview of judgments awarded and of the recommendations

No.	Type of indicator (*, C)	Performance indicator	Judgment	Recommendations
1		A.1.1.1	Fulfilled	
2		A.1.1.2	Fulfilled	
3		A.1.2.1	Fulfilled	
4		A.1.2.2	Fulfilled	
5		A.1.3.1	Fulfilled	
6	*	A.1.3.2	Fulfilled	
7	*	A.1.3.3	Fulfilled	
8	C	A.2.1.1	Fulfilled	
9	C	A.3.1.1	Fulfilled	
10	*	A.3.1.2	Fulfilled	
11		A.3.1.3	Fulfilled	
12	*	A.3.1.4	Fulfilled	Students should be more evenly distributed among supervisors
13	C	A.3.2.1	Fulfilled	Supervisors should target journals with higher impact factors, within Q1-Q2 rank
14	*	A.3.2.2	Fulfilled	
15	*	B.1.1.1	Fulfilled	it is suggested to increase the promotion of the doctoral field in other Higher Education Institutions different to TUCN, so that the indicator can be easily accomplished
16	*	B.1.2.1	Fulfilled	

17		B.1.2.2	Fulfilled	
18		B.2.1.1	Fulfilled	
19		B.2.1.2	Fulfilled	
20		B.2.1.3	Fulfilled	The disciplines' curricula should explicitly address the learning outcomes that students are expected to achieve
21		B.2.1.4	Fulfilled	
22	C	B.2.1.5	Fulfilled	
23	C	B.3.1.1	Fulfilled	contributions should target at least one journal paper with impact factor per student
24	*	B.3.1.2	Fulfilled	
25	*	B.3.2.1	Fulfilled	
26	*	B.3.2.2	Fulfilled	
27		C.1.1.1	Fulfilled	The action plan should include the remedy actions are proposed along with a deadline, a responsible person and the indicators to measure the evolution of the detected problem
28	*	C.1.1.2	Fulfilled	
29	C	C.2.1.1	Fulfilled	
30		C.2.2.1	Fulfilled	
31		C.2.2.2	Fulfilled	
32		C.2.2.3	Fulfilled	
33	*	C.3.1.1	Fulfilled	
34		C.3.1.2	Fulfilled	
35		C.3.1.3	Fulfilled	

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 presnted 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).

From the analysis performed on the Internal Evaluation Report, as a result of the meetings held at all levels, it can be concluded that the field of doctoral Computers and Information Technology has a clear mission and well-defined objectives and programs, successfully responding to the growing needs of the market, being an interdisciplinary doctoral program that offers highly qualified specialists for research.

PhD students have access to the research infrastructure of the Doctoral School, the electronic resources more relevant in the field and anti-plagiarism software. Supervisors reach the CNATDCU requirements and are quite active in terms of their participation in European projects.

All quality indicators related to the standards and evaluation criteria are met, being proposed only specific recommendations for the continuation of good practices and for the permanent improvement of the quality of the doctoral field.

As general recommendations, it was found that students should be more evenly distributed among supervisors and supervisors should target journals with higher impact factors, within Q1-Q2 rank. It is also suggested to increase the promotion of the doctoral field in other Higher Education Institutions

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.*