The External Evaluation Report of a Doctoral Study Domain Mathematics

Contents

I. Introduction[1]

I.1 Context

This document is report on Periodic External Evaluation of Doctoral Study Domain Mathematics of the School of Advanced Studies of the Romanian Academy (SCOSAAR) at the Simon Stoilov Institute of Mathematics of the Romanian Academy (IMAR).

Dates of site visit: site visit and meetings with stakeholders took place on-line from Friday, October 22, 2021, until Friday, November 19, 2021, on ARACIS Zoom platform. All meetings were recorded. Transcripts of plenary meetings are provided.

Expert Team (ET) members:

- Prof. univ. dr. Marin Marin, “Transilvania” University of Brasov (Coordinator)
- Prof. dr. sc. Ivan Slapničar, University of Split, Croatia (International expert)
- Alexandra-Maria Chiper, “A. I. Cuza” University of Iasi (PhD student)

Coordinators from Romanian Accreditation Agency (ARACIS):

- Prof. univ. dr. ing. Neculai-Eugen Seghedin, ”Gheorghe Asachi” Technical University of Iași
- Assoc. Prof. PhD Irina Cozminca, "Gheorghe Asachi” Technical University of Iași

Sources of information for the Report

- School of Advanced Studies of the Romanian Academy, Mathematics, Self-Evaluation Report, 2021.

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

- Annexes for the Self-Evaluation Report
- CVs of doctoral advisors
- Lists of qualifying papers by doctoral advisors
- Guide on conducting the process of Periodic External Evaluation of Doctoral Study Domains, ARACIS, 2021

Requested documents

- Regulations of doctoral studies
- Description of admittance process for doctoral students
- Syllabi of the courses
- Example of the yearly report of the doctoral school

Received documents

- Regulamentul de organizare a studiilor universitare de doctorat în cadrul Şcolii de Studii Avansate a Academiei Române, Bucureşti, Iulie 2013 (received by mail and on-line link provided)
- Metodologia organizării și desfășurării concursului de admitere la studiile universitare de doctorat (received by e-mail and on-line link provided)
- Syllabi of the courses (on-line link provided)
- Raport Annual Institutul de Matematica "Simion Stoilow" al Academiei Romane, 2020

Criteria used for domain evaluation

- Guide on conducting the process of Periodic External Evaluation of Doctoral Study Domains, ARACIS, 2021

Site visit schedule

Hour	*Activity*	*Participants*
Friday, **22.10.2021**		
16:00 - 17:00	*Meeting of panel members for discussing main methodological aspects related to the evaluation of doctoral studies*	*IOSUD evaluation panel* **-** *all evaluation panel members*
Monday, **25.10.2021**		
17:00 - 17:45	*Online preliminary meeting for the preparation and harmonization of evaluation steps, in hybrid mode, of doctoral study domains and IOSUD*	*IOSUD evaluation panel* **-** *all evaluation panel members*

Hour	*Activity*	*Participants*
18:00 - 18:45	*Online meeting with representatives of the Academy and of the Council for Academic Doctoral Studies (CSUD)*	*IOSUD and domains evaluation panels* *- all evaluation panel members* *- representatives of the Academy's management* *- representatives of the CSUD and of the Doctoral School* *- the contact person for IOSUD / doctoral domains*
Tuesday, **26.10.2021**		
16:00 - 16:45	*Evaluation activities* *Online meeting with the Commission for Quality Evaluation and Assurance (CEAC) members / Quality Assurance Department*	*IOSUD evaluation panel* *- all evaluation panel members* *- representatives of Commission for Quality Evaluation and Assurance (CEAC) / Quality Assurance Department*
17:00- 18:00	*Continuation of the doctoral study domain evaluation activities*	*Domain evaluation panel Mathematics at Domain level - Mathematics at doctoral study domain level*
Friday, **29.10.2021**		
10:00- 10:45	*Evaluation activities* *Domain: Online meeting with the contact person for the doctoral study domain under review and the team who drafted the internal evaluation report*	*Domain evaluation panel Mathematics* *- members of domain evaluation panel* *- The doctoral studies domain contact person and the team who drafted the internal evaluation report:* *- Professor Cezar Joita* *- Professor Dan Timotin* *- Rares Stan, PhD student*
11:00- 11:45	*Evaluation activities* *Domain: Online meeting with the academic staff corresponding to the doctoral study domain*	*Domain evaluation panel – Mathematics* *- members of domain evaluation panel* *- Doctoral coordinators:* *- Professor Cezar Joita* *- Professor Vasile Brinzanescu* *- Professor Radu Purice* *- Profesor Sergiu Moroianu* *- Professor Gabriela Marinoschi* *- Professor Lucian Beznea*
12:00- 12:45	*Evaluation activities* *Domain: Online meeting with the Directors/ persons in charge of the research centers/laboratories within the doctoral study domain*	*Domain evaluation panel Mathematics* *- members of domain evaluation panel* *- directors of research centers/ laboratories* *- Professor Lucian Beznea* *- Professor Gabriela Marinoschi*

Hour	Activity	Participants
	Monday, **01.11.2021**	
14:00-14:45	*Evaluation activities* *Domain: Online meeting with PhD students*	*Domain evaluation panel - Mathematics* *- members of domain evaluation panel* *- PhD students:* *- Alexandru Mustatea* *- Cipriana Anghel* *- Catalin-Ioan Vrabie* *- Maria-Cristina Sandu* *- Rares Stan*
15:00-15.45	*Evaluation activities* *Domain: Online meeting with graduates for the respective doctoral study domain*	*Domain evaluation panel – Mathematics* *- members of domain evaluation panel* *- representatives of doctoral graduates:* *- Dr Iulian Cimpean* *- Ovidiu Preda* *- Dr Ioana Boaca*
16:00-16.45	*Evaluation activities* *Domain: Online meeting with employers of Doctoral graduates in the domain* ***This meeting was cancelled***	*Domain evaluation panel* *- members of domain evaluation panel* *- employers' representatives*
	Tuesday, **2.11.2021**	
10:00 - 12:45	*Continuation of the doctoral study domain evaluation activities*	*Domain evaluation panel Mathematics at doctoral study domain level*
18:00 - 18:45	*Online meeting with the members of the Ethics Commission*	*IOSUD and domains evaluation panels* *- all evaluation panel members* *- Ethics Commission members*
	Thursday, **03.11.2021**	
09:00 - 09:45	*Online technical meeting to identify specific issues that need to be clarified, if necessary, during the on-site visit*	*IOSUD and domains evaluation panels* *- all evaluation panel members*
10:00-14:00	*Face-to-face working meetings, visiting the educational and research infrastructure*	*- the coordinator of the domain evaluation panel - Mathematics* *- university's representatives*
	Completion of the evaluation documents	*IOSUD and domains evaluation panels* *- at IOSUD level* *- at doctoral study domain level*
	Friday, **19.11.2021**	
16:00-17:00	*Online meeting for conclusions*	*IOSUD and domains evaluation panels* *- all evaluation panel members*
17:00-18:00	*Meeting with representatives of the institution under review to discuss on the conclusions of the evaluation process and the main reccomandations*	*IOSUD and domains evaluation panels* *- all evaluation panel members* *- Academy's representatives*

I.2 Review of Doctoral School

Romanian Academy is the highest national forum for scientific and cultural consecration, are the organization of higher professional qualification activities, postgraduate courses, PhDs, as well as the granting of scientific and academic titles. The main instrument through which the Academy achieves these objectives is the School of Advanced Studies of the Romanian Academy (SCOSAAR), which organizes doctoral university studies in accordance with the provisions of the Law on National Education and the Law 752/2001 regarding the organization and functioning of the Romanian Academy.

According to the SCOSAAR regulation, the principles that guide the development of doctoral study programs within SCOSAAR are the following:
a) promoting scientific merit and excellence in research,
b) quality professional training of doctoral students,
c) equal opportunities and the principle of non-discrimination; d) university autonomy exercised responsibly,
e) ensuring the quality and coherence of doctoral university study programs at national and European level,
f) transparency regarding the administrative, financial and organizational information of the doctoral study programs,
g) ensuring the internal and international mobility of doctoral students.

SCOSAAR is organized in five departments: Dept. of Exact Sciences, Dept. of Life, Medical and agriculture Sciences, Dept. of Human Sciences, Dept. of Economics, Social and Legal Sciences and Dept. of Mechanical Engineering and Computers. In every department some doctoral domains are organized, an analogy to faculties in the universities. Currently, all doctoral domains have some 500 doctoral students enrolled. SCOSAAR also has three branches located in Cluj, Iasi and Timisoara.

I.3 Review of Doctoral Study Domain

The Simion Stoilow Institute of Mathematics of the Romanian Academy (IMAR) is the main institute in the SCOSAAR structure within which doctoral studies are carried out in the field of mathematics. Besides 21 PhD supervisor in IMAR, there are two other PhD supervisors active at the Institute of Mathematical Statistics and Applied Mathematics "Gheorghe Mihoc - Caius Iacob" (ISMMA).

Founded in 1949 as a research institute of the Romanian Academy, IMAR is one of the most significant centers of scientific life in Romania. Since its establishment, IMAR has been the most representative and active center of mathematical research in Romania, having extensive connections with worldwide mathematical activity. ISMMA was founded in 2001, by merging the Center for Mathematical Statistics "Gheoghe Mihoc" (founded in 1964 by separating the probability section of IMAR) with the Institute of Applied Mathematics of the Romanian Academy (founded in 1991).

In 2000, following the participation in a project competition within FP5, IMAR was named Center of Excellence by the European Commission, benefiting from the European funding of a 3-year program. In the last decades, IMAR's activity is based on numerous collaborations in international programs including FP6 programs and bilateral France-Romania programs.

Currently, 23 doctoral supervisors in the field of mathematics are working within SCOSAAR, all of them renown mathematicians with remarkable publication and citations records and significant international contacts, and all but few of them satisfy several times high formal requirements for doctoral supervisors. During last five years (2016-2020) nine students defended their PhD thesis. Currently 14 students are enrolled in the PhD program.

The research activity is carried out within the research teams of IMAR and ISMMA. Under the coordination of the scientific director, the doctoral students follow training courses on advanced research topics, participate in scientific seminars in which they make presentations of the obtained results and verify the follow-up of their doctoral program. During the doctoral studies, the students are engaged in the research work, and the results are visible through the joint works with their supervisors.

II. Methods used

The methods and sources used in the external evaluation process are the following:

- The analysis of the Self-Evaluation Report of the School of Advanced Studies of the Romanian Academy, Mathematics, 2021, and discussing elements of the report among the members of the ET.
- The analysis of the Annexes of the Self-Evaluation Report of and discussing elements of the Annexes among the members of the ET.
- The analysis and discussion about requested documents listed in Section I.1.
- The analysis of documents, data and information available on the SCOSAAR and IMAR web sites in electronic format.
- The ET discussed usage of buildings included in the institution's property (classrooms, office space, library, IT equipment, residences, cafeteria) with students, graduates and doctoral mentors. Coordinator visited IMAR in person.
- Meeting with representatives of the Academy and of the Council for Academic Doctoral Studies (CSUD).
- Meeting with the Commission for Quality Evaluation and Assurance (CEAC) members / Quality Assurance Department.
- Meeting and discussions with PhD students in the doctoral study domain Mathematics.
- Meeting and discussions with the graduates of the doctoral study domain Mathematics.
- Meeting and discussions with the school officials of the Doctoral School of SCOSAAR at IMAR.
- Meeting and discussions with the doctoral advisors in the doctoral study domain Mathematics.
- Meeting with the members of the Ethics Commission.
- On-site visit to premises of study domain Mathematics by the Coordinator,

Findings and conclusion resulting from these meetings are described in the analysis of ARACIS's performance indicators in section III.

III. Analysis of ARACIS's performance indicators

Domain A. INSTITUTIONAL CAPACITY

Romanian Academy, SCOSAAR doctoral schools and IMAR are all prime scientific research institutions fully capable of carrying out high quality doctoral studies. The institutions provide excellent research facilities and ample funding, as well as abundance of highly qualified mentors/supervisors, most of them being world renown scientists. The fact that the institutes within SCOSAAR and their doctoral studies are not financed by the Ministry of Education is a hinderance in the sense that students do no have same level of financial assistance as do the students of doctoral studies at universities.

On the other side, at IMAR, the lack of teaching duties of mentors and doctoral students enables them to have daily full-time interaction throughout the study program, which includes PhD courses individually adjusted to each student, and results in high quality publications by the doctoral students. Finally, although internationalization is proclaimed and partially present, not enough efforts have been invested into fully internationalizing the studies and attracting foreign students.

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

Administrative and managerial structure of SCOSAAR is the following: President, Vice-President, Scientific Secretary, Scientific Councils, Administration Board and Secretariate. This structure is ensuring functioning of five departments listed in section I.2 and providing unified activities (regulations, dissemination). Each of the departments of SCOSAAR is run by the corresponding Institute of the Academy. Financing is at the state level either from Academy to SCOSAAR or to the corresponding institute.

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.

IMAR had adopted all documentation from SCOSAAR and it is accessible via the web site of the PhD program Mathematics. The documents are used in regular activities of the doctoral studies program.

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 adopted documentation is used in regular activities of doctoral study program Mathematics. The documentation gives detailed description of rules and regulations regarding doctoral studies. The documents are:

- Ghid de redactare a tezei de doctorat (Anexe)
- Metodologie susținere teză de doctorat (Anexe)
- Metodologie privind situațiile de prelungire sau încetare a calității de student-doctorand (Anexe)
- Metodologie privind acordarea burselor (Anexe)
- Metodologia privind acordarea și revocarea calității de conducător de doctorat în cadrul SCOSAAR (Anexe)
- Mecanisme de recunoaștere a calității de conducător de doctorat
- Metodologia de evaluare a conducătorilor de doctorat (Anexe)
- Metodologie pentru analiza și aprobarea tematicilor programelor de studii universitare
- Metodologie privind doctoratele în cotutelă (Anexa 1, Anexa 2, Anexa 3, Anexa 4, Anexa 5, Anexa 6, Anexa 7, Anexa 8)
- Metodologie privind mobilitatea academică a studenților-doctoranzi (Anexa 1)
- Metodologie privind schimbarea conducătorilor de doctorat
- Metodologia privind transferul rezultatelor formative între programe de studii

The documentation enables smooth functioning of the doctoral school and ensures overall high quality of the doctoral program. Students and mentors are aware of the documentation.

The documents, as well as entire web pages of SCOSAAR, are in Romanian, which is clear obstacle towards proclaimed internationalization. Since the documentation is mostly at the level of SCOSAAR, it is recommended that all documents and web pages be translated in English.

Recommendations: Provide English translation of documentation, at SCOSAAR level.

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.*

Doctoral school regulations, as described in A.1.1.1, include all criteria set forth in the Article 17 (5) of the Government Decision No. 681/2011.

Recommendations: Provide English translation of documentation.

The indicator is fulfilled.

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

Due to small number of doctoral students in the study domain Mathematics, their development is tracked fully by using IT software at IMAR. The antiplagiarism software is provided at the level of SCOSAAR and is used by mentors and students and is being adequately used. Using the software is obligatory for checking PhD thesis.

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.*

Due to small number of doctoral students in the study domain Mathematics, their development is tracked fully by using IT software at IMAR. It is advisable to provide comprehensive IT solution at the level of SCOSAAR.

Recommendations: Provide IT solution at the level of SCOSAAR.

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.*

According to Ethical Code published at Cod de Etică și Deontologie al SCOSAAR, students and mentors are obliged to use antiplagiarism software which is available from SCOSAAR. The software is used properly. The software is accessible on-line with password. Software can also be used at early stage of research to discover potential existing research on the topic of the thesis. Using the software is obligatory fo checking PhD thesis, although plagiarism in Mathematics is in general very low.

Recommendations: Use the software also in early stages of research to discover possible already discovered results.

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.

Through analysis of the Self-Evaluation Report and discussion with PhD students, graduates, and supervisors, it is evident that there is sufficient number of competitive scientific grants used for PhD related research and financial aid to PhD students for salaries and travel for dissem0inatiuon of results.

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.*

Doctoral students at IMAR do not get a scholarship as students from universities, they get only a small tuition from Ministry of Finance. Currently there are four research grants by IMAR PhD supervisors, all of them include research related to PhD topics and involve PhD students. The grants are also used to upgrade salaries of PhD researchers employed at IMAR, according to law. Altogether, in the last five years PhD supervisors from IMAR obtained 18 research grants. There are also shorter Bitdefender grants (2-6 month) aimed at young researchers, postdocs and visiting professors.

Although the level of financing of PhD students from above grants is sufficient for Romanian students, it is insufficient to attract international students. Also, grants typically allow for only shorter stays of students abroad (usually for one week for conference or workshop)

Recommendations: Increase the level of financing in order to attract more students, including international students and enable longer scientific visits (several months) of doctoral students abroad.

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%.*

Currently five out of 14 enrolled PhD students receive supplementary financial support from grants obtained by their PhD supervisors.

Recommendations: Increase the number of students receiving supplementary financial support.

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*

[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 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.).

PhD students frequently attend conferences and workshop in Romania and abroad (currently also on-line) and publish high quality papers. Short stays of students are financed by IMAR.

Recommendations: Increase funding to enable longer stays abroad (several months).
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The indicator is fulfilled.

Criterion A.2. Research infrastructure

Being an institute of the Romanian Academy and a leading research institute in the are of mathematics in the country, IMAR has excellent research infrastructure.

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

The research infrastructure at IMAR includes an excellent library, on-line access to all important journals, adequate offices for researchers and lecture halls for small lectures as well as seminars.

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.*

Senior researchers have offices for individual use, while several doctoral researchers share an office. There are lecture halls, some of them very nice, including large seminar hall which accommodates up to 100 persons. All offices are equipped with adequate computers which are purchased regularly each year. Software used is either licenced (several licences are purchased each year) or open source. Library is the best mathematical library in Romania with on-line catalogues and is regularly used by mentors and students. Licences for international data bases is regularly financed. Besides that, the library maintains list of Romanian mathematical journals published either by IMAR, Romanian Mathematical Society or universities.

What is missing is a high-performance computer system which could either be acquired by IMAR or opportunity to use such computers elsewhere should be systematically provided.

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.

Recommendations: Establish access to high-performance computer system to all researchers and students.

The indicator is fulfilled.

Criterion A.3. Quality of Human Resources

**general description of the criterion analysis.*

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

As a flagship mathematical institute of Romanian Academy, IMAR has excellent research staff capable of mentoring high-quality candidates towards relevant PhD thesis.

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.*

IMAR has 23 doctoral advisors of which 21 (91,3%) satisfy minimal standards of CNATDCU. Such number of high-quality advisors could supervise larger number of PhD students than is presently the case.

Recommendations: Increase the number of PhD students.

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.*

All of 23 doctoral advisors are tenured at IMAR. Some important emerging research areas, in particular, data science, artificial intelligence and machine learning are not comprehensively covered.

Recommendations: Increase coverage of newly emerging research areas by new employments, if possible.

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.*

Number of PhD courses taught in the previous years is as follows: 15 courses in 2015, 5 courses in 2016, 23 courses in 2017, 12 courses in 2018, 17 courses in 2019 and 17 courses in 2020. All courses are high-level courses taught by CS I Professors, with occasional lectures by visiting professors. Varying number of courses each year is due to the fact that courses are adjusted to needs of particular PhD students enrolled in the given year. Courses are very intense with small number of students taking each course. Descriptions of courses on web pages are insufficient, they contain neither detailed syllabus nor literature.

Recommendations: Improve descriptions of courses.

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%.*

None of the PhD advisors at IMAR coordinate more than 8 doctoral thesis. However, 23 high-quality advisors could mentor more PhD students that 14 students currently mentored. IMAR researchers could easily accommodate 50 PhD students.

Recommendations: Increase the number of doctoral students.

The indicator is fulfilled.

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

Doctoral advisors at study Domain mathematics jointly have more than 1000 published papers which are indexed in Web of Science. This is very high concentration of excellent scientific production.

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*

[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.

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.

Each of of the 23 advisors from IMAR has at least five papers referenced in Web of Science. In the last five years, doctoral advisors were invited to present their work at 38 international conferences, they were members of 17 PhD defence committees at foreign universities, they were members of scientific committees of 8 international conferences and members of editorial boards of 15 international journals. Professor Lucian Beznea was a member of a commission of the European mathematical society and Professor dan Tiba was a member of the Mathematics panel of the European Research Council.

Recommendations: Continue such good work.

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.*

Currently, all but two of the 23 advisors meet the score requested by the minimum CNATDCU standards.

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Recommendations: Improve the scores of the two advisors.

The indicator is fulfilled.

Domain B. EDUCATIONAL EFFECTIVENESS

Educational effectiveness was analysed by inspecting scientific outputs of supervisors and students. Input for the analysis was Self-Evaluation report, meetings, and internet material. In general, the PhD program of Mathematics at IMAR excels in all aspects, except the number of students. Students particularly benefit from personally tailored courses. However, it is advised to consider eventual introduction of several obligatory courses for all students in order to produce more versatile graduates.

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

Currently 14 students are enrolled in the PhD studies in the Study Domain Mathematics. Having in mind that PhD studies in Mathematics is a difficult endeavour requiring special talent and strong work commitment, this number is fine. However, capacities of researchers in IMAR allow for more than triple

the student number. All students are from Romania, so the program is lacking internationalization in this sense.

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.

IMAR, as a prime institute of Romanian Academy with excellent supervisors is successful in attracting high quality students from Romania. This standing is, however, not yet used to attract international students.

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.*

Due to circumstance that the PhD program in Study Domain Mathematics is run at an institute, and not university, all students are graduates from other higher education institutions.

Recommendations: None.

The indicator is fulfilled.

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

All students demonstrate high academic, research and professional performance. They have been carefully selected and are all able to keep up with requirements of the program and intensive work with their respective supervisors. This is demonstrated by students taking parts in conferences and publishing joint papers with their supervisors in prestigious journals.

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.*

Admission to doctoral studies is made according to the regulation on the organization of doctoral studies of SCOSAAR. The basis for admission is written test and oral test. Generally, admitted students already had informal contacts with their potential supervisors and are aware of their future research topic.

Recommendations: Attract more good candidates, also internationally.

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%.*

During last five years one student dropped out of doctoral school and one continued pursuing doctorate at an institution in Great Britain. Through last five years 20 students were enrolled in the doctorate so the performance indicator is satisfied.

Recommendations: Attract more good candidates.

The indicator is fulfilled.

Criterion B.2. The content of doctoral programs

Since this doctoral program is carried in an institute, students have unique opportunity to meet their supervisors very often and work with them during the entire studies. This joint research and guidance results constantly raises competences of the students. Both courses and research are tailored individually to fit each student's interests and capabilities.

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

Intensive individual work with supervisors and other excellent researchers, scientific seminars by world renown scientist, individually tailored courses and good facilities ensure development of students' skills.

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.*

Each of the PhD students obtains personalized training program with at lest three courses important for their scientific training and related to topic of PhD research. The students become acquainted with current research in respective field. This is an excellent opportunity but is also very demanding for the students. Potential drawback is that students become concentrated in their narrow field which may lead to them becoming kind of clones of their advisors and not possessing general doctoral level depth in some other areas. Research methodology is discussed in each of these courses and in special module "General research methods and methodology of scientific papers".

Recommendations: Eventually derive a set of obligatory courses for all students in different basic mathematical disciplines

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The indicator is fulfilled.

[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.

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.*

Each year a course of methodology and ethics of scientific research is taught at IMAR for all PhD study programs (Mathematics, Informatics, and Engineering and Mechanical Sciences and Computers). In this course, the students are taught general aspects of research work: research objectives, motivation, importance of methodology, different types of research – fundamental and applied, quantitative and qualitative methods, the use of specialized literature and the observance of the principles of scientific ethics.

Recommendations: None.

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*[5]*.*

The student training program addresses the required learning outcomes in several manners. Most important is a permanent intensive contact with doctoral supervisor during their research. The guidance commission and its members are available to student any time. However, there are at least three mandatory meetings with the guidance commission when students need to present their progress on the thesis. These meetings are established in the research plan and are one in the first year, and two in the second or third year, depending on the plan. Other meetings with the commission can be during joint work on papers or to support the PhD student. These meetings can be as frequent as is necessary and are not included in a plan or official documents. Also, members of the commission give support during student presentations in yearly colloquium for young researchers, and other meetings. Last colloquium was held on-line on November 19, 2021, and I enjoyed several nice lectures. On such occasions student demonstrates the correct acquisition of knowledge and ability for independent work, but also receives valuable feedback from members of the commission and other researchers. Also, extremely important for students' scientific development is opportunity to frequently attend numerous seminars and talks by world class scientists held at IMAR, or recently on-line. All seminars are announced on web pages, albeit sometimes hard to find. However, learning outcomes are not specified as they should be. They should be specified on the level of SCOSAAR for general outcomes and at the level of IMAR related to mathematics.

[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.

Recommendations: Formally specify general learning outcomes at the level of SCOSAAR and particular learning outcomes at the level of IMAR. Remove web pages which are not used and create confusion and improve organisation of web.

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 guidance commission is formed for every student. Although there is no written feedback, except for exams, students benefit greatly from the counselling. There are three mandatory meetings with the guidance commission when students present their progress on the thesis. These meetings are established in the research plan and are one in the first year, and two in the second or third year. Other meetings with the commission can be during joint work on papers and during student presentations in yearly colloquium for young researchers.

Recommendations: None.

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.*

Currently, 16 students receive guidance from 19 researchers. There is room for increasing number of students three times.

Recommendations: Take actions aiming to Increase number of students also international ones.

The indicator is fulfilled.

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

Students of doctoral studies in Mathematics have solid scientific output during studies and dissemination of their research which continues after graduation.

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

During doctoral studies, the students present their work in Workshop for young researcher and publish joint papers with their supervisors and other researchers. Usually, each student publishes one or two papers (or has papers accepted) prior to defense of their PhD. The students capitalize on this

experience after graduating and continue publishing, even more since the graduates of the study program Mathematics remain employed at IMAR or some university as postdocs.

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.*

During last five years, 8 graduated students published 18 papers (ranging from one to six papers per student). Most of the papers are published in prestigious journals and contain significant original contributions. Majority of the papers are not co-authored by the supervisors of respective students, which demonstrates independence in research acquired through PhD studies.

Recommendations: Encourage publications of more than one high quality paper per graduate.

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.*

In the last five years, five graduated students presented 15 talks at prestigious international congresses, conferences, or workshops. The number of presentation ranges between one to six per graduate.

Recommendations: None.

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

Supervisors at IMAR have excellent scientific contacts throughout world and use them to invite external specialists to PhD commissions where appropriate.

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.*

During the past five years six candidates defended their PhD thesis at study domain Mathematics. The six defence committees had 13 external referees, among which three were from abroad. No external referees were assigned to more than one thesis committee.

Recommendations: None.

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 analysed.*

During the past five years six doctoral thesis were defended so the indicator is not applicable.

Recommendations: None.

The indicator is not applicable.

Domain C. QUALITY MANAGEMENT

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

Romanian Academy does not have a Commission for Quality Assurance and Evaluation – instead, there is a Commission for Monitoring the Internal Managerial Control. There is a member of the commission in charge of research issues, organizing conferences and relations between institutes. IMAR has Research Council which meets twice a year and analyses research results.

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 Quality evaluation in SCOSAAR has 2 components: individual evaluation of every doctoral coordinator according to the results regarding the PhD students' activity, and institutional evaluation. These evaluation results are communicated to the Academy's management as a Report. Also, on the Academy's website could be found the doctoral school regulations and methodologies, regarding the quality assurance. However, the documentation is not in English, which hinders internationalization. However, the yearly report of SCOSAAR for 2020 devotes only one page of 30 to doctoral students with just a list of students and evaluators.

Reports are made at Academy's level, regarding the global evaluation of the Academy's activity, which includes the results of the SCOSAAR evaluation. This Report is presented in the General Assembly (in February every year) and is published on the Academy's website. There are two evaluations per year,

the results of which are discussed in the Scientific Council and then presented in the General Assembly of the Academy.

There is no procedure for evaluation of advisors by the students. In the special circumstances of IMAR, the students are working 8 hours/day together with their coordinators and the researchers from a certain institute. In this familiar working atmosphere problems are discussed frankly, and everyone is trying to find solutions if issues occur. During meetings, this was the common opinion of students, graduates, research staff, and management.

There is an auditor in every institute, which develops some audit missions every year, mostly related to personnel and finances.

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.

Yearly reports of IMAR demonstrate items (a) and (d) and publishing papers in the item (f) above. The report is for the entire activity of IMAR, and doctoral students are mentioned at one page. The report has annex with impressive list of citations of the works by researchers of IMAR. There should be a full report on doctoral studies, perhaps as another annex of the main report. Also, in order for the evaluation process and quality assurance to demonstrate continuous development, Quality Assurance system should be established, starting with the QA Manual which should contain needed procedure for all items (a) – (f).

Recommendations: Publish comprehensive yearly report of study domain Mathematics. Establish full QA system, preferably at the level of SCOSAAR.

The indicator is partially 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 no Quality Assurance manual, and mechanisms for feedback from doctoral students are informal. In the special environment of IMAR, the students are working 8 hours/day together with their coordinators and the researchers and use the opportunity to discuss all issues in this familiar working atmosphere. Everyone is trying to find solutions if issues occur.

Recommendations: Establish the QA system, preferably at the SCOSAAR level. In particular, develop QA manual which describes all above listed procedures and includes evaluations of different aspects of doctoral study by the students.

The indicator is partially fulfilled.

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

After inspection of the web sites of SCOSAAR and IMAR, the conclusion is that main documentation of interest to students is fully published. Sometimes, however, the links and accessibility are not logical. Information for the public is less well organised and sometimes incomplete. Learning resources are readily accessible to doctoral students.

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

Documentation of interest for doctoral students are readily available, information for future candidates and information of public interest should be improved.

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.

Items (a), (b), (c), (d), (f) and (h) are published in full, but most of them in Romanian. Items (e) are published, but should be enhanced to contain detailed syllabus, learning outcomes and additional

literature. Items (i) are published on web pages of SCOSAAR and IMAR but some cases links to documents or resumes are missing.

Recommendations: Publish all basic documents in English in order to attract international students. Provide detailed syllabus and literature for all courses. At SCOSAAR level unify information about doctoral thesis and make sure all institutes adhere to it.

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

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IMAR and ISMMA provide access to high quality mathematical electronic resources through the national project Anelis Plus 2020. Access to software for checking similarity with other works is also available centrally through SCOSAAR. Study domain mathematics requires only IT lab resources and they are readily available to all students.

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.*

Electronic Resources include MathSciNet data base, access to Elsevier, Springer, Oxford and Cambridge math journals collections and access to various books from those publishers.

Recommendations: None.

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.*

Access to electronic system for checking the degree of similarity to other scientific work is available through SCOSAAR.

Recommendations: None.

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 requirement for research laboratories in the study domain Mathematics is simple. Graduate students require solid internet connections, good computers, and some software licenses, which they all have. Licences and computers are purchased / renewed annually and are financed through the institutional budget or from the individual grants. The access to high performance computers is lacking.

Recommendations: Enable access to high performance computers.

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.

Internationalization is achieved through lectures by visiting professors, members of committees from abroad and visits of students to conferences and workshops (usually one week, and in some cases longer stays of students abroad. Visits abroad are financed from research grants from supervisors. Important source of internationalization is collaboration agreement of IMAR and *Agence Universitaire Francophone,* which facilitates the mobility of PhD students to and from French-speaking countries.

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.*

Out of six graduate students in the last five years four took part in Workshops, Schools and Conferences, typically for duration of one week. There we altogether six visits, one to Germany, one to Italy and four to France.

Recommendations: Increase outgoing mobility in terms of number and duration of visits. Try to establish incoming visits by foreign students.

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.*

In the past five years, 13 foreign professors gave 21 courses and seminars for PhD student at IMAR. Students had the opportunity to engage in conversation with these professors and receive advice.

Recommendations: Increase the number of visits.
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.).*

During last five years the foreign experts were members of doctoral commissions.

Recommendations: Increase number of foreign experts in commissions.

The indicator is fulfilled.

IV. SWOT Analysis

Strengths:	**Weaknesses:**
- PhD program at elite scientific institutions. - Excellent mentors with international connections. - Excellent students. - Nice working environment with excellent resources (journals, books). - Some students have good scholarships. - Opportunity to work daily with supervisors. - Courses tailored individually for each student. - Opportunities for visits abroad. - Issues are discussed in an informal manner, - Detailed documentation about program available on internet. - Lectures from international professors and international committee members. - Students publish high quality papers and attend conferences before graduating.	- Small number of students. - No international students. - PhD program is not at the University so financing of students is inadequate. - International visits of students are often short. - Documentation about program is mainly in Romanian. - Most postdocs are in Romania. - Some newly emerging research areas related to machine learning are nor covered. - No student questionnaires for PhD students. - Quality assurance system is nor fully developed.
Opportunities:	**Threats:**
- Increase funding for PhD students. - Advertise unique qualities of the program in order to attract more students from Romania and	- Not being able to increase funding for PhD students. - Not being able to attract more students,

more foreign applicants. All documents should be translated to English. - Introduce emerging areas of research regarding machine learning. - Increase duration of research visits abroad. - Increase number of postdocs abroad. - Develop complete Quality Assurance system.	domestic and international. - Not being able to maintain high scientific quality of advisors.

V. Overview of judgments awarded and of the recommendations

No.	Type of indicator (PI, PI *, CPI)	Performance indicator	Judgment	Recommendations
1.	**PI**	**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.	**fulfilled**	**Provide English translation of documentation at SCOSAAR level.**
2.	**PI**	**A.1.1.2.** The doctoral school' Regulation includes mandatory criteria, procedures and	**fulfilled**	**Provide English translation of documentation.**

No.	Type of indicator (PI, PI *, CPI)	Performance indicator	Judgment	Recommendations
		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.		
3.	**PI**	**A.1.2.1.** The existence and effectiveness of an appropriate IT system to keep track of doctoral students and their academic background.	**fulfilled**	**Provide IT solution at the level of SCOSAAR.**
4.	**PI**	**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.	**fulfilled**	**Use the software also in early stages of research to discover possible already discovered results.**
5.	**IP**	**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.	**fulfilled**	**Increase the level of financing in order to attract more students, including international students and enable longer scientific visits (several months) of doctoral students abroad.**
6.	**PI ***	**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%.	**fulfilled**	**Increase the number of students receiving supplementary financial support.**
7.	**PI ***	**A.1.3.3.** 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	**fulfilled**	**Increase funding to enable longer stays abroad (several months).**

No.	Type of indicator (PI, PI *, CPI)	Performance indicator	Judgment	Recommendations
		specific forms of dissemination etc.).		
8.	**CPI**	**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	**fulfilled**	**Establish access to high-performance computer system to all researchers and students.**
9.	**CPI**	**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.	**fulfilled**	**Increase the number of PhD students to full capacity of advisors.**
10.	**PI ***	**A.3.1.2.** At least 50% of all doctoral advisors have a full-time employment contract for an indefinite period with the IOSUD.	**fulfilled**	**Increase coverage of newly emerging research areas by new employments, if possible.**
11.	**PI**	**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.	**fulfilled**	**Improve descriptions of courses.**
12.	**PI ***	**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	**fulfilled**	**Increase the number of doctoral students.**

No.	Type of indicator (PI, PI *, CPI)	Performance indicator	Judgment	Recommendations
		programs does not exceed 20%.		
13.	**CPI**	**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 defence 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.	**fulfilled**	**Continue such good work.**
14.	**PI ***	**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	**fulfilled**	**Improve the scores of the two advisors.**
15.	**PI ***	**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	**fulfilled**	**None.**

No.	Type of indicator (PI, PI *, CPI)	Performance indicator	Judgment	Recommendations
		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.		
16.	**PI ***	**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.	**fulfilled**	**Attract more good candidates, also internationally.**
17.	**PI**	**B.1.2.2.** The expelling rate, including renouncement / dropping out of doctoral students 3, respectively 4, years after admission does not exceed 30%.	**fulfilled**	**Attract more good candidates.**
18.	**PI**	**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.	**fulfilled**	**Eventually derive a set of obligatory courses for all students in different basic mathematical disciplines.**
19.	**PI**	**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.	**fulfilled**	**None.**
20.	**PI**	**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.	**fulfilled**	**Formally specify general learning outcomes at the level of SCOSAAR and particular learning outcomes at the level of IMAR. Remove web pages which are not used and create confusion and improve organisation of web.**
21.	**PI**	**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	**fulfilled**	**None.**

No.	Type of indicator (PI, PI *, CPI)	Performance indicator	Judgment	Recommendations
		meeting.		
22.	**CPI**	**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.	**fulfilled**	**Take actions aiming to Increase number of students also international ones.**
23.	**CPI**	**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	**fulfilled**	**Encourage publications of more than one high quality paper by each graduate.**
24.	**PI ***	**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.	**fulfilled**	**None.**
25.	**PI ***	**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.	**fulfilled**	**None.** **OK**
26.	**PI ***	**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	**not applicable**	**Increase the number of defended PhD thesis.**

No.	Type of indicator (PI, PI *, CPI)	Performance indicator	Judgment	Recommendations
		should be analyzed.		
27.	**PI**	**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.	**partially fulfilled**	**Publish comprehensive yearly report of study domain Mathematics. Establish full QA system, preferably at the level of SCOSAAR.**
28.	**PI ***	**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.	**partially fulfilled**	**Establish the QA system, preferably at the SCOSAAR level. In particular, develop QA manual which describes all above listed procedures and includes evaluations of different aspects of doctoral study by the students.**
29.	**CPI**	**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	**fulfilled**	**Publish all basic documents in English in order to attract international students. Provide detailed syllabus and literature for all courses. At SCOSAAR level unify information about doctoral thesis and make sure all institutes adhere to it.**

No.	Type of indicator (PI, PI *, CPI)	Performance indicator	Judgment	Recommendations
		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.		
30.	**PI**	**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.	**fulfilled**	**None.**
31.	**PI**	**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.	**fulfilled**	**None.**
32.	**PI**	**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.	**fulfilled**	**Enable access to high performance computers.**
33.	**PI ***	**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.	**fulfilled**	**Increase outgoing mobility in terms of number and duration of visits. Try to establish incoming visits by foreign students.**
34.	**PI**	**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	**fulfilled**	**Increase the number of visits.**

No.	Type of indicator (PI, PI *, CPI)	Performance indicator	Judgment	Recommendations
		leading experts to deliver courses/lectures for doctoral students.		
35.	**PI**	**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.).	**fulfilled**	**Increase number of foreign experts in commissions.**

VI. Conclusions and general recommendations

It is an excellent PhD program carried out at superior institution where student enjoy intense individual tutoring and research work with supervisors. Further actions should include improved funding of PhD students, attracting more students from Romania, attracting more international students, and completing development of Quality assurance system.

In accordance to the Guide on conducting the process of Periodic External Evaluation of Doctoral Study Domains Section 5.1, Situation C, ... the PhD Program of the *School of Advanced Studies of the Romanian Academy* in study domain Mathematics carried out at the *"Simion Stoilow" Institute of Mathematics of the Romanian Academy* and *the Institute of Mathematical Statistics and Applied Mathematics "Gheorghe Mihoc - Caius Iacob"* for a 5 years period.

VII. Annexes

No Annexes.

November 23, 2021

International Evaluator

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