

Report

of the Expert Panel on the Reaccreditation

of

Postgraduate Doctoral Study Programme in the Area of Engineering Sciences, in the Fields of Mechanical Engineering, Naval Architecture, Basic Engineering Sciences and Interdisciplinary Engineering Sciences

> Date of the visit to the University of Rijeka Faculty of Engineering June 1st, 2016

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INTRODUCTION

The Expert Panel appointed by the Agency for Science and Higher Education (ASHE) created this Report on the Re-accreditation of the University Postgraduate (Doctoral) Programme *Doctoral Study Programme in the Area of Engineering Sciences, in the Field of Mechanical Engineering, Naval Architecture, Basic Engineering Sciences and Interdisciplinary Engineering Sciences* on the basis of the Self-Evaluation Report of the Programme, other documentation submitted and a visit to the Faculty of Engineering.

The Agency for Science and Higher Education (ASHE), a public body listed in EQAR (European Quality Assurance Register for Higher Education) and a full member of ENQA (European Association for Quality Assurance in Higher Education), re-accredits higher education institutions (hereinafter: HEIs) and their study programmes in line with the Act on Quality Assurance in Science and Higher Education (Official Gazette 45/09) and the Ordinance on the Content of a Licence and Conditions for Issuing a Licence for Performing Higher Education Activity, Carrying out a Study Programme and Re-Accreditation of Higher Education Institutions (OG 24/10). In this procedure, parts of activities of higher education institutions and university postgraduate study programmes are re-accredited.

The Expert Panel is appointed by the Agency's Accreditation Council, an independent expert body, to carry out independent evaluation of post-graduate university study programmes.

The Report contains the following elements:

- Short description of the study programme,
- The recommendation of the Expert Panel to the Agency's Accreditation Council,
- Recommendations for institutional improvement and measures to be implemented in the following period (and checked within a follow-up procedure),
- A brief analysis of the institutional advantages and disadvantages,
- A list of good practices found at the institution,
- Conclusions on compliance with the prescribed conditions of delivery of a study programme,
- Conclusions on compliance with the criteria for quality assessment.

Members of the Expert Panel:

- President of the Expert Panel, Dr. Gordon Dalton, University College Cork, Ireland,
- Prof. Daniele Nardi, Sapienza University of Rome, Italy,
- Prof. Karol Kalna, College of Engineering, Swansea University, UK,
- Prof. Jens Grabowski, Georg-August-Universität Göttingen, Germany,
- Prof. Aurélio Campilho, Faculdade de Engenharia da Universidade do Porto, Portugal,
- Prof. Aurelian Francillon, EURECOM Graduate School and Research Center in Communication System, France,
- Prof. Zoltán Fülöp, University of Szeged, Hungary,
- Giuseppe Moschetti, Huddersfield University, UK,
- Prof. Ove T. Gudmestad, University of Stavanger, Norway,
- Maximilian Lesellier, Robotique et de Microélectronique de Montpellier (LIRMM), France,
- Massimiliano Ferrucci, National Physical Laboratory, KU Leuven, Belgium,
- Prof. Hongming Xu, Department of Mechanical Engineering, University of Birmingham, UK,
- Prof. Vadim Silberschmidt, Wolfson School of Mechanical, Electrical and Manufacturing Engineering, Loughborough University, UK,
- Prof. Sergey V. Utyuzhnikov, School of Mechanical, Aerospace and Civil Engineering, University of Manchester, UK,
- Stjepan Sučić, Končar inženjering za energetiku i transport, d.d., Croatia,

- Ana Carolina dos Santos Paulino, University of Strasbourg, France,
- Prof. Kjell Ivar Øvergård, Faculty of Technology and Maritime Science, University College of Southeast Norway, Norway,
- Prof. Aleksander Sladkowski, Silesian University of Technology, Poland,
- Prof. Stojan Petelin, univ. dipl. inž. stroj., Fakulteta za pomorstvo in promet, Univerza v Ljubljani, Slovenia,
- Hilde Sandhåland, Department of Maritime Studies, Stord/Haugesund University College, Norway.

The following Expert Panel members visited the higher education institution:

- Professor Sergey V. Utyuzhnikov, School of Mechanical, Aerospace and Civil Engineering, University of Manchester, United Kingdom of Great Britain and Northern Ireland,
- Professor Ove T Gudmestad, University of Stavanger, Kingdom of Norway,
- Maximilian Lesellier, Robotique et de Microélectronique de Montpellier (LIRMM), French Republic, doctoral candidate,
- Massimiliano Ferrucci, National Physical Laboratory, KU Leuven, Kingdom of Belgium, doctoral candidate,
- Giuseppe Moschetti, Huddersfield University, United Kingdom of Great Britain and Northern Ireland, doctoral candidate.

In the analysis of the documentation, site visit and writing of the report the Panel was supported by:

- Viktorija Juriša, coordinator, ASHE, and
- Ivana Rončević, interpreter at the site visit and translator of the Report, ASHE.

During the visit to the Institution, the Expert Panel held meetings with the representatives of the following groups:

- Management (Dean, Vice Deans),
- Head of the PhD programme,
- Internal meeting of the Expert panel (document analyses),
- PhD candidates in a group,
- PhD candidates individual or small group meetings,
- Supervisors and lecturers on the PhD study programme.

The Expert Panel also had a tour of the library, IT rooms, student register desk, classrooms and the laboratories.

SHORT DESCRIPTION OF THE STUDY PROGRAMME

Name of the study programme contained in the licence: Postgraduate Doctoral Study Programme in the Area of Engineering Sciences, in the Field of Mechanical Engineering, Naval Architecture, Basic Engineering Sciences and Interdisciplinary Engineering Sciences Institution providing the programme: University of Rijeka Faculty of Engineering Education provider(s): University of Rijeka Faculty of Engineering Place of delivery: University of Rijeka Faculty of Engineering Scientific area and field: Engineering Sciences; Mechanical Engineering, Naval Architecture, Basic Engineering Sciences and Interdisciplinary Engineering Sciences Learning outcomes of the study programme: Not defined Number of doctoral candidates: 71 Number of teachers: 68 Number of supervisors: 40 The ratio of doctoral students and supervisors: 1.7:1

RECOMMENDATION BY THE EXPERT PANEL TO THE ASHE'S ACCREDITATION COUNCIL

Upon the completion of the re-accreditation procedure and the examination of the materials submitted (Self-Evaluation Report etc.), the visit to the higher education institution and interviews with HEI members in accordance with the visit protocol, the Expert Panel renders its opinion in which it recommends to the Accreditation Council of the Agency the following:

Issuing a letter of expectation.

RECOMMENDATIONS FOR THE CONTINUED IMPROVEMENT OF THE STUDY PROGRAMME

- 1. The access to international journal papers should be prioritized. In case databases are not available, students should utilize the library exchange system, whereby literature could be provided from international contacts. The students should allow reasonable time for the library system to obtain such information.
- 2. International cooperation and student exchange should be highly prioritized, for example through the increased use of Erasmus + grant applications and bilateral agreements with foreign universities. Likewise, the University should attempt to attract international exchange students.
- 3. The PhD students must be given sufficient time to work on their research task. Teaching contracts should clearly state the agreed number of teaching hours. Furthermore, it should be very clear to all PhD students which requirements are set to submitted or approved papers prior to the submission of the thesis
- 4. A thesis based on published and/or submitted papers and a comprehensive summary of how the papers are linked to answer the research question should be permitted as an alternative to the presentation of a monograph report.
- 5. Cooperation with industry should be maintained through these challenging times for the industry. The possibility to establish industry advisory boards should be investigated. Multidisciplinary projects (for example with naval architecture) will strengthen the programme.
- 6. The HEI is expected to draft learning outcomes for both the programme and specializations/modules.

ADVANTAGES OF THE STUDY PROGRAMME

- 1. The taught element is beneficial for PhD education and provides a good background for research.
- 2. Many of the PhD thesis subjects appear very relevant for industry.
- 3. Many of the staff members have important international connections.
- 4. It was noted that students manage to publish interesting papers on conferences and in journals.
- 5. The students were in general well motivated for the research work being undertaken.

DISADVANTAGES OF THE STUDY PROGRAMME

- 1. The international dimension of the programme should be broadened by inviting exchange students to the University; this will be possible through a more frequent use of the English language.
- 2. Stakeholders should be more involved, see the suggestion above.
- 3. Students working in industry have a hard time finalizing their research as the time available "after work" may not be sufficient. They could be encouraged by the possibility to submit paper based thesis.

EXAMPLES OF GOOD PRACTICE

- 1. The University of Rijeka has obtained external funding in the amount of EUR 5 million from EU structural fund.
- 2. Increased use of the English language ensures wide dissemination of research results.
- 3. Publications are important parts of dissertations.
- 4. The impression was that the mentors and the students work very well together.

COMPLIANCE WITH THE PRESCRIBED CONDITIONS FOR THE DELIVERY OF A STUDY PROGRAMME

Minimal legal conditions:	YES/NO
	notes
1. Higher education institution (HEI) is listed in the Register of Scientific Organisations in the scientific area of the programme, and has a positive reaccreditation decision on performing higher education activities and scientific activity.	YES
2. HEI delivers programmes in the two cycles leading to the doctoral programme, i.e., first two cycles in the same area and field/fields (for interdisciplinary programmes), and employs a sufficient number of teachers as defined by Article 6 of the Ordinance on the Content of a Licence and Conditions for Issuing a Licence for Performing Higher Education Activity, Carrying out a Study Programme and Re-Accreditation of Higher Education Institutions (OG 24/10).	YES
3. HEI employs a sufficient number of researchers, as defined by Article 7 of the the Ordinance on Conditions for Issuing Licence for Scientific Activity, Conditions for Re-Accreditation of Scientific Organisations and Content of Licence (OG 83/2010).	YES
4. At least 50 % of teaching as expressed in norm-hours is delivered by teachers employed at the HEI (full-time, elected into scientific-teaching titles).	YES
5. Student: teacher ratio at the HEI is below 30:1.	YES
6. HEI ensures that doctoral theses are public.	YES
7. HEI launches the procedure of revoking the academic title if it is determined that it has been attained contrary to the conditions stipulated for its attainment, by severe violation of the studying rules or based on a doctoral thesis (dissertation) that has proved to be a plagiarism or a forgery according to provisions of the statute or other enactments.	YES
Additional/recommended conditions of the ASHE Accreditation Council for passing a	YES/NO
positive opinion	notes
1. HEI (or HEIs in joint programmes) has at least five teachers appointed to scientific-teaching titles in the field, or fields relevant for the programme involved in its delivery.	YES
2. In the most recent reaccreditation, HEI had the standard Scientific and Professional Activity marked as at least "partly implemented" (3).	YES
3. The doctoral programme is aligned with the HEI's research strategy.	YES
4. The candidate: supervisor ratio at the HEI is not above 3:1.	YES
 5. All supervisors meet the following conditions: a) PhD, elected into a scientific title, holds a scientific or a scientific-teaching position and/or has at least two years of postdoctoral research experience; b) active researcher in the scientific area of the programme, as evidenced by publications, participation in scientific conferences and/or projects in the past five years (table 2, 	YES YES
Supervisors and candidates); c) confirms feasibility of the draft research plan upon admission of the candidate (or submission of the proposal);	YES
d) ensures the conditions (and funding) necessary to implement the candidate's research (in line with the draft research plan) as a research project leader, co-leader, participant,	NO
collaborator or in other ways;	NO
e) trained for the role before assuming it (through workshops, co-supervisions etc.);	NO
f) received a positive opinion of the HEI on previous supervisory work.	
6. All teachers meet the following conditions:	YES
a) holds a scientific or a scientific-teaching position;b) active researcher, recognized in the field relevant for the course (table 1, Teachers).	YES
7. The supervisor normally does not participate in the assessment committees.	NO
 8. The programme ensures that all candidates spend at least three years doing independent research (while studying, individually, within or outside courses), which includes writing the thesis, publishing, participating in international conferences, field work, attending courses relevant for research etc. 	YES
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cooperation between HEIs is based on adequate contracts; joint programmes are delivered in	
cooperation with accredited HEIs; the HEI delivers the programme within a doctoral school in	
line with the regulations and ensures good coordination aimed at supporting the candidates;	
at least 80% of courses are delivered by teachers employed at HEIs within the consortium.	

QUALITY ASSESSMENT

		Quality assessment ("high level of quality" or "improvements are necessary") and the explanation of the Expert Panel
1.	RESOURCES: TEACHERS, SUPERVISORS, RESEARCH CAPACITIES AND INFRASTRUCTURE	
1.1.	HEI is distinguished by its scientific/artistic achievements in the discipline in which the doctoral study programme is delivered.	Improvements are necessary The HEI is competitive in research on an international level. This competitiveness is demonstrated by the amount of scientific publications produced and the HEI's participation in international collaborations. The HEI is also aggressive in its pursuit of resources both within Croatia and international sources, e.g. the European Union. The HEI has established a vision for the future of Croatia's competitiveness in global research and is actively working towards ensuring its vision. The Expert Panel recognizes these efforts and encourages their continuity.
1.2.	The number and workload of teachers involved in the study programme ensure quality doctoral education.	High level of quality The HEI has a mechanism for ensuring quality education; > 80% of coursework is administered by teachers employed by the faculty.
1.3.	The teachers are highly qualified researchers who actively engage with the topics they teach, providing a quality doctoral programme.	High level of quality The majority of teachers have one or more publications in the relevant research field in the past five years. According to table 1 in the self- evaluation report submitted by the HEI, only three teachers do not have any recorded publications in the past five years. It should be noted, however, that these three teachers do not supervise any PhD candidates.
1.4.	The number of supervisors and their qualifications provide for quality in producing the doctoral thesis.	High level of quality The HEI has established regulations for ensuring quality in the production of doctoral theses. The HEI's supervisor: candidate ratio is 1:1.7, which satisfies the suggested threshold of 1:3. All supervisors of PhD candidates have at least one publication in the last five years as indicated by table 2. The majority of PhD candidates have at least one publication in their field of research.
1.5.	The HEI has developed methods of assessing the qualifications and competencies of teachers and supervisors.	Improvements are necessary The HEI has established a mechanism for ensuring quality supervision of PhD candidates. In particular, only teachers who have published at least two papers in the past five years can be appointed as doctoral thesis supervisors. The Expert Panel notes that table 2 provided in the HEI's self-evaluation report indicates that three supervisors have only one publication in the past five years.
1.6.	The HEI has access to high-quality resources for research, as required by the programme discipline.	High level of quality The HEI provides an extensive number of laboratory facilities and lecture halls for the execution of the doctoral study. Resources accessible to the PhD candidates include computer centres and a library. The HEI has been proactive in modernizing their facilities by pursuing external sources of funding, one particular example being the application to a 5 million euro structural fund for new scientific equipment. Despite the lack of wide

		access to online journal databases (a phenomenon common to all Croatian higher education institutions and not a consequence of the HEI's management), the HEI has ensured access to many publications through alternative methods, such as collaboration with other institutes.
	INTERNAL QUALITY ASSURANCE OF THE PROGRAMME	
2.1.	The HEI has established and accepted effective procedures for proposing, approving and delivering doctoral education. The procedures include identification of scientific/ artistic, cultural, social and economic needs.	High level of quality The University of Rijeka has prescribed a precise procedure for the application and the amendment of study programmes by the Regulations on Accreditation of Study Programmes, which are available on the university website. The panel noted that the three-month oversea internship is a very good and useful practice. Students' satisfaction with the programme is quite high.
2.2.	The programme is aligned with the HEI research mission and vision, i.e. research strategy.	High level of quality The programme is aligned with the scientific research strategy of the Faculty and the University.
		High level of quality
2.3.	The HEI systematically monitors the success of the programmes through periodic reviews, and implements improvements.	 The scientific productivity indicators of doctoral candidates have been systematically monitored and annual reports have been published. The indicators include the following: Continuous monitoring and analyses of research productivity of supervisors and candidates; Collecting and analysing feedback from candidates; Mandatory annual evaluation of supervisors by doctoral candidates.
2.4.	HEI continuously monitors supervisors' performance and has mechanisms for evaluating supervisors, and, if necessary, changing them and mediating between the supervisors and the candidates.	 High level of quality There is mandatory annual evaluation of supervisors by doctoral candidates in which candidates provide a short overview of their work and an evaluation of their supervisor and the study programme. The Regulations define the procedure for changing the supervisor when a candidate is not satisfied with the current one. There is no reliable statistics on the completion rate. However, it is significantly higher than the national one.
2.5.	HEI assures academic integrity and freedom.	High level of quality The doctoral thesis has been checked by the university official software for detecting plagiarism. Ethical content is covered in the course "Scientific Research Methodology".
2.6.	The process of developing and defending the thesis proposal is transparent and objective, and includes a public presentation.	Improvements are necessary The programme has established procedures for producing and defending the doctoral thesis proposal. The candidate defends the proposal before the Committee for the Assessment of the Doctoral Thesis Proposal.
		The recommendation of the panel is that at least one member of the

		Committee for the Assessment of the Doctoral Thesis Proposal must be external (from another university or from abroad).
		Neither a thesis proposal nor an assessment template has been submitted.
		The panel noted that the research topic is fixed at the end of the second year. The research might not be focused because the scopes of the project are unclear.
		Improvements are necessary
2.7.	Thesis assessment results from a scientifically sound assessment of an independent committee.	The study programme has elaborate procedures for writing, assessing and defending a doctoral thesis. The doctoral thesis is assessed by the Committee for the Assessment and Defence of the Doctoral Thesis. At least one member of the Committee is external.
		The panel recommended the Scandinavian style of dissertations as one of the options of thesis defence. The current requirement of six publications for this option seems too strict.
2.8.	The HEI publishes all necessary information on the study programme, admissions, delivery and conditions for progression and completion, in accessible outlets and media.	High level of quality All necessary information on the study programme, admissions, delivery and conditions for progression and completion is available on the website of the Faculty.
2.9.	way that ensures sustainability	
2.10	. Tuition fees are determined on the basis of transparent criteria (and real costs of studying).	High level of quality The amount of the tuition fee is based on the cost of study that includes the average cost of teaching and research, cost of visiting lecturers, cost of equipment use and the like.
	SUPPORT TO DOCTORAL CANDIDATES AND THEIR PROGRESSION	
3.1.	The HEI establishes admission quotas with respect to its teaching	High level of quality The admission policy of the Faculty of Engineering depends on the number and capacity of available teachers/supervisors. Admission quotas

	and supervision capacities.	are determined at the level of the University of Rijeka. Until the academic year 2010/2011, the admission quota was 20 candidates per year, and since then it has increased to 30 candidates. From 2010/2011 to this academic year, new junior teachers have been involved in the study programme, which has increased supervision capacity. The optimal number of candidates is 30 per academic year. This estimate takes into account available space, equipment, the number of teachers, and the number of potential supervisors. The estimate is 1 or 2 candidates per supervisor (less than the 3 mandatory), in order to ensure as best conditions as possible for every doctoral candidate. In the past two years, 15 doctoral theses were defended, and only two supervisors had two candidates. This means that supervisors were not overburdened. The precise role of supervisors, co-supervisors and candidates is determined in the Regulations).
3.2.	The HEI establishes admission quotas on the basis of scientific/ artistic, cultural, social, economic and other needs.	High level of quality The optimal number of candidates takes into account available space, equipment, number of teachers, and the number of potential supervisors. Most of the projects are being carried out in cooperation with the naval industry, even if the economic situation is currently in a difficult phase which led to a decrease. As a rule, all Bachelors and Masters are employed immediately after graduation (sometimes even before), and Doctors of Science are usually already employed in the industry or at a university. There are no known unemployed Doctors of Science. No statistics of the present work status for companies funded candidates was available.
3.3.	The HEI establishes the admission quotas taking into account the funding available to the candidates, that is, on the basis of the absorption potentials of research projects or other sources of funding.	High level of quality Most doctoral candidates finance their studies from their own funds, or their employer pays their tuition. These part-time candidates provide confirmation at registration indicating who will be paying for the study, and they are required to immediately pay the tuition fee for the year they are enrolling into. Full-time candidates are research assistants or researchers who are financed by the Croatian Science Foundation and who are involved in research projects. They are exempt from paying tuition fees.
3.4.	The HEI should pay attention to the number of candidates admitted as to provide each with an advisor (a potential supervisor). From the point of admission to the end of doctoral education, efforts are invested so that each candidate has a sustainable research plan and is able to complete doctoral research successfully.	Improvements are necessary Before admission to the study programme, the candidates are required to submit a statement signed by the supervisor that he or she will guide and advise them during the PhD, and a statement showing motivation for a given field of the doctoral programme. In accordance with the Regulations, the candidates are required to submit an annual report and to present the results of their research in a public presentation in the second and fourth semester. The supervisor is also required to submit an annual report. If the supervisor's evaluation of the candidate is negative, the candidate has a right to give his or her view of the matter. The candidate is able to change his or her supervisor to fit better to the

	theme and to ensure the best research quality. The PhD thesis proposal is defined formally only at the end of the fourth semester. Before that, the research plan is defined informally. The panel advises that an earlier formal definition of the doctoral study theme may provide student with more focus. Admissions should be based on sustainable research plan of the candidates with support of the (potential) supervisors.
3.5. The HEI ensures that interested, talented and highly motivated candidates are recruited internationally.	Improvements are necessary The call for applications to doctoral study programmes is advertised on the faculty's website six months before the enrolment. The Faculty tries to motivate its best graduate students to get involved in research projects, and searches for funding. The candidates are required to submit two references by relevant persons in their application. In the past two academic years, four foreign students have enrolled into the study programme (out of a total of 38 candidates). However the applications are published only in Croatian and the administration tends to not allow Scandinavian-style thesis, which is an international standard. The number of publications and thesis submissions in English is low.
3.6. The selection process is public and based on choosing the best applicants.	High level of quality The call for applications to doctoral study programmes is advertised on the faculty's website six months before the enrolment. Internal regulations define the procedure for candidate selection and admission to the doctoral programme. They list documents that need to be attached to the application (curriculum, certificates, marks, references, etc.), and specify how to carry out the scoring and ranking of the candidates. The criteria such as appropriateness of previous studies, achieved grades and research interests are taken in account. An interview is then carried out with all of the applicants. The resulting ranking list is confirmed by the Faculty Council.
3.7. The HEI ensures that the selection procedure is transparent and in line with published criteria, and that there is a transparent complaints procedure.	High level of quality Since the number of applicants so far has been less than or equal to the admission quota, there have not been any applications rejected on this basis. Several applicants have been turned down because their previous education was not suitable for the scientific field of the doctoral study programmes, or because they did not complete a university study programme. These applicants were interviewed, so there were no complaints. All application documents are filed in the Faculty's Office of Student Records.
3.8. There is a possibility to recognize applicants' and candidates' prior learning.	High level of quality Candidates with significant scientific achievements can be exempt from attending classes and taking exams. Candidates who have attended classes and taken exams at other postgraduate master or doctoral studies could be exempted from attending some classes and taking some exams, but only up to 30 ECTS.
3.9. Candidates' rights and obligations are defined in relevant HEI regulations and a contract on	Improvements are necessary Documents describing the doctoral study programme in detail are available on the Faculty's website (including the aforementioned

studying that provides for a high level of supervisory and institutional support to the candidates.	Regulations). The applicants on a part-time basis, paying for their, sign a contract regulating mutual rights and obligations. Contracts may also be signed with institutions hosting the candidates as part of the doctoral study programmes. The applicants admitted on a full-time basis sign a contract for the position of a teaching assistant for a period of six years. These doctoral students have the teaching duty of 150+/-30h a year. The teaching workload may represent up to 50%, even sometimes 70% of the workload, leaving little time for the research. The heavy workload of the teaching duty can negatively affect the quality of the research for the candidates. The panel advises to put a procedure in place to limit the teaching workload to ensure the candidate's research quality.
3.10. There are institutional support mechanisms for candidates' successful progression.	High level of quality The institutional support is carried by the different bodies of the postgraduate doctoral study programme (Dean, Vice Dean for Research, Faculty Council, supervisors, etc.). They also seek funding for the doctoral projects. In addition, supervisors also help candidates in shaping the programme of the doctoral study, guide them in choosing the subject of research, and help them to achieve their doctoral project. The supervisor submits an annual report on the candidate's work.
4. PROGRAMME AND OUTCOMES	
4.1. The content and quality of the doctoral programme are aligned with internationally recognized standards.	 Improvements are necessary The quality is assessed on the basis of the programme as it was delivered to the panel. The programme is of acceptable quality as it is research-oriented and focused on the candidate's independent work (it provides for at least three years of independent research experience, as regulated by the Croatian Qualifications Framework - CroQF). Teaching is included as required by the needs of candidate's research and enables the candidate to acquire generic skills and international experience. The programme is meeting an acceptable international standard of doctoral education in the relevant discipline: The programme – and the programme content – is comparable to programmes at international HEIs, with respect to programme duration, specialisations, volume of teaching and the ratio between teaching and research, number of compulsory and elective courses; There is comparability of thesis formats and assessment committees, however, it might be advantageous for students, in particular those employed by industry to prepare a thesis based on papers presented and submitted at conferences and in journals; There is comparability with international HEIs in complying with national and international professional standards. The programme should strive for a higher degree of interdisciplinary, in particular in cooperation with the electrical engineering programme at the University.

4.2. Programme learning outcomes, as well as the learning outcomes of modules and subject units, are aligned with the level 8.2 of the CroQF. They clearly describe the competencies the candidates will develop during the doctoral programme, including the ethical requirements of doing research.	 High level of quality Although programme learning outcomes were not defined, the HEI stated that its programme meets the CroQF level 8.2 by quality descriptions of the PhD level. We encourage the HEI to use a learning outcome methodology to monitor its quality and candidates' competences. The reaccreditation panel assessed that the following skills and competencies are acquired: Research competencies (interviews with candidates, review of programme description and submitted theses demonstrated the quality of acquired research competencies, such as collecting information and sources, critical reading and identifying biases, etc.); Project planning and management competencies (developing research proposals, organising research, timely identification of potential issues and budgeting); Competencies in research methodologies (using relevant hardware and software, statistical analyses, statistical inference, making conclusions based on quantitative data); Reading and writing skills (speaking and listening, presenting data and conclusions to non-experts); Teaching and assessment skills; Competence in demonstrating individual professional and ethical authority; Readiness to accept ethical and social responsibility for performing research successfully, delivering socially useful research results and readiness to face new social and economic challenges.
4.3. Programme learning outcomes are logically and clearly connected with teaching contents, as well as the contents included in supervision and research.	High level of quality Although programme learning outcomes were not defined, SER and interviews with candidates (and alumni) demonstrated that learning outcomes of courses are logically aligned with individual course teaching content, supervisory work and research (acceptable level of quality). We encourage the HEI to use learning outcome methodology to monitor its quality.
4.4. The doctoral programme ensures the achievement of learning outcomes and competencies aligned with the level 8.2 of the CroQF.	 High level of quality The quality and level of achieved learning outcomes was assessed (level 8.2 of the CroQF). The reaccreditation panel assessed the programme, its quality assurance procedures and a sample of theses, and checked that the programme enables candidates to acquire competencies at the level 8.2 through reviewing the submitted theses (the panel identified that some of the sample theses are of high quality). The programme submitted: A sample of theses; A sample of candidates' publications (especially high-impact publications coming out of doctoral research);
4.5. Teaching methods (and ECTS, if applicable) are appropriate for level 8.2 of the CroQF and assure achievement of clearly defined learning outcomes.	 A sample of seminar papers, conference presentations, etc. High level of quality The quality of teaching methods was assessed. A few courses are delivered <i>ex-cathedra</i> and the majority of courses are delivered through colloquia, research, experimental or laboratory work. The panel examined the programme and course structure and

	descriptions and assessed that the methods used (minimum <i>ex-cathedra</i> teaching, the majority of courses delivered through individual work with the supervisor, discussion groups, workshops, etc.) are appropriate for achieving learning outcomes of 8.2. level, but the learning outcome of programme needs to be defined.
4.6. The programme enables acquisition of general (transferable) skills.	Improvements are necessary The programme provides for the acquisition of generic (transferable) skills, e.g. through workshops or other forms of support for the development of business and managerial skills, presentation, writing and project management skills, applying for funding, etc. The HEI documented that candidates are informed of opportunities to participate in internal and external trainings and that the acquisition of these skills is assessed within the programme. The efficient use of EU funding represents an excellent possibility for international exchange. The panel will also encourage even more collaboration with industry.
4.7. Teaching content is adapted to the needs of current and future research and candidates' training (individual course plans, generic skills etc.).	High level of qualityCourses delivered are flexible and adapted to individual academic needsand research plans.The HEI uses examples and/or programme structure to demonstrate thatteaching is individualised and adapted to candidates' research plans. Evenbetter contact with stakeholders and taking into account the stakeholders'needs is encouraged.
4.8. The programme ensures quality through international connections and teacher and candidate mobility.	 Improvements are necessary The programme is considered to be of acceptable quality as it strives to improve its quality through internationalisation and mobility: Internationalisation of the doctoral programme is achieved by providing opportunities for, and using research staff mobility; It systematically provides information on opportunities for candidate mobility, encourages and achieves it (Erasmus + funding); The HEI is acquainted with the European Charter of Researchers and Code of Conduct and implements its principles. Evidence for this criterion was presented: Opportunities for candidates to study abroad (spend a part of their education on another, foreign HEI) and evidence that programme regulations enable and encourage that type of international mobility; Evidence on encouraging candidates to participate in international conferences (systematically informing them on important conferences, assisting in applying for travel funds, etc.); Opportunities to replace the thesis by publication in internationally recognized outlets; Attract international faculty and excellent international candidates to the programme (or a part of it).

* NOTE: RECOMMENDATIONS OF THE EXPERT PANEL TO THE ASHE'S ACCREDITATION COUNCIL AND QUALITY LABEL

The role of the Expert Panel in the re-accreditation of doctoral study programmes is manifold. The Expert Panel or part of the Expert Panel visiting a higher education institution drafts a report on the basis of a self-evaluation report, the accompanying relevant documentation, and a site visit to HEI. The draft report is adopted by all members of the Cluster Expert Panel, while the president of the Cluster Expert Panel is responsible for coordinating the assessment levels.

The report contains an assessment on whether a doctoral study programme delivered at a higher education institution complies with the prescribed laws and by-laws, as well as any additional/recommended requirements defined by the Agency's Accreditation Council, and whether a higher education institution can obtain a positive, i.e. satisfactory quality assessment according to the criteria set out in this document. Moreover, the Expert Panel must make recommendations for quality improvement.

Based on the assessment of all these elements, the Expert Panel may propose to the Accreditation Council of the Agency to issue either a confirmation on compliance, a letter of expectation for the period up to three (3) years in which period the higher education institution should eliminate the identified deficiencies, or to deny the license.

If the Expert Panel has assessed that a doctoral study programme delivered by a higher education institution does not meet legal and other requirements or that the quality of a study programme is not ensured (i.e. that HEI does not meet additional requirements or recommendations made by the Accreditation Council, or has a very poor quality assessment), they should propose to the Accreditation Council to deny the license.

If the Expert Panel considers that the relevant laws and bylaws have been met by a higher education institution, but that certain elements mentioned above do not meet the quality requirements, while they consider that the identified shortcomings can be corrected within a time frame of three years, they should issue a letter of expectation.

If the Expert Panel considers that all legal and additional/recommended requirements have been met and the quality assessment is satisfactory, i.e. that a study programme fulfils the learning outcomes appropriately defined for that level and scientific area, they may propose the issuance of a certificate and have a HEI commit to quality improvement and reporting to the Agency during the follow-up period.

Finally, if the Expert Panel has, in accordance with the criteria mentioned above, proposed issuing the certificate of compliance and assessed that, in addition to meeting the minimum quality requirements – i.e. the qualification framework level - for a study programme, the programme should be identified as a doctoral programme of a 'high level of quality', the Expert Panel may propose to the Agency's Accreditation Council that such a doctoral study programme be awarded the 'high quality label'. Thus the Agency, with the consent of the Accreditation Council, grants a higher education institution the right to use the label for their academic and promotional purposes.

The 'high quality label' cannot be proposed or awarded to a programme or a higher education institution that does not comply with the requirements laid down by the laws and bylaws mentioned in this document, and any additional requirements recommended by the Accreditation Council. Moreover, the quality assessment awarded to a study programme should reflect a high level of quality inasmuch that at least half of the sub-criteria in each of the quality assessment criteria are assessed as being of high quality. The Accreditation Council of the Agency issues a final opinion on the label awarded. The content and form of the quality labels shall be prescribed by the Agency in a relevant general act.

The Accreditation Council of the Agency discusses the final report with all recommendations and suggestions, and issues their opinion on the report. Based on a prior opinion of the Accreditation Council, the Agency issues an Accreditation Recommendation to the minister responsible for science and higher education, and upon receipt of the minister's final decision on the outcome of the procedure, awards the 'high quality label" to a higher education institution.