



**Report
of the Expert Panel
on the REACCREDITATION
of the University Postgraduate (Doctoral) Programme
Geodesy and Geoinformatics**

Date of the visit to the Faculty of Geodesy, University of Zagreb:
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CONTENTS

***INTRODUCTION**..... 3*

***SHORT DESCRIPTION OF THE STUDY PROGRAMME** 5*

***RECOMMENDATION BY THE EXPERT PANEL TO THE ASHE'S ACCREDITATION COUNCIL**..... 6*

***RECOMMENDATIONS FOR THE IMPROVEMENT OF THE STUDY PROGRAMME**..... 6*

***ADVANTAGES OF THE STUDY PROGRAMME**..... 7*

***DISADVANTAGES OF THE STUDY PROGRAMME** 7*

***EXAMPLES OF GOOD PRACTICE IN THE CURRENT PROGRAMME**..... 8*

***COMPLIANCE WITH THE PRESCRIBED CONDITIONS FOR THE DELIVERY OF A STUDY PROGRAMME**..... 9*

***QUALITY ASSESSMENT**..... 11*

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 *Geodesy and Geoinformatics* on the basis of the Self-Evaluation Report of the Programme, other documentation submitted and a visit to the Faculty of Geodesy, University of Zagreb.

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.

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:

- Professor Christopher Kotsakis, Aristotle University of Thessaloniki, Greece
- Professor Peter van Oosterom, Delft University of Technology, Netherlands
- Iliana Tsali, doctoral candidate, University of Calgary, Canada
- Professor Ashraf S. Ayoub, City University London, United Kingdom of Great Britain and Northern Ireland
- Professor Hendrik Voll, Tallinn University of Technology, Estonia
- Nicholas Lippiatt, doctoral candidate, KU Leuven, Belgium
- Professor Elias Kassa, Norwegian University of Science and Technology (NTNU), Kingdom of Norway
- Professor John Bridgeman, University of Birmingham, United Kingdom of Great Britain and Northern Ireland – Chair of the Expert Panel
- Samer Sabry Fahmy Mehanny Gendy, doctoral candidate, City University London, United Kingdom of Great Britain and Northern Ireland
- Professor Johan Verbeke, Aarhus School of Architecture, Denmark
- Professor Elena Mussinelli, Politecnico di Milano, Italy
- Professor Franklin van der Hoeven, Delft University of Technology, Netherlands
- Teodora Iulia Constantinescu, doctoral candidate, Universiteit Hasselt, Belgium

The higher education institution was visited by the following Expert Panel members:

- Prof. Christoforos Kotsakis
- Prof. Peter van Oosterom
- Iliana Tsali, doctoral candidate.

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

- Irena Petrušić, coordinator, ASHE
- Vlatka Derenčinović, interpreter at the site visit, ASHE.

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

- Management
- Doctoral candidates
- Teachers and supervisors
- Alumni

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

SHORT DESCRIPTION OF THE STUDY PROGRAMME

Name of the study programme contained in the licence: ***Geodesy and Geoinformatics***

Institution providing the programme: **Faculty of Geodesy University of Zagreb**

Education provider(s): **University of Zagreb University of Zagreb**

Place of delivery: **Zagreb**

Scientific area and field: **Technical Sciences/Geodesy**

Learning outcomes of the study programme:

1. Knowledge and skills needed for critical analysis, judgement and synthesis of new and complex concepts and technologies, as well as the development of new methodological procedures in the research area of geodesy (and geomatics).
2. Ability to work on research and in profession independently, in designing, modelling, analysis, integration, management and decision making in the processes related to spatial data both in geodetic and geoinformation context, and in interdisciplinary context for the purpose of other professions and users. The acquired competences include also the development of the ability and skills in solving specific problems in the interdisciplinary environment.
3. Ability to develop and improve one's own knowledge by adopting new ideas, research, planning, designing, performing and conducting the most complex tasks and systems.
4. The development or improvement of abilities in presenting one's own work and making discussion with logical argumentation of positive scientific facts (related to the information, ideas, problems and possible solutions) to the professional and non-professional public.
5. Ability to promote technological development in the society based on knowledge and independent activity within the academic community.

Number of doctoral candidates: 48 (19 with thesis topic officially accepted)

Number of teachers: 31

Number of supervisors: 9 + 4 (9 are officially appointed supervisors to 19 students, others are counsellor supervisors)

Doctoral student : supervisor ratio: 1 :2.1 (if officially appointed supervisors are taken into account)

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:

3. issue a letter of recommendation for the period up to three (3) years in which period the higher education institution should make the necessary improvements.

RECOMMENDATIONS FOR THE IMPROVEMENT OF THE STUDY PROGRAMME

1. Whilst it is good to offer a breadth of study areas, within this setting it is crucial to next focus on a limited number (2-3) of key areas in which the HEI wants to excel in this broad field of geodesy-geoinformatics and attract PhD students and staff from all over the world (at least from other EU countries).
2. Make the programme more international: courses in English, PhD theses in English, and also the majority of papers by PhD student and supervisors in English.
3. Try to reduce the time for completing the PhD research; a good target would be 4 years (like in the new 2+2 scheme). Some teaching is good, but not more than 20% for getting experience on topic that are of additional interest for a PhD project. These can be MA courses too. It can be stimulating to have contacts between the PhD students and possible MSc theses students doing projects in line with the PhD-research.
4. Reward all involved when a good quality PhD research is finished in time: (financial or other) bonus for supervisor and PhD candidate. It would be best if this was even a national policy.
5. Make sure that a procedure for revoking an awarded PhD degree is established (but hopefully it is never needed). Plagiarism should be taken into consideration and the academic title should be revoked in this case. This is something that is not implemented and needs to be re-assessed by the Faculty.
6. Courses should be offered in English and promoted on the Faculty's website, making it more internationally known, especially for non-Croatian potential students. Additionally, supervisors should encourage students to write papers in English, making the respective international scientific community more familiar with the area of interest.
7. There is a need for increasing the number of successful graduations, as approximately 2 students graduate every year, while trying to reduce the duration of the PhD studies (6-8 years). PhD teaching limitation policy should be defined for assistants, so they can mainly be occupied with their research.
8. The reputation of the Faculty can be promoted especially by getting external evaluators for different purposes. For example, an external evaluator for a PhD defence, objectively assessing the work of the upcoming doctor of sciences without any conflict of interest. In this way, the work and reputation of the university and the Faculty will be promoted internationally.

ADVANTAGES OF THE STUDY PROGRAMME

1. Good academic quality of the supervising staff. Also a good number of BSc and MSc students involved in aspects of PhD research (and for their project or master thesis).
2. Broadness of the coverage of the whole domain (geodesy-geoinformatics), so multi-disciplinary geo-research topics can be supervised well.
3. The quality of the PhD theses seems to be appropriate. This is a bit hard to assess as most of them are in Croatian, but overall they make solid impression.
4. Reasonable percentage of PhD candidates that finally graduate. These numbers could always be higher, but care must be taken that this is not at the cost of lower quality.
5. Good setting, attending relevant conferences possible, good facilities within the Faculty (including various types of Croatian journals).
6. Availability and scientific support from supervisors to students was significantly outlined from students' side, making their studies pleasant, while monitoring and improving their research work as they are receiving valuable feedback frequently. Increased interaction and communication with the Faculty was mentioned and also observed by the Expert Panel.
7. The duration of the postgraduate programme, lasting from 4 years to usually 6-8 years can be seen as an advantage to those students who have to work part-time or full-time outside university for financial reasons. It shows the flexibility of the programme; however its duration should be overall monitored.
8. The Faculty offers a wide variety of research topics to PhD candidates.
9. Both supervisors and students seem willing to 'internationalize' the programme, where the first ones are willing to implement and offer courses in English and the latter are willing to write their thesis in English.
10. The Faculty appears to be active in promoting their work by publishing national bulletins of their achievements in an annual and not only basis, making the students more engaged to their research.

DISADVANTAGES OF THE STUDY PROGRAMME

1. Nearly all supervisors and all PhD candidates are from Croatia. Therefore, there is limited international mixing/enrichment.
2. Graduation takes a long time (7 years is typical). In many cases this is due to a quite heavy teaching load of the assistants. This is not bad *per se*, but a 50/50 position for PhD research/teaching should not be compared to a full PhD position.
3. There are a limited number of publications in international scientific journals, and nearly all PhD theses are in Croatian. More audience causes more reflections and feedback and encourages higher quality papers.
4. Nearly all of the current PhD students obtained their BSc or MSc from the same Faculty (and quite often stay at the Faculty after obtaining PhD degree). This does not stimulate free and original thinking, because of internal dependencies.
5. It would be good if the relationships (overlapping topics, connections, courses, research topics) between the MSc programme and the PhD programme would be more clear (however, what is covered in the MSc programme should not be repeated in the PhD programme).
6. Decreased job opportunities after students' graduation.
7. Insufficient funding sources for supporting PhD student research.
8. The coursework (taught part of the programme) seems a bit overwhelming and intense for the PhD candidates, who had already obtained a graduate degree (Master's), focusing basically on the coursework of various topics of their interest during that time. So, the workload of the lecturing part of the programme might need to be reconsidered, allowing more time for students to work on their research from day one.

9. Trend of the incoming PhD candidates includes mainly Zagreb students joining the programme, which has its advantages and disadvantages, as the education can be considered one-dimensional as there is no variety of different educational backgrounds or students from various institutions.
10. Light should be shed on the plagiarism check in every student's report or any official scientific documentation (mainly, paper publications in a national journal paper and doctoral theses).
11. The process regarding the students' annual progress report and any additional reported documentation of any type between supervisor-student (progress report presentation and meetings) is unclear.

EXAMPLES OF GOOD PRACTICE IN THE CURRENT PROGRAMME

1. The practice of inviting foreign professors/researchers to participate in the final assessment of PhD thesis work (as independent assessors, but mainly as top experts in the topic related to the thesis) is welcomed.
2. Participation at, and even organization of, international scientific events (e.g. in context of IAG, ICA, ISPRS, FIG, but could also be related to advanced standardization topics in the field via OGC or ISO/TC211 participations).
3. Student mobility via promotion of the possibility to spend a part of the PhD studies abroad (depending on situation ranging from a few weeks up to half a year) at leading organizations in the field of their PhD research topic.
4. Links with government and industry. This is both a potential source of funding, and also a method to get relevant research topics (and an environment in which to assess the proposed and developed solutions during the PhD research).
5. Covering conference participation costs almost once per year for every postgraduate student that present their work as a first author is considered an innovative step, particularly considering the difficulties occurring with regard to funding availability.
6. The organization of topical workshops, seminars, etc. for promoting the Faculty is acknowledged and welcomed.
7. Industrial liaison enhances the funding sources and promotes networking after students' graduation.
8. The strong willingness and effort to increase the financial sources for covering the expenses of all the accepted PhD students is very positive.

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

Minimal legal conditions:	
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 positive opinion:	
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
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, Supervisors and candidates); c) confirms feasibility of the draft research plan upon admission of the candidate (or submission of the proposal); 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, collaborator or in other ways; e) trained for the role before assuming it (through workshops, co-supervisions etc.); f) received a positive opinion of the HEI on previous supervisory work.	YES
6. All teachers meet the following conditions: 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.	YES
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

9. For joint programmes and doctoral schools (at the university level): 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.	N/A
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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.	<p>HIGH-LEVEL OF QUALITY</p> <p>HEI employs good and qualified staff, active in relevant (inter) national organizations. The Faculty has strong relations with the State Geodetic Administration, and is collaborating with about thirty academic institutions in the world through ERASMUS and bilateral agreements or teacher collaboration. Further, the Faculty is an academic member of FIG (International Federation of Surveyors) and active in EuroGeographics and CLGE. Research is conducted within a large number of national projects and also a few international projects. Also a number of international events were organized: CROPOS 2011, 2013, 2015, SIG2016.</p>
1.2. The number and workload of teachers involved in the study programme ensure quality doctoral education.	<p>HIGH-LEVEL OF QUALITY</p> <p>There is a good balance in numbers of teachers and students, assuming that teachers indeed have time available for guiding the PhD students, and this aspect was challenging to assess. Nevertheless, there was no indication that teacher workload was too high. There are approximately 30 teachers engaged in the programme.</p>
1.3. The teachers are highly qualified researchers who actively engage with the topics they teach, providing a quality doctoral programme.	<p>HIGH-LEVEL OF QUALITY</p> <p>The scientific quality of the teachers as assessed by their publications record (although it is not always clear what part of this was in international scientific journals with high impact factor), and also their funding record for successful research proposals, is of high value. A systematic improvement for training the supervisors in their tasks and roles (on regular basis) is recommended. Even for more experienced supervisors it is possible to learn and acquire more skills via such continuous learning process.</p>
1.4. The number of supervisors and their qualifications provide for quality in producing the doctoral thesis.	<p>IMPROVEMENTS ARE NECESSARY</p> <p>The number of potential supervisors is at good level (31 teacher), but the ratio of total number of students to supervisors is not. There are 48 students enrolled at the doctoral programme and only 9 supervisors were officially appointed (to 19 students with approved thesis proposals). 16 in total are acting as counsellor (to 1st and 2nd year students). We urge the HEI to appoint a supervisor to all doctoral students from day one, taking into account that supervisors are not overburdened (1:3 ratio).</p> <p>Moreover, more active participation in a leading (international) research project should be achieved in the future. The same</p>

	conclusion applies for more international publications in international ISI (or other indexed) scientific journals.
1.5. The HEI has developed methods of assessing the qualifications and competencies of teachers and supervisors.	<p>IMPROVEMENTS ARE NECESSARY</p> <p>The supervisors' qualifications are of good quality from scientific point of view (given their publication track record). There are also good rules concerning the appointment of supervisors. But besides their scientific achievements and skills, supervisors should also have other skills that are needed for supervision. It is unfortunate to learn that the University in Zagreb has stopped organising workshops for supervisors. Therefore the Faculty is urged to implement its decision (of 21st May 2016) and define the conditions that would replace workshops for supervisors. More systematic and clear monitoring of supervision and student progress reporting is needed.</p>
1.6. The HEI has access to high-quality resources for research, as required by the programme discipline.	<p>HIGH-LEVEL OF QUALITY</p> <p>As indicated in the Self-Evaluation Report (SER) and confirmed in the interviews during the site visit the doctoral candidates at the Faculty of Geodesy have all the geodetic, information and other equipment at their disposal: GNSS receivers, gravimeters, magnetometers, astronomic devices, unmanned aerial vehicles, INS sensors, automated and classical total stations, laser and hydrographic devices, various software packages and applications (ArcGIS, AutoCAD, ZWCad, etc.), and additional facilities available via partnerships with companies and institutions.</p>
2. 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.	<p>HIGH-LEVEL OF QUALITY</p> <p>The Faculty has a clear vision on the purpose of postgraduate doctoral studies of Geodesy and Geoinformatics As the SER states, 'modern, global society is based on accurate, reliable, high-quality updated information about space and the relationship among objects in space. Ordered, accurate, reliable and updated information is fundamental for the development of modern society, i.e. state. The development of scientific capacities, research activities and transfer of acquired knowledge into economy and state administration are extremely important activities for each state, and especially for the state in transition as Croatia.'</p>
2.2. The programme is aligned with the HEI research mission and vision, i.e. research strategy.	<p>HIGH-LEVEL OF QUALITY</p> <p>The scope of the programme of the Faculty is quite broad and organized in a number of (research) institutes, each with their own research goals: Institute for Geomatics, Institute for Cartography and Photogrammetry, Institute for Applied Geodesy, and the Observatory Hvar. The doctoral education has the same breadth (and in that sense both are well-aligned). Within these institutes it would be wise and more feasible to have a very limited number of key areas (2 or 3 for the whole</p>

	Faculty).
2.3. The HEI systematically monitors the success of the programmes through periodic reviews, and implements improvements.	<p>IMPROVEMENTS ARE NECESSARY</p> <p>As the SER states, activities are put in place for continuous monitoring and analysis of the research productivity of supervisors and candidates, assuring the quality of the programme within the scope of research projects. Specific opinion polls for reviewing the work of advisors and supervisors have not been made. More systematic periodically repeated and well documented monitoring and analysis would be preferred.</p>
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.	<p>IMPROVEMENTS ARE NECESSARY</p> <p>An example of a good, systematic approach to evaluation of supervisors was the analysis of the Dr.Sc.04 forms (annual report by the student). According to the SER, the analysis of the 27 forms for the year 2011/12 delivered the average grade for supervisors to be 4.7 (at the scale from 1 to 5). Such evaluation of supervision should be done every year. There have been no special situations in the last five years in which it would have been necessary to change supervisors. However, it would be good to have a policy and a procedure for this made explicit (in case needed). It would also be good to have clear and transparent mechanisms for rewarding the successful supervisors.</p>
2.5. HEI assures academic integrity and freedom.	<p>IMPROVEMENTS ARE NECESSARY</p> <p>All doctoral theses are presented to the public during the assessment procedure, and every teacher can submit his/her comment to the Committee for the assessment of doctoral thesis. It would be good to systematically check all PhD theses for plagiarism when submitted. This does not seem to be the case yet, and therefore should be improved.</p>
2.6. The process of developing and defending the thesis proposal is transparent and objective, and includes a public presentation.	<p>HIGH-LEVEL OF QUALITY</p> <p>The regulations of the postgraduate doctoral study programme are clear (starting with the doctoral thesis proposal), well documented and well applied in practice, including the rule that each committee should have one member from another institution. This could be improved, e.g. at least one international expert in the field. Also the defence protocol for the doctoral thesis is clear and well specified in the regulations (including the needed forms). All mentioned materials were available to the committee (and made positive impression), but due to Croatian language this was not always possible to fully check.</p>
2.7. Thesis assessment results from a scientifically sound assessment of an independent committee.	<p>HIGH-LEVEL OF QUALITY</p> <p>The regulations and protocol for the evaluation of thesis and defence is at good level (and also well applied in practice). All doctoral theses defended at the Faculty of Geodesy since 1st January 2015 have been made in the form of a monograph. All completed PhD theses from the last 5 years were available for</p>

	<p>the Expert Panel to check during the site visit (and made a solid impression). There are clear rules, instructions (and again forms for preparation of the doctoral thesis and for the evaluation of the doctoral thesis). There is a secretary of the doctoral studies who is responsible for the specified protocol of the defence.</p>
<p>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.</p>	<p>IMPROVEMENTS ARE NECESSARY The SER states that the Faculty of Geodesy publishes all necessary information on its web pages. It would have been nice if the relevant URLs were also mentioned in that report. Moreover, the Faculty's website seems to have some relevant links for the postgraduate studies programme, which, however, were only given in Croatian.</p>
<p>2.9. Funds collected for the needs of doctoral education are distributed transparently and in a way that ensures sustainability and further development of doctoral education (ensures that candidates' research is carried out and supported, so that doctoral education can be completed successfully).</p>	<p>HIGH-LEVEL OF QUALITY The SER provides information on expenditure of funds collected for years 2014, 2015 and 2016 specifying the main categories of expenditures (and their amounts). Rules on how to spend the fees are well explained (and applied) in the SER document. From the Expert Panel visit, the main impression was that most PhD students do not pay tuition fees as they are staff members of the HEI (for which the fees do not apply).</p>
<p>2.10. Tuition fees are determined on the basis of transparent criteria (and real costs of studying).</p>	<p>HIGH-LEVEL OF QUALITY This is well explained in the SER. The cost of the semester at the doctoral programme in the last five year was 10,000HRK. The programme lasts for 3 years, i.e. 6 semesters, hence the total study expense amounts to 60,000HRK. The expenses for the preparation of the doctoral thesis are not included and they depend on the individual doctoral thesis, i.e. research.</p>
<p>3. SUPPORT TO DOCTORAL CANDIDATES AND THEIR PROGRESSION</p>	
<p>3.1. The HEI establishes admission quotas with respect to its teaching and supervision capacities.</p>	<p>IMPROVEMENTS ARE NECESSARY For the past 10 years, approximately since the Bologna System was introduced, the rate of enrolled postgraduate students (PhDs) has ranged from 1 to 22, with an average of 10.7 students per year. Entry numbers have never reached the maximum quota estimated at 25. Although the Faculty claims that it does not have insufficiency in supervisors' availability and workload, it seems that it has never faced the case of rejecting a student in admissions, and therefore accepts all the applicants that fulfil the general conditions. We encourage improvements in this respect. It is stated in the SER that the ratio between officially appointed supervisors and doctoral candidates is ~1:2, a bit lower than the limit of 1:3, due to the reduced interest of doctoral candidates. However, this ratio <u>does not</u> account for previous PhD students with already appointed supervisors, nor 1st and 2nd year students who do not have official supervisors yet. As a result, the real ratio</p>

	<p>between (some) supervisors and doctoral candidates could be significantly higher than 1:3 which makes us conclude admissions quotas of 25 per year is too high.</p> <p>Although it was mentioned that there has never been a problem of insufficient supervisors or their workload, we encourage the Faculty to appoint supervisors directly after the enrolment or even base its enrolments criteria on the availability of the appropriate supervisors.</p> <p>It was also mentioned that more light was shed on the enhancement of the quality of the postgraduate studies. Focusing more on the quality, the Faculty members seemed updated with the state-of-art applications of the real world needs, by publishing annually and semi-annually in different frequency bulletins their and their students' achievements. Obviously, the supervisors' self-education and will for further development is evident. However their exposure to international conferences and collaborations can always enhance their reputation, expand their knowledge and increase their visibility. Additionally, according to the Faculty's record, the Faculty was visited by 13 scientists lecturing, from various countries internationally promoting wider knowledge and research-prospective variety at the Faculty. Also, it seems that some of them co-supervised doctoral candidates.</p> <p>More specific comments about the supervisor and student obligations and tasks can be found in part 3.9.</p>
<p>3.2. The HEI establishes admission quotas on the basis of scientific/ artistic, cultural, social, economic and other needs.</p>	<p>IMPROVEMENTS ARE NECESSARY</p> <p>Based on the Faculty's report about the postgraduate students' job offers after graduation, it seems that there was no unemployed geodesists, holding a doctoral degree, despite the recession of the past 8 years, up to 2015, considered as the start of a new era for Geodesy and Geoinformatics with increasing demand and needs by society. The positive fact is that both students who were employed by the Faculty and students who are working on an industry-based-project are partially financially supported.</p> <p>A concern is the extended length of the postgraduate studies varying from 6-8 years on average, implying no 'top' state-of-art theses/topics and possibly different economic needs for the industry can be met in such long time.</p> <p>However, of greater concern is that with an admissions quota of 25 students each year, but enrolment of 2 every second year, it is concluded that quotas are too high.</p>
<p>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.</p>	<p>IMPROVEMENTS ARE NECESSARY</p> <p>Although the capacity of absorption has been estimated to 25 students per year, currently in the organised part of the programme there are 15 full-time doctoral candidates, who are financially covered and 1 self-funded. The Faculty covers the expenses for the full-time students of doctoral studies who have the rank of assistant (are employed at the Faculty). It is financed</p>

	<p>with the available funds out of the income of the Faculty. Also, some students are financially covered as they are working on an industry-research project.</p> <p>Consideration needs to be paid to the financial implications of increased enrolments, up to the quota of 25. It is unclear if the Faculty has funding to cover the costs associated with increased student numbers.</p> <p>If the Faculty plans to increase its doctoral students' numbers perhaps it should look for additional funding through its relations with industry as one of the strongest contributors of financial support and further networking for the students.</p>
<p>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.</p>	<p>IMPROVEMENTS ARE NECESSARY</p> <p>For the time being, with the decreasing demand for doctoral studies, the average ratio is around 1: 2.</p> <p>However, it is unclear what number of advisors and supervisors are appointed to PhD students in total since the official supervisor is only appointed at the end of 2nd year or later. We recommend that supervisors should be appointed from day one and although the HEI has defined its own threshold of maximum 7 students per advisor, this seems rather high.</p> <p>Regarding the research plan, based on the structure of the doctoral programme during the first year, doctoral candidates are occupied by the course load which seems unduly onerous for PhD studies, as the students have already accomplished the previous steps of their education (e.g. Master's degree) and they are well equipped with the required knowledge for their potential upcoming research. It is unclear when the students start working on their doctoral topic; simultaneously with the coursework or right after i.e. at the end of their 2nd year of PhD studies. In the latter case, the defined length of the PhD studies, defined as 4 years, seems underestimated and the reason why most students extend it to 5-6 years seems more logical. The Expert Panel recommends research to start earlier, from the point of admission through sustainable research plan and appointed supervisor.</p>
<p>3.5. The HEI ensures that interested, talented and highly motivated candidates are recruited internationally.</p>	<p>IMPROVEMENTS ARE NECESSARY</p> <p>Based on the acceptance rate of students for the past decade, where less interest was shown than demand, it is hard to assess the students' acceptance process and if the criteria of the Faculty were strictly met. However, according to the Faculty's report, talented students, motivated for excellence are assessed by being employed by the Faculty, where currently 48 doctoral students are enrolled and 17 of them are Faculty staff members.</p> <p>Considering the international level of students entering the Faculty, according to the Faculty's report, currently there are 5 foreigners students enrolled. However, the international level of interest seems low overall, attributing to the fact of the programme's structure and the linguistic restrictions imposed. Particularly, it seems that the programme's reputation is not well</p>

	<p>advertised or enough promoted by its own integrity and the linguistic component of the offered courses in English is not clear to the international students, who, for example, are thinking of visiting the Faculty. However, all Faculty students have the option of composing their thesis in English, making both national and international students approaching a wider research community through their published thesis.</p>
<p>3.6. The selection process is public and based on choosing the best applicants.</p>	<p>HIGH-LEVEL OF QUALITY</p> <p>There is a public announcement every year in September for postgraduate admissions from the PhD candidates that clearly states that postgraduate students are accepted through a detailed procedure, by taking into account different credentials and qualifications, accounting for a variety of candidate cases.</p>
<p>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.</p>	<p>HIGH-LEVEL OF QUALITY</p> <p>The procedure documentation followed and details of the the selected candidates are archived and open to the public, demonstrating the procedure's clarity and transparency from the Faculty's side.</p>
<p>3.8. There is a possibility to recognize applicants' and candidates' prior learning.</p>	<p>HIGH-LEVEL OF QUALITY</p> <p>According to the admission requirements, Article 5 of the regulations, applicant's prior education is taken into consideration since the candidate's admission request, by acknowledging their prior institutions' learning and scientific achievements. Different cases are mentioned in the Self-Evaluation Report of the Faculty.</p>
<p>3.9. Candidates' rights and obligations are defined in relevant HEI regulations and a contract on studying that provides for a high level of supervisory and institutional support to the candidates.</p>	<p>IMPROVEMENTS ARE NECESSARY</p> <p>Students seem happy with their supervisors' behaviour and treatment, with no objections raised by the student representatives. According to the students, they are able to meet and talk to their supervisors about their research on regular basis, enabling them to receive feedback frequently, which is considered of significant importance and indispensable support during the postgraduate studies.</p> <p>Also, the regulations concerning the mentorship and doctoral candidates' duties, rights and obligations are strictly defined by regulations. Nevertheless, two main topics remain slightly unclear.</p> <p>First, the annual report that needs to be filled out and submitted by both the supervisor and the doctoral candidate seems to be confusing; this procedure is not strictly followed by both parties, resulting in late submissions, or one or both parties unaware of the final outcome of the complete report.</p> <p>Secondly, the doctoral candidate is required to publish or have accepted for publishing at least one internationally reviewed work before defence, which is not always the case. These obligations should be clarified to the doctoral student, supervisor and Faculty in advance.</p> <p>Additionally, it is considered very beneficial to have the "Info</p>

	<p>Day" for newly enrolled PhD candidates, welcoming and introducing them to the Faculty's different administrative components.</p> <p>Finally, it is unclear how the doctoral students were appointed and officially assigned to the assistant responsibilities of the Faculty such as teaching. We recommend that this be made more official, through a documentation e.g. contract between the Faculty and the student accepted with specified responsibilities. However, it is expected that the Faculty should start introducing official contracts from the upcoming academic year 2016-2017.</p>
<p>3.10. There are institutional support mechanisms for candidates' successful progression.</p>	<p>HIGH-LEVEL OF QUALITY</p> <p>Especially after meeting in person the mentors of the Faculty, it was obvious that there is an unprecedented will from the Faculty members to assist doctoral students not only academically but also financially. According to the Faculty, the main constraint is the possibility for such an action, especially since the Regulations of Postgraduate Doctoral Study Programme of Geodesy and Geoinformatics do not define the issues of financial support for the doctoral candidates. Efforts are still made by the Faculty and the project-based researches, in collaboration with the industry, through providing the tuition fees coverage for students who are employed by the Faculty.</p> <p>A feasible recommendation for future financial improvement would be to increase international project funding offered by agencies in Europe (e.g. European Space Agency ESA) spreading the Faculty's research activities, enhancing its reputation and providing funds for all the accepted candidates (providing that they are accepted based on merit).</p>
<p>4. PROGRAMME AND OUTCOMES</p>	
<p>4.1. The content and quality of the doctoral programme are aligned with internationally recognized standards.</p>	<p>HIGH-LEVEL OF QUALITY</p> <p>The four-year programme of doctoral studies in the Faculty of Geodesy and Geoinformatics has a clear research-oriented focus. The first year of the programme includes mostly course-based student work while the next three years are entirely devoted to the doctoral candidates' independent research work under the academic supervision of their mentors. The international experience gained by the students during the programme comes mostly from short-term visits to foreign universities and research institutes and (at few cases) from the mentoring they receive by appointed external co-mentors during the preparation of their doctoral dissertation. This could possibly be improved in the future and further actions can be pursued towards this direction of internationalization. The current efforts, in cooperation with the Technical University of Munich, to revive the organization of annual doctoral seminars offered to graduate students of both institutions are in the right direction and should be materialized. Inter-disciplinarity seems to be rather low in terms of active involvement of Faculty members from other faculties/departments in the (co-)supervision/mentoring of PhD</p>

	<p>projects, although the variety of doctoral topics that have been pursued by the students during the last five years seems to well-cover a multitude of scientific application areas with definite multi-disciplinary interest.</p> <p>Overall, the doctoral programme shares structural similarities with high-quality doctoral programmes in geodesy at central European universities (Austria, Germany) and it has successfully implemented most of the formal academic procedures for the admission and the academic evaluation of the doctoral candidates valid internationally. Currently, it seems that HEI works at a reasonable quality level, which should be further improved by particular actions that were mentioned in the beginning of this report.</p>
<p>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.</p>	<p>HIGH-LEVEL OF QUALITY</p> <p>The intended learning outcomes of the delivered graduate courses of the doctoral studies programme are explicitly stated in the course descriptions within the academic syllabus. The acquired knowledge and skills, as well as the detailed description of each course's contents, are clearly documented. The evaluation method(s) that are followed for each course are also listed, along with some recommended (mostly Croatian) bibliography. The development of competence in ethical research methodology, reading/writing/presentation skills, critical analysis and synthetic thinking for innovative research work, seem to be well-served by the compulsory course "Methods of scientific work" which is given during the first semester of the doctoral studies programme. The follow-on project based courses provide also the opportunity to the doctoral students to implement such skills in actual research-oriented problems, in preparation of their main research work towards their PhD dissertation. Considering all the above, the Expert Panel's assessment is that the learning outcomes of the doctoral programme, and especially with regard to its teaching component, adhere to the quality level 8.2 of the Croatian Qualifications Framework.</p>
<p>4.3. Programme learning outcomes are logically and clearly connected with teaching contents, as well as the contents included in supervision and research.</p>	<p>HIGH-LEVEL OF QUALITY</p> <p>The Expert Panel during its visit to the Faculty of Geodesy and Geoinformatics met with a number of doctoral students and also with a number of graduate alumni, and discussed in depth their academic experience with regard to the teaching and learning environment that is/was provided by the doctoral studies programme. There was an overall high satisfaction level in terms of their individual experiences related to their doctoral studies, both at teaching level and at research-supervision level. The students' general feeling is that they actually learn and gain a lot from the current programme, although they suggested that additional improvements should consider the increase in international mobility and also a reasonable balance in their teaching duties/assignments within the undergraduate studies programme.</p>

<p>4.4. The doctoral programme ensures the achievement of learning outcomes and competencies aligned with the level 8.2 of the CroQF.</p>	<p>HIGH LEVEL OF QUALITY</p> <p>Based on the submitted samples of PhD theses (two of them were written in English) and also a submitted collection of research articles/papers that were (co)authored by doctoral candidates, it has been assessed that the research work performed by the doctoral candidates is of high-quality and adheres to the academic standards expected by an academic graduate studies programme in the fields of Geodesy and Geoinformatics. Nevertheless, the remarks that are provided in section 4.8 should be also be considered for further improvements in the quality of the achieved learning outcomes of the programme.</p>
<p>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.</p>	<p>IMPROVEMENTS ARE NECESSARY</p> <p>The teaching component in the doctoral programme is currently composed of (i) general-type courses which are taught during the first semester and they are delivered mostly through class lectures to the students by specific Faculty members, and (ii) 1+2 project-based seminars and workshops which are undertaken on an individual basis during the first and second semester of the doctoral studies programme. In addition, the Faculty of Geodesy and Geoinformatics in cooperation with the Technical University of Munich tries to enforce the systematic organization of specialized technical seminar series with active participation of its doctoral students.</p> <p>It is recommended that Faculty members should also try, based on their established research and academic partnerships with other foreign universities and academic institutions, to invite guest scientists to deliver short-duration seminar-type courses on state-of-the-art specialized topics. This would increase the exposure of the doctoral students to the most current scientific developments and give them the ability to interact with other international leading scientists in the fields of Geodesy and Geoinformatics. Some additional comments and suggestions on the teaching structure of the doctoral programme are given in section 4.7.</p>
<p>4.6. The programme enables acquisition of general (transferable) skills.</p>	<p>IMPROVEMENTS ARE NECESSARY</p> <p>The programme's current structure gives the opportunity to the doctoral students to acquire strong skills related to organizing and managing their research work, as well as to presenting (in both oral and written form) the outcomes of their individual research. But concerning general skills, there is no established structure with the Faculty's academic programme aiming to offer special managerial, business and funding skills to the doctoral students in terms of dedicated compulsory or optional workshops.</p>

<p>4.7. Teaching content is adapted to the needs of current and future research and candidates' training (individual course plans, generic skills etc.).</p>	<p>HIGH LEVEL OF QUALITY</p> <p>The programme has a fixed structure in terms of the offered courses to the doctoral students. The number of these courses varies between two and three (the third course may be optionally substituted by an individual research project) and they all have to be completed during the first semester of the programme. The contents of these courses cover the general areas of (i) mathematical and statistical methods in geodesy, (ii) general methodological aspects of scientific work, and (iii) formal methods in geoinformatics. For students who have not completed a pre-doctoral programme in geodesy, the Faculty offers four different clusters of additional graduate courses covering the areas of geodetic positioning, photogrammetry and remote sensing, cartography, and spatial data management (including cadastral surveying and engineering geodesy). Also, according to the syllabus of the post-graduate doctoral studies programme for the academic year 2015-2016, first-year doctoral students have to complete two project workshops and (optionally) one project seminar, whose topics are suggested from a panel of five Faculty members. This gives a relative freedom to the doctoral students to get involved with research projects that are closer to their individual interests and scientific preferences. Yet, no student annual research plans have been provided in the Faculty's Self-Evaluation Report.</p> <p>Overall, the teaching component of the doctoral programme seems to be well-structured, putting emphasis on both general-knowledge skills and individual specialization of particular research area. However, a larger variety of the offered courses and an increase on the number of the involved Faculty members in the student-based research projects/workshops is suggested in order to strengthen the quality and to better serve individual student academic needs.</p>
<p>4.8. The programme ensures quality through international connections and teacher and candidate mobility.</p>	<p>IMPROVEMENTS ARE NECESSARY</p> <p>The programme seems to satisfy reasonable quality standards through its "internationalization" efforts, yet more work should be put towards the strengthening of this aspect. The number of doctoral candidates that have completed their dissertations in English during the last five years is considered to be very low, and the Faculty should encourage this practice to students more strongly. The current effort to invite and involve international scientists from different countries (Germany, Slovenia, USA, Greece, Belgium, Turkey) as external co-mentors in doctoral theses should be continued, as it can indirectly enforce even more theses to be delivered in English (and thus increase the international exposure of the academic/research work produced by the doctoral candidates).</p> <p>An additional aspect that could be looked at towards the quality increase of the programme is the placement of more strict requirements in terms of the published work by the doctoral students. According to the current Faculty regulations (Article</p>

	<p>13) the doctoral dissertation can be composed of a series of at least three (3) published journal papers, out of which at least one (1) should be published in a journal with a “high” impact factor- The latter is vaguely quantified within the regulations. It would be in the programme’s best interest to upraise such a requirement to higher quality standards.</p>
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*** 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.