REPORT of the Expert Panel on the

RE-ACCREDITATION OF Faculty of Science, University of Zagreb

Date of the site visit: 13-15 April 2015

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INTRODUCTION

This report on the re-accreditation of the Faculty of Science University of Zagreb was written by the Expert Panel appointed by the Agency for Science and Higher Education, on the basis of the self-evaluation of the institution and supporting documentation and a visit to the institution.

The re-accreditation procedure performed by 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*), is obligatory once in five years for all higher education institutions working in the Republic of Croatia, in line with the Act on Quality Assurance in Higher Education.

The Expert Panel is appointed by the ASHE Accreditation Council, an independent expert body, to perform an independent peer-review-based evaluation of the institution and their study programmes.

The report contains:

- a brief analysis of the institutional advantages and disadvantages,
- detailed analysis of the compliance to the Standards and Criteria for Re-Accreditation,
- recommendations for institutional improvement and measures to be implemented in the following period (and checked within a follow-up procedure), and
- list of good practices found at the institution.

The members of the Expert Panel were:

- Professor Alan Barr, University of Oxford, Department of Physics, United Kingdom of Great Britain and Northern Ireland, Chair
- Professor Malte Braack, Christian-Albrechts-Universität zu Kiel, Federal Republic of Germany
- Professor Donald Bruce Dingwell, Ludwig-Maximilians University Munich, Federal Republic of Germany
- Professor Ilja Doršner, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture, University of Split, Republic of Croatia
- Professor Pierre Sebban, Paris Sud University, French Republic
- Professor Frank Witlox, Department of Geography, Ghent University, Kingdom of Belgium
- Domagoj Vugić, student, Faculty of Science, University of Split, Republic of Croatia

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

- Marina Matešić, Head of Department of Accreditation in Science, coordinator
- Mina Đorđević, Department of Analytics and Statistics, assistant coordinator
- Đurđica Dragojević, Department of International Cooperation, interpreter

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

- The Management (Vice-Deans, without the Dean who was on a sick leave);
- The Vice Dean for Teaching and the representative of the Committee for Quality Management;
- The Vice Dean for Science and Doctoral Studies and the Vice Dean for International Cooperation;
- The Vice Dean for Finance and the Vice Dean for Investment and Development;
- Students and student representatives (self-selected);
- Department Heads and their Deputies;
- Teaching-scientific staff, together with the Heads of Study Programmes and Leaders of Research Projects;
- Teaching-research assistants and junior researchers;
- The Vice Dean for Science and Doctoral Studies and the Heads of Doctoral Study Programmes;
- Representatives of external stakeholders research partners (Ruder Bošković Institute, Institute for Physics and other scientific institutes and higher education institutions)

The Expert Panel also had a tour of the libraries, IT rooms, student register desk, and the classrooms, and practical laboratories at the PMF Zagreb. They held a brief question and answer session with the students of several departments. In a change to the planned programme for the Site Visit, the Panel was unable to meet with the Dean due to his illness – and hence met the wider decanal team in his place.

Upon the completion of the re-accreditation procedure, the Accreditation Council renders its opinion on the basis of this Re-accreditation Report, the Assessment of Quality of the higher education institution and the Report of Fulfilment of Quantitative Criteria acquired from the Agency's information system.

Once the Accreditation Council renders its opinion, the Agency issues an Accreditation Recommendation by which the Agency recommends to the Minister of Science, Education and Sports to:

- 1. **issue a confirmation on compliance** with the requirements for performing higher education activities or parts of activities (renew the licence),
- 2. **deny the license** for performing the higher education activities or parts of activities to the higher education institution, or

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. The letter of recommendation may include suspension of student enrolment for the defined period.

The Accreditation Recommendation also includes an Assessment of Quality of the higher education institution as well as recommendations for quality development.

SHORT DESCRIPTION OF THE EVALUATED INSTITUTION

NAME OF HIGHER EDUCATION INSTITUTION: Faculty of Science, University of Zagreb ADDRESS: Horvatovac 102a, HR-10000 Zagreb, Croatia NAME OF THE HEAD OF HIGHER EDUCATION INSTITUTION: Prof. Zoran Curić, Ph. D. ORGANISATIONAL STRUCTURE (e.g. chairs, departments, centres)

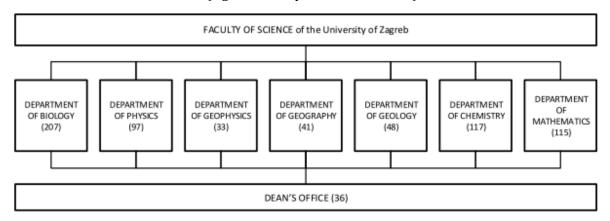


Figure 1.1 Organisational structure of the Faculty of Science

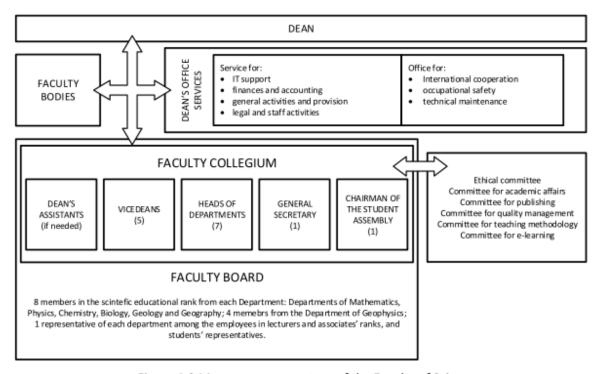


Figure 1.2 Management structure of the Faculty of Science

Source: Self-evaluation document of the Faculty of Science, University of Zagreb, pg. 17

LIST OF STUDY PROGRAMMES (and levels)

Undergraduate university study programmes:

- Biology
- Molecular Biology
- Environmental Sciences
- Geophysics
- Geography; research programme
- Geology
- Chemistry
- Mathematics
- Mathematics Education,

Integrated undergraduate and graduate university study programmes:

- Biology and Chemistry Education
- Physics; research programme
- Physics Education
- Physics and Computer Science Education
- Physics and Technology Education
- Physics and Chemistry Education
- Geography and History Education
- Mathematics and Physics Education

Graduate university study programmes:

- Experimental Biology
- Ecology and Nature Preservation
- Molecular Biology
- Environmental Sciences
- Physics Geophysics; concentrations: Seismology and Physics of solid Earth, Meteorology and Physical Oceanography
- Geography; concentrations: Physical Geography with Geoecology, Spatial Planning and Regional Development, Heritage and Tourism, Geographical Information Systems
- Geography Education (single major)
- Geology
- Environmental Geology
- Chemistry; research programme
- Chemistry Education (single major)
- Theoretical Mathematics
- Applied Mathematics
- Mathematical Statistics
- Financial and Business Mathematics
- Computer Science and Mathematics

- Mathematics Education
- Mathematics and Computer Science Education,

Postgraduate university studies:

- Biology
- Physics
- Geography
- Geology
- Chemistry
- Mathematics
- Interdisciplinary doctoral study in Oceanology;

Postgraduate specialist study:

• Actuarial Mathematics

NUMBER OF STUDENTS

Student structure by Departments

DIAC Proportion ont	2013/2014		2014/2015	
PMF Department	Regular students	Final-year students	Regular students	Final-year students
Department of Biology	1043	90	1009	70
Department of Physics	686	29	659	20
Department of Geophysics	57	2	70	0
Department of Geography	461	30	404	16
Department of Geology	251	31	262	23
Department of Chemistry	480	18	405	13
Department of Mathematics	1756	38	1777	33
PMF total	4734	238	4586	175

Source: Self-evaluation document of the Faculty of Science, University of Zagreb, pg.164

NUMBER OF TEACHERS (full-time, external associates)

Staff category	Full time	Part time
Full professors	97	38
Associate professors	74	20
Assistant professors	86	30
Lecturers and Senior lecturers	12	11
Teaching assistants	23	21
Expert associates	28	4
Junior researchers	135	13
TOTAL	455	137

Source: Self-evaluation document of the Faculty of Science, University of Zagreb, pg. 191

NUMBER OF SCIENTISTS (doctors of science, elected to grades, full-time): 257

TOTAL BUDGET (in kunas): 164,007,840.61 HRK

MSES FUNDING (percentage): 140.924.003,84 HRK or 85,9 % OWN FUNDING (percentage): 23.083.836,77 HRK or 14,1 % SHORT DESCRIPTION OF HIGHER EDUCATION INSTITUTION:

The Faculty of Science of the University of Zagreb (*Prirodoslovno-matematički fakultet* or PMF) was established in 1946. It has gone through numerous functional and organizational changes ever since. Today the Faculty includes 7 departments and the Dean's Office and connected services. The Department of Geophysics includes the Republic of Croatia Seismological Service, the Mareographic and meteorological stations, while the Botanical Garden is part of the Department of Biology. The Faculty has 257 full professors, associate and assistant professors, 135 junior researchers and about 4500 students. The Faculty offers undergraduate, graduate, and postgraduate study programmes, and pursues research in the fields of natural sciences and mathematics.

CONCLUSIONS OF THE EXPERT PANEL

The Faculty of Science of the University of Zagreb (*Prirodoslovno-matematički fakultet* or PMF) is arguably the most important faculty in the country, possessing as it does the largest student body of natural sciences together with the broadest range of teaching and research disciplines in a Croatian University setting. This positioning was reflected by the self-evaluation report and during the site-visit of the Panel. The most important positive impressions of the PMF are related to the following strengths:

- 1. **A national success.** The faculty enjoys the status of being a national and regional focus point for research and teaching. It can and must continue to be actively involved in setting the Croatian national best practice in the natural sciences.
- 2. Engaged staff and students. The Expert Panel found the faculty to be full of enthusiastic, engaged and ambitious students and teachers, researchers and other staff at all levels. Members of the faculty, from first year students to full professors, demonstrate a real sense of community. It was obvious that they enjoy good collegiality, a true sense of pride in the institution, and they seem open to providing high levels of mentoring and assistance to one another.
- 3. **Community engagement.** From the number and breadth of outreach activities reported it seems clear that the faculty is very actively engaged in promoting science to their local and national communities.
- 4. **Northern Campus facilities.** The Northern Campus location offers an ideal location for collaboration with the national research institutes. The Mathematics and Physics departments, which are already well established on that site, benefit from excellent, modern facilities for teaching and research. These departments and their collaborating national institutes benefit significantly from the proximity of these departments to the national research facilities and to one another.
- 5. ERC success. The accession of Croatia into the EU has offered the Faculty the chance to access European structural funds, and research grants. The EU context provides the possibility of greatly increased incoming and outgoing mobility of students, teachers and researchers, which should be to the benefit to all parties. It also provides access to new forms of grants and funding, which the faculty is starting successfully to exploit, including the successful award of its first large grant from the European Research Council.

In contrast to these strengths, there are also certain threats identified by the Panel:

1. **Financial constraints.** It was clear to the Expert Panel that the Faculty and departmental management felt very stretched in the face of continuing and escalating

financial constraints. The Panel were told that the PMF faces severe difficulty in appointing new staff at all levels, which we believe to be reducing mobility, innovation and knowledge transfer. Resources for libraries and journals were reported to be under threat from an imminent loss of government funding. Seed-corn funding of research, as well as funds for dissemination of results, is severely constrained, generating a significant risk of loss of international leadership. The Panel believes that the need to find short-term financial savings is negatively impacting the ability of the Faculty to obtain better long-term financial security through access to international research grants. Those grants, in turn, are essential in attracting and retaining world-class teaching and research staff. The Panel is of the opinion that, with national government funding apparently tightly constrained, the Faculty has no alternative but to think broadly and go beyond their usual comfort zone in seeking novel and non-traditional sources of support.

- 2. **Limited internationalisation.** The Panel observed that recent changes resulting from conforming to the Bologna course structure have already resulted in rapid and sometimes difficult change. Nevertheless mobility remains limited, with significant barriers facing staff moving both into and out of the institutes, and with the majority of the faculty having had nationally-focused careers. The panel believes that the faculty will have to make further rapid, radical changes to its culture and operation to make the best of the opportunity of internationalisation.
- 3. **Geo-Bio science geographical dispersal.** The Panel believes that the faculty faces a desperate and urgent need for improved facilities for biological and geo-sciences. It considers the current facilities for these departments to be entirely inadequate. The existing buildings, which are in places unsuitable, cramped and generally geographically dispersed, are, we believe, having a crippling effect on those departments' ability to perform research, teaching and collaboration. It seems clear that the result has been a serious loss of efficiency in both time and resource. We believe that the completion of the proposed new Biology-Geology-Geography (BGG) building is essential and of the highest priority.

DETAILED ANALYSIS OF INSTITUTIONAL COMPLIANCE TO THE STANDARDS AND CRITERIA FOR RE-ACCREDITATION

The analysis is stated below according to the Criteria of ASHE. The Expert Panel makes certain recommendations, with the goal of further increasing the scientific and teaching excellence of the PMF. The Panel recognises that this is the first review and accreditation of its type. Nevertheless the Panel encourages the faculty to be ambitious, and to establish a regional

example of best practice, by timely consideration and adoption of the panel's recommendations. The initial recommendation of the Panel is also that the Dean should circulate this Report of the Expert Panel to the faculty staff and to the student representatives. He should ensure that there are effective forums in which staff and students can meet with one another, and with the departmental and faculty leadership, to discuss these recommendations. The decanal team should ensure that there are effective mechanisms in place to plan and monitor the implementation of these recommendations. The particular recommendations in each area follow. Items the Expert Panel consider to be of the most importance and/or requiring urgent attention are flagged with asterisks (**).

1. Institutional management and quality assurance

The continued adherence to the highest standard of governance will be an essential prerequisite for building this shared strategy, and its associated culture of continual improvement and development. In an increasingly competitive and internationalised job market it is more important than ever that the Faculty members adhere to, and be seen to be adhering to, the highest standards of transparency and avoidance of conflict of interest.

Criterion 1.1

A strategy plan was provided to the Panel. The Panel found the plan to be an accurate description of the current state of the Faculty. Nevertheless, the document offered little insight into its future aims. From what the Panel could ascertain, it was crafted by the management, without significant engagement from the teaching and research staff. The strategy document did not describe the Faculty's operational plans and monitoring mechanisms.

Criterion 1.2

The organisational structure of the Faculty was clearly described, and the legislative documents indicated. The Panel had concerns that the short term of office of the decanal team appeared to be leading to a lack of continuity in management. The panel was concerned about the resulting impact on the effectiveness of the Faculty in policy implementation and external stakeholder engagement.

Criterion 1.3

The University strategy in the natural sciences is largely derived from the Faculty strategy, so the two are naturally aligned.

Criterion 1.4

The study programmes were found to be in line with the institutional mission. The relevant documents were publicly available, and the learning outcomes described. The panel considered that in some cases the Faculty may wish to reconsider whether there might be scope for rationalisation and consolidation of some courses, as described in section 2.

Criterion 1.5

The Faculty collects a wide range of information regarding institutional activities. As well as formal procedures, members of the Faculty at all levels, and in most departments, reported that informal feedback was well received by the departmental and Faculty management. There remains significant scope for improvement in providing dissemination of the analysis of quality assurance information to a wider range of staff and students.

Criterion 1.6

The Faculty takes care in collecting and analysing a wide range of information regarding teaching quality. The Panel encourages the HEI to enable student representatives to be more directly involved in evaluating the teaching feedback, and in the process of proposing and verifying changes and improvements. The Panel believes there to be scope for improvement in offering teaching peer review, and pedagogic training, particularly for new teachers.

Criterion 1.7

Scientific productivity and excellence is rightly seen as an integral part of career progression in the Faculty, and is monitored at an appropriate level to ensure this goal. The Panel was not made aware of a more regular formal regular self-evaluation, discussion and feedback process for research staff. Participation of research staff and students in conferences is widespread, but not automatic – it was reported to be contingent on associated research projects having been awarded.

Criterion 1.8

The code of ethics exists, and is in line with that of the University. However, a small number of informal reports of alleged unethical behaviour were received by the Panel, which seemed not to have been confronted via that process. The Panel had concerns that the effectiveness of the policy was being rendered less effective by complacency in the Faculty management, and that sporadic instances of unethical behaviour therefore might be going undetected.

Recommendations: On the basis of these criteria, the Panel makes the following recommendations with regard to the institutional management and quality assurance:

1.a (**) Strategic goals: To develop new directions for future strategy, then to transform strategic goals into reality, requires wide-ranging institutional consultation. The Faculty decanal team should consult widely with its departments, the research institutes, and industry when redeveloping its research strategy in the future. Departments should, through internal consultation, set and monitor five-year goals for research strategy, income, interdisciplinary and international collaboration, industrial and professional engagement and scientific outputs. Forums to develop inter-departmental discussions on interdisciplinary research opportunities should be evaluated, and further developed. In order to enhance continuity of service for the implementation of such a Faculty strategy the PMF should consider whether the current 2+2-year arrangements for the dean and

vice-deans should be replaced by longer terms, e.g. 3+2 or 4+2. Such an extension might aid continuity of development and implementation of strategy.

- 1.b (**) Teaching quality: Each department should establish a teaching committee, including the student representatives, which should have an active involvement in the analysis of teaching feedback, evaluation, and improvement. Best practice in teaching and learning should be encouraged by making examples of highly rated teachers' feedback analysis available to all faculty and teaching assistants. New teachers should be provided with a more experienced teaching mentor who can provide early and constructive criticism, for example by attending and discussing a lecture or class, or by discussing a recording of a lecture.
- 1.c Geoscience Departments: The Geoscience Departments has a strong expertise in urban/spatial planning. In order to use this strength more efficient, PMF should lobby the national legislature to require geo-scientific input in all issues related to planning and land use. In particular, spatial geographers/geoscientists should be allowed to sign official documents related to urban/spatial planning.
- 1.d Partner institutions: Framework agreements should be agreed at Faculty level to enable appropriate individuals at institutes outside of the university to deliver effective and recognised teaching, and supervision of students. The agreements should also ensure appropriate access to national facilities' equipment, for the benefit of the students.

2. Study programmes

The Faculty covers a broad range of science academic domains from natural sciences to geophysics and geography, as well as environment studies. The general finding of the Panel was that the student population is generally rather positive concerning their studies at the Faculty. The high enthusiasm and positive energy of students are a benefit that PMF should leverage to further improve the quality of the study programs and the way courses are delivered.

Criterion 2.1

The self-evaluation document explains the usual practice for evaluating and improving study programmes on p. 88. It is clear to the Panel that significant changes to the courses had taken place. There remains scope for making these procedures more effective, and to improve oversight and best practice, e.g. through a formalised system of departmental teaching committees, and through increased student participation in the evaluation process, as proposed in the Recommendations.

Criterion 2.2

The needs of the market are mentioned several times in the self-evaluation document, and seemed to be well understood by the decanal team. It was clear from the Panel's meeting with national institute representatives that the Faculty is meeting a demand from them for well-trained students in its disciplines. However there appears to be no systematic market analysis, nor were opinions or information from external stakeholders presented.

Criterion 2.3

Mozvag statistics were not mentioned in the self-evaluation document. The statistics from the national Employment Service presented in Table 2.G show clearly that PMF students do find jobs soon after graduation. The quotas seem appropriate for institutional resources and for the intake capacities of the research departments.

Criterion 2.4

Learning outcomes were documented in the self-evaluation document.

Criterion 2.5

While generally good alignment of learning outcomes with assessment was documented and observed, the Panel believes that the timing and frequency of examinations is suboptimal both for student assimilation and for assessing learning outcomes.

Criterion 2.6

The ECTS norms are generally followed with care, and are being revised. Some issues were reported by students concerning particular assessments having different ECTS depending on the learning programme.

Criterion 2.7

The Panel observed that course content was generally of high quality and conformed to internationally recognized standards, though there was some variation in standards between courses.

Criterion 2.8

A variety of teaching methods are used, including lectures, auditory exercises, seminars, post graduate seminars, practical training, field, teaching practise and e-learning, each generally the most appropriate to the subject matter. Difficulties in encouraging active participatory learning with large cohorts, particularly in the first year of undergraduate courses were acknowledged. Nevertheless the Panel found instances of study groups small enough to allow very active learning, but where this opportunity was not being exploited.

Criterion 2.9

These resources are generally readily available, with very few exceptions found.

Criterion 2.10

Links with industry, and industrial internships are patchy and should be reinforced.

Recommendations:

During the site visits performed in the different departments and meetings with students, the Panel received generally rather positive comments on how programmes are taught, other than

in the points mentioned above. However, rationalising teaching and examining is essential to reducing teaching load, allowing teachers further time for internationally-competitive research. While much good practice exists, there is scope for further improvement in teaching and learning methodology, with significant differences remaining between and within departments. Further involvement of students in the development and appraisal of teaching feedback offers the advantages both of improved feedback from the students, and increased transparency of the evaluation process. The following recommendations can be formulated:

- 2.a(**) Courses: The faculty and departmental teaching committees should investigate rationalising courses. In particular they should investigate whether there might be any residual course duplication, and revisit the advantages for mobility and internationalisation which would result from adopting 3+2 vear undergraduate/graduate courses rather than 5+0 integrated courses (where the latter exist). The teacher of each undergraduate and graduate course should be cycled with regularity to reduce the risk of stagnation of content and materials, and the burden on the teacher. Continuation of the course teacher after five years maximum generally should be considered nonstandard practice and permitted only in the most exceptional cases. In the context of Geography courses, there should be rapid implementation and validation of the proposed changes suggested by the student body in the course in Geography, with active student involvement throughout.
- *2.bMobility:* To facilitate students' participation in exchange schemes, better recognition should be provided in ECTS credits for study abroad, for example via the Erasmus programme. Financial support should be available for field courses and trips, so that no student is disadvantaged by their personal financial circumstances.
- 2.c (**) Examinations: In line with the Faculty ordinances for examination departments should rationalise the amount of examining to reduce burden on students, teachers and examiners. For example they should consider examining each course on fewer occasions, at well-separated times though the year and after a reasonable period has passed for assimilation of knowledge by the students. The faculty should establish, publish and implement clear and consistent cross-departmental faculty ordinances for undergraduate and graduate examining. Departmental teaching committees should ensure that an experienced teacher, different from the course teacher, cross checks examination paper on a regular basis to ensure its assurance, quality, level of difficulty and novelty.

3. Students

Criterion 3.1

The method of deciding on the admission criteria is well explained and published online. All students and their success regarding the admission criteria is very well monitored and explained including difference in high schools, analysing the grades, choices and other criteria. The Panel believes that the drop-out rate, while high in some particular courses, is generally acceptable and similar to the most of faculties in Croatia. The Panel recognises the perception that the State Matura exam standards may be lowering the quality of the student intake in recent years.

Criterion 3.2

The students the Panel met with, including student representatives, reported that the Faculty is providing generally excellent support for students in their extracurricular activities especially sport, student associations, but also other projects.

Criterion 3.3

The Faculty does not have dedicated facilities to offer counselling, mentorship or professional orientation. Such facilities exist at the level of the university, but seem not to be widely used. There may be scope for making the availability of these services more widely recognised. The Panel found great encouragement in the reports from students that most professors, heads of department and vice deans are very open to informal discussions with any student. The Faculty did not establish office for psychological counselling but same was offered to students at the beginning of each year in form of seminars, lectures.

Criterion 3.4

The Faculty has established a framework for assessing skills and knowledge which is applied to assessments, grading and monitoring of student work in each course. Students are informed in time on assessment and methods of establishing the final grade. At the beginning of each semester or year students are given year calendar of midterm exams and finals. Students are entitled to a grade appeal in line with an established procedure. No complaints about these procedures were recorded in the last few years. Students can reject the grade and retake the exam. The institution analyses pass rates on each module and course every year especially for the first year students. Also criteria for assessment and final grade are not unified for whole Faculty and there are huge differences from Department to Department. Outside from personal there is no official feedback from professors to students on how they should improve their studying. But there are lot of seminars, consultations professor to student, student to student which are giving them real feedback and help in studying.

Criterion 3.5

The institution has no mechanism to maintain contact with its former students other than via informal personal relationships.

Criterion 3.6

The institution is very active in promoting its study programmes especially in the city and University of Zagreb. Students are involved in many open days of Faculty and some Departments. Panel members generally found the web pages to provide a less attractive face to the wider world, particularly the international world. Some members reported finding the web pages to be confusing, to lack content in English for international students, or simply to lack style and visual appeal.

Criterion 3.7

All of the students, and especially student representatives, can express their opinions and give suggestion for improvement - for example at Faculty Council. The Panel noted the good practice of regular student influence at the Council when the decisions concerning students are being made. However the Panel found that the absence of student representatives in the formal evaluation and improvement of teaching delivery within departments was reducing the perception of students to influence and improve their course.

Criterion 3.8

Students reported that they were not receiving any feedback from student surveys, and they do not perceive their feedback to be effective. There was a general perception in all departments that while students could express their opinions, they had no influence on whether their proposed improvements were agreed or implemented.

Recommendations: The Panel's other recommendations with respect to student issues are:

- 3.a PhD studies: The reduction in the expected normal time for completion of a PhD thesis from 6 to 4 years should be adopted and communicated as soon as possible. It is recommended that an external person (i.e. not linked to the department) be present, votes and writes short report to dean on each PhD thesis defence. To reduce the burden on students, the faculty and departments should encourage a culture where theses are done in cumulative fashion (published papers) and in the English language are the expected norm rather than monographs. Where this is impractical they should identify and move to reduce barriers to this model.
- 3.b Presentations of research results: Mechanisms should be established to ensure that every graduate student in the faculty has the opportunity to present their research results to an international audience, preferably abroad, at least once during their postgraduate study. Moreover, there should be an annual full-day "students" event in each department. This could take the form of a one-day local meeting in which every graduate student in the department reports, in a short talk, on the state of their research progress.
- *3.cAlumni:* The departments should further improve their engagement with national and foreign scientific institutions, academia, and industry, by introducing an electronic database to track contacts with alumni, maintained at Faculty level.
- 3.d Web site: The effectiveness and visitor experience of the Faculty web site should be reviewed. Several panel members noted that they found it difficult to find relevant information or that the site failed to present the Faculty in the attractive light it deserved.

4. Teachers

Criterion 4.1.

The number of scientific teaching staff is not excessive, and in line with the ordinance. This teaching staff is generally well qualified. The site visit showed that there was still a potential to enhance the teaching quality.

Criterion 4.2.

The growth and development of human resources is limited by the absence of information on job vacancies in an international context. In some departments of the Faculty, job competitions are only carried out on a local (or at most regional) level. Also job vacancies are mostly advertised internationally, the requirement of the Croatian language is a severe obstacle for international recruitment. An involvement of external actors (from other departments) in the recruitment committees would foster the inter-department communication. This is beneficial for teaching duties between departments (and for future interdisciplinary research as well). Furthermore, the Panel sees the potential to enhance the international recognition of the teaching assistants (or Post-Doc) of the PMF by promoting international experience. The rules for retirement at the age of 65 should be rigorously enforced in order to promote young researchers as good as possible with the limited amount of available positions. However, the panel recognizes the already existing efforts in the departments of the PMF to promote the staff by e.g. participation at conferences.

Criterion 4.3.

The number of full-time teachers is reasonable for the established study programmes. The self-evaluation report does not include statistics on class sizes, but the site visit has shown that certain graduate courses exhibit a quite low acceptance by the students resulting in courses with very few students.

Criterion 4.4.

Although the teaching staff is generally well prepared for their research and teaching duties, the panel recognizes that the staff is usually not informed about possible training courses to improve and update their teaching skills.

Criterion 4.5.

As already pointed out in Criterion 4.1, the number of teachers is not excessive. Although the teaching load seems to be more or less equally distributed between the departments, the teaching staff from the Departments of Geophysics, Geography, Geology and Chemistry exhibits an average workload beyond 360 norm hours per year and teacher. On the individual level, the real teaching load is unacceptably high in some cases.

Criterion 4.6.

The panel does not see any indication in the self-evaluation report nor during the visit that the teaching staff is negatively affected by abundant external commitments. The existing measures are sufficient to monitor external collaborations of the scientific teaching staff.

Recommendations:

- 4.a (**) Recruitment: To help address the lack of recruitment opportunities for junior teachers and professors, the existing policy requiring retirement of professors at a stated retirement age should be consistently and rigorously enforced. The faculty should ensure the transparency in promotion and appointment by requiring at least one unconflicted external committee member (from another department) to be present as an observer on appointment and promotion boards. It should be the duty of that observer to write report on the appointment process to the dean, and ensure that the process adheres to appropriate ethical standards regarding, for example, lack of conflict of interest and anti-discrimination. Moreover, the composition of departmental appointment and promotion boards should regularly be renewed. A policy, for example that no member should serve for more than two appointments or promotions in any consecutive five, should be implemented. Guidelines for minimum accepted international experience in the recruitment of faculty professors should be established.
- 4.b Teaching load: Teaching duties for Teaching Assistants should allow flexibility so that the research opportunities of postgraduate students are not endangered. This is important at all stages of their PhD, and especially when writing up their theses. Teaching committees should provide the opportunity for more flexible sabbatical opportunities for all professors for example one semester in seven rather than one year in seven. The faculty should ensure that reduction of teaching duty is available for and expected of all faculty members with significant research administrative duties.
- 4.c Career: All staff should write regular self-appraisals and be offered regular (e.g. biannual) opportunities to discuss their career development goals with their line managers.

5. Scientific and professional activity

Criterion 5.1

The Faculty has produced a short-term strategic programme of research activities at the departmental level. This programme does not go beyond current capabilities and research topics of relevant groups and/or individual scientists. The research agenda was therefore lacking long-term strategic goals and associated focus areas. There is also a lack of central monitoring mechanisms that could help implement institutional research agenda goals if these were to exist or be specified. The Faculty's ability to efficiently respond to the changing socio-economic and research environment is thus questionable.

Criterion 5.2

The Faculty does cooperate with external stakeholders and partners. However this collaboration is not as extensive as should be and is primarily driven by personal efforts of enthusiastic individuals/groups. There is space for the Faculty to significantly improve cooperation with partners both domestically and abroad. The Panel found no evidence that the Faculty's external stakeholders and partners were involved in informing its research strategy.

Criterion 5.3

The Faculty has an adequate number of researchers to implement strategic research agenda. However, apart from the fact that the strategic research agenda is not well-defined, the ability of the academic staff to perform cutting-edge research is hindered by significant teaching load. The Faculty's researchers do not have supporting structure that would facilitate application for competitive international projects. Interdisciplinary potential within the Faculty is only partially used due to dislocation of resources and faculty members.

Criterion 5.4

The faculty members produce a satisfactory output of high-quality publications that are, in most cases, well cited by members of international scientific community. There is, however, lack of uniformity in the amount of scientific output and its quality between departments. The Faculty is actively working towards establishing desired equality across all of its constituents.

Criterion 5.5

The Faculty does not have an effective and transparent mechanism to recognize excellence of its employees. Career advancement based on excellence is especially affected by economic situation. The Faculty does not have sanctioning mechanisms in place that could constructively improve research output. Scientific productivity beyond state-regulated levels is not prominently recognized within the Faculty except in few exceptional instances.

Criterion 5.6

The number of peer-reviewed scientific publications of the Faculty members is at an acceptable level in view of all relevant factors. This level has been constant for the last couple of years. Since increasing numbers of teaching staff seems unlikely in the current financial climate, it is an imperative for the Faculty to optimize teaching courses, and reduce some teaching loads, if it is to increase its scientific output.

Criterion 5.7

The Faculty has an adequate number of domestic projects. Number of international projects could be substantially increased. This increase could be facilitated by development of supporting structure for potential applicants and grant recipients.

Criterion 5.8

Transfer of knowledge is limited in scope and depth. The Faculty does not have (long-term) strategy and associated mechanisms for transfer of knowledge that are developed in cooperation with e.g. national or international industry.

Criterion 5.9

The Faculty supports professional activities. There exist well-documented examples of commercial activity based on research expertise. There is though ample room for improvement since this practice is not as well represented in some departments as others.

Criterion 5.10

The Faculty has a unified approach to doctoral programs of individual departments that is monitored and controlled by authorized body. The Faculty has well-established procedures to help candidates complete doctoral studies within appropriate time period. The scientific output of candidates that is prerequisite to thesis defence is defined. However, the expectations for the format of the PhD theses vary from one mentor to another. The Faculty does not facilitate exchange of experiences between PhD candidates and does not enable candidates to see each other progress through Faculty-organized event(s).

Recommendations: In an environment of tightly constrained national funding, the faculty and departments have to think carefully about how best to organise themselves internally, and with external collaborators, to perform maximum amount of internationally leading research within the funds currently available. Looking forward they must invest further in seed-corn funding, and share knowledge about how best to expand their non-traditional forms of support including further European funding. Beyond Recommendation 1a, the Panel suggests:

5.a External funding: A dedicated task force should develop an innovative and ambitious strategy for developing a wide range of non-traditional sources of funding, such as alumni, industry, sponsorship, benefactions, private companies, foreign private foundations. Moreover, the Faculty should encourage (and enable) postdoctoral researchers to apply for research projects.

6. International cooperation and mobility

Criterion 6.1

The Faculty has little trouble in attracting good students nationally and regionally.

Criterion 6.2

Exchange programmes exist, but their use has been restricted to a small number of students.

Criterion 6.3

The ability of existing teachers/researchers to travel for research is hampered by ineffective procedures to deal with teaching cover during sabbatical.

Criterion 6.4

The Faculty is part of relevant international associations, but lacks significant engagement with the large scientific projects which are starting to dominate much of science at European and international scale.

Criterion 6.5

The complete absence of full courses (e.g. complete 2-year masters courses) taught in the English language presents an insurmountable barrier to most students from outside the region.

Criterion 6.6

By demanding Croatian language competence at the point of application for academic positions, rather than after some time in post (as is common elsewhere), the PMF immediately strikes out the majority of the world's pool of suitable candidates. The situation is worsened again by the requirement of a particular Croatian professional qualification prior to application for the post, which is required regardless of the candidate's capabilities or international standing.

Criterion 6.7

Exchange programs and bilateral agreements exist, and could be extended.

Recommendations: Overlain on the general considerations of internationalization of the Faculty is the historic fact that Croatia finds itself in the immediate wake of the accession to the European Union, with all its consequences, expected and unexpected. A further element, affecting vast areas of the Faculty research, is that it is being published exclusively in a "foreign" language – English. The fact is now a global reality. The general impression gained was one of a powerful faculty with highly dedicated members who are reacting to the new realities of international teaching and research. If the faculty can react nimbly to these challenges then they will become opportunities. On the basis of these unavoidable truths the Panel proposes:

6.a (**) EU funds: There are various EU funds that should be featured more prominently in the PMF agenda. The Faculty should encourage the application of researchers for grants from all sectors of the Horizon 2020 program, including the European Research Council. The overhead obtained from successful Horizon 2020 applications can be used in order to enhance the positioning of the Faculty with respect to future calls for funding. PMF should take influence within the University and at the national level in order to ensure that a significant portion of so-called "structural funds" from the EU are invested in Research and Innovation within the faculty for large projects such as building infrastructure. The Faculty participation in EU mobility programs such as Marie Sklodowska-Curie and Erasmus programs can be proactively enhanced. The transfer of students for a semester or a year to foreign Universities as a regular part of their study programs should be further encouraged. Further steps may include the enlistment of researchers at the Faculty to register themselves as experts in the EU expert portals of Horizon 2020. The participation of all Faculty researchers involved in EU evaluations should be tracked. These researchers should be enlisted as speakers at the PMF organized events to enable them to share their experiences with the rest of the Faculty.

It should be checked that professors self-register as assessors for EU and other foreign grant application processes to further improve their understanding of the process and procedures.

- 6.b (**) Research office: The Faculty should ensure provision, at Faculty level, for research administration support. This support should be focused on meeting the needs of the members of the faculty in effective preparation and administration of research grants. The office should have expertise in financial and legal matters. They should be active in finding and dissemination research opportunities, and local examples of success and best practice. Set up an information office/liaison, including regular presence in Brussels, to EU research programs may maximize the profit from the opportunities provided by the Horizon 2020 Program.
- 6.c(**) Language: Adapt the recruiting process further to the international context by relaxing Croatian language requirements (de facto) such that Croatian language skills and the ability to teach and perform administration in Croatian are to be expected after a few years, rather than being a prerequisite for employment. Push the University to enhance its language offerings for non-Croatian speakers and to create a climate and culture of welcoming for immigrant researchers within the Faculty. Higher level English language skills from students should be required at graduation. Each department should develop and promote at least one entire course to be delivered in a foreign language, often English. Circulate even more widely and actively recruit informally, non-residents of Croatia that are potential research leaders in the future of the faculty.
- *6.d ERA:* Organise bids for ERA (European Research Area) Chairs to establish excellence in areas of the Faculty by recruiting from abroad.

7. Resources: Administration, Space, Equipment and Finance

Criterion 7.1.

The Faculty provides overall appropriate learning resources for all its enrolled students. The range of learning resources is however very diverse, ranging from classrooms, laboratories and libraries, computer equipment and learning spaces. The Panel (subdivided in 3 groups according to disciplines) had the opportunity during its visit to take a tour of the facilities to validate the status of a wide range of classrooms, laboratories, libraries, computers and other equipment. In all, and on average, the Panel assessed the state of the resources to be evaluated as satisfactory, but vast differences can be determined between departments. Excellent facilities exist, particularly in the new Mathematics and Physics departments in the Northern Campus.

Several examples can be listed where improvement (investment) is needed. For example, the top floor lecture room (GIS lab) in the Geography Department cannot be considered as a well-equipped, modern, adequate learning space. Similarly the Panel found laboratories in various states or suitability, ranging from ideal in some cases to others which were ill-suited to purpose.

There was also great variation in the fitness for purpose of the libraries. With the additional comment that the new (state) directive will make the university sole responsible for organising its electronic subscription to journals. It was reported that some standard journals like Science and Nature are not accessible to some students and scientists. Continued collaboration is essential, not only between departments, but also between faculties, and even universities. Bringing departments closer together and integrating libraries will also lead to additional synergies: extended opening hours, more access to journals, create adequate learning spaces, more e-books, etc. This is also linked to Criterion 7.6.

The proposed new BGG building will solve many of these problems. It will lead to more space for teaching, offices, for storing equipment, for putting in place laboratories and an integrated library. Also, the new BGG building will give more room to the Department of Geophysics when the Geology Department (now partly situated at the top floor) will move to the new premises, and the Department of Geography, now located near the city centre, will also benefit from moving closer to the other Geo-departments.

Criterion 7.2.

The Faculty, as can be deduced from Table 7A, has an adequate ratio of teaching and non-teaching staff. As a rule, a ratio of 2 is considered as satisfactory. The total for PMF is 1.9. But again important difference exists between different departments. Departments like Mathematics, Geography and Geology have ratios above 3, while Chemistry and Geophysics are below 1.7. The rather inflexible system that exists, stemming from national law, that prevents workplace type exchanges (shifting between administrative, technical, and ancillary staff) does not add to creating more flexible job completions.

Criterion 7.3.

The Faculty has well-developed policies that ensure the professional development of non-teaching staff. The Faculty also encourages its non-teaching staff to develop professionally by participating in trainings, courses and further education. Evidence of this can be found on p. 329 of the self-evaluation, and was found in conversation with post-holders by the Panel.

Criterion 7.4.

There are computer labs in which lectures and exercises are carried out as well as electro, chemical, biological and technical laboratories where the equipment is mainly used for laboratory exercises. Again, it is important to stress, vast differences between departments are found. For example, the physics laboratories were well equipped. The GIS lab of the Department of Geography needs additional attention, as does the Department of Geology.

Criterion 7.5.

The institution has access to high-quality, modern equipment which provides for quality teaching and research and this either through its own facilities or by working together with external colleagues. Here again important differences exist between departments.

Criterion 7.6.

The size, usability and availability of the libraries are considered as satisfactory. Due to a cutback in financial resources some volumes of journals did not get extended or end at 2010, which results in gaps in the collection. Most relevant journals are accessible (not available). It was reported to the panel that some libraries do not allow students to borrow core text books. We consider the lack of future government funding for electronic journal access to be a serious threat to the HEI. Consolidating libraries for the natural sciences to a smaller number, perhaps even one, in the Northern Campus area might help alleviate the problem.

Criterion 7.7.

The Faculty's funding is just sufficient to cover all costs so that students can successfully complete their study programs. The financial tables related to funding provided in the self-evaluation are sufficiently transparent, and do not limit the institution's autonomy. There are however concerns regarding the future budget given that sources other than the government are more difficult to obtain.

Criterion 7.8.

The HEI uses part of its own funds to raise the quality of teaching and scientific research in line with its mission statement. However, more is required. There are important initiatives such as using Faculty resources for seed-corn funding of new research activities, providing teaching and research excellence grants, supporting graduate student travel to present their research, supporting sabbaticals, etc. which would represent significant improvements for staff and students.

Recommendations: The proposed new Biology-Geology-Geography building in the Northern Campus is absolutely essential to operation of the faculty. The challenge of raising the required funding is very real. Nevertheless, this challenge also offers an opportunity for enhanced engagement of the Faculty with alumni, policy makers, media, and industrial and institutional partners. A new promotional initiative with wide-ranging stakeholder engagement seems to the panel to be essential in making the building a reality. The faculty has an impressive story to tell about the inadequacy of the current facilities, and the opportunities available with the new building on the Northern Campus site.

7.a (**) BGG building: Members of the faculty at all levels, and especially those in leadership positions should put the utmost effort into communicating the desperate and urgent need for an adequate combined facility for Biology, Geology and Geography in the North Campus area. The urgency of the requirement must be understood and communicated in a dedicated and sustained communication campaign involving departments, faculty, university, scientific societies, alumni, industry, and the city and national governments. This new building enforces the need of accommodation in the vicinity of the Northern Campus for new students and visiting researcher/teachers. For the funding public-private partnership models should be elicited as well.

7.b Maintenance: The Faculty should provide a suitable financial reserve for maintenance of research equipment, for example via a partial cost recovery for equipment repairs.					

FEATURES OF GOOD PRACTICE

There are some obvious examples of good practice that were listed in the self-evaluation report that the Panel could not evaluate/attend due to their particular nature. We refer here primarily to constant promotion of the Faculty through various events organized by the institution or individual departments that aim to attract new students, inform current and prospective students about job placements, promote given fields of science and create links with potential partners in industry. Beside these, the Panel here lists some that were observed and/or explicitly discussed during the panel visit in no particular order.

- 1. The faculty members, despite their heavy teaching load, aggressively pursue possible external funding. For example, the Faculty staff members are very competitive at domestic level when it comes to application for funding. There exist a large number of applications to governmental funding agencies with high success rate (around 50%) in the past three years.
- 2. The Panel has observed that the capital equipment is extensively and efficiently used and, where possible shared between various experimental groups. For example, devices that provide extremely high magnetic fields service different research groups at Physics Department.
- 3. The fact that the number of students in some programmes in final year of study is small, combined with the openness of the faculty to one-to-one interaction, creates very positive academic atmosphere that fosters student development. Students feel that they part of one coherent academic family.
- 4. Some of the Faculty teaching staff exhibits extraordinary ability to actively engage students during lectures using modern teaching techniques.
- 5. Although it is difficult to ascertain who the best teachers are, some of Faculty's departments are making an effort to find them and to publicly acknowledge them.
- 6. There exists good communication between Faculty's libraries and other libraries in the vicinity that provides added value to the library users. For example, this cooperation allows users of the Faculty's libraries to have access to a particular journal/data-base that the other library is subscribed to but is not directly available through the Faculty subscription and vice versa. This is especially important in view of the expected cutbacks in the number of governmentally sponsored subscriptions.
- 7. Student representatives are actively involved in the election/promotion of the faculty members.
- 8. The Faculty shows capability to respond to current market demand for certain vocations/profiles. For example, Department of Mathematics meets national and regional demand by providing a targeted course for actuaries.
- 9. The Faculty provides extensive services for internationally renowned companies.

- 10. Some departments have created dedicated councils to facilitate promotion and/or employment of its faculty members. This is a very promising step towards long term strategic planning.
- 11. The Faculty has successfully implemented a unified approach towards graduate program of all seven of its departments. This, again, is a signal that the Faculty could make and implement well-coordinated long-term strategic decisions.