

Evaluation of the Research and Professional Activity of the Institutes of the Czech Academy of Sciences (CAS) for the period 2010–2014

Final Report on the Evaluation of the Institute

Name of the Institute: Institute of Geonics of the CAS, v. v. i.

Fields, in which the Institute registered its teams:

Mechanical and civil engineering

Observer representing the Academy Council of the CAS: Jiří Chýla

Observer representing the Institute: Josef Foldyna, substitute observer Richard Šňupárek

Commission No. 8: Engineering and technology

Chair: em Prof.DI.Dr.Dr.hc. Hans Peter Nachtnebel

Date(s) of the visit of the Institute: October 12 - October 21, 2015

Programme of the visit of the Institute: see attached Minutes from the visit

Evaluated research teams:

No. 1 - Department of material disintegration

INSTITUTE OF GEONICS

1. INTRODUCTION

1.1 Structure and location of the institute

The institute of Geonics consists of 5 departments:

- Department of Laboratory Research on Geomaterials
- Department of Geomechanics and Mining Research
- Department of Material Disintegration
- Department of Applied Mathematics, Computer Science and IT4innovations
- Department of Environmental Geography

The main location of the institute is in Ostrava. There is secondary location in Brno. Since 2011, the department of Applied Mathematics, Computer Science and IT4innovations was split into two departments, but for the purpose of the evaluation, these are considered as one. Also, for the purpose of the evaluation, the department of Environmental Geography is split in two teams: Physical Geography and Human Geography.

1.2 Brief history of the institute

The institute was founded in 1982 as Mining Institute in Ostrava of the Czechoslovak Academy of Sciences. The spectrum of activities has gradually broadened. The institute obtained its current name in 1993 as a result of the founding of the Academy of Sciences of the Czech Republic in 1992.

1.3 Mission and research topics

The area of research of the institute spans processes in the geotechnical environment, especially those associated with human utilisation of the earth crust. The range of research topics broadens gradually, with recent research on geological deposition of radioactive waste and plans to start research on geothermal energy, underground storage of energy by compressed air and underground storage of CO₂.

1.4 Staff size and full time equivalents age distribution

The number of staff is about 100 FTE. About 60 FTE are researchers. The spreading over the age categories in intervals of 5 years (categories: <25; 25-30, ..., 65-70, >70) is quite even, with somewhat higher numbers in the category of young people (< 25 years), due to presence of Ph.D. students and in the category of 30-35 years, due to blockage of recruitment in the past and recent relaxation of this blockage.

2. STRENGTHS AND OPPORTUNITIES

2.1 Topicality of research subjects

The research subjects are all well-chosen.

2.2 Budget: Ratio of institutional budget, grants and contractual resources, international funds

About 50 % of the income of the institute comes from direct funding by the Academy of Sciences, without any aspect of competition. About 12.5 % is from industrial contract work. About 37.5 % comes from project grants of different sources, earned in a competitive way: Academy of Sciences, Czech Science Foundation, EU and others. The institute would prefer a larger part of the funding provided directly by the Academy of Sciences, without competition. The institute also considers that its chances to gain competitive funding by the Czech Science Foundation are hindered by the character of the research topics of the institute. The evaluation commission understands that it would be much more comfortable for the institute to have a larger amount of non-competitive funding and to have a larger chance of success with projects submitted to the Czech Science Foundation. However, in contrast to the opinion of the institute, the evaluation commission judges that the repartition of the income sources of the institute is well balanced and is comparable to the repartition of a typical research group in mechanical or civil engineering at a university in western European countries.

2.3 Intensity of collaboration among teams and among institutes, national collaboration and international involvement

The different departments work mainly in their own areas with only limited collaborations between the departments of the institute, although there are examples of collaborations. The evaluation commission does not judge this as a shortcoming, since the topics covered by the different departments are quite distinct. There also seems to be only limited collaborations with other institutes of the Academy of Sciences, but, again the evaluation commission does not see this as a shortcoming. Intense collaborations exist with several Czech universities, with foreign research institutes and three foreign universities. The evaluation commission judges that collaborations are well chosen. The institute collaborates also with foreign research teams through EU-projects and other types of international research projects.

2.4 Position of the institute within the Czech scientific community and its international position

The institute is very relevant in the national context and international context.

2.5 The overall capacity of staff

The overall capacity of the staff is good. There are no particular weaknesses.

2.6 Reasonability of the structure of the institute and the departments

The evaluation commission judges that the structure of the institute is appropriate.

2.7 Comments on the age structure

The age distribution of the staff is well balanced. The presence of older staff members, in the categories 65-70 years and above 70 years is not reported as a drawback by the institute. The gender repartition is about 2/3 male 1/3 female staff members, which is also very good.

2.8 Frequency and quality of publications

The number of journal publications in the evaluation period of 5 years is about 160. About 11.25 % of these are in first-quartile journals. The number of citations is also about 160, of which about 5.6 % are in first-quartile journals. The institute publishes a peer-reviewed journal. 7 books were published by members of the institute during the evaluation period.

The number of publications has increased by a factor of 3 with respect to the previous evaluation period.

2.9 Patents and role in contractual work

There is no precise information for the institute as a whole. But there are patents and there is a considerable amount of contract research work.

3. WEAKNESSES AND THREATS

3.1 Topicality of research subjects

The research subjects are relevant.

3.2 Budget: Ratio of institutional budget, grants and contractual resources, international funds

The evaluation commission judges that the distribution of the income of the institute among the three main sources (direct funding by the Academy of Sciences, industrial contract work, grants obtained from agencies in a competitive way) is well balanced. A threat, to which most research teams in western and middle Europe are confronted with, including the Institute of Geonics, is the tendency for reduction of the funding possibilities on the national level and thus the necessity to be more successful in projects with EU funding or international funding. The institute is fully aware of this necessity and has succeeded in participating in large EU projects, with considerable funding for acquiring research equipment. Clearly, continued efforts in trying to participate in EU projects are necessary.

3.3 Intensity of collaboration among teams and among institutes, national collaboration and international involvement

Structured collaborations with foreign research institutes and university teams are rather weak. It looks appropriate that research teams of the institute define well-chosen foreign partners for long-time co-operation, in particular within the EU. This can be beneficial on the pure scientific level and certainly opens the possibility for larger participation in EU funded projects or internationally funded projects.

3.4 Position of the institute within the Czech scientific community and its international position

The institute is relevant on the national and international level due its research topics, its national and international contacts and the overall quality of its publications.

3.5 The overall capacity of staff

The overall capacity of the staff is good.

3.6 Reasonability of the structure of the institute and the departments

The structure of the institute is good.

3.7 Comments on the age structure

The age structure is good.

3.8 Frequency and quality of publications

The amount of journal publications is not very high, about 0.53 per year and per researcher. The institute is certainly aware about this rather low amount, because a very strong effort has been done in the current evaluation period to increase the amount of publications. It has increased with a factor of 3 with respect to the previous evaluation period. The level of the journals is also not very high, since only about 11.25 % of the journal publications are in first-quartile journals. The consequence is then also that the amount of citations is rather low in general and is particularly low in first-quartile journals.

3.9 Patents and role in contractual work

There is no precise information for the institute as a whole. But there are patents and there is a considerable amount of contract research work.

4. RECOMMENDATIONS

4.1 Re-organisation of the internal structure of the institute and departments, laboratories, teams and groups considering the critical mass of each unit, the overlap of units

There is no need to re-organise the internal structure of the institute.

4.2 Internal programs to stimulate actions to enforce strengths and to reduce weaknesses

The institute should think about methods to stimulate the departments in the search for complementary foreign research partners. Increasing structured co-operation with well-chosen partners is scientifically beneficial and increases the possibilities for obtaining funding from EU sources or international sources.

The institute should also think about methods to stimulate the departments in publishing more in highly-ranked journals. This increases the international visibility of the institute and increases the chances in obtaining funding from EU sources and international sources.

4.3 Identification of new research topics

There does not seem a direct need to search for new research topics. These come spontaneously.

5. DETAILED EVALUATION

5.1 Declaration on the quality of the results and share in their acquisition

Characterisation of the main research activities (experiments, theoretical areas)

Activities encompass research of experimental type, data collection and analysis type, and numerical type.

Relevance in the national and international context

The research is relevant in the national and international context.

Overall quality of publications

The overall quality of the publications is rather moderate in the sense that the percentage of journal publications in first-quartile journals is rather low and that the number of citations is also rather low. It may be that the quality of the research is, in general, quite high as seen on the national level, but the quality on the international level cannot be assessed precisely by a foreign evaluator.

Specification of the main achievements

The institute itself considers the development of mathematical tools and the development of water jet technology as main achievements. The evaluation commission agrees with this claim.

Specification of the contributions of the team to publications

Publications are for a significant part oriented towards the national level.

5.2 Declaration on the involvement of students in research

Involvement of students (doctoral, undergraduate) into research

During the evaluation period, the institute was involved in 80 supervisions of bachelor, master and doctoral students and the number of defended Ph.D. theses with supervision or co-supervision by members of the institute was 19. Further, the institute organises a yearly Ph.D. workshop with presentations by the Ph.D. students with supervisors or co-supervisors of the institute. The evaluation commission judges the involvement of the institute in student supervision as very good.

Particular contributions of students to research

Ph.D. students contribute to the research.

Number of defended PhD students in relation to students involved (success rate)

There are 19 defended Ph.D. theses with supervision or co-supervision by members of the institute in the evaluation period. This is a good number.

Employment of former Phd students (career options)

There is no precise information for the institute as a whole about Ph.D. students who are recruited after finishing their Ph.D. But it is clear that the institute recruits scientists from Ph.D. students.

5.3 Declaration on societal relevance

Impacts of the results and other activities on economy

There is certainly a contribution to the economy by the activities of the institute, but it is difficult to quantify it.

Impacts of the results and other activities on education

The contribution of the institute to education is significant, by providing lecturers to several universities, as well as supervisors on the bachelor, masters and doctoral student levels.

Popularisation and similar activities

The institute does a big effort in publications with the objective of popularisation of science. It participates in the science week of the Academy of Sciences, as well as in 4 yearly one-day events on different topics of science. The evaluation commission judges the effort of the institute in science popularisation as very good.

5.4 Declaration on the position in the international and national context

Comparison of the position, recognition, outputs and impacts with leading and international teams

The number of journal publications in journals of the highest quality (first quartile) is rather low. The institute should do an effort to further improve its publication output. The institute has done already a serious effort in this sense in the evaluation period, but continued effort is necessary.

Role and position in international collaboration

International collaborations are rather weak. The institute should do an effort in identifying strong foreign partners with which targeted collaborations can be set up. Such collaborations can then be a good basis for submitting international research proposals.

5.5 Declaration on the vitality and sustainability

Composition of staff with respect to age and gender, qualification, international experience

The composition of the staff is well balanced with respect to age, gender, qualification and international experience.

Attraction of research programmes for young people

The research programmes seem very attractive to the evaluation commission. But the institute reports difficulties in recruiting young people. This must be caused by factors outside the influence of the institute.

Funding (structure of the resources and its comparison with the outputs, grants and project activity)

The sources of the funding are well balanced. But, there is clearly a need to focus more on funding of international nature.

Effectiveness of research (based on comparing size of groups, funding and output)

The number of publications per FTE and per year of the institute is not very high. The institute could do an effort in improving on the number of publications. But, since there has been done already a very big effort in increasing the number of publications in the evaluation period, it is more reasonable that the next effort should be more on improving the quality of the publications, seen on in international context, so an effort towards publications in highly-ranked journals.

5.6 Declaration on the strategy and plans for the future

Relevance of the outlined strategy and research plans

Generally, the institute plans to continue research of the same character as done now. This point of view seems all right to the evaluation commission.

Adequacy of available means and human resources to achieve these plans

The institute aims already at obtaining a larger part of its funding from EU and international sources. The institute participates already in four Strategy AV21 projects of the Academy of Sciences, implying co-operation with research teams of other institutes of the Academy of Sciences. The AV21 projects provide considerable funding for equipment, but there remains the necessity to acquire funding for salaries.

Missing issues in the strategy

There are no obvious missing actions for the institute as a whole.

INSTITUTE OF GEONICS

Team No. 1: Department of material disintegration

1. INTRODUCTION

1.1 Structure and location of the department

The department is part of the institute of Geonics and is located in Ostrava.

1.2 Mission and research topics

The research topics of the department are centred during the evaluation period around high-speed water jets for cutting, disintegration of materials and surface hardening of metals.

1.3 Staff size and full time equivalents age distribution

The number of research staff of the department itself is on average about 4.4 FTE during the evaluation period. Supplementary contribution by Ph.D. students is the order of 1. So, the research team is very small. The age distribution is quite even.

2. STRENGTHS AND OPPORTUNITIES

2.1 Topicality of research subjects

The research topics of the department have high value for a number of industrial applications.

2.2 Budget: Ratio of institutional budget, grants and contractual resources, international funds

The team acquires funding from contract research for foreign and national industrial partners, from the Academy of Sciences, the Czech Science Foundation, regional science support and EU projects. The funding sources are diverse.

2.3 National collaboration and international involvement

The research team collaborates with another department of the institute, a research team of another institute of the Academy of Sciences and with foreign partners within an EU-project.

2.4 Frequency and quality of publications

The number of publications of the department is, as such, very good. In the evaluation period, there are 30 publications in journals with impact factor, 2 books, 2 chapters in books and 45 conference contributions; this all, with a team of about 5 FTE. The department has, however, not much attention to the ISI-ranking of the journals. There are no publications in first-quartile and second-quartile journals. Moreover, publications were mainly ranked in Phase 1 of the evaluation in the categories 3 and 4.

2.5 Patents and role in contractual work

The department has 6 patents in the evaluation period. The department has sold one license agreement to an important foreign manufacturer.

3. WEAKNESSES AND THREATS

3.1 Topicality of research subjects

The research topics of the department are industrially extremely relevant. There are no weaknesses and threats related to research topics.

3.2 Budget: Ratio of institutional budget, grants and contractual resources, international funds

The budget is well balanced. There are no weaknesses and threats related to budget.

3.3 Intensity of national collaboration and international involvement

There are no structured collaborations with foreign research institutes and university teams. There are project-type collaborations within an existing EU-project and within a starting EU-project. The character of the research work of the department is rather confidential, which most likely makes collaborations delicate.

3.4 Capacity of the staff

The number of staff members is very small. This is clearly a threat. Search for a few young researchers on the post-doctoral level is necessary.

3.5 Frequency and quality of publications

The number of publications is very high. There are, however, no publications in first-quartile and second-quartile journals. Moreover, publications were mainly ranked in Phase 1 of the evaluation in the categories 3 and 4.

3.6 Patents and role in contractual work

There are no weaknesses and threats related to patents.

4. RECOMMENDATIONS

4.1 Re-organisation of the internal structure of the departments, laboratories, teams and groups considering the critical mass of each unit, the overlap of units

Re-organisation of the department is not a subject. The department is just one, small, research team.

4.2 Internal programs to stimulate actions to enforce strengths and to reduce weaknesses

Strict internal programs cannot be a subject in a small research team. The department does already an effort in identifying complementary foreign research partners, who can also be partners in EU-funded projects. The department should continue in this way. It seems vital to identify research topics related to water jets that are not connected to particular industrial enterprises so that they can be subjects of international research projects. The department is already thinking in this sense and should continue in this way. More involvement in pure scientific research projects creates also the possibility to publish in higher-ranked journals. This can significantly improve the scientific visibility of the department. This then helps in becoming partner in EU-projects.

4.3 Identification of new research topics

There does not seem a direct need to search for new research topics. These come spontaneously.

5. DETAILED EVALUATION

5.1 Declaration on the quality of the results and share in their acquisition

Characterisation of the main research activities (experiments, theoretical areas)

Research activities span experimental and numerical research.

Relevance in the national and international context

The research is very relevant in the national and international context.

Overall quality of publications

The overall quality of the publications is moderate in the sense that there are no publications in first-quartile and second-quartile journals and that the number of citations is low. Judged on the description of the research projects, a foreign reviewer can conclude that the quality of the research is, in general, quite high as seen on the national level. But the international value cannot be assessed by a foreign evaluator who is not exactly in the same research field.

Specification of the main achievements

Realisation of water jet cutting tools of different kinds forms a major technical achievement.

5.2 Declaration on the involvement of students in research

Involvement of students (doctoral, undergraduate) into research

Four Ph.D. students were involved in research activities during the evaluation period. Two of them already defended their Ph.D. thesis. The two others are still in their Ph.D. phase. The department contributes also to teaching on different levels. The involvement of the department in student supervision is very good.

Particular contributions of students to research

Ph.D. students contribute to the research.

Number of defended PhD students in relation to students involved (success rate)

There are 2 defended Ph.D. theses with supervision by members of the department in the evaluation period. This is a very good number.

Employment of former Ph.D. students (career options)

The two Ph.D. students who defended their thesis during the evaluation period work now as post-doctoral researchers in department. Recruitment possibilities by the department and career possibilities of former Ph.D. students are very good.

5.3 Declaration on societal relevance

Impacts of the results and other activities on economy

There is certainly a contribution to the economy by the activities of the department.

Impacts of the results and other activities on education

The department participates in education.

Popularisation and similar activities

The department participates in activities of popularisation of science.

5.4 Declaration on the position in the international and national context

Comparison of the position, recognition, outputs and impacts with leading and international teams

Publications in journals of the highest quality (first and second quartile) are absent. The department should do an effort to publish more in highly-ranked journals.

Role and position in international collaboration

The department is already doing an effort in identifying complementary foreign partners. The department should continue and increase this effort.

5.5 Declaration on the vitality and sustainability

Composition of staff with respect to age and gender, qualification, international experience

This topic is not very relevant due to the very small size of the research team of the department. The age distribution is good.

Attraction of research programmes for young people

The research programmes seem very attractive for young people.

Funding (structure of the resources and its comparison with the outputs, grants and project activity)

The department is already increasing efforts in obtain more funding from EU sources. This effort should be continued.

Effectiveness of research (based on comparing size of groups, funding and output)

The output of the department in number of publications and patents is very good.

5.6 Declaration on the strategy and plans for the future

Relevance of the outlined strategy and research plans

The research plans for the near future are very good.

Adequacy of available means and human resources to achieve these plans

The capabilities of the existing research team are very good. Supplementary recruitment of researchers will be necessary. Obtaining supplementary funding will also be necessary.

Missing issues in the strategy

The department searches for foreign complementary research partners. The department participates in a Strategy AV21 project of the Academy of Sciences, implying co-operation with research teams of other institutes of the Academy of Sciences. But there is nothing in the strategy about possible co-operation within the institute of Geonics itself. The department intends to develop numerical models of systems for generation of pulsating water jets. The department uses up to now commercial CFD software. There is a danger that the numerical methods in a commercial CFD package will be of insufficient quality for numerical simulation of pulsating water jets. Therefore, it seems appropriate that the department of material disintegration contacts the department of applied mathematics and computer science on possible help in development of appropriate numerical methods.

The department does not mention explicitly that recruitment of one or more young researchers on the post-doctoral level is an objective. It seems nevertheless desirable that the number of staff members can increase somewhat.

Date: January 20, 2016

Commission Chair: em Prof.DI.Dr.Dr.hc. Hans Peter Nachtnebel