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Guidelines for Reviewers

Czech Audit

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Introduction

The Czech Ministry of Education, Youth and Sport has commissioned an international audit in order to improve higher education, research, development and innovation in the Czech Republic. The objective of the international audit is to provide an external and independent evaluation of the research, development and innovation system in the country. One important part of the international audit is the review of the Evaluation Methodology whether it provides a 'fair' assessment and consecutive allocation of funds. The Evaluation Methodology is a quantitative assessment of research outputs, and measures directly past performance.

Three approaches are used for reviewing the Evaluation Methodology; one of them is to combine a self-evaluation of a number of selected research groups with a site visit by a number of international experts. By reading and commenting on the self assessment report and directly interacting with representatives of the research team / institute, the experts can get a comprehensive overview of what is considered as quality of research and research performance in specific contexts. It also provides the best opportunity to understand which factors (such as management, human resource policy, composition of staff, research infrastructure, equipment, and funding, but also contextual factors such as the overall mission of the parent institution, changes in the funding regime or legal reforms) can explain the specific performance of the group.

An important objective of this qualitative assessment is also to understand the ways in which research groups are functioning in the Czech Republic. The reviewers learn about the research groups that are evaluated, and the research groups benefit from the self-assessment and the feedback they get from international experts.

This report contains the review of one Natural Sciences group:

- The Necas Center for Mathematical Modeling, in which three different research organizations cooperate: the Department of Mathematical Analysis and Department of Numerical Mathematics (Faculty of Mathematics and Physics: Mathematical Institute of Charles University), Department of Mathematics (Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague) and the Department of Evolution Differential Equations (Institute of Mathematics of the Academy of Sciences of the Czech Republic).

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The review was done by a group of international experts:

- Prof. Ria Broer, Theoretical Chemistry, Zernike Institute for Advanced Materials, University of Groningen, The Netherlands.

- Prof. Barry Koren, Centrum Wiskunde & Informatica (CWI, Amsterdam) and Mathematical Institute, Leiden University, The Netherlands.

- Prof.em. Louis Schlapbach, Swiss Federal Laboratories for Material Science and Technology (EMPA), Dübendorf-Zurich, and ETH Dept. of Physics, Switzerland.

The next chapter discusses the research programme, teaming and strategic partners, achievements and users of research results, management and human resources policy, research funding, barriers and evaluation methods. The last chapter holds some recommendations of the experts that visited three institutes in the natural sciences domain.

1. Review of the Necas Center for Mathematical Modelling

1.1 Research programme

The research program is well-focused; it concentrates on problems modelled by partial differential equations, in particular on the analysis of these problems (existence, uniqueness and stability of solutions), and on their numerical solution. Most of the problems considered originate from continuum mechanics, particularly from fluid dynamics. Although old and well-established, many of the corresponding partial differential equations still allow for scientifically and socially relevant research.

However, for the benefit of its own future, the Necas Center could be more active in updating and broadening the range of applications of the mathematical models studied. In view of its future, the Necas Center should have a larger variety of "application irons" in the fire. Mathematics, by its very nature of being an abstract science, allows this.

Many of today's disciplines have their computer-simulation version; besides computational physics there is computational biology, computational finance, etc. Computer simulation is of crucial and growing importance to today's and tomorrow's society. Although computer simulation has spread over many disciplines, it has to be considered as an independent discipline because of the specific expertise it requires. Analysis and numerical mathematics remain to be the heart of computer simulation. The Necas Center has some excellent, internationally renowned analytical and numerical mathematicians (genuine scholars) in its ranks. Given these facts, within the Czech Republic, the Necas Center is in a potentially very strong position to set up and successfully perform highly relevant joint research with other disciplines. Innovative interdisciplinary research can be very fruitful, from both a scientific and a financial point of view as breakthroughs are often made in interdisciplinary research areas.

1.2 Teaming and strategic partners

1.2.1 Staff

The scientific quality and composition of the Necas Center's staff is outstanding; mathematicians as Feireisl, Feistauer and Malek have very good international reputations, particularly Feireisl has.

The presence of excellent researchers within the Necas Center is further enriched by an active visitor programme for both students and top researchers and – also – by a very active programme of national and international workshops. The Necas Center is a true open-door center of

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excellence, albeit mainly for mathematicians. The outreach to top researchers in other disciplines could be improved, with the goal to set up high-quality, externally funded multidisciplinary research.

Concerning funding, with his excellent track record, Prof. Eduard Feireisl seems qualified to, for instance, the preparation and submission of an ERC Advanced Grant. The prestigious Praemium Academiae that was awarded to him in 2007 may be exploited as an achievement in support of ambitious fund-raising efforts.

In general, one opportunity to be further exploited by the Necas Center is to actively bring the deep and vast knowledge in analysis and numerics closer to practice, without sacrificing the excellent quality of the Center's mathematics research. The Center needs to have a permanent alertness for promising future research co-operations, with strong partners in a wide range of other disciplines. Not all opportunities should be grasped though; scientific quality and societal relevance should be important selection criteria.

1.2.2 Strategic partners

The research partners of the Necas Center are mathematicians mainly. As mentioned above, it is recommended that promising research co-operations be set up with top researchers in other disciplines.

1.3 Achievements and users of your research results

The output is very well related and directed to colleague mathematicians, nationally and internationally. Concerning the relation with colleagues in other disciplines (who may very well be mathematicians by education, but spread out to other disciplines), there is room for improvement. Given the excellent mathematical quality of the analytical and numerical research of the Necas Center members and the still fast growth in the possibilities of computational science, good opportunities exist here for the Necas Center.

All researchers of the Necas Center have the highest standards with respect to scientific integrity. They are modest, honest, hard-working scientists, which makes them very amicable. Without losing their integrity, they could be somewhat less modest though, somewhat more outreaching and more communicative about their own research highlights. The important higher goal of this proposed enlargement of research impact is to strengthen and stabilize the viability of the Necas Center, ideally, to establish the Necas Center as a permanent institution.

1.4 Management and human resources policy

The management structure of the Necas Center is well-balanced. The Center has a harmoniously performing pair of "directors": Malek and Feireisl. The management is very flat and non-bureaucratic. Moreover, the managers themselves are prolific mathematicians. All this is good for an institute as the Necas Center.

There are no conflicting roles, and streamlining of the management is not necessary. Some management tasks might be added though, particularly with the aim to ensure a more permanent future status for the Necas Center.

Project-acquisition advice might be added, i.e., advice given to researchers who are preparing project proposals. This advice could be given by researchers who have actively participated in acquisition themselves and/or in juries for research-project proposals.

Further, a tenure-track programme for highly promising young researchers might be opened; researchers starting from scratch a new line of research within the Center and building up their own group of (externally funded) PhD-students and post-docs. Tenure decisions must be very competitive. “Securing permanent positions”, as mentioned on the one-but-lowest line on p.30 of the self-assessment report, may never be a goal; a research institute should not be a safe haven.

If not existing yet, a salary-bonus system may also be set up for above-average performance: ad-hoc bonuses for publications and acquisition of external funding, for instance, and structural salary bonuses for more continuous above-average performance.

What might also be added is a small international scientific advisory committee, meeting with the Necas Center’s Steering Committee once a year for one day.

What should definitively be considered is more strategic research planning with the development of vision and a mission. As it is now, it seems that the major mission is continuation of good past performance. There could be more corporate identity within the Necas Center; the reputation of the Necas Center is not yet as good as the reputation of some of its individual researchers. The self-assessment report reflects all this; it is retrospective not prospective, and it is not self-critical (a SWOT-analysis is missing, e.g.). By publications and conference contributions the Center has reached high visibility in the international academic community of the field; in order to strengthen dissemination of results it is recommended to strengthen communication to non-specialists of the field including broader public and politicians.

The relatively large critical mass of the Necas Center makes that it can significantly profit - scientifically and financially - from a good strategic planning by its management. Such a planning should go without bureaucracy.

1.5 Research funding

Competitive funding, i.e. external funding, is relatively low given the excellent scientific quality of the research performed by the Necas

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Center's researchers. The contribution of external funding to total funding should be improved. As it is known now, in 2011 already, the institutional funding of the Necas Center will stop.

1.6 Perceived barriers in the context of your organisation

One "barrier" that arose from one of the researchers was about the pre-revolutionary attitude still present here and there, the attitude in which a characteristic such as own initiative is insufficiently appreciated. We fully understand this. Future external reviewers are also expected to understand it.

1.7 Allocating institutional funding and the "Methodology of Evaluation of Research and Development Results in the Czech Republic"

The "Evaluation of Research and Development Results in the Czech Republic" must not be bureaucratic, and should respect the specific character of each discipline, particularly when using the results of bibliometric studies.

The evaluation procedure should compare the quality, output, impact and viability of the specific research group/institute with those of research groups/institutes in the same discipline, possibly abroad. The evaluation procedure cannot be quantitative only; it should also be qualitative (soft benchmarking).

2. Observations and recommendations

This last chapter holds observations and recommendations that are not specific for one of the three research groups that have been visited but do apply for the Czech system in general.

From an international perspective Czech researchers receive relatively low basis salaries. Although these salaries may be augmented with bonuses for above-average performance, this is a barrier for full integration in the international world of science and technology as it is financially not attractive for foreign scientists to come to work in the Czech Republic.

A limitation (or drawback) is concerned with the present structure, with on the one hand universities (degree-granting, research and teaching) and on the other hand the Academy of Sciences (fundamental research). The two entities profit not yet as much from the synergetic possibilities of their co-existence as in many foreign countries.

For two of the three Academy of Sciences institutes that we visited, part-time full-professor appointments appear to be hard. Requirements for full professorships in the Czech Republic seem to be mainly based on education-related factors. For the Czech science system to get more in tune with the rest of the scientific world and to profit more from the research in other institutions such as the Academy of Sciences or companies it is recommended that also qualified scientists from outside the university can be appointed as part-time full professor. When, vice versa, more university professors hold a part-time research position outside university (in industry for instance), significant cross-fertilization may be the result.

In order to have a more complete evaluation of a research team it is recommended that the context within which the team operates (the Institute) should also be taken into consideration.

In order for the Czech Republic to profit more from the knowledge that is created within its science system, researchers should be made better aware of the societal and commercial value of their work and - if appropriate - be trained in protecting and commercialising their intellectual properties.

In order to spread knowledge on importance and impact of scientific research, outreach events should be developed for a broader public, including children and opinion leaders.

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