

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 Chemical Process Fundamentals of the CAS

Fields, in which the Institute registered its teams:

Chemical sciences

Observer representing the Academy Council of the CAS: Jiri Ctyroky

Observer representing the Institute: Petr Kluson

Commission No. 4: Chemical sciences

Chair: Dr Habil, Academician Christian Amatore

Date(s) of the visit of the Institute: November 30 - December 4, 2015

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

Evaluated research team:

- **Department of Analytical and Material Chemistry**

A. Evaluation of the Institute as a whole

General Evaluation

As presented with care by the Institute Director, the Institute's mission is to serve as a center for fundamental research in chemical engineering in a broader sense, i.e., encompassing chemical, biochemical, catalytic, and environmental engineering together with their interactions with physical chemistry, inorganic and organic chemistries, industrial chemistry, and biotechnology.

The Institute is the only one in the Czech Academy of Sciences active in the fields of process and chemical reaction engineering researches including novel instrumentations and technologies development. It also holds a prominent position in these fields within the context of the Czech Republic. This unique position associated to the Institute multidisciplinary spectrum of competences allows on the one hand its acting as a graduate school for Ph.D. studies in the field of chemical, biochemical, and environmental engineering and processes and, on the other hand, offers a great value for solving complex problems stimulated by external scientific cooperation in the Czech Republic or abroad (several EU Framework programs, organization or co-organization of many international scientific events and conferences). In this respect, it is noted with high interest that while the Institute devotes a substantial fraction of its research efforts to fundamental issues, it has been able to cultivate a considerable network of cooperative partnership with many industrial companies in the Czech Republic and Europe (or non-European ones through their European branches).

The Institute gathers 80 research scientists, 26 research assistants, 34 support staff (14 administrative employees, 14 technical and 6 service ones) and hosts 31 Ph.D. students. The personnel age distribution follows a double Gaussian with one maximum located around 30-35 years and a second broad one around 55-60 years, thus providing good expectations for the Institute short-term and long-term future.

Interestingly, as noted from the Director's report, qualification audits of individual researchers are performed at 5-year intervals and serve as a basis for evaluating personal promotions and qualification for leading positions in each department, as well as when taking decisions related to the opportunity in hiring additional staff or acquiring expensive instruments.

The research and development plans, including international and industrial cooperation, presented by the Institute Director appear sensible in view of the fundamental knowledge and competences gathered in the institute and its mission towards applied researches.

Finally, since most of the Institute teams were not evaluated by this Committee, only one of its components was evaluated in detail. However, the general reports provided by the Director about its structure, scientific and educational accomplishments were found excellent in every respect.

Nota Bene: Since the Committee evaluated only a minor component of the Institute research structure, it did not feel appropriate commenting on the items 1-3 beyond the overall positive appreciations given above.

B. Evaluation of the individual teams

Evaluation of the Team: Department of Analytical and Material Chemistry

1. Introduction

The Team was assembled over the past years through a series of consecutive merging of several formerly independent different groups. In this way, service chemistry groups of different history and background were combined seemingly not for a real purpose aimed to federate a structured department in analytical chemical sciences in the Institute but rather to assemble together sub-groups whose activities was not relevant to the other departments. As a result, the Team covers an ad-hoc package consisting of very broad topics ranging from organic synthesis, through organometallics, material chemistry, biosensor research, NMR and analytical services as well as a scale-up service. This brings about a confusing scientific dispersion with a too large number of groups working in non-interconnected areas of chemistry without any apparent perspective of improvement. The result of such assemblage of sub-groups, in which none has the size required to develop its announced scientific goals with the required strength (and sometimes the advanced modern expertise), it that the overall production is limited and in many instances stops before reaching an internationally visible level. Know-how without proper strategical understanding and dedicated efforts is evidently not sufficient to produce high-quality research outputs.

Currently, the Team has about 24 scientific members, several technicians and a reasonably high relative number of students (9 Ph.D.s, i.e., one third of the total Ph.D.s in the Institute) showing that despite the Team awkward ad-hoc composition its announced general themes (viz., Analytical and Material Chemistry) constitute an attractive beacon for students. This, and the need of other departments of the Institute clearly evidence that a team with expertise on these themes would be a necessary component of the Institute provided its researches were more integrated and focused.

2. Strengths and Opportunities

Some groups inside the Team have a valuable know-how (e.g. laser or organometallic groups). Though this does not seem to be fully exploited, the presence of such “Chemical” expertise within an Institute whose main focus is on

engineering and processes are most certainly prone to offer fruitful collaborations inside the Institute.

3. Weaknesses and Threats

In absence of unifying strategy, the fragmented research topics developed in the Team may only perpetuate the historical research-conglomerate without offering any chance for collaborations inside the Team. Similarly, no clear information on how the Team's members collaborate with rest of the ICPF — or are encouraged to do so — was provided and no argument was offered in answering to the many questions of the Committee Members on these two crucial issues. Only vague ideas about future and development of the Team and its groups were delivered.

Owing to its low size in its different fields, while selecting areas in which the competition is high and to much higher levels not only at the international level but also with other Institutes of CAS or in Czech Universities create a drastic problem in terms of the Team's success in grant applications. In this respect it was surprising that the details of financial support of the Team could not be clearly provided to the Panel during the on-site evaluation.

4. Recommendations

It is clear from the above that, due to its historical accumulation of scientifically unrelated sub-groups, this Team lacks any proper scientific strategy. In particular, the Team must absolutely define how its service-abilities and expertise should on the one hand be proficiently supporting demands from other department of the Institute within collaborative or service works and, on the other hand, how the Team defines a few topics to develop its own researches and allocate sufficient task-force to these few axes by inter-linking the present know-how to reach nationally and internationally visible levels.

It is clear that despite his wishes the present Director of the Team has not been able to imprint such vision and strategy to the rest of his sub-groups. The required reorganization must then fully supported by the Direction of the Institute and possibly at the CAS level, in order to enforce with sufficient determination and strength the development of collaborative works within the Team on the few axes selected, and possibly develop other ones through collaboration with other groups (e.g. in

nanoscience, catalysis, organic synthesis, sensors) at least within the Czech Republic.

This only may encourage research plans that may promote competitiveness from which the Team and its members will ultimately benefit as well as the Institute.

5. Detailed evaluations

Members of the Team, probably due to way of its formation, do have very different scientific history and quality. The Team is heterogeneous but some results are encouraging, though needing higher development to reach proper national and international visibility. However, other axes must be terminated based on their poor achievements.

There was no real distinction between what amounts to service-works that the Team is required to provide to the rest of the Institute or decides to offer to external partners, and what is its own research.

There is some special know-how and appropriate equipment but these intrinsic advantages do not seem to be wisely employed and the unique, if any, competence of the Team sustained to reach high-level competitiveness. For example, several works presented to illustrate the Team's successes in organic or organometallic topics are hopelessly analyzed in comparison with other's approaches — including from Teams present in other CAS Institutes.

As a consequence, the Team's members are not publishing in high-quality international journals in their areas of research and the Team's Members are much less involved in international collaborations than the almost all the other teams evaluated by the Panel in this or other Institutes.

On the other hand, some results obtained in the Team have been advanced into commercialization. International visibility and collaborations of the Team's members are rather low if compared with other teams evaluated by this Chemical Science Panel. Some works of the Team might be useful in solving societal problems though the Committee did not observe that such issues were examined with care so as to select those on which the Team should focus part of its task-force.

The Team members teach at universities and, thus, they are able to attract student to work on their projects. Consequently, they are involved in supervising of a reasonable number of Ph.D. and M.Sc. students.

Plans for the future involve only rather slight changes vis-à-vis what was done in the past and no clear vision could emerge from the written material available to the Committee or during the on-site visit. Evidently, this is a direct a consequence of the history of the team but this needs to be strongly remediated. Innovative ideas must be defined based on the competences of the Team, promoted and their development enforced with the determined help of the Institute Direction.

Date: December 26, 2015

Commission Chair: Dr Habil, Academician Christian Amatore