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Research Collaboration Between a Small Technology Company and Universities: Results, Opinions, and Conclusions

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Abstract: The incentives for research collaboration between industry and academia are discussed. The problems and the lessons learnt during several projects are analyzed, both from a university and an industry point of view. In the second part, the results of a big collaborations project between Solvias and several universities are shown, and the significant addition of know-how to the Solvias Toolbox will be addressed. Finally, the focus for the future catalysis research in Solvias is described.

Keywords: Collaboration between industry and academia · Solvias Catalysis Toolbox

Introduction

As pointed out in the introductory text and also in the address of F. L'Eplattenier, science is an important basis for a technology company such as Solvias. Obviously carrying out research is expensive and Solvias no longer has the resources it used to have when it was still part of Ciba-Geigy or Novartis, and this limited R&D budget has to be managed very carefully. On the other hand, Solvias now has more freedom to focus research as it sees fit and in addition there is very high flexibility for research collaborations with various partners. In particular, collaborations with universities can be beneficial for both partners if it is done right. In addition, both national and international agencies are often willing to support such cooperations when small companies are involved. In this contribution we will discuss briefly some experiences and conclusions concerning academic collaboration both when collaborating within individual projects such as a Ph.D. thesis or when participating in research networks such as the research project 'Technical Catalysis for Selective Reactions' sponsored by the Novartis Technology Advisory Board (TAB Project).

The TAB project was a team effort between our industrial catalysis research group and three universities. The areas investigated were C–C coupling, oxidation, and ligand synthesis. We had installed a formal project organization with the Technology Advisory Board as sponsor and a steering committee consisting of A. Togni, M. Beller, J. Bäckvall, H.U. Blaser (head) and M. Studer (who was also the operational project leader). The three subprojects were headed by senior Solvias scientists. In addition we also had internal consultants from the research and development departments of the Novartis Pharma and Agro divisions in order to provide input on the needs of our customers. During about four years, three Ph.D. thesis, two postdocs and several internal teams were sponsored. Regular meetings took place between all teams, the steering group, and the consultants to present, discuss, and assess the results and recommend priorities for further work. These efforts significantly enlarged the Solvias Catalysis Toolbox and up to now have resulted in seven publications (with many more planned), three patent applications, and several poster presentations. Last but not least, two technical processes were realized based on the know-how gathered within this project.

Incentives and Ways to Collaborate

What is the motivation for cooperation between industry and academic groups? The following points come to mind:

- Access to new ideas. This is especially important for smaller industrial research units limited to selected fields of expertise.
- Access to know-how and new technical methods.
- Universities are interested in relevant problems and contacts (and also the money).
- Possible source for good job candidates for industry.
- Resources at universities are relatively inexpensive (compared to industrial research) and funding is sometimes available.
- Last but not least: It's fun!

There are many ways and forms to organize interactions and collaboration between industry and universities. Each has positive and negative aspects as can be seen in Table 1.

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Type of collaboration	Advantages	Disadvantages
Loose collaboration	+ No contract necessary + Very flexible + Not expensive	– Often too informal – Problems with IP rights
Consulting / Collaboration with contract	+ Well defined, clear rules + Material exchange easier + Usually not very expensive	– Getting a contract can be very time consuming – Little possibility to influence research
Sponsoring a PhD thesis or postdoc	+ Close collaboration + Long term, well defined + Possibility to influence topic	– Can be very time and energy consuming – Relatively expensive
Formal networks	+ A lot of resources (human and others) + Cross fertilization + External funding possible	– Complicated to organize – Contract negotiations can be difficult – Can be very bureaucratic – Political issues

Table 1. Advantages and disadvantages of several types of collaboration

Lessons Learnt

In his lecture, A. Togni described important results obtained during several research collaboration with industry and formulated and commented on seven theses concerning what he has learnt from these undertakings. We list these without much further comment:

Thesis 1. The purpose of collaboration between academic institutions and industry, in terms of common research projects and/or consulting relationships, is the basic advancement in a specific area of common (shared) scientific interest.

Thesis 2. The partners should be concerned about the real mutual benefits of a collaboration and should clearly define goals.

- Academics: Resist the temptation of engaging in collaborative work with industry primarily because it provides extra research funding.
- Industry: Do not finance projects at an academic institution just because the manpower is cheaper.

Thesis 3. The immediate function of the consulting academic partner is not to provide solutions to the most pressing problems an industrial laboratory may have.

Thesis 4. Collaboration with different companies is conceivable. In this case, different non-interacting research areas should be chosen in order to avoid possible conflicts of interest.

Thesis 5. The relationship between academic and industrial partners is based upon trust. Trust derives from a functioning communication between colleagues.

Thesis 6. The goals of a shared project should clearly be formulated by the academic partner, who also takes the responsibility of supervising and mentoring the students involved.

Thesis 7. The timely publication of research results is both a duty and a fundamental freedom for the academic partner. Publications should not be drastically delayed or even thwarted by the industrial partner.

Interestingly, these theses are in amazing agreement with the summary presented by M. Studer from the Solvias' point of view. His conclusions on how to make a collaboration more productive and/or less frustrating were as follows:

- An informal or loose cooperation is only advisable if a very good relation with the partner already exists. Otherwise the danger of misunderstanding is very real.
- Explain what you want and especially why you want to address a specific question. This allows the partner to contribute his ideas much more effectively. Keep in mind: While the industrial partner sets the goals, it is the academic partner who chooses the approach and what is actually done.
- A good contract is essential: Clearly defined goals, schedule and timing, defined roles and contact persons, reporting; how patents and publishing are handled; money.
- Meet and exchange information on a regular basis. This is probably the most essential part, especially when networks are involved.
- Try to get involved in the life of the university research group(s). This will help to understand what can reasonably be expected from the academic partner (very often it is more than one thinks).
- Be open for changes in the goals. The more ambitious the goals, the more likely that they will not be attained in a linear fashion.
- Even though organization was much more demanding, the TAB Project showed us that networks of this sort have significant synergies.
- Last but not least: Be prepared to invest not just some money but a lot of management energy as well!

As a general conclusion, it can be stated that a good collaboration needs a clear definition and the willingness to invest a lot of energy, good will and some money.

Results from the Current Collaboration

Let's come back to the successful TAB Project. Obviously, research at Solvias has the one and only goal of gaining a competitive advantage by offering better services to our customers. In the field of catalysis and synthesis this means that we have to be able to

- make a fast and accurate assessment of a specific customer problem and make a suitable offer to show the feasibility of our proposal, in a time and cost effective manner,
- be able to develop a technically feasible synthesis or catalytic method,
- attain high success rates.

These abilities were considerably improved through the project. Table 2 gives our assessment of how the Solvias Catalysis Toolbox has benefited from the results and contributions of the TAB Project.

Where is Catalysis Research at Solvias heading in the near future? On the one hand Solvias has reduced the number of research topics and will focus on chiral ligand synthesis, asymmetric reductions, and modified heterogeneous catalysts. On the other hand, more new methods with high synthetic potential will be established, in order to be ready to tackle any synthetic problem in fine chemical synthesis. The Scientific Advisory Board members A. Pfaltz and A. Togni will help us to make the right choices.

Tool	Solvias offers	Additions through project
Catalytic enantio- and diastereo-selective reactions	· Better than state of the art in hydrogenation · State of the art in many other transformations	· Several classes of new ligands · Technology to immobilize and functionalize ligands
Catalytic chemo-selective reactions	· State of the art and better for many catalytic reactions, esp. with modified heterogeneous catalysts	· New ligands and catalyst systems
C–C coupling	· State of the art and better in Heck, Suzuki, Sonogashira and carbonylation reactions	· New know-how for the activation of Ar–Cl · Direct method for 1° amide synthesis · New catalysts and precursors
Oxidation	· Know-how in dehydrogenation and other selected oxidation reactions	· Assessment of area · Know-how in the oxidation of benzylic carbon atoms and of alcohols
Immob. / funct. Ligands	· Better than state of the art technology	· New functionalized ligand classes
Fast Screening	· State of the art equipment, efficient screening	· Improvement of equipment · Improvement of productivity · Profiling of ligands
Precursor/ ligand collection	· Better than state of the art collection · Technical quantities of selected ligands	· Addition of significant number of new ligands and precursors
Metal removal	· Kit for the removal of trace metal	· Improved know-how through functionalization of ligands

Table 2. Solvias Catalysis Toolbox and additions through the TAB project

Concerning cooperation: Solvias has just started a three-year project with A. Pfaltz on chiral ligand synthesis, partially financed by the Swiss Government *via* KTI (Commission for Technology and Innovation); similarly we have initiated a joint research project with Ciba LSM on a similar topic. At the moment M. Studer is also actively involved in the discussion on the role of catalysis within the sixth EU framework program.

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Laudatio for Benoît Pugin, the First Solvias Leading Scientist

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Abstract: On June 25, 2001, Prof. Dr. François L'Eplattenier presented the first 'Solvias Leading Scientist' award to Dr. Benoît Pugin, Solvias AG.

Keywords: Solvias Leading Scientist · Spin-off and outsourcing · Success factors for R&D in small companies.

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Dear Leading Scientist, Ladies and Gentlemen,

before coming to the laudatio of Solvias' first leading scientist, I would like to make some comments on industrial R&D and to describe a few key success factors for its management, particularly in smaller enterprises. This will bring me back to today's award ceremony and to our laureate.

Among the numerous expressions of the so-called Wall Street English, let's focus on the following four:

- Spin-off and Outsourcing
- Start-up and Insourcing

As you well know, a spin-off company usually emerges out of a big corporation, whose management decided to outsource some of its activities which are no longer needed or which are no longer considered as core activities. A spin-off