CHAPTER 10

Technology Transfer at the Swiss Federal Institute of Technology Zurich (ETHZ)

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INTRODUCTION

The Swiss Federal Institute of Technology Zurich (ETHZ) is one of the leading science—oriented universities in the world. Although in the last few years important goals for technology transfer were reached, there is still a lot to be done. In every area—research collaboration, commercialization, spin-off-promotion—substantial progress has been achieved, and ETHZ is certainly a trendsetter for technology transfer in Switzerland. Nevertheless, in the coming years, the basic conditions for technology transfer—such as the public perception, the internal anchorage and legal conditions—will change, and there is an interesting challenge to the university to manage these changes.

DEFINITION AND BASIC CONDITIONS FOR TECHNOLOGY TRANSFER IN SWITZERLAND

Definition

Technology transfer is a term used in a very broad way, but this chapter focuses on three main areas:

- Research Collaboration: The University and the Private Sector as Partners in Research
- Licensing of Intellectual Property to the Private Sector

- Spin-off-Promotion as a motor of innovation.

The first important way for the university to transfer knowledge from its research into society is through its students. Those who graduate from ETHZ are highly skilled and can quickly transfer their knowledge to the companies they join. Their network of contacts—professors, scientific collaborators, colleagues—is one of the decisive factors for efficient technology transfer.

The private sector sometimes see technology transfer as a one-way service: universities are obliged to deliver know-how, technologies or the results of their research for free, to whoever intends to use it. But, successful technology transfer offers a much wider perspective:

- Benefits to society—resulting from innovative products that provide new opportunities to the public.
- Benefits to researchers—resulting from the expansion of know-how and external contact.
- Benefits to research in Switzerland—resulting from exposure to new aspects of a problem.
- Benefits to ETHZ—resulting from a more positive image and additional income.
- Benefits to our partners—resulting from sustainable business opportunities generated by research collaboration.

In the long term, all of these interests should be respected in order to support a sustainable ongoing innovation process. If not, the process is endangered, for instance by public opinion, which will not be willing to finance research, if the benefit for society is not visible.

An Overview of ETHZ

The Federal Institute of Technology Zurich was founded in 1854. Until 1969, it was the only national university in Switzerland. Today, ETHZ comprises 83 institutes and laboratories, 330 professors and about 840 lecturers, who conduct research and fulfill teaching obligations. Research and education fall within the competence of 17 departments. A staff of more than 7'500 work in teaching, research and administration. Current statistics show about 11'700 registered students. Each year, around 1'250 receive a degree and a further 530 complete a doctoral thesis. Annual expenditure has reached 1 billion Swiss francs (approx. 660'000'000 US$).

Based on its research activities, ETHZ is able to offer state-of-the-art knowledge in its teaching and continuing education courses. In its mission statement, the university commits itself to the following principles:

- to promote and maintain quality in teaching and research at a high international level;
- to support a universal and system-oriented approach;
- to preserve specialist and cultural diversity and academic freedom in teaching and research;
- to secure an adequate infrastructure and guarantee its renovation;
- to optimize central scientific services in information and communication systems as well as administrative support covering the needs of teaching and research.

The organization of the university is run along the lines of a presidential system, in which the President chairs the Executive Board and bears responsibility for the management of the university. The President is supported by the Rector, who is responsible for teaching, the Vice-president of research and business relations, and by the Vice-president of planning and logistics.

The technology transfer office at ETHZ is called *ETH transfer* and it is one of three branches within the office of the Vice-president for research and business relations. Four Technology Transfer Managers currently work with ETH transfer; they are supported by a full-time secretary and a part-time communications consultant. These managers are responsible for some of the departments of ETHZ. They can rely on a broad network of freelance-specialist (e.g., lawyers) to solve upcoming problems. One of their experiences is that, in technology transfer, the exception is the rule.

Basic Conditions

Economic Situation: One basic factor influencing the policy on technology transfer at ETHZ is the limited "home-market". In 1995, 99.8 % of private companies had less than 250 full time employees. These companies offered about 75 % of all working places in Switzerland.

The budget for R&D in small companies does not allow for substantial collaboration with universities. This leaves open possibilities in a lot of different areas and for a lot of different clients, but requires a lot of small projects and the building up of cluster-projects, which allow the small companies to participate in technology transfer programs and to achieve real benefit.

Comparison with the USA: One difference is in intellectual property. In the United States, the universities are the exclusive owners of the intellectual property created on their campuses. So they can decide what to do with an invention very fast.

In Switzerland, the situation is unclear and attempts to solve this question at national level have not been successful up to now. At ETHZ, there are presently at least three main players who own the intellectual property:

- ETHZ
- The Institute concerned
- The inventors (all the researchers, from the professor to the students who were involved in the project).

If there is collaboration with other universities, or with the private sector, the respective institutions are part of the ownership as well. And, of course, the more people are involved, the more complex negotiations will be.

A second difference of great influence on technology transfer in the United States and Switzerland is the question of security. In Switzerland, we face a much bigger influence of security-thinking on decisions concerning innovation. This may be illustrated with the following example: in the USA, the spirit of "Let's try" is much stronger; in Switzerland, in the same situation, people will say: "Let's wait and evaluate it once more to be sure..."

In both countries, money—or the lack of it—was one of the major factors that enforced technology transfer in the universities. In the United States, the end of the war in Vietnam, later of the disarmament contracts, and then the end of the cold war resulted in reduced military budgets. Since the Pentagon was the most important financial source for research, a lot of research groups lost this income. So, financial pressure was one major aspect that promoted the development of technology transfer offices at American universities.

In Switzerland, the recession in the early nineteen nineties forced the universities to invest in technology transfer. In addition, public opinion, in a pragmatic way, was asking for more "visible output", more "return on investment" of the public money paid to the universities. Up to now, ETHZ is not allowed to take shares in spin-off-companies, while some universities (like Geneva) can take shares in their spin-offs.

RESEARCH COLLABORATION AND COMMERCIALIZATION OF RESEARCH RESULTS

Up to now, research collaboration is the most important part of the work of our Technology Transfer Managers. Efforts during the last years, both by scientists and by ETH transfer have yielded remarkable results. The sum of money generated increased constantly from CHF 40 million to CHF 45 million. Because only contracts with a volume of at least CHF 20'000 are registered by ETH transfer, the following section is based on that information.

Research Contracts

At ETHZ, two kinds of research collaboration are currently treated in different ways. The most fundamental difference concerns the Intellectual Prop-

erty (IP). If the IP is dedicated to the partner who also more or less decides on the aims and the direction of the research planned, the collaboration is called « Research-Order » and the private company has to pay an additional fee to ETHZ.

The alternative « Research-Participation » is much more university-determined. For its contribution, the private company is granted the right to use the results, for instance by the possibility to buy a license. The IP questions are normally solved within the respective contract.

Right now, the area of research collaboration at ETHZ is being evaluated. There are ideas for a complete new system in order to create more incentives for the institutes and scientists and to hold the IP in the possession of ETHZ.

The development in this area during the past four years is very positive. The number of research-orders grew from 20 in 1997 to 30 in 2000. During the same period, the research-participations grew from 68 to 90. Each of these contracts concerned a volume of at least CHF 20'000. Collaborations concerning smaller amounts are signed by the professors and are not registered. The experience is that scientists are using the services of ETH transfer more and more in earlier stages of contract negotiation in order to prevent legal conflicts. Even the private companies are interested to have secure legal situations. The strategy of ETHZ is to come to basic agreements with its partners, which deal with the important issues like IP or the right of publications.

Licensing

Rising importance is being put on the concrete commercialization of research results, know-how or software developed within research projects. The policy of ETHZ is not to sell IP, as was sometimes done in earlier years, but to license it. There are different kinds of license agreements: exclusive, non-exclusive, restricted to a certain area, etc. If the commercialization possibilities of a certain result are not evident enough to decide on its value, ETHZ offers options on licenses.

Also in this area, an increase from 8 license contracts in 1997 to 25 in 2000 occurred. The income is divided between ETHZ, the institute and the inventors.

The basis for licensing is of course patents. But, up to now, there was no database of patents filed by ETHZ. It is now one of the most important goals of ETH transfer to elaborate such a database. Since the structure of ETHZ is very diverse, it is not easy to obtain the necessary information in time.

Problems to be solved

One of the common aspects of almost every research collaboration project is the question of publications. ETH transfer tries to fix the right for publica-

tions in a basic agreement, to be respected during all the different collaborations with the same company. The private companies have an interest to restrict publication of research results. But, for the scientist it is crucial to have the right to publish. Normally, ETH transfer tries to fix a time range of 3 month after submission of a manuscript to allow the company to examine it. After this time range, the scientists are free to publish. Some scientists have the tendency to forget about the possibility of patenting. So a lot of the commercialization potential of IP is lost. EHT transfer therefore tries to raise awareness of this issue. Crucial to this question is to show to the scientist that publications and patents can easily be combined.

SPIN-OFF PROMOTION

One of the most important areas of technology transfer is the promotion of spin-off companies. Sometimes, existing companies are not interested in new products, because they do not want to endanger their own similar products. Or, nobody really believes in an idea, except its inventor. This is the right time to create a start-up. At ETHZ, the recognition that encouraging start-ups is one of the most important means of applying research to the benefit of society has grown even stronger over the last few years. Not only are new products realized with spin-offs, but also attractive new jobs are created. ETHZ has its own label for companies, which are acknowledged as spin-off-companies. Currently, there are about 120 of them, most of them founded during the last five years. This is the result of a strategy to promote the creation of new companies.

Courses and Competitions

ETHZ created a series of courses on founding a company, which within a few years has become the best attended series of courses on founding a firm in Switzerland: over 12,000 people have participated in the programme until now. The results from the first three years of the course were that hundreds of firms and over 930 jobs were created by participants. The unique speciality of the program is its broad variety of participants—from the highly-skilled doctoral student to the carpenter, who has to take over and relaunch the company of his father. The program itself became a spin-off company under the name of *b-tools* and is operating now for three years with ongoing success.

In 1997, together with the management consulting firm McKinsey & Company Switzerland, ETHZ launched the first country-wide business plan competition *Venture 98—companies for tomorrow* with great success. This led to similar initiatives in several countries. Now, the third generation of this competition, *Venture 2002*, is underway, organized by ETH transfer and McKinsey. It is a mixture of competition, networking opportunities, business

events for venture capitalists and high-level seminars. For ETHZ, it is an instrument to detect bright brains with entrepreneurial sprits in our laboratories. Even if most of the participants from ETHZ do not really start their own company, ETH transfer is able to support them in other fields, perhaps in patenting, or in the commercialization of an invention.

The experience of the first business plan competition demonstrates that participation in it contributes significantly to the founding of firms: of 87 business plans submitted, 27 firms were founded, and others are in the process of being founded. The winner of Venture 98, today called Sensirion AG, in Zurich, has 45 employees. Sensirion is active in the sensor technology area. "Our idea was to found a company which should only guarantee a sufficient income for both of us," says Felix Mayer, one of the two founders of Sensirion AG. "But, during the competition, we recognized how much bigger the potential of our ideas was." In 1998, the company was founded under the name of Alpha-Sensors. Today, Sensirion is the technology leader for intelligent digital solutions for relative humidity sensor systems, mass flow, liquid mass flow, air flow, gas flow and differential pressure sensors. Sensiron provides OEM/Business-to-Business customers with high quality, fully-integrated sensor system solutions.

Program to support start-ups

Like others, the founders of Sensirion participated in the spin-off program of ETH transfer. Besides the already mentioned courses and the business plan competition, ETH transfer provides a broad variety of services to start-ups.

In the first phase of the spin-off-process, the scientist (perhaps a doctoral student who wants to make use of the results of a thesis) is supported by coaching in order to concretize an idea, to elaborate a business plan, and to organize the next steps, such as founding or financing. During this period, the scientist is still employed by ETHZ, but with reduced duties.

During the same period, the needs of the new company are also identified. Is there infrastructure at ETHZ, such as laboratories, that can be used? Are there instruments needed to develop a prototype? What about the intellectual property? These questions are discussed by the technology managers of ETH transfer and the scientists and are fixed in contracts. In addition to infrastructure, ETHZ is ready to support the spin-off with loans up to CHF 50'000.

The second phase of the ETHZ spin-off program starts with the first real operations of the new company. The founder can reduce his or her job step by step. All the above-mentioned questions are solved in the spin-off-contract, which normally provides the company with infrastructure for two years. All this is not for free, but the spin-off gets reasonable conditions. After two years, the company has to pay back the loan and to leave the

rooms rented from ETHZ. This is to prevent the competition between the ETHZ spin-off and an other company becoming too strained. There are some possibilities to extend this range. But, normally, two years are sufficient to build up companies, if the business idea and the team are optimized.

In the following period, the spin-off becomes increasingly independent of ETHZ. For its founders, there is the possibility to participate in a regular spin-off-event, which is used to widen their network. ETHZ is affiliated with the "Technopark" in Zurich, which was opened in 1993. The Technopark provides facilities for start-ups, as well as for innovative established companies. Located near ETHZ and the Universities of Applied Sciences of Zurich and Winterthur are around 190 companies with around 1400 employees. ETHZ has participated and supported the Technopark from the beginning. The ETHZ section (about 10 % of the total 44000 m^2) is administered by ETH transfer. More applied research oriented groups are located there as well as spin-off companies or special projects. Especially for spin-off companies, the entrepreneurial spirit and the possibilities provided at the Technopark are very fruitful. Therefore, they often stay in the building when they have to leave the ETHZ section after the two years mentioned above.

The results in this area are remarkable. Over 90 percent of the companies founded since 1990 (about 80) are active and some of them are growing fast. They are presented on the website www.spinoff.ethz.ch.

DIFFICULTIES, STRATEGIES AND CONCLUSIONS

Difficulties regarding the private sector

As mentioned above, the diversity of the Swiss economy and the great number of small companies are one of the major problems that ETHZ faces in order to broaden its research collaboration. And although there are constantly voices who urge ETHZ to go for more cooperation, the problem is located also on the side of the companies. A few issues in this area are that:

- CEOs of small and medium size companies are busy with daily business. To establish collaboration between such a company and ETHZ needs some efforts, especially to find the ideal partner.
- The communication between the world of pragmatic business and research is not always very easy. Perhaps moderators are needed.
- We observe a certain shyness towards the university.

Strategies to face these issues have to be long term oriented. ETHZ has to do everything possible that will lead to more real contacts between society and research and to show possibilities of interaction between private companies and our institution. There is thus a strategy to establish ETHZ even

more as an institution that is open towards the interests of the private company and society in general.

ETHZ was heavily engaged in organizing the *Zürcher Festival des Wissens* (Zurich Festival of Knowledge) in May 2001 in the hall of the main railway station. During four days, about 100'000 visitors came into contact with research. If we are successful in building bridges between society and research in general, this will promote the perception of ETHZ within the group of economic leaders.

In the same line, there is the engagement of ETHZ in Expo.02, the Swiss national exhibition. *Ada–the intelligent space* was realized in cooperation with the University of Zurich. Already now, after a very short time of operating, it is clear that this exhibition has opened contacts to ETHZ that would not have been possible without the public awareness of Expo.02.

Ada—the intelligent space awaits you at Expo.02.
Experience how our brain functions. Play and communicate with a space that has its own personality. Gain a sense of what artificial intelligence is all about these days. Think ahead to what this actually means to your life. Take part in one of the most exciting research projects being conducted by the University of Zurich and ETH Zurich and visit *Ada—the intelligent space* at the *arteplage* in Neuchâtel. An exhibition that is highly entertaining and simultaneously opens up entirely new horizons.

A step into the future
Ada—the intelligent space is more than just an exhibition. Through various events and commentaries, you'll take a look ahead at our future and the relationship between man, machine and artificial intelligence. Care to join us?

In fact, research and collaboration between universities and private companies has to become just a daily thing.

On the other hand, it is crucial to maintain an independent position for research. If ETHZ does not defend its independence towards the economic interest of the private sector, it may lose its top position in research. To communicate this message to private partners is one of the most important tasks of the technology transfer managers.

Internal difficulties and strategies

ETH transfer also faces some internal conditions that are hindering more efficient technology transfer. First, there is the organizational structure of ETHZ. Since our departments, institutes and especially our professors are very independent, there is no chance to urge them to do something, like perhaps be more aware of intellectual property. "To convince by service" is the

strategy chosen. But the efforts have to be communicated. In order to strengthen the internal know-how, ETH transfer organized a series of luncheon seminars. After short introductions in the various fields, prominent professors or other scientists presented case studies and reported their experience with the services of ETH-transfer. More than 300 participants joined this pilot project, which for sure will be followed by a second edition. But, there are still people working at ETHZ who do not know about the existence of ETH transfer and its services. So a lot of work is to be done yet.

Also in the fields of teaching and of research, ETHZ is currently enforcing its efforts. Since about three years, there is a professorship for technology management and entrepreneurship.

On a political level, finally, ETHZ has to urge for clarification of the legal situation in the field of intellectual property and the possibility to take shares in private companies as part of its spin-off promotion.

CONCLUSIONS

- In technology transfer, the exception is the rule. Almost every project has its speciality, and too much generalization endangers success.
- Technology transfer cannot be dictated, but it is important to provide a broad range of opportunities to participate, for both the scientists and the private sector.
- In order to overcome the diverse structure of the Swiss economy, there has to be opportunities to bundle interests of different companies and allow them to be part of the game.
- Technology transfer, even more than any other university administration area, has to be known within the respective institution as the most friendly and service-oriented office.
- The independency of research is more important than single research collaborations. If the collaboration endangers the right to publish, for instance, it is not worth signing.
- Even if the last years have showed a clear improvement and better financial return on investments in technology transfer at ETHZ, a lot remains to be done.

FURTHER INFORMATION

www.ethz.ch
www.transfer.ethz.ch
www.spinoff.ethz.ch
www.ada-ausstellung.ch