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Arbeitspapiere/ Working Papers

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University-Industry Knowledge and
Technology Transfer in Switzerland:
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University-Industry Knowledge and Technology Transfer in Switzerland: The University View*

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Abstract

This descriptive paper is part of a large project aiming at exploring the factors determining the propensity of Swiss science institutions to interact with private enterprises in Switzerland (universities and other research institution), i.e. to get involved in knowledge and technology transfer (KTT) activities. On the other hand, a second part of this project investigates the factors determining the propensity of Swiss private enterprises for KTT activities. We are especially interested in the different forms of this interaction, not only through joint research projects but also through training, mobility of academic personnel, jointly supervised master theses and PhDs, consulting and so on. Further, our study investigates the channels of KTT such as e.g. scientific publications, patents, spin-offs as well as the mediating institutions (e.g. Technology Transfer Offices, Commission for Technology and Innovation (KTI), Swiss Research Foundation (SNF)). We also discuss the relative importance of a series of motives for and impediments of KTT activities. Finally, we take also a look at the impact of KTT activities on the research orientation, on teaching and least but not last, the financial position of institutes co-orating with private enterprises.

1. Introduction

Experiences of the USA suggest that research of often publicly financed science institutions and commercialization of research results by private enterprises are compatible goals that reinforce each other, if both sides adopt a long-term perspective (as e.g. in aerospace, computers and telecommunication). However, there is accumulating evidence that many OECD countries are lagging behind in this aspect (see e.g. OECD 2002). Still, fears are also expressed in the literature that the tendency to commercialization of university research may cause universities to neglect basic research and teaching which are their main tasks, especially when commercialization revenues are substituted for public funds.¹ The interface between business firms and science institutions, especially universities has to be improved and as a consequence knowledge and technology transfer activities have to be intensified. Also in Switzerland it is asserted by many observers that the industry-science interface is far from being satisfactory (see e.g. Zinkl and Huber 2003). However, so far there does not exist a comprehensive study on extent, intensity, channels, content, goals, and impediments of KTT activities either on part of the science institutions or the private enterprises in Switzerland.

This paper is part of a large project aiming at exploring, at the one hand, the factors determining the propensity of Swiss science institutions to interact with private enterprises in Switzerland (universities and other research institution), i.e. to get involved in knowledge and technology transfer (KTT) activities in order to provide firms with scientific knowledge in research fields which are relevant for their own innovation activities. On the other hand, a second part of this project investigates the factors determining the propensity of Swiss private enterprises for KTT activities (see Arvanitis et al. 2005). We are especially interested in the different forms of this interaction, not only through joint research projects but also through training, mobility of academic personnel, jointly supervised master theses and PhDs, consulting and so on. Further, our study investigates the channels of KTT such as e.g. scientific publications, patents, spin-offs as well as the mediating institutions (e.g. Technology Transfer Offices, Commission for Technology and Innovation (KTI), Swiss Research Foundation (SNF)). We also discuss the relative importance of a series of motives for and impediments of KTT activities. Finally, we take also a look at the impact of KTT activities on the research orientation, on teaching and least but not last, the financial position of institutes co-operating with private enterprises. We hope that our analysis will cast some light

¹ For example, Rosenberg and Nelson (1994) argue for the maintenance of the “traditional” division of labour between university and industry also under the conditions of closer collaboration and more intensive exchange of knowledge taking place in many countries in the last years; Stephan (2001) discusses possible negative implications of university-industry technology transfer; in Nature (2001) was the opinion expressed that industry’s trend towards “closed science”, and closer ties to universities may endanger the intellectual independence of university basic research. Tijssen (2004) concludes in a study based on bibliometric data for the period 1996-2001 that companies “may well have redirected the goals of basic research and narrowed the focus towards strategic and applied research with shorter time-horizons.....”, a development which might also have influence their relationship to university.

on the industry-science interface problem addressed to above. This is to our knowledge the first Swiss institute-level study on this matter.²

2. Data

The data used in this study were collected in the course of a survey among Swiss enterprises using a questionnaire which included questions on the incidence of KTT activities among institutes or departments of Swiss science institutions (Federal Institutes of Technology (ETH), Federal Research Organizations, Universities and Universities of Applied Science – Fachhochschulen), forms, channels, motives and impediments of the KTT activities of Swiss science institutions as well on some basic institute or department characteristics such as the number of staff, categories of staff with regard to formal qualification (Diploma, Ph.D.) and function (technical, administrative), academic output (publications, academic degrees), technology output (patent applications, licenses, spin-offs), distribution of human resources over several academic tasks (basic and applied research, teaching, other tasks), and funds from outside the university.³ The survey was based on sample of all institutes and departments of the two federal technical universities (with the exception of the departments of humanities), the four federal research organization, the institutes and departments of engineering, natural sciences, mathematics and physics, medicine and economics and business administration of the ten canton universities as well as the seven regional universities of applied science, on the whole 630 single institutes and departments covering all scientific fields related to technology and science (see table 1 in the appendix for the composition of the sample). This sample has been constructed according to Internet information on the structure of each institution especially for this study. We received 241 completed questionnaires, i.e. 38.3% of the institutes and departments responded to our survey. However, the response rates vary significantly among the single universities (see column 3 in table 1). Thus, there is a tendency of the universities of applied sciences and the federal institutions to be over-represented, of the canton universities to be under-represented in our data set. Institutions from the French-speaking or Italian speaking part of the country have responded less frequently than those of the German-speaking part.

Finally, we tried to substitute for missing values in the variables due to item non-response by using the multiple imputations technique, but these attempts were not successful.

Table 2 shows the size distribution of the institutes or departments in our sample; the size class (10-19 institute employees) has the highest frequency (26.2% of responding institutes).

² In a recent study Vock et al. (2004) presented and discussed the results of a survey on codified forms of KTT (number of R&D projects in co-operation with firms, patents, licences); this survey was addressed to technology transfer offices at universities. Thierstein et al. (2002) investigated the spin-offs/start-ups of graduates of the universities of Eastern Switzerland, Berwert et al. (2002) the spin-offs/start-ups of Swiss technical universities.

³ Versions of the questionnaire in German, French and English are available in www.kof.ethz.ch.

Table 3 shows the distribution of the institutes by scientific field; Engineering is the most frequently reported scientific field (32.8% of all institutes).

3. Descriptive Analysis: Main Facts

Incidence of KTT Activities

According to the results in table 4 84.2% of the responding institutes or departments were involved in KTT activities with private enterprises in the period 2002-2004 or/and before 2002, 71.4% of respondents reported also KTT activities with foreign firms. This is a very high incidence of KTT activities also in international comparison, but it has to be considered with caution because of the rather low total response rate of 38.3%. We suppose that there exist some positive bias towards KTT in our sample. There are not significant differences among the various institutions (federal institutes of technology, federal research institutions, canton universities and regional universities of applied sciences) with respect to propensity to KTT activities. The comparably rather low figures for the Federal Institute of Technology in Lausanne and the University of Lausanne may be not be fully reliable because of the above-average low response rates of these two institutions (see table 1). As expected, universities of applied sciences show a higher propensity to KTT than the two other categories of science institutions but as already mentioned the differences are not large. KTT activities with foreign firms are also widespread, 94.1% of KTT active institutes co-operate with European firms, 48.2% with American and 18.2% with Japanese firms.

Forms of KTT Activities

Institutes reported their assessment of the importance of 19 single forms of KTT activities on a five-point Likert scale (1: “not important”; 5: “very important”) which were grouped together in the following five categories: informal informational activities, activities related to technical infrastructure, educational activities, research activities and consulting. By calculating the share of institutes that reported the values 4 or 5 for any single form or category of forms of KTT activities we could determine a ranking of the importance of various forms of KTT activities (see table 5). Educational activities were given the first priority (80.2% of all KTT active institutes), followed closely by informal informational activities (78.7%) and research activities (75.2%). Much less important were consulting (49.0%) and activities related to technical infrastructure (17.4%); the latter is quite understandable in view of the high endowment in technical equipment of Swiss science institutions. The two most important single educational activities were “contacts with former staff employed in the business sector” (46.5%) and “thesis projects in collaboration with firms” (42.1%). However, there are some remarkable differences among the various institutions: for the institutions of the ETH domain and the universities of applied sciences (see also table 6 for a ranking of the five main forms of KTT activities for every single

institution). For the institutions of the ETH domain and the universities of applied science have research activities a higher priority than informal informational activities. For universities are educational activities less important than informal informational activities. The access to joint technical infrastructure is relatively more important for the universities being confronted with more severe financial restrictions than the other two categories of institutions. Finally, among educational activities is the single activity “doctoral projects in collaboration with firms” quite important for the ETH domain (41.8%) and “thesis projects in collaboration with firms” (77.2%) for the universities of applied sciences.

Educational activities are a top priority for engineering institutes and institutes of economics and business administration, research for engineering, natural sciences and mathematics/physics (see table 7).

Institute Funds from Outside Sources

According to the data in table 8 the mean share of funds from outside sources varied considerably among Swiss science institutions, namely between 28.5% and 69.0% (simple unweighted means). These differences almost disappear when we consider the three groups of institutions (federal, canton and regional institutions); the means of the means of the single institutes of amount to 40.7% for federal institutions, 41.2% for canton universities and 47.8% for universities of applied sciences. On the average 53.1% of outside funds of the universities of applied sciences come from the business sector. The corresponding shares for the federal institutions and the canton universities are 27.5% and 37.9% respectively. As expected the universities of applied sciences raised a considerably higher share of their funds from the business sector than the other two categories of more basic research oriented institutions.

Output of Science Institutions in Co-operation with the Business Sector

The mean share of diplomas in co-operation with private enterprises varied considerably among the various Swiss science institutions, namely between 0.0% and 80.5% (unweighted data; see table 9). The mean share of doctorates (without the universities of applied science which do not grant doctorates) varied between 3.5% and 33.8%. Universities of applied sciences have considerably higher shares of diplomas in co-operation with firms than universities and federal institutions. With respect to doctorates there are not large differences among the various institutions. A remarkably high share both of diplomas and doctorates has the University of St. Gallen, which is specialized in economics and business administration.

Table 10 contains data on university patenting, university licensing and university spin-offs. 34.45% of all institutes in our sample reported patent applications in the period 2002-2004. Only 12.2% of all institutes reported licenses in the same period, 21.7% helped spin-offs to start operations. The shares of institutes with patent applications are rather evenly distributed among the various science institutions. Considerably more than half of patents of the universities of applied sciences and the universities are done in co-operation with private

enterprises. In the federal institutions have less than half of patents achieved in co-operation with firms. Licensing is more frequent among federal institutions than between the other two groups of institutions. Finally, spin-offs are on average more often initiated in the federal institutions and the universities of applied sciences than in the canton universities.

Transfer-mediating Institutions, Transfer Media

What kind of transfer-mediating institutions is more relevant for institutes pursuing KTT activities? Table 11 contains information on the importance as reported by institutes of technology transfer offices of the single institutions, the government innovation agency KTI (applied research), the Swiss Research Foundation (SNF; basic research), the EU Framework Programmes and other EU programmes (mostly applied research). 27.7% of institutes assessed the KTI to be quite important for KTT activities. 20.6% reported the EU Framework Programmes (12.9% other EU programmes), 19.6% the SNF as very important mediating institutions. Only 16.8% of institutes found transfer offices to be relevant mediating institutions.

What type of transfer media is more often used? Knowledge transfer takes place primarily through scientific publications (60% of KTT active institutes; see table 12). Patents, licenses and spin-offs are found to be important transfer media by only 21.0%, 16.7% and 17.6% of KTT active institutes respectively.

Motives for KTT activities

Institutes reported their assessments for 24 single goals or motives for KTT activities on a five-point Likert scale (1: “not important”; 5: “very important”) which were grouped together in the following five categories: financial motives, access to human capital (“tacit knowledge”), access to business sector research findings (“codified knowledge”), access to business sector R&D facilities and institutional and organizational motives. By calculating the share of institutes that reported the values 4 or 5 for any single motive or category of motives for KTT activities we could determine a ranking of the importance of various groups of motives (see table 13).

Financial motives are the most often reported motives for KTT activities with private enterprises (about 90% of KTT active institutes). About 75% found the “access to human capital (tacit knowledge)” and institutional and organizational motives respectively as very important. Only approximately 45% assessed “access to business sector research findings” and “access to business sector R&D facilities” as highly relevant. This ranking of the importance of the five motive categories is valid for all three groups of institutions (ETH domain, universities and universities of applied sciences). Almost the same pattern can be found also for most of the single institutions (see table 14) and for engineering institutes and institutes of economics and business administration (see table 15). In medicine and mathematics and physics are the motives “access to codified knowledge” and “access to R&D

facilities” not relevant. For natural sciences is “access to codified knowledge the least important group of motives for KTT activities.

Impediments of KTT activities

Institutes reported their assessments for 26 single obstacles of KTT activities on a five-point Likert scale (1: “not important”; 5: “very important”) which were grouped together in the following six categories: lack of information, problems in the areas of teaching and basic research, deficiencies of potential industry partners, deficiencies of science institutions themselves, cost, risks and uncertainty, institutional or organizational obstacles. By calculating the share of institutes that reported the values 4 or 5 for any single obstacle or category of obstacles of KTT activities we could determine a ranking of the importance of various groups of obstacles (see table 16, also table 17 for the results by science institution).

Organizational or institutional problems seem to be the most frequently reported obstacle of KTT activities (60.4% of KTT active institutes). This kind of problems is of similar concern for institutes of all three groups of institutions. “resource-intensive administrative and approval procedures, legal restrictions” are the most important single obstacle for the total of KTT active institutes (38.1%). Rather unexpected, for universities of applied sciences they are the most important single obstacle in all categories (46.4%). Organizational or institutional are not so relevant for die institutes of the ETH domain (26.9%).

Problems related to a (possible) neglect of teaching and/or basic science (53.6%) constitute the second most important obstacle category. “Teaching requires too much time” is the most important single big concern in this category (33.0% of KTT active institutes), particularly for universities (40.0%) and universities for applied universities (42.3%); this kind of problems is of no relevance for the institutes of the ETH domain (11.5%). Presumably, these divergences reflect differences with respect to teaching obligations among the various types of institutions.

Costs, risks and uncertainty with respect to co-operation results (48.7%), deficiencies on part of the potential industry partners (47.2%) and informational problems (46.5%) constitute the third most important group of KTT obstacles. The most frequently reported single obstacles in these categories are the “too low level of R&D budgets of potential business partners” (42.1%) and the “lack of interest in scientific projects on part of potential industry partners” (41.6%), The former seems to be a problem particularly for the institutes of the ETH domain (53.8%) and the universities of applied sciences (60.7%) but not for the “classical” universities (23.6%); the latter seems to be a severe obstacle of KTT activities especially for the institutes of the ETH domain (50.0%).

It is quite remarkable that the group of obstacles “deficiencies on part of the institutes themselves” (40.4%) is the least important category of obstacles according to institutes’ own assessment.

The lack of information on industry R&D and organizational or institutional problems seem to be important KTT obstacles almost at the same extent for all five scientific fields (see table 18). There are substantial differences of ranking of the importance of the other three categories of obstacles. Neglect of teaching and basic research are more relevant in economics/business administration but less relevant in mathematics and physics. Deficiencies on part of business partners are more important for mathematics and physics but less so for medicine. Finally, deficiencies of the institutes themselves are a severe obstacle particularly for natural sciences, but of much less importance for engineering.

Impact of KTT Activities

KTT active institutes were asked to assess the impact of their KTT activities with respect to a) financial matters, b) their research orientation, c) teaching and other education activities and d) their scientific reputation. For all three groups of institutions a comparably high share of institutes asserted a positive financial result leading primarily to additional resources for research (73.7% to 83.3% of KTT active institutes; see table 19), less so to additional resources for technical facilities (28.1% to 43.7%). 54.5% of the university institutes and 62.3% of the institutes of the ETH domain reported that KTT activities did not cause any change of their research orientation. 46.6% of the university institutes and 39.6% of institute of the ETH domain asserted that KTT activities led to more applied research. The institutes of applied sciences experienced the strongest push towards applied research (73.7% of KTT active institutes), which quite understandable in view of the re-orientation of the mission of this type of institutions from teaching towards more applied research in the last years. This explains also why 23.2% of these the institutes reported at the same time that as consequence of KTT activities less time for teaching and student support were available. KTT activities also helped to provide education more geared towards practice for 83.9% of institutes of applied science universities and 63.0% of institutes of the ETH domain but only 42.5% of the university institutes. Finally, scientific reputation was not at all damaged, as some European academics fear that in case of intensive KTT activities could happen. On the contrary, 86.0% of respondents of the universities of the applied sciences, 66.0% of those of the ETH domain and 54.7% of the university respondents reported that KTT activities led to a better reputation of their institute. On the whole, the overall impact of KTT activities seems to be positive.

4. Conclusions and Summary

The most important findings of the study refer to the overall propensity to KTT activities with private enterprises. Institutes belonging to the federal institutes of technology (ETH) are more inclined to KTT activities than institutes of the other three groups of institutions. In accordance to expectations, institutes of economics and business administration, natural sciences, engineering and medicine, ranking as above presented, are stronger involved in KTT activities than institutes of mathematics and physics. Financial motives seem to be the most

frequently reported category of motives for KTT activities. Institutes not involved in KTT activities were seriously impeded from undertaking such activities by a series of single obstacles that primarily reflect the (legitimate) fears of academics of neglecting their main task or reduce the quality of their work in case they get involved in KTT activities.

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Table 1: Composition of Net Sample, Response Sample and Response Rates

| Institutions | <i>Net Sample</i> Number of Institutes or Departments | <i>Responses</i> Number of Institutes or Departments | <i>Response Rate</i> (%) |
|--|--|---|-----------------------------|
| <i>ETH Domain</i> | | | |
| Swiss Federal Institute of Zurich | 87 | 45 | 51.7 |
| Swiss Federal Institute of Technology Lausanne | 31 | 12 | 38.7 |
| Federal Research Institutions (*) | 11 | 11 | 100.0 |
| <i>University of</i> | | | |
| Basle | 32 | 11 | 34.4 |
| Berne | 84 | 33 | 39.3 |
| Fribourg | 17 | 5 | 29.4 |
| Geneva | 46 | 15 | 32.6 |
| Italian Switzerland | 9 | 2 | 22.2 |
| Lausanne | 69 | 12 | 17.4 |
| Neuchâtel | 22 | 6 | 27.3 |
| St. Gallen | 21 | 8 | 38.1 |
| Zurich | 74 | 22 | 29.7 |
| <i>University of Applied Sciences of</i> | | | |
| Berne | 13 | 9 | 69.2 |
| Central Switzerland | 10 | 5 | 50.0 |
| Eastern Switzerland | 36 | 14 | 38.9 |
| Italian Switzerland | 7 | 2 | 28.6 |
| North-western Switzerland | 27 | 17 | 63.0 |
| Western Switzerland | 12 | 4 | 33.3 |
| Zurich | 22 | 8 | 36.4 |
| Total | 630 | 241 | 38.3 |

(*): Paul-Scherrer Institute (PSI); EAWAG; EMPA; WSL.

Table 2: Institute Size

| Number of employees (*) | N | Percentage of institutes |
|-------------------------|------------|-----------------------------|
| up to 9 employees | 36 | 14.9 |
| 10-19 employees | 63 | 26.2 |
| 20-39 employees | 47 | 19.5 |
| 40-99 employees | 54 | 22.4 |
| 100 and more employees | 41 | 17.0 |
| Total | 241 | 100.0 |

(*): Institute employees: professors, academic staff with doctorate and 'habilitation', academic staff without doctorate, technical staff with university degree, staff carrying out other supporting and administrative functions in full-time equivalents

Table 3: Institutes by Scientific Field

| Scientific field | N | Percentage institutes |
|------------------------------------|-----|-----------------------|
| Economics, Business Administration | 47 | 19.5 |
| Engineering | 79 | 32.8 |
| Mathematics, Physics | 21 | 8.7 |
| Medicine | 62 | 25.7 |
| Natural Sciences | 32 | 13.3 |
| Total | 241 | 100.0 |

Table 4: Incidence of Knowledge and Technology Transfer (KTT) Activities
of Swiss Science Institutions (percentage of institutes)

| Institutions | N | KTT (*) | Foreign KTT |
|--|------------|-------------|----------------|
| <i>ETH Domain</i> | | | |
| Swiss Federal Institute of Zurich | 45 | 88.9 | 77.8 |
| Swiss Federal Institute of Technology Lausanne | 12 | 58.3 | 58.3 |
| Federal Research Institutions (**) | 11 | 72.7 | 63.6 |
| <i>University of</i> | | | |
| Basle | 11 | 81.8 | 81.8 |
| Berne | 33 | 84.8 | 78.8 |
| Fribourg | 5 | 80.0 | 60.0 |
| Geneva | 15 | 73.3 | 46.7 |
| Italian Switzerland | 2 | 50.0 | 100.0 |
| Lausanne | 12 | 66.7 | 58.3 |
| Neuchâtel | 6 | 83.3 | 100.0 |
| St. Gallen | 8 | 87.5 | 75.0 |
| Zurich | 22 | 81.8 | 77.3 |
| <i>University of Applied Sciences of</i> | | | |
| Berne | 9 | 88.9 | 55.6 |
| Central Switzerland | 5 | 100.0 | 20.0 |
| Eastern Switzerland | 14 | 92.9 | 64.3 |
| Italian Switzerland | 2 | 100.0 | 50.0 |
| North-western Switzerland | 17 | 100.0 | 70.6 |
| Western Switzerland | 4 | 100.0 | 100.0 |
| Zurich | 8 | 100.0 | 75.0 |
| Total | 241 | 84.2 | 71.4 |

(*) KTT: knowledge and technology transfer in the period 2002-2004 and/or in the period before 2002; (**): Paul-Scherrer Institute (PSI); EAWAG; EMPA; WSL.

Table 5: Forms of Knowledge and Technology Transfer Activities of Swiss Science
Institutions by Type of Science Institutions (percentage of institutes with values 4 or 5 for a
single form or any single form belonging to the same main group of forms of KTT activities)

| Forms of KTT activities | ETH Domain | Universities | Universities of Applied Sciences | Total |
|---|-------------------|-------------------|--|--------------------|
| <i>Informal contacts, personal network of contacts</i> <i>N</i> | 74.5 55 | 78.9 90 | 82.5 57 | 78.7 202 |
| Informal contacts (phone, email) | 65.5 | 63.3 | 75.4 | 67.3 |
| Conferences, exhibitions, workshops | 29.1 | 37.8 | 38.6 | 35.6 |
| Academic publications of business sector | 21.8 | 25.6 | 31.6 | 26.2 |
| <i>Technical facilities</i> <i>N</i> | 12.7 55 | 22.5 89 | 14.0 57 | 17.4 201 |
| Joint laboratories | 5.5 | 10.1 | 10.5 | 9.0 |
| Technical facilities or research centres at business sector R&D departments | 9.1 | 19.1 | 5.3 | 12.4 |
| <i>Training, further education, staff mobility</i> <i>N</i> | 80.0 55 | 71.1 90 | 94.7 57 | 80.2 202 |
| Contacts with graduates employed in the business sector | 52.7 | 46.7 | 59.6 | 52.0 |
| Contacts with former staff employed in the business sector | 56.4 | 44.4 | 40.4 | 46.5 |
| Student participation in corporate R&D projects | 30.9 | 18.9 | 45.6 | 29.7 |
| Thesis projects in collaboration with firms | 40.0 | 21.1 | 77.2 | 42.1 |
| Doctoral projects in collaboration with firms | 41.8 | 25.6 | 5.3 | 24.3 |
| Engagement of business sector scientists in university research projects | 27.3 | 27.8 | 33.3 | 29.2 |
| Joint teaching courses or programmes | 7.3 | 27.8 | 21.1 | 20.3 |
| Teaching assignments for business sector staff | 10.9 | 21.1 | 45.6 | 25.2 |
| Attendance of courses or programmes of institute by business sector scientists | 40.0 | 20.0 | 47.4 | 33.2 |
| <i>Research</i> <i>N</i> | 78.2 55 | 66.7 90 | 86.0 57 | 75.2 202 |
| Research projects in collaboration | 67.3 | 56.7 | 82.5 | 66.8 |
| Longer-term research contracts | 49.1 | 38.9 | 42.1 | 42.6 |
| Research consortiums | 47.3 | 24.4 | 36.8 | 34.2 |
| <i>Consulting</i> <i>N</i> | 43.6 55 | 47.8 90 | 56.1 57 | 49.0 202 |
| Expertises/reports for the business sector | 29.1 | 32.2 | 36.8 | 32.7 |
| Consulting for the business sector | 36.4 | 42.2 | 50.9 | 43.1 |

(*): Paul-Scherrer Institute (PSI); EAWAG; EMPA; WSL.

Table 6: Main Forms of Knowledge and Technology Transfer Activities of Swiss Science Institutions by Science Institution
(percentage of institutes with values 4 or 5 for any of the single forms belonging to the same group of forms of KTT activities)

| Institutions | Informal contacts, personal network of contacts | Technical facilities | Training, further education, staff mobility | Research | Consulting | N |
|---|---|----------------------|---|----------|------------|----|
| Swiss Federal Institute of Zurich | 72.5 | 10.0 | 75.0 | 77.50 | 40.0 | 40 |
| Swiss Federal Institute of Technology Lausanne | 71.4 | 28.6 | 85.7 | 85.71 | 57.1 | 7 |
| Federal Research Institutions (*) | 87.5 | 12.5 | 100.0 | 75.00 | 50.0 | 8 |
| University of Basle | 66.7 | 44.4 | 77.8 | 55.56 | 66.7 | 9 |
| University of Berne | 89.3 | 28.6 | 64.3 | 78.57 | 32.1 | 28 |
| University of Fribourg | 50.0 | 0.0 | 50.0 | 100.00 | 50.0 | 4 |
| University of Geneva | 60.0 | 20.0 | 80.0 | 70.00 | 60.0 | 10 |
| University of Italian Switzerland | - | - | - | - | - | 1 |
| University of Lausanne | 87.5 | 12.5 | 75.0 | 50.00 | 75.0 | 8 |
| University of Neuchâtel | 80.0 | 40.0 | 80.0 | 80.00 | 60.0 | 5 |
| University of St. Gallen | 71.4 | 0.0 | 100.0 | 71.43 | 85.7 | 7 |
| University of Zurich | 83.3 | 17.6 | 61.1 | 50.00 | 22.2 | 18 |
| University of Applied Sciences of Berne | 87.5 | 0.0 | 75.0 | 75.00 | 50.0 | 8 |
| University of Applied Sciences of Central Switzerland | 80.0 | 0.0 | 100.0 | 80.00 | 40.0 | 5 |
| University of Applied Sciences of Eastern Switzerland | 76.9 | 15.4 | 100.0 | 92.31 | 53.8 | 13 |
| University of Applied Sciences of Italian Switzerland | 50.0 | 0.0 | 100.0 | 50.00 | 50.0 | 2 |
| University of Applied Sciences of North-western Switzerland | 88.2 | 17.6 | 100.0 | 88.24 | 52.9 | 17 |
| University of Applied Sciences of Western Switzerland | 100.0 | 50.0 | 100.0 | 100.00 | 100.0 | 4 |
| University of Applied Sciences of Zurich | 75.0 | 12.5 | 87.5 | 87.50 | 62.5 | 8 |

(*): Paul-Scherrer Institute (PSI); EAWAG; EMPA; WSL.

Table 7: Main Forms of Knowledge and Technology Transfer Activities of Swiss Science
Institutions by Scientific Field (percentage of institutes with values 4 or 5 for any of the single
forms belonging to the same main group of forms of KTT activities)

| Main forms of KTT activities | Informal contacts, personal network of contacts | Technical facilities | Training, further education, staff mobility | Research | Consulting | N |
|------------------------------|---|-------------------------|---|----------|------------|----|
| Engineering | 83.8 | 17.6 | 93.2 | 81.1 | 54.1 | 74 |
| Economics/Management | 73.3 | 0.0 | 91.1 | 73.3 | 66.7 | 45 |
| Medicine | 83.0 | 23.4 | 57.4 | 63.8 | 40.4 | 47 |
| Mathematics, Physics | 60.0 | 30.0 | 70.0 | 80.0 | 10.0 | 10 |
| Natural Sciences | 73.1 | 32.0 | 69.2 | 80.8 | 34.6 | 26 |

Table 8: Funds from Outside Sources (percentage share of an institute's funds)

| Institutions | N | Share of Funds from Outside Sources (means) | | Share of Funds from the Business Sector (means) | |
|---|----|---|----------|---|----------|
| | | unweighted | weighted | unweighted | weighted |
| Swiss Federal Institute of Zurich | 44 | 39.2 | 36.4 | 36.5 | 34.7 |
| Swiss Federal Institute of Technology Lausanne | 10 | 39.7 | 43.5 | 13.5 | 16.1 |
| Federal Research Institutions | 11 | 43.2 | 25.4 | 32.5 | 60.7 |
| University of Basle | 10 | 37.9 | 32.2 | 53.8 | 30.7 |
| University of Berne | 26 | 40.6 | 28.6 | 42.2 | 45.5 |
| University of Fribourg | 4 | 42.8 | 38.2 | 31.3 | 20.9 |
| University of Geneva | 13 | 37.7 | 25.3 | 29.2 | 33.7 |
| University of Italian Switzerland | 2 | 100.0 | 100.0 | 40.0 | 42.0 |
| University of Lausanne | 11 | 28.5 | 13.9 | 36.2 | 24.5 |
| University of Neuchâtel | 6 | 41.0 | 44.0 | 18.2 | 16.8 |
| University of St. Gallen | 7 | 68.7 | 75.8 | 67.6 | 79.2 |
| University of Zurich | 19 | 32.4 | 28.0 | 22.4 | 21.8 |
| University of Applied Sciences of Berne | 9 | 31.2 | 19.3 | 59.3 | 74.1 |
| University of Applied Sciences of Central Switzerland | 5 | 53.2 | 61.4 | 49.0 | 48.2 |
| University of Applied Sciences of Eastern Switzerland | 14 | 59.4 | 29.4 | 60.8 | 76.0 |
| University of Applied Sciences of Italian Switzerland | 2 | 69.0 | 70.8 | 68.0 | 71.6 |
| University of Applied Sciences of North-western Switzerland | 15 | 43.6 | 12.6 | 45.6 | 77.0 |
| University of Applied Sciences of Western Switzerland | 4 | 25.5 | 25.9 | 47.3 | 45.3 |
| University of Applied Sciences of Zurich | 8 | 52.5 | 46.1 | 46.6 | 52.5 |

Weights: number of employees of single institutes.

Table 9: Output of Science Institutions in Co-operation with the Business Sector. Diplomas, Doctorates (percentage share of an institute's diplomas and doctorates respectively)

| Institutions | N | Share of Diplomas (means) | | Share of Doctorates (means) | |
|---|----|---------------------------|----------|-----------------------------|----------|
| | | unweighted | weighted | unweighted | weighted |
| Swiss Federal Institute of Zurich | 41 | 20.7 | 14.0 | 19.9 | 20.2 |
| Swiss Federal Institute of Technology Lausanne | 10 | 14.0 | 18.6 | 10.5 | 14.1 |
| Federal Research Institutions | 10 | 6.7 | 10.1 | 11.1 | 17.8 |
| University of Basle | 8 | 9.4 | 5.9 | 12.3 | 7.7 |
| University of Berne | 19 | 14.3 | 25.1 | 12.7 | 14.3 |
| University of Fribourg | 4 | 8.5 | 4.8 | 12.5 | 17.1 |
| University of Geneva | 11 | 7.6 | 25.1 | 3.5 | 4.8 |
| University of Italian Switzerland | 1 | - | - | - | - |
| University of Lausanne | 4 | 0.0 | 0.0 | 10.9 | 8.8 |
| University of Neuchâtel | 4 | 7.8 | 6.3 | 12.8 | 9.0 |
| University of St. Gallen | 84 | 32.5 | 19.3 | 33.8 | 57.2 |
| University of Zurich | 11 | 6.4 | 7.7 | 15.0 | 6.6 |
| University of Applied Sciences of Berne | 9 | 57.8 | 56.0 | // | // |
| University of Applied Sciences of Central Switzerland | 5 | 68.0 | 65.1 | // | // |
| University of Applied Sciences of Eastern Switzerland | 13 | 80.5 | 84.4 | // | // |
| University of Applied Sciences of Italian Switzerland | 0 | - | - | // | // |
| University of Applied Sciences of North-western Switzerland | 17 | 67.7 | 82.1 | // | // |
| University of Applied Sciences of Western Switzerland | 3 | 79.0 | 81.7 | // | // |
| University of Applied Sciences of Zurich | 8 | 57.6 | 50.4 | // | // |

Weights: number of diplomas and doctorates respectively.

Table 10: Output of Science Institutions in Co-operation with the Business Sectors: Patents, Licences, Spin-offs

| Institutions | N | % of Institutes with Patents | N | % of Patents in Co-operation with Firms (means) | | N | % of Institutes with Licences | N | % of Institutes with Spin-offs |
|---|-----|------------------------------|----|---|----------|-----|-------------------------------|-----|--------------------------------|
| | | | | unweighted | weighted | | | | |
| Swiss Federal Institute of Zurich | 45 | 51.1 | 21 | 45.2 | 57.9 | 45 | 13.3 | 45 | 33.3 |
| Swiss Federal Institute of Technology Lausanne | 12 | 41.7 | 5 | 44.4 | 55.1 | 12 | 33.3 | 12 | 41.7 |
| Federal Research Institutions | 11 | 36.4 | 4 | 36.0 | 36.9 | 11 | 45.5 | 11 | 36.4 |
| University of Basle | 11 | 45.5 | 5 | 64.0 | 66.7 | 11 | 9.1 | 11 | 9.1 |
| University of Berne | 33 | 21.2 | 6 | 67.2 | 67.4 | 33 | 3.0 | 33 | 15.2 |
| University of Fribourg | 5 | 20.0 | 1 | 100.0 | 100.0 | 5 | 20.0 | 5 | 0.0 |
| University of Geneva | 15 | 33.3 | 5 | 62.0 | 46.3 | 14 | 21.4 | 15 | 13.3 |
| University of Italian Switzerland | 2 | 0.0 | 0 | - | - | 0 | - | 2 | 50.0 |
| University of Lausanne | 12 | 33.3 | 3 | 90.0 | 72.7 | 12 | 8.3 | 12 | 8.3 |
| University of Neuchâtel | 6 | 50.0 | 3 | 63.3 | 55.6 | 6 | 16.7 | 6 | 16.7 |
| University of St. Gallen | 8 | 0.0 | 0 | - | | 8 | 12.5 | 7 | 28.6 |
| University of Zurich | 22 | 31.8 | 7 | 64.6 | 58.4 | 22 | 4.5 | 22 | 4.5 |
| University of Applied Sciences of Berne | 9 | 33.3 | 2 | 100.0 | 100.0 | 9 | 0.0 | 9 | 55.6 |
| University of Applied Sciences of Central Switzerland | 5 | 0.0 | 0 | - | - | 5 | 20.0 | 5 | 20.0 |
| University of Applied Sciences of Eastern Switzerland | 14 | 35.7 | 5 | 100.0 | 100.0 | 14 | 7.1 | 14 | 14.3 |
| University of Applied Sciences of Italian Switzerland | 2 | 0.0 | 0 | - | - | 2 | 0.0 | 2 | 0.0 |
| University of Applied Sciences of North-western Switzerland | 17 | 35.3 | 5 | 100.0 | 100.0 | 17 | 5.9 | 17 | 17.6 |
| University of Applied Sciences of Western Switzerland | 4 | 50.0 | 2 | 50.0 | 18.2 | 4 | 0.0 | 4 | 50.0 |
| University of Applied Sciences of Zurich | 8 | 37.5 | 3 | 67.7 | 51.5 | 8 | 12.5 | 8 | 12.5 |
| All institutes | 241 | 34.4 | 77 | | | 238 | 12.2 | 239 | 21.7 |

Weights: number of patents.

Table 11: Transfer-mediating Institutions (percentage share of institutes reporting values 4 or 5)

| Institutions | N | Transfer Office | KTI | SNF | EU Framework | Other EU programmes |
|---|-----|-----------------|------|------|--------------|---------------------|
| Swiss Federal Institute of Zurich | 40 | 22.5 | 35.0 | 15.0 | 35.0 | 7.5 |
| Swiss Federal Institute of Technology Lausanne | 7 | 28.6 | 85.7 | 28.6 | 57.1 | 42.9 |
| Federal Research Institutions | 8 | 25.0 | 37.5 | 0.0 | 37.5 | 25.0 |
| University of Basle | 9 | 0.0 | 0.0 | 11.1 | 0.0 | 0.0 |
| University of Berne | 28 | 10.7 | 28.6 | 28.6 | 7.1 | 7.1 |
| University of Fribourg | 4 | 0.0 | 0.0 | 25.0 | 25.0 | 25.0 |
| University of Geneva | 9 | 11.1 | 0.0 | 44.4 | 22.2 | 22.2 |
| University of Italian Switzerland | 1 | - | - | - | - | - |
| University of Lausanne | 8 | 37.5 | 25.0 | 50.0 | 12.5 | 25.0 |
| University of Neuchâtel | 5 | 20.0 | 20.0 | 60.0 | 60.0 | 60.0 |
| University of St. Gallen | 7 | 14.3 | 28.6 | 14.3 | 14.3 | 28.6 |
| University of Zurich | 16 | 37.5 | 18.8 | 31.3 | 18.8 | 6.3 |
| University of Applied Sciences of Berne | 8 | 0.0 | 25.0 | 0.0 | 0.0 | 0.0 |
| University of Applied Sciences of Central Switzerland | 5 | 20.0 | 20.0 | 0.0 | 0.0 | 0.0 |
| University of Applied Sciences of Eastern Switzerland | 13 | 23.1 | 38.5 | 7.7 | 15.4 | 15.4 |
| University of Applied Sciences of Italian Switzerland | 2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| University of Applied Sciences of North-western Switzerland | 17 | 5.9 | 29.4 | 5.9 | 11.8 | 5.9 |
| University of Applied Sciences of Western Switzerland | 4 | 25.0 | 50.0 | 0.0 | 50.0 | 25.0 |
| University of Applied Sciences of Zurich | 8 | 12.5 | 50.0 | 12.5 | 12.5 | 12.5 |
| All institutes | 199 | 16.8 | 27.7 | 19.6 | 20.6 | 12.9 |

Table 12: Transfer Media (percentage share of institutes reporting values 4 or 5)

| Institutions | N | Academic Publications | Patents | Licences | Spin-offs/ start-ups |
|---|-----|-----------------------|---------|----------|-------------------------|
| Swiss Federal Institute of Zurich | 40 | 52.5 | 35.0 | 17.5 | 35.0 |
| Swiss Federal Institute of Technology Lausanne | 7 | 42.9 | 28.6 | 42.9 | 71.4 |
| Federal Research Institutions | 8 | 75.0 | 37.5 | 25.0 | 0.0 |
| University of Basle | 9 | 66.7 | 11.1 | 11.1 | 11.1 |
| University of Berne | 28 | 64.3 | 25.0 | 17.9 | 17.9 |
| University of Fribourg | 4 | 50.0 | 0.0 | 0.0 | 0.0 |
| University of Geneva | 9 | 77.8 | 22.2 | 22.2 | 0.0 |
| University of Italian Switzerland | 1 | - | - | - | - |
| University of Lausanne | 8 | 75.0 | 25.0 | 25.0 | 12.5 |
| University of Neuchâtel | 5 | 80.0 | 20.0 | 20.0 | 40.0 |
| University of St. Gallen | 7 | 71.4 | 0.0 | 14.3 | 14.3 |
| University of Zurich | 18 | 66.7 | 22.2 | 22.2 | 5.6 |
| University of Applied Sciences of Berne | 8 | 25.0 | 0.0 | 0.0 | 0.0 |
| University of Applied Sciences of Central Switzerland | 5 | 40.0 | 0.0 | 0.0 | 0.0 |
| University of Applied Sciences of Eastern Switzerland | 12 | 41.7 | 8.3 | 8.3 | 16.7 |
| University of Applied Sciences of Italian Switzerland | 2 | 50.0 | 0.0 | 0.0 | 0.0 |
| University of Applied Sciences of North-western Switzerland | 17 | 64.7 | 5.9 | 5.9 | 11.8 |
| University of Applied Sciences of Western Switzerland | 4 | 75.0 | 25.0 | 50.0 | 50.0 |
| University of Applied Sciences of Zurich | 8 | 75.0 | 37.5 | 12.5 | 0.0 |
| All institutes | 200 | 60.0 | 21.0 | 16.7 | 17.6 |

Table 13: Motives, Objectives for KTT Activities of Science Institutions by Type of Science Institution (percentage share of institutes with values 4 or 5 for a single motive or any of the single motives belonging to the same category of motives)

| Motives | ETH Domain | Universities | Universities of Applied Sciences | Total |
|---|-------------|--------------|----------------------------------|-------------|
| Financial Motives | 90.9 | 84.4 | 98.2 | 90.1 |
| <i>N</i> | <i>55</i> | <i>90</i> | <i>57</i> | <i>202</i> |
| Cost savings | 20.0 | 32.2 | 28.1 | 27.7 |
| Time savings | 12.7 | 20.0 | 21.1 | 18.3 |
| Additional resources for basic research | 49.1 | 58.9 | 15.8 | 44.1 |
| Additional resources for research facilities | 50.9 | 47.8 | 22.8 | 41.6 |
| Commercial success | 32.7 | 15.6 | 47.4 | 29.2 |
| Business funding more flexible than public funding | 47.3 | 48.9 | 26.3 | 42.1 |
| Reference for more public funding | 50.9 | 24.4 | 66.7 | 43.6 |
| Applied research possible only in collaboration | 72.7 | 60.0 | 87.7 | 71.3 |
| Access to human capital (tacit knowledge) | 81.5 | 64.8 | 86.0 | 75.4 |
| <i>N</i> | <i>54</i> | <i>88</i> | <i>57</i> | <i>199</i> |
| Access to specific capabilities complementary to own ones | 46.3 | 40.9 | 54.4 | 46.2 |
| Research impetus | 55.6 | 42.0 | 63.2 | 51.8 |
| Exchange of experience with industrial researchers | 51.9 | 35.2 | 54.4 | 45.2 |
| Practical experience for staff/students | 55.6 | 37.5 | 59.6 | 48.7 |
| Additional insights in own research field | 48.1 | 37.5 | 63.2 | 47.7 |
| Access to business sector research findings (codified knowledge) | 42.6 | 32.6 | 64.9 | 44.5 |
| <i>N</i> | <i>54</i> | <i>89</i> | <i>57</i> | <i>200</i> |
| Access to patents, licenses | 3.7 | 6.7 | 10.5 | 7.0 |
| Gaining knowledge about practical problems for curriculum | 40.7 | 29.2 | 63.2 | 42.0 |

| | | | | |
|---|-------------|-------------|-------------|-------------|
| <i>Access to business sector R&D facilities</i> | 50.0 | 39.8 | 46.4 | 44.4 |
| <i>N</i> | <i>54</i> | <i>88</i> | <i>56</i> | <i>198</i> |
| Access to technological equipment, specialised technology | 7.4 | 23.9 | 12.5 | 16.2 |
| Test own research findings in practice | 50.0 | 29.5 | 42.9 | 38.9 |
| <i>Institutional or organisational motives</i> | 81.5 | 62.9 | 87.7 | 75.0 |
| <i>N</i> | <i>54</i> | <i>89</i> | <i>57</i> | <i>200</i> |
| Securing good job prospects for students/staff | 51.9 | 37.1 | 57.9 | 47 |
| Presence of business representatives in university's academic consultant bodies | 18.5 | 22.5 | 49.1 | 29.0 |
| Extending university's mission | 44.4 | 32.6 | 56.1 | 42.5 |
| Promoting the diffusion of a particular technology | 57.4 | 30.3 | 56.1 | 45.0 |
| Promoting the diffusion of key findings | 44.4 | 32.6 | 63.2 | 44.5 |
| Promoting regional development | 25.9 | 30.3 | 63.2 | 38.5 |
| Improving image of science | 38.9 | 43.8 | 36.8 | 40.5 |

Table 14: Main Categories of Motives for KTT Activities by Science Institution (percentage share of institutes with values 4 or 5 for any of the single motives belonging to the same group of motives)

| Institutions | N | Financial Motives | Access to human capital (tacit knowledge) | Access to firms' research findings (codified knowledge) | Access to business sector R&D facilities | Institutional or organisational motives |
|---|----|-------------------|---|---|--|---|
| Swiss Federal Institute of Zurich | 40 | 87.5 | 79.5 | 35.9 | 48.7 | 76.9 |
| Swiss Federal Institute of Technology Lausanne | 7 | 100.0 | 85.7 | 71.4 | 71.4 | 100.0 |
| Federal Research Institutions | 8 | 100.0 | 87.5 | 50.0 | 37.5 | 87.5 |
| University of Basle | 9 | 77.8 | 55.6 | 11.1 | 33.3 | 55.6 |
| University of Berne | 28 | 89.3 | 66.7 | 25.0 | 40.7 | 50.0 |
| University of Fribourg | 4 | 75.0 | 100.0 | 50.0 | 25.0 | 75.0 |
| University of Geneva | 10 | 90.0 | 55.6 | 33.3 | 44.4 | 100.0 |
| University of Italian Switzerland | 1 | - | - | - | - | - |
| University of Lausanne | 8 | 75.0 | 50.0 | 25.0 | 25.0 | 62.5 |
| University of Neuchâtel | 5 | 80.0 | 80.0 | 40.0 | 80.0 | 80.0 |
| University of St. Gallen | 7 | 85.7 | 71.4 | 71.4 | 42.9 | 71.4 |
| University of Zurich | 18 | 83.3 | 61.1 | 38.9 | 33.3 | 55.6 |
| University of Applied Sciences of Berne | 8 | 100.0 | 62.5 | 37.5 | 25.0 | 75.0 |
| University of Applied Sciences of Central Switzerland | 5 | 100.0 | 100.0 | 80.0 | 0.0 | 60.0 |
| University of Applied Sciences of Eastern Switzerland | 13 | 100.0 | 100.0 | 76.9 | 46.2 | 100.0 |
| University of Applied Sciences of Italian Switzerland | 2 | 100.0 | 100.0 | 0.0 | 50.0 | 50.0 |
| University of Applied Sciences of North-western Switzerland | 17 | 94.1 | 76.5 | 58.8 | 47.1 | 94.1 |
| University of Applied Sciences of Western Switzerland | 4 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| University of Applied Sciences of Zurich | 8 | 100.0 | 87.5 | 75.0 | 71.4 | 87.5 |

Table 15: Main Categories of Motives by Scientific Field (percentage share of institutes with values 4 or 5 for any of the single motives belonging to the respective group of motives)

| | N | Financial motives | Access to human capital ("tacit knowledge") | Access to business research findings ("codified knowledge") | Access to business sector R&D facilities | Institutional or organizational motives |
|----------------------|----|-------------------|---|---|--|---|
| Scientific fields | | | | | | |
| Engineering | 74 | 93.2 | 83.8 | 55.4 | 51.4 | 87.8 |
| Economics/Management | 45 | 93.3 | 77.8 | 66.7 | 45.5 | 84.4 |
| Medicine | 47 | 85.1 | 58.7 | 21.3 | 34.8 | 48.9 |
| Mathematics, Physics | 10 | 100.0 | 77.8 | 11.1 | 11.1 | 66.7 |
| Natural Sciences | 26 | 80.8 | 76.0 | 28.0 | 52.0 | 72.0 |

Table 16: Obstacles of KTT Activities of Science Institutions by Type of Science Institution
(percentage share of institutes with values 4 or 5 for a single obstacle or any of the single obstacles belonging to the same group of obstacles)

| Obstacles | ETH Domain | Universities | Universities of Applied Sciences | Total |
|---|-------------|--------------|----------------------------------|-------------|
| <i>Lack of information</i> | 46.2 | 44.4 | 50 | 46.5 |
| <i>N</i> | <i>52</i> | <i>90</i> | <i>56</i> | <i>198</i> |
| Lack of Information about firms' research activities | 36.5 | 27.8 | 28.6 | 30.3 |
| Difficulty to find an appropriate partner | 28.8 | 32.2 | 28.6 | 30.3 |
| Interface to the business sector poorly equipped | 11.5 | 11.1 | 23.2 | 14.6 |
| <i>Problems in the areas of teaching, basic research</i> | 42.3 | 57.8 | 57.7 | 53.6 |
| <i>N</i> | <i>52</i> | <i>90</i> | <i>52</i> | <i>194</i> |
| Teaching requires too much time | 11.5 | 40.0 | 42.3 | 33.0 |
| Scientific independence impaired | 11.5 | 21.1 | 13.5 | 16.5 |
| Hindrance to academic publication activities | 25.0 | 18.9 | 5.8 | 17.0 |
| Neglecting basic research | 13.5 | 20.0 | 11.5 | 16.0 |
| <i>Necessary conditions for KTT lacking among potential partners in the business sector</i> | 57.7 | 41.6 | 46.4 | 47.2 |
| <i>N</i> | <i>52</i> | <i>89</i> | <i>56</i> | <i>197</i> |
| Lack of qualified staff | 21.2 | 7.9 | 12.5 | 12.7 |
| Lack of technical facilities | 5.8 | 2.2 | 0.0 | 2.5 |
| Lack of interest in scientific projects | 50.0 | 37.1 | 41.1 | 41.6 |
| Insufficient interesting research questions | 21.2 | 20.2 | 23.2 | 21.3 |
| <i>Necessary conditions for KTT lacking in institute</i> | 29.6 | 45.5 | 42.9 | 40.4 |
| <i>N</i> | <i>54</i> | <i>88</i> | <i>56</i> | <i>198</i> |
| Lack of academic specialists for KTT activities | 18.5 | 33.0 | 32.1 | 28.8 |
| Approach of staff not entrepreneurial enough | 11.1 | 18.2 | 23.2 | 17.7 |
| Insufficient interesting research focus for firms | 3.7 | 14.8 | 7.1 | 9.6 |
| No possibility of commercialising research findings | 11.1 | 17.0 | 10.7 | 13.6 |

| | | | | |
|---|-------------|-------------|-------------|-------------|
| <i>Costs, risks, uncertainty</i> | 63.5 | 31.5 | 62.5 | 48.7 |
| <i>N</i> | <i>52</i> | <i>89</i> | <i>56</i> | <i>197</i> |
| Uncertainty about R&D results | 21.2 | 10.1 | 14.3 | 14.2 |
| Differing ideas on costs and/or productivity | 28.8 | 16.9 | 25.0 | 22.3 |
| R&D budgets of potential business partners too low | 53.8 | 23.6 | 60.7 | 42.1 |
| <i>Organisational, institutional obstacles</i> | 61.5 | 57.3 | 64.3 | 60.4 |
| <i>N</i> | <i>52</i> | <i>89</i> | <i>56</i> | <i>197</i> |
| Resource-intensive administrative and approval procedures, legal restrictions | 26.9 | 39.3 | 46.4 | 38.1 |
| Lack of project administration support on the part of the academic institution | 9.6 | 24.7 | 28.6 | 21.8 |
| Lack of support for the commercialisation of findings on the part of the academic institution | 19.2 | 15.7 | 16.1 | 16.8 |
| Property Rights problems | 26.9 | 13.5 | 5.4 | 14.7 |
| Project management problems | 11.5 | 12.4 | 16.1 | 13.2 |
| Different views on urgency with regard to scheduling | 28.8 | 18.0 | 28.6 | 23.9 |
| Lack of confidence | 3.8 | 3.4 | 7.1 | 4.6 |
| Reputation at risk | 5.8 | 3.4 | 8.9 | 5.6 |

Table 17: Main Categories of Obstacles of KTT Activities of Science Institutions by Science Institution (percentage share of institutes with values 4 for any of the single obstacles belonging to the same group of obstacles)

| Institutions | N | Lack of information | Problems in the areas of teaching, basic research | Necessary conditions for KTT lacking in business sector | Necessary conditions for KTT lacking in institute | Costs, risks, uncertainty | Organisational, institutional obstacles |
|--|----|---------------------|---|---|---|---------------------------|---|
| Swiss Federal Institute of Zurich | 37 | 43.2 | 37.8 | 48.6 | 20.5 | 62.2 | 59.5 |
| Swiss Federal Institute of Technology Lausanne | 7 | 57.1 | 85.7 | 85.7 | 71.4 | 71.4 | 71.4 |
| Federal Research Institutions | 8 | 50.0 | 25.0 | 75.0 | 37.5 | 62.5 | 62.5 |
| University of Basle | 9 | 66.7 | 77.8 | 55.6 | 66.7 | 44.4 | 66.7 |
| University of Berne | 28 | 42.9 | 53.6 | 28.6 | 33.3 | 33.3 | 60.7 |
| University of Fribourg | 4 | 25.0 | 25.0 | 50.0 | 50.0 | 0.0 | 0.0 |
| University of Geneva | 10 | 50.0 | 80.0 | 50.0 | 88.9 | 10.0 | 70.0 |
| University of Italian Switzerland | 1 | - | - | - | - | - | - |
| University of Lausanne | 8 | 25.0 | 25.0 | 14.3 | 25.0 | 12.5 | 62.5 |
| University of Neuchâtel | 5 | 60.0 | 80.0 | 40.0 | 60.0 | 20.0 | 80.0 |
| University of St. Gallen | 7 | 28.6 | 71.4 | 57.1 | 0.0 | 28.6 | 16.7 |
| University of Zurich | 18 | 50.0 | 55.6 | 50.0 | 55.6 | 55.6 | 55.6 |
| University of Applied Sciences of Berne | 8 | 25.0 | 75.0 | 37.5 | 50.0 | 50.0 | 50.0 |
| University of Applied Sciences of Central Switzerland | 5 | 100.0 | 40.0 | 100.0 | 100.0 | 80.0 | 100.0 |
| University of Applied Sciences of Eastern Switzerland | 13 | 61.5 | 50.0 | 38.5 | 30.8 | 76.9 | 76.9 |
| University of Applied Sciences of Italian Switzerland | 2 | 50.0 | 100.0 | 50.0 | 0.0 | 100.0 | 0.0 |
| University of Applied Sciences of Northwestern Switzerland | 16 | 31.3 | 50.0 | 43.8 | 41.2 | 50.0 | 62.5 |
| University of Applied Sciences of Western Switzerland | 4 | 25.0 | 100.0 | 50.0 | 50.0 | 75.0 | 50.0 |
| University of Applied Sciences of Zurich | 8 | 75.0 | 57.1 | 37.5 | 28.6 | 50.0 | 62.5 |

Table 18: Main Categories of Obstacles of KTT Activities of Science Institutions by Scientific Field (percentage share of institutes with values 4 for any of the single obstacles belonging to the same group of obstacles)

| Scientific field | N | Lack of information | Teaching Problems, basic research | Necessary conditions for KTT lacking in business sector | Necessary conditions for KTT lacking in institute | Costs, risks, uncertainty | Organisational, institutional obstacles |
|----------------------|----|---------------------|-----------------------------------|---|---|---------------------------|---|
| Engineering | 72 | 48.6 | 52.9 | 49.3 | 31.1 | 62.0 | 63.4 |
| Economics/Management | 45 | 44.4 | 62.2 | 53.3 | 43.2 | 44.4 | 54.5 |
| Medicine | 47 | 48.9 | 48.9 | 39.1 | 45.7 | 37.0 | 68.1 |
| Mathematics, Physics | 10 | 40.0 | 40.0 | 60.0 | 33.3 | 40.0 | 60.0 |
| Natural Sciences | 24 | 41.7 | 54.2 | 40.0 | 56.0 | 44.0 | 48.0 |

Table 19: Impact of KTT Activities by Type of Science Institution (percentage share of institutes)

| Impact | ETH Domain | Universities | Universities of Applied Sciences |
|---|------------|--------------|----------------------------------|
| <i>Change of financial position</i> | | | |
| <i>N</i> | <i>54</i> | <i>87</i> | <i>57</i> |
| No change | 14.8 | 17.2 | 19.3 |
| Additional resources for research | 83.3 | 77.0 | 73.7 |
| Additional resources for teaching | 13.0 | 12.6 | 7.0 |
| Additional resources for technical facilities | 37.0 | 43.7 | 28.1 |
| <i>Change of research orientation</i> | | | |
| <i>N</i> | <i>53</i> | <i>88</i> | <i>57</i> |
| No change | 62.3 | 54.5 | 26.3 |
| More geared to applied research | 39.6 | 46.6 | 73.7 |
| More geared to basic research | 5.7 | 2.3 | 0.0 |
| <i>Teaching, further education or further training activities</i> | | | |
| <i>N</i> | <i>54</i> | <i>87</i> | <i>56</i> |
| No impact | 33.3 | 54.0 | 10.7 |
| Education provided is more geared towards practice | 63.0 | 42.5 | 83.9 |
| Less time available for teaching and student support | 7.4 | 8.0 | 23.2 |
| <i>Scientific reputation</i> | | | |
| <i>N</i> | <i>53</i> | <i>86</i> | <i>57</i> |
| No change | 35.8 | 44.2 | 12.3 |
| Better reputation | 66.0 | 54.7 | 86.0 |
| Worse reputation | 0.0 | 1.2 | 1.8 |