Chapter 13
Striving for Differentiation: Ambiguities of the Applied Research Mandate in Swiss Universities of Applied Sciences

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Introduction

In the European non-university higher education landscape, the Swiss Universities of Applied Sciences (UASs) represent a very specific case, since their creation in 1997 these institutions received a research mandate, and the development of research was considered as one of the key objectives in the transformation of vocational schools in higher education institutions. Moreover, the research mandate of UASs was clearly distinct from universities, being focused on applied research and transfer of knowledge to private companies. Hence, it was an integral component of the binary divide and helped to distinguish the two sectors rather than to promote their convergence like in other countries (Lepori, 2008).

Moreover, in the second half of the 1990s, the Swiss state launched a number of initiatives and support measures to promote research in UASs, since these institutions started with a very low level of research activities. As we shall see, this policy was quite successful and after a few years Swiss UASs grew into significant research actors, at least in technology.

The aim of this chapter is twofold. First, I will explain the rationales and the forces behind these choices, as well as the reasons of the success of this policy. Second, I will discuss a number of open issues and ambiguities which emerged in the recent years, concerning the function of research in UASs and the delimitation of the applied research mandate, the relative priority of research and education and, finally, the extreme differences between subject domains in the extent and level of research activities. Thus, I will argue that both of these issues and a number of developments in the Swiss higher education system – including the introduction of the Bologna model and the foreseen reforms of the governance of higher education – are likely to lead to major changes in the UAS organisation in the next years and, to some

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extent, might lead to a weakening of a binary divide which has proved until now to be quite stable.

This chapter is organised in five sections. First, I introduce the overall organisation of the Swiss higher education system and some specificities which are relevant also for analysing UASs. Second, I deal with the definition of the applied research mandate, with the public policies used to implement it and the nation-wide discussions on its future. Third, I look at the institutions themselves, analysing their research strategies, profile and support measures, and provide information on the extent and distribution of research activities and their development in the recent years. The fourth section discusses some tensions and issues which emerged concerning the development of research activities in UASs, while the last section frames them in the overall future evolution of Swiss higher education and of the binary system.

The chapter is based on an extensive body of research conducted on research in Swiss UASs, including a large study commissioned by the Swiss Innovation Agency and based on an on-line questionnaire and face-to-face interviews with research seniors (Lepori & Attar, 2006), as well as two studies on the funding of research, financed by the Federal Office of Professional Education and Technology and by the Rectors' Conference of Swiss UASs (Lepori, 2007a). Moreover, I will draw largely on documents concerning research strategies of the institutions and of some of their departments, for example, research reports and strategic documents, as well as the systematic analysis of institutional websites, looking for descriptions of the research mission and of research units and their competences. This also includes official documents, like the UAS law, the UAS strategic plan for each 4-year period (*Masterplan*, BBT, 2007) and a number of documents published by the Federal Office of Professional Education and Technology, the Swiss Innovation Agency and the Rectors' Conference of Swiss UASs.

The Policy Context: Swiss Higher Education and the Binary Divide

It is hardly possible to understand the development of research in the Swiss UASs without some background information on the organisation of the Swiss higher education system and of its specificities.

A Fragmented Governance Landscape

Switzerland is a federal state where competences are shared between the Confederation and the Cantons. In general, education is a strict competence domain of the Cantons and, thus, until the secondary level, federal competences are extremely limited. However, concerning higher education, the historical development has led to a complex division of competences, which largely impairs the coordination of the system (Perellon, 2001).

Historically, some Cantons have had their own university since the middle ages (University of Basel was created in 1460): nowadays, there are ten cantonal universities, directly ruled by their host canton through cantonal laws. With the creation of the federal state in 1848, the Confederation received the right to create and manage polytechnic schools: thus, two Federal Institutes of Technology (FITs) were created in Zurich (ETHZ) in 1854 and in Lausanne (EPFL) in 1968. FITs have the same degree structure as universities, but are specialised in natural sciences and technology.

Since the Second World War, the separated system has evolved towards a more integrated setting, however, without the clarification of jurisdiction. Thus, the Confederation has progressively developed a set of instruments financing project research also in higher education, the two most important being the Swiss National Science Foundation (SNF) and the Swiss Innovation Agency (CTI). Moreover, since 1967 the Confederation has financed cantonal universities and, accordingly, a framework law has been introduced; a joint body between the Confederation and the Cantons named the Swiss University Conference (SUC) progressively emerged as the *locus* for construction of consensus in higher education, while a large part of the coordination has been delegated to the Rectors' Conference of Swiss Universities.

What should be retained is that there is no common system of rules for Swiss higher education institutions (Lepori, 2007). Thus, individual universities and FIT are funded according to different channels and rules, there are no uniform organisational structures, or personnel statutes, career organisation and wage level. The unity of the system has been largely kept by academic rules and norms, even with quite different interpretations according to the regions. Concerning curricula, the introduction of the Bologna model brought uniformity in the length of the curricula, but there are no basic curricular plans at national level. Moreover, the coordination has been essentially based on mutual consensus, with a number of actors having a de facto blocking power on reforms: this strongly limits the ability of redesigning the system and led repeatedly in the past to partial reforms, which increased the complexity of the system.

The Vocational Education Sector and the Creation of a Binary System

Historically, Switzerland has been characterised by a very large vocational education sector both at the secondary and at the tertiary level. Namely, the separation between general curricula and vocational curricula began already at the secondary level, with the widespread practice of the apprenticeship (OECD, 2003). Progressively, vocational tertiary-level schools began to emerge, mostly offering rather short curricula. This model and the early selection between general and vocational curricula explain why Switzerland has been characterised by very low levels of access to higher education when compared to the other European countries (OECD, 2003; Perellon, 2003).

Like other European countries (Kyvik, 2004), the non-university higher education sector emerged through the upgrade of vocational institutions. This process was pushed from the early 1990s from concerns on the quality of vocational education; thus, in 1994, the Confederation introduced a professional maturity as the main diploma for access into the professional tertiary level, while in 1995 the new UAS act was approved (Conseil fédéral, 1994), which provided the framework for the merging of existing tertiary-level schools in technology, economics and management and applied arts (Lepori & Attar, 2006; Perellon, 2003). Seven public UASs were then created, each covering different regions of Switzerland followed, in 2005 and 2007, by two private UASs which were accredited, but without the right to public subsidies.

A fundamental difference with universities is that for vocational education the Confederation has the right to edict common rules and thus has a more direct power of intervention. A second difference is that, historically, vocational education has been considered as a part of economic policy and thus it is managed at the federal level by the Ministry of Economic Affairs (while general education and research are the resort of the Ministry of Internal Affairs).

The second stream leading to the creation of UASs was the perceived need to reinforce Swiss technology policy and to promote cooperation between higher education and private companies. While Swiss research policy had (and still largely has) a tradition of separation of functions between public and private research, from the 1970s it was perceived that some economic sectors and SMEs needed more support (Conseil fédéral, 1992; OECD, 1989). The chosen solution was not to directly finance industrial R&D, but to create a research actor situated downstream from basic research performed in universities towards applied research and development in cooperation with private companies. At the end of the 1990s, the two streams converged also organisationally with the merging of the offices in the Ministry of Economic Affairs responsible of technological policy and vocational education, into the new Federal Office of Professional Education and Technology (BBT), which became the main body supervising UASs.

Thus, the creation of UASs was accompanied by the creation in the Ministry of Economy of a parallel structure to the Ministry of Internal Affairs oriented towards vocational education and applied research, including a specific Swiss Innovation Agency funding applied research in cooperation with private companies. Thus, the binary divide was built from the beginning on two different institutional structures and this largely explains its stability (Lepori, 2006).

Merging and Expansion

While at the beginning UASs included only a few sectors with a strong focus on technology, in the last 10 years they have progressively integrated tertiary vocational schools in domains like social work, health, arts, teacher education. As a consequence, student numbers have grown from about 24,000 students in 2000 to 63,000

in 2008, against 121,000 in universities and in FITs. According to the forecasts of the Swiss Federal Statistical Office, the number of bachelor diplomas awarded by UASs will exceed those awarded by universities in the next years. Moreover, they evolved from institutions focused on engineering and technology (which comprised about half of the students in 1998) to generalist institutions covering most of the fields and with three quarters of students in non-technical domains.

The creation of UASs has been decisive to promote the expansion of higher education in a country historically characterised by a very low participation rate in higher education and by a very large tertiary professional sector (ISCED 5B level, OECD, 2003). The entry rate into higher education increased from 16.1% in 1995 to 34.5% in 2008 (source: Swiss Federal Statistical Office). This led also to a strong increase of expenditures since upgrading vocational education entailed also an increase of the costs per student. Public expenditures in tertiary education were stable around 1% of GDP from 1981 to 1995/6 and then increased to 1.5% in 2006 (source: OECD. Education at glance). Overall, the total expenditures of UASs have almost doubled between 2000 and 2007 from 678 to 1,922 million CHF (against about 6 billion CHF spent for universities and FITs).

Nowadays, UASs offer essentially a 3-year curricula which has been adapted to fit into the Bologna model and lead to the title of UAS bachelor; from 2008 they will be allowed to offer professionally oriented master degrees in a limited number of domains. While in the beginning the university and UAS curricula were considered as completely separated, the introduction of the Bologna model has led to some reconsideration and, at least in the same subject domains, UAS bachelor holders will, in the future, be allowed to enrol into university master's, subject to some conditions. As in other countries, the introduction of the bachelor–master is thus profoundly influencing the binary divide (De Weert, 2006).

Complexities in the Governance Structure

The creation of UASs was essentially based on geographical criteria, with each of the seven UASs covering a part of the Swiss territory. This implied that not only UASs started as a conglomerate of more than 60 pre-existing schools, but also five of seven UASs happened to cover more than one canton and this complicated the merger process and the set-up of central structures. Namely, intercantonal UASs are based on intercantonal agreements, which are difficult to modify and are subject to internal tensions, with each Canton supporting the schools located in its territory. Moreover, UASs are subject to federal (framework) regulations while the institutions themselves are subject to cantonal rules, for example, concerning accounting practices, employment rules, etc., being the transformation of former cantonal professional schools. As a consequence, the responsibility for the steering of the system is fragmented among different bodies and jurisdictions (Lepori, 2007; Perellon, 2003).

Both the UAS peer review (Commission fédérale des HES, 2002) and our work have showed a great deal of variation in the strength of the central UAS directions

and in the progress of their transformation from groupings of individual schools to more unitary structures. Key elements of this process are the creation of a governing board and the nomination of a director with strong power; the centralisation of the allocation of financial resources; the reorganisation in subject departments and the concentration of subject domains in a single location. While some UASs have now well-defined central structures and rules and are organised in subject departments like universities, others have to be largely considered as holding organisations of largely autonomous individual institutions, with practically no central structures and power and, in many cases, with the same subject domains present in different locations. As a consequence, for some UASs, the level of the individual schools is more relevant for the development of research strategies than the whole UAS.

The Applied Research Mandate and Its Implementation

The research mandate of the UAS was already defined in the act of 1995. Namely, UASs should concentrate on applied research and development, focusing on the support to small and medium enterprises (SMEs; Conseil fédéral, 1994, 1997). The official documents position UASs as the link between the basic research performed in the universities and the private economy, thus with the function of transferring existing knowledge into application useful for the companies in direct cooperation with them (BBT, 2002; Conseil fédéral, 1997). Even if it is not any more accepted as a relevant description of the innovation process (Nightingale & Martin, 2000), the linear model of innovation still was the conceptual basis of the Swiss innovation policy in the 1990s.

The background of this discourse was the perception that the Swiss research system was very good in the production of basic knowledge, but weak in its transfer towards innovation and concerns about the diminishing innovation performance of the Swiss economy and the lack of an explicit technology policy (Conseil fédéral, 1992; OECD, 1989).

Thus, the attribution of a research mandate was one of the main policy goals behind the creation of the UAS and helped to clearly differentiate them from universities; this is critical since in the Swiss context the existence of a research mandate and of sizeable research activity is considered as necessary for belonging to higher education (and distinguishing UASs from other tertiary education schools). We also notice the strong reference of these formulations to technology, which constituted the core of the UAS at their creation.

In the last 10 years, the applied research mandate has been quite stable. Some shifts have occurred in two directions, as stated by the most recent document of the Rector's Conference of Swiss UASs (KFH, 2005): first, emphasising the reference to the application of knowledge and cooperation with practice, without an explicit reference to technology (thus including, for example, action-research in

social sciences); second, accepting that UASs can and should develop basic knowledge in emerging fields where this is critically needed for application (use-inspired basic research; Stokes, 1997).

An Active Policy to Develop Research

The schools that merged into UASs in 1997 had quite limited research competencies, were concentrated in informatics, mechanical engineering and production processes and were largely the outcome of a national programme launched in the 1990s to support the introduction of Computer Integrated Manufacturing in the Swiss manufacturing industry. Activities were mostly concerned with the development of applications and performed by individual teachers or very small teams. For UASs to be able to fulfil their mandate, support measures were clearly needed.

An action plan was launched in 1997 by the Confederation, which attributed to the Swiss Innovation Agency additional funds to coach UASs in the development of their research strategies, to train their personnel and to finance exploratory projects and competence networks among Swiss UASs in specific research areas (Conseil fédéral, 1997). In the period 1997–2007 more than 120 million euros has been invested, a substantial amount given that in the year 2000 total R&D expenditures of UASs were just 50 million euros. To provide a comparison, the German programme for research in *Fachhochschulen* had in 2006 a volume of €16 million, while Dutch *Hogescholen* received €35 million for their *lectorates*.

The second measure was the reinforcement of the Swiss Innovation Agency (CTI) and its reorientation as an instrument to finance applied research in UASs. The CTI had a difficult life since its creation in 1944, but regained progressively a role in the Swiss research policy from the 1970s (Lepori, 2006). At the end of the 1990s, it was explicitly designed as the agency for supporting applied research, thus mirroring the role of SNF for academic research. Moreover, its main funding instrument – collaborative projects between HEIs and private companies – was very well adapted to research in UASs. Not only has the CTI budget strongly increased in the last 10 years, but UASs have also become the main beneficiary surpassing the FITs. Thus, the second ingredient for the development of research was the availability of a specific funding agency for the type of research done in UASs.

Finally, additional support to research activities was provided by the Confederation and by the Cantons through the general budget of UASs. Thus, the Confederation has, since 2004, a specific budgetary line for research in their general subsidy to UASs, while Cantons granted support either in the general budget or as strategic funds for research.

If we compare the funding volume provided through these measures with the starting level – even if there is no precise data, total R&D expenditures in 1997 probably did not exceed 30 million euros – we can conclude that research in UASs was promoted and supported by the state to an extent where financial means were probably a less important issue than building the necessary research competences.

A Funding System Oriented Towards Education

A closer look to the funding system of UASs allows a better understanding of the role of research and emerging tensions with education. Namely, most of the UASs' budgets are attributed for education and calculated on the basis of standard costs per student, fixed in their 4-year development plan agreed between Cantons and the Confederation (*Masterplan*). Of these costs, about three quarters are borne by the Cantons and one quarter by the Confederation (Lepori, 2007a).

Research is funded through three main sources (Fig. 13.1): direct contributions of the Cantons, a small contribution of the Confederation allocated on the basis of the third-party funds and of the personnel engaged both in research and in education and, finally, third-party funds, especially CTI projects and contracts from private companies. There are, however, large differences between UASs in the amount of research funds attributed by their Cantons, since, unlike education, there are no standard national rules.

While it was originally assumed that research, being of direct interest to customers, should be essentially financed by third-party funds, today general funds cover about 60% of the total R&D expenditures. A specific feature of UASs is their bookkeeping system, which requires a strict separation between educational and research activities (with daily time sheets); at least in principle, it is assumed that the educational and the research budget are clearly separated and there are no transfers between the two.

The drawback of this funding system is that, with the today's mechanism, an increase in the number of students automatically increases the educational budget, since the standard costs per student are almost fixed, while at the same time resources for research have to be additionally set aside by the state; in the today's situation where the Cantons push for integrating most of tertiary vocational education into UASs – to get also the right to the federal subsidies – and the number of

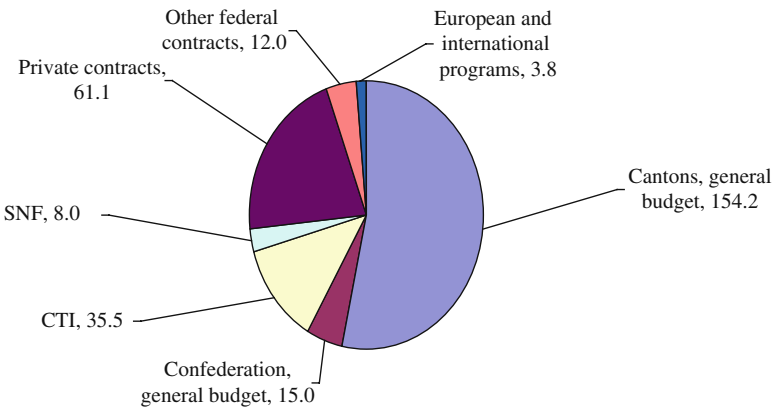


Fig. 13.1 Funding (million CHF) of R&D in Swiss UASs (2007)
Source: Swiss Federal Statistical Office

UAS students is strongly increasing, educational funding has the priority and R&D funding is limited to the remaining resources for UASs.

A Weakly – Regulated Environment

If we go beyond the general definition of the research mandate and the funding system, general norms and rules concerning the organisation of research are quite limited in the Swiss context. Namely, the Confederation has decided detailed rules concerning the organisation of curricula and their accreditation, but much less concerning research. How research should be organised, its repartition by domains, the organisation of researcher's careers and their qualification are essentially the responsibilities of the UASs themselves.

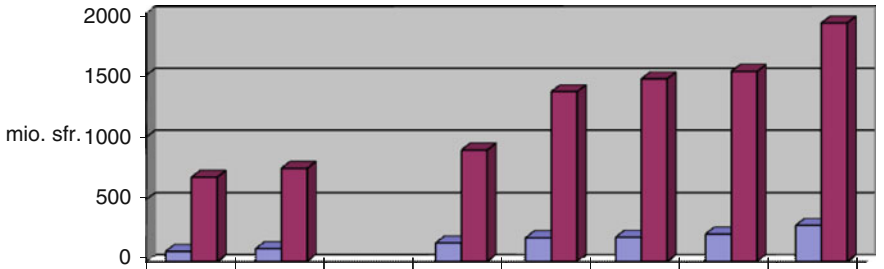
To some extent, the Rectors' Conference of Swiss UASs tried to promote common practices between UASs through internal discussion and the publication of guidelines, for example, on the nature of applied R&D, on careers, etc.; but as the quite different application of the title of UAS professors clearly shows, practices in the individual UASs can differ strongly.

However, it is relevant that research activities are considered as a necessary component of UASs and thus examined in the overall assessment of these schools (as in the peer review exercise performed in 2002; Commission fédérale des HES, 2002). Moreover, the Swiss Innovation Agency has financed a number of studies on the development of research in UASs, including a study on UAS research strategies (Lepori & Attar, 2006), an analysis of the development of research competences (Mayer, Sturn, & Zellweger, 2006) and an evaluation of the UAS research networks. Thus, strong normative pressure has been put on UASs to develop research and to demonstrate its quality.

Research Development and Institutional Strategies

In the last 10 years research in UASs has developed strongly. Total R&D expenditures have increased from 79 million CHF in 2000 to 194 million CHF in 2005 and to 289 million CHF in 2007 (Fig. 13.2). UASs also have been successful in getting funds from the CTI for collaborative projects with private companies, as well as direct contracts from the companies themselves (26 million CHF in 2004 from the CTI and 34 million CHF from private contracts). Moreover, in a recent survey the number of companies mentioning UASs as a partner in technology transfer was very close to those mentioning the two FITs and much higher than the cantonal universities (Arvanitis, Kubli, Sydow, & Wörter, 2005). Research is also now clearly identifiable in the website of all UASs and of most departments, and in most cases, indications are given about research domains and units.

If compared to the starting situation these developments are impressive, but in quantitative terms UASs account for only about 8% of the total R&D expenditures of the Swiss higher education sector. On the average, UASs spend only about 15% of



	2000	2001	2002	2003	2004	2005	2006	2007
R&D	79	101		148	190	194	220	290
Total	679	751		898	1365	1468	1529	1922

Fig. 13.2 Expenditures of UASs (million CHF)
Source: Swiss Federal Statistical Office. Data for 2002 have not been released due to insufficient quality

their budget for R&D against more than 50% in universities. Moreover, the increase of research was largely offset by the strong expansion of educational activities and by the integration of new domains with practically no research activities. According to the UAS planning for 2008–2011, the growth of R&D expenditures will slow down in the next years due to the lack of financial means; at the same time, expenditures devoted to R&D will stay at about 15% of total expenditures, the same level as in 2001, while the long-term objective is to reach 20%.

Active Institutional Policies and Instruments

The national policy has been actively backed up by strategies and actions at the level of the UASs themselves and their departments. Thus, five out of the seven UASs have produced a strategic document concerning research. Earlier documents of the period 2000–2003 have been mostly concerned with the establishment of general principles, the set-up of structures and internal funding mechanisms, while recently at least four of the seven UASs have developed a list of competence or priority domains. At the management level, five out of seven UASs created a research commission in charge of developing strategies and of managing central research funds; the exceptions are the two UASs where overall central structures do not exist. Four out of seven UASs dispose of internal project funds allocated by competitive procedures. The allocation of additional resources to external contracts has also become a widespread practice.

The most important actions have been taken at the level of the departments and subject units, especially in technology, informatics and, to some extent, economy and social work. Namely, departments tried to structure their research activity in a number of identifiable units, like research institutes, centres and research groups, with defined research domains. Our investigation shows that in almost all domains

with a significant research activity, UASs have undergone the transition from largely individual and sporadic research to more structured organisation with identifiable units. A related aspect has been the emergence of research managers as a distinct function, who actively promote research and look for external funding.

Thus, the successful development of research in UASs can be interpreted as a case of convergence between the objectives of the different actors involved: the state, which defined the normative framework and provided the needed financial means; the UAS directions, which endorsed this mission as one of the core tasks of their institutions, and, finally, the researchers themselves, which have seen the development of research not only as an institutional mission, but also as an opportunity to develop their interests and competences.

However, there is still a considerable fragmentation of research units, which limits their ability of getting external funding and of competing with universities. A rough estimate based on the number of teams identified in their websites leads to an average size of about five full-time equivalents in R&D per team. Also, most respondents to our on-line questionnaire affirmed that their team was too small to compete with other players and to ensure a regular flow of funds. In fact, the main issue in this phase was not shortage of funds, but dependence on a small number of contracts, meaning uncertainty and difficulty in developing human resources (since researcher positions are in many cases financed through external contracts).

This situation has been explained in our interviews as the outcome of a soft consolidation process, where UASs tried to group people with similar research interests, but without defining precise priorities. This leads to a rather large number of research priorities if compared with the limited research volume of these institutions.

Most of the respondents agreed that further consolidation and focalisation on priority domains is needed. However, this conflicts with two framework conditions: first, the increasing diversity of the subject domains in UASs and, second, the diversity of the needs of the customers in the regional market, which require a large palette of competences (for example, in technology). Thus, for institutions oriented towards the regional market and SMEs, to focus on research niches might be more difficult than in basic research.

A Strong Concentration in Technology

This helicopter view oversees a major issue, namely the extreme differences between subject domains. Namely, the development of research has taken place essentially in technology (including construction and chemistry), which accounted in 2007 for 55% of the research volume. In these domains the share of research in the overall activities exceeds 20%; while significantly lower than universities (where the share of R&D reaches 50%), research is a major activity at the department level (see Table 13.1). In domains with an R&D share lower than 10% research can be a relevant activity of some subunits, but these are in largely teaching-only departments. Moreover, since this data covers seven UASs and, in some of them, subject

Table 13.1 Research resources (full-time equivalent staff; FTE) and students in UASs by domain (2007)

	Personnel			Students
	FTE	FTE R&D	% R&D	
Architecture and construction	650	184	28	2,992
Technology and informatics	2,124	788	37	9,005
Chemistry and life sciences	466	134	29	1,706
Agriculture and forestry	91	27	30	337
Economics	1,553	239	15	18,457
Design	413	58	14	2,356
Sport	17	5	30	131
Music and theatre	957	61	6	5,014
Linguistics	78	16	21	524
Social work	640	96	15	6,435
Psychology	93	17	18	731
Health	638	50	8	3,968
Teacher training	2,681	229	9	12,069
Undivided	1,635	77	5	22
Total	12,036	1,982	16	63,347

Source: The Swiss Federal Statistical Office.

domains are not concentrated in a single location, the volume of research outside technology is insufficient to maintain sizeable research units everywhere.

Our interviews confirmed this view. Most technology departments in UASs are recognised regional poles of applied R&D and transfer, with a considerable portfolio of projects and of competences. Unsurprisingly, all of them are in medium-size towns outside the cities hosting the two FITs and the large cantonal universities. These departments made the largest progress in the consolidation of research in institutes, in developing management capacities and specialised personnel.

In other domains, like economics, social work and design, we identified a number of research units of smaller size (typically five to ten people) scattered in basically teaching departments. Competences are a major problem, since practical experience (for example, in the private economy) is no substitute for methodological competences requiring a university degree and most of the teachers have no research experience. Finally, in some of the newly integrated domains, like music, theatre, health and, to some extent, teacher training, there is practically no research tradition in Switzerland.

A number of factors make these differences difficult to overcome. First, some domains with low research intensity like economics, social work and teacher training account for large and increasing numbers of students; second, as we shall see, the interpretation and application in practice of the applied research mandate has proved to be more difficult than in technology; finally, in these domains UASs are more directly confronted with the competition with cantonal universities, which in reality perform much of the applied work and consultancy in domains like economics.

Human Resources Policies

From the beginning, the development of human resources appeared a central issue as UASs inherited a large part of their personnel from previous professional schools with practically no research experience. The existing data shows that this problem has been essentially solved by the creation of a category of research assistants performing about two thirds of the whole research effort. These include young research assistants with a UAS bachelor who work for 3–4 years in applied research projects and then leave to private companies, but also a number of senior research assistants with a more permanent status (see Table 13.2). On the contrary, professors and teachers devote only a small part of their time to R&D activities, even if one has to take into account the extreme differences between individuals and domains.

In this respect, clear differences emerge between domains in the profile of the recruited people: while in technology most junior researchers come directly from the UASs themselves and senior researchers from private companies (some years after a university degree and in many cases a PhD), in the soft domains UASs hire for their research mostly university graduates with no prior professional experience.

At the upper level, the introduction of the UAS professor title (which is not equivalent to the university professor) was meant to select the best people in UASs having also research competences. In practice, in many UASs this title has been attributed to most full-time teachers and thus largely lost its specific value. According to the interviews, research competences and activities are concentrated in just a fraction of the UAS professors. However, for the recruitment of new professors, at least in domains with existing research activities, most UASs have introduced selection procedures which better take into account research competences.

This overview raises two major issues for the future. The first one is how to handle the discrepancy between the official definition of UAS professors as teachers-researchers and a reality where most of them are just teachers. Realistically, both the lack of research competences and the sheer number of UAS professors make it impossible to attribute some research time to all of them, in a context where most of research activities are performed by specialised people (an option which

Table 13.2 Personnel structure of UASs (2007)

	Persons	FTE	FTE in R&D activities	% of R&D in total activities
Professors	6,369	4,167	533	13%
Other teachers	19,373	1,945	129	7%
Assistants and researchers	4,970	2,268	1,106	49%
Technical and administrative staff	6,524	3,656	215	6%
Total	37,236	12,036	1,982	16%

Source: Swiss Federal Statistical Office.

certainly is better suited to the customer-orientation of today's UAS research) and where research resources are limited.

The second issue concerns recruitment and career perspectives of UAS researchers. Namely, most of these positions are temporary – except at the upper researcher's level, where there is an opportunity to get the permanent professor status. Moreover, since UASs cannot attribute the PhD title, junior researchers lack the incentive to work in UASs and, as a result, UASs have to pay salaries similar to private companies to attract good graduates (unlike universities which employ large numbers of PhD students as a comparatively cheap workforce). The introduction of master studies will probably address some of these issues for junior staff, who could work part time and in parallel get a master diploma, but for senior research staff this issue is largely unsolved.

Which Role for Research in Swiss UASs?

UASs have successfully established themselves in the recent years as actors in the Swiss research and higher education system and the fact that they perform research and are part of the same system as universities (albeit with a different mandate and rules) is not any more in discussion. However, the central issues for the next years pertain to the precise role of research in these institutions and, more precisely, the nature and applicability of the applied research mandate, the choice between concentration and diffusion of research and, finally, the relationship between research and education.

Success and Limitations of the Applied Research Mandate

As already discussed, the original research mandate the UASs aimed at responding to the technological needs of SMEs. This choice has proved to be largely successful in technology: UASs succeeded in building a specific profile distinguished from universities and found a market niche in cooperation with SMEs (both through contract funding and thanks to the CTI subsidies). At the same time, the level of development of research, but also the features of technical training, made the integration between research and education easier, especially in the practical work for the diploma and in the practice of engaging for some years bachelor recipients as research staff, before they leave to private industry. The introduction of the professional master studies from 2008 is likely to reinforce this model. Thus, the applied research mandate was crucial to the establishment of UASs as research actors and to justify their funding.

Outside technology the situation is more complex and research managers are not very comfortable with the applied research mandate or, even, deny that it is a useful guidance. This is the result of different factors: the lack of a workable distinction between basic and applied research and of accepted concepts of what is applied research, for example, in social sciences or in economics; a stronger competition with cantonal universities, which are more present in the regions and in some fields perform essentially applied research; the weakness of the funding instruments

for applied and practice-oriented research, and finally, the lack of clearly identifiable customers like companies (the amount of public administration mandates being much smaller). A final factor is that, unlike in technology, in most of these domains there is no distinct competence profile for a UAS researcher, since the required methodological competences are largely the same as in a university and practical experience plays a more limited role.

In this respect, Swiss UASs are confronted with a difficult choice: broadening the research mandate would help to find suitable approaches outside technology, but at the price of weakening their identity and the risk of losing political support. Taking the opposite way entails the risk of reinforcing the divide between technological departments, active both in professional education and in applied research and teaching-only departments in other domains.

Specialisation or Diffusion of Research Activities?

A second issue concerns the distribution of research activities between domains and the UAS personnel. Even if it is not officially stated, it is more or less assumed that research should be present in all UAS subject domains equally because research is considered to be a constitutive element of these institutions (distinguishing them from other tertiary schools). However, to some extent this idea is in contradiction with the model of applied research oriented towards specific customers, which implies that research should be developed where there is an external demand for it. This debate reflects itself also in the funding model of research: in a customer-oriented model general research funds should be used primarily to develop the domains where there is an external demand and, thus, linked to the funds received from external contracts, while if research should be present almost everywhere, it would be better to distribute more evenly these resources.

The relevance of this issue is given by the merger in UASs of domains which have practically no research competences and activities, like arts, teacher training and, to a less extent, social work, and by the concentration of existing research activities in a few domains only. Given the available resources, there is a risk that a catching-up strategy in all domains would fail to develop research to a sufficient level and would weaken the domains where UASs have successfully positioned themselves at the national level, namely technology. However, a concentration strategy, supporting only a limited number of sectors (either already established or with favourable perspectives), would require a profound revision of the concept of the UAS and their research model, accepting that some departments are teaching-only (with all the relevant implications for the status of education, but also of teachers).

Research and Education: Conflicting Priorities

The third issue concerns conflicting priorities between education and research for public resources. As explained, the professional education and the applied research mandate of UASs came from two quite different rationales and thus it is not

surprising that their funding and budgeting systems provide for a clear separation between the two activities, which should also be financed differently.

What makes this discussion relevant is the increase in student numbers and the high costs per student in social sciences. Namely, even if data should be treated with care since accounting systems are different, in technical sciences educational costs per student in UASs are similar to universities, while in social and human sciences they are significantly higher.

This is not surprising since UASs have maintained the model of small classes in most of their activity domains, with small ratios of students to teachers, while universities have a strongly differentiated model, with high students to teacher ratios in social sciences and much smaller ratios in natural sciences, technology and medicine; costs per student differ accordingly (Filippini & Lepori, 2007). Since in the last two decades the increase in student numbers was concentrated in social sciences, educational costs did not rise to the same extent as enrolments and this reduced conflicts for resources between education and research.

Since UASs profile themselves as providers of quality professional education, it is not easy for UASs to reduce the costs per student to compensate the increasing numbers. Moreover, while in technology the level of research activities makes integration with education feasible (for example, in diploma work) and thus benefits of the joint mandate are apparent, in other domains the development of research is a cost subtracted from education (at least in the short run).

This issue was overseen at the beginning because of the assumption that UAS research, being market-oriented, could be funded by external sources. However, in 2004 R&D expenditures were covered only by 40% with external sources and thus even in technology the development of research has been possible only thanks to a substantial investment from the general budget and this will be even more the case in soft sciences.

In my view UASs are caught in a dilemma: developing research outside technology will be possible only by subtracting resources available to education, in a context where educational costs are already under pressure. Not only this is not acceptable politically, but it would also impair the main marketing argument in education, namely specific professional education in small classes. However, today's level of research outside technology is too low to justify its existence in a long-term perspective and would lead to pressures to limit the research mandate for technology (as already advocated by Economiesuisse).

Research and Future of the Binary Divide

After a long preparation phase, in spring 2009, the Swiss government has published the proposal for a new higher education act, which shall replace from the year 2012 the university act and the UAS act, providing a common framework for the whole Swiss higher education sector (Conseil fédéral, 2007; Département fédéral de l'intérieur, 2004). The new act will create a joint political body between

the Confederation and the Cantons to steer the whole higher education system and the administrations responsible for universities and UASs will probably be merged into a single ministry. Even if the two types of institutions will keep largely distinct missions, organisation and funding models, and even if, to some extent, the binary divide will be kept also at the institutional level – for example, the future rectors' conference will have two chambers for universities and UASs respectively – it is clear that this reform makes a decisive step towards considering universities and UASs as a part a unique system and thus destabilising the binary divide by removing some institutional barriers (even if this is not wished by all actors).

The introduction of the Bologna model and the start of UAS (professional) master's from 2008/2009 are also very likely to promote some convergence between the two domains (De Weert, 2006). First, the bachelor–master organisation of studies includes a provision for mutual access to universities and UAS master's: thus, UAS bachelor recipients will have access to university master's in the same fields by recuperating a number of credits; even if the maximum is 1 year, it is likely that in some domains the number of credits will be lower and they can be recuperated during the same year. Second, at least in some domains, UASs are pushing for a standard curriculum of 5 years and this will weaken the basic distinction between the two sectors based on the today's different length of the curricula.

The implications for research in the non-university sector are largely open and will depend on the strategic choices of the different actors, especially of the UASs themselves. From one side, at the system level, the rationale for a distinct research profile of these institutions will be probably weakened. Moreover, most specific research support measures for UASs in technology have been terminated, while the SNF plans to integrate its programme to support practice-oriented research in social sciences (the DO-RE programme) within its normal funding from 2012; thus, UASs will have to compete with universities for research funding according to the same rules.

These evolutions are likely to support voices inside the UASs themselves pushing for a more generic research mandate and convergence with universities, including the right of delivering a doctorate, especially in the sectors which are less comfortable with the today's applied research mandate.

To the other side, the experience of technology shows that a specific research mandate concentrated in a niche not well-covered by other research actors was crucial for allowing the successful development of research, precisely because competition with universities from institutions with lower research intensity and institutional priorities proves to be difficult. In reality, convergence with university could even reinforce the today's differences between domains in UASs, since the new sectors will be faced to much more difficult conditions for the development of research than in technology.

Thus, the key issue for UAS research in the next years will be to find a balance between the convergence tendencies and the need of developing a specific profile inside Swiss higher education in order to compete with stronger institutions; while in the past this differentiation was successfully promoted by regulatory intervention

of the state, in the future it will be more and more left to the strategic decision of the actors themselves. Stronger differentiation between the UASs themselves is likely to occur in this respect.

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