Short version of the final report (*)

Research at Universities of Applied Sciences, 2012: Descriptions, Analysis, Conclusions

for the Federal Commission for Universities of Applied Sciences (EFHK) and the Federal Office for Professional Education and Technology (OPET)

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(*) The complete version of this study is available online (in german and french) at www.bbt.admin.ch

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1. Introduction

All seven public universities of applied sciences (UAS) in Switzerland are legally required to offer degree programmes and continuing education and training (CET) courses, provide services and conduct applied applied research and development (R&D).[1] It is important to note, however, that there are major differences from one UAS branch of study to another as far as tradition, type and importance of research activities are concerned.

Background: raising the profile of UAS

With the UAS Act of 1995 (SR 414.71), many PET colleges (*Höhere Fachschulen, ISCED 5B*) were grouped together to form a new type of higher education institution, the university of applied sciences (*Fachhochschule*, ISCED 5A). At the time, some of these PET colleges already had a long tradition of conducting R&D activities. Others had to develop R&D activities from scratch, in some cases as new institutions. In 2005, the Commission for Technology and Innovation (CTI) commissioned Lepori / Attar (2006)[2] to conduct a study on R&D strategies and approaches adopted by the various UAS. Six years later, the initial phase of expansion of R&D activities at UAS is now complete. The present study was commissioned by the Federal Office for Professional Education and Technology (OPET) and the Federal Commission for Universities of Applied Sciences (EFHK) for the purpose of taking stock of current R&D activities at UAS.

Research questions

The present study was intended to answer the following questions: What are the main features of R&D activities at UAS? What problems have been encountered? What visions are being pursued? Since R&D activities at UAS fall into various categories, we wanted to determine similarities and differences between UAS as well as between branches of study. Specifically, we sought answers to the following questions:

- What is the orientation of R&D activities in the various UAS and branches of study?
- How are R&D activities understood and defined? What quality criteria are used?
- How are R&D activities managed, funded and what structures are used to conduct these activities?
- Who conducts R&D activities?
- Who are the partners?
- What are the main areas of tension and how do the various protagonists resolve them?

Study design: UAS and branch of study as two dimensions considered in our analysis

R&D activities at UAS have been influenced by various factors (academic culture, traditions, linguistic region in which UAS is based, organisational structure, governance, profiling strategies, personnel, etc.). These influencing factors were combined to systematically analyse the dimensions “UAS” and “branch of study”. In addition to documents and data, the main source of information came from interviews with UAS representatives at various levels of responsibility.[3]

R&D split between two different orientations: practical motive vs. scientific motive

In our study, we found that there were two opposing orientations in R&D: the practical motive (mainly understood as a desire to use research findings to develop products and services to be sold on economic markets) and the *scientific motive* (understood as the desire to contribute to the body of scientific knowledge). These two different orientations also lead to opposing quality criteria “market success” vs. “scientific reputation”.

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[1] Art. 3, para. 3 of UAS Act (SR 414.71) – In this report, the terms “research” and “R&D” are generally used synonymously.

[2] Lepori Benedetto, Attar Liliana (2006), Research Strategies and Framework Conditions for Research in Swiss Universities of Applied Sciences. A Study mandated by CTI. Lugano. Online: http://www.bbt.admin.ch/dokumentation/00335/00402/index.html?lang=de

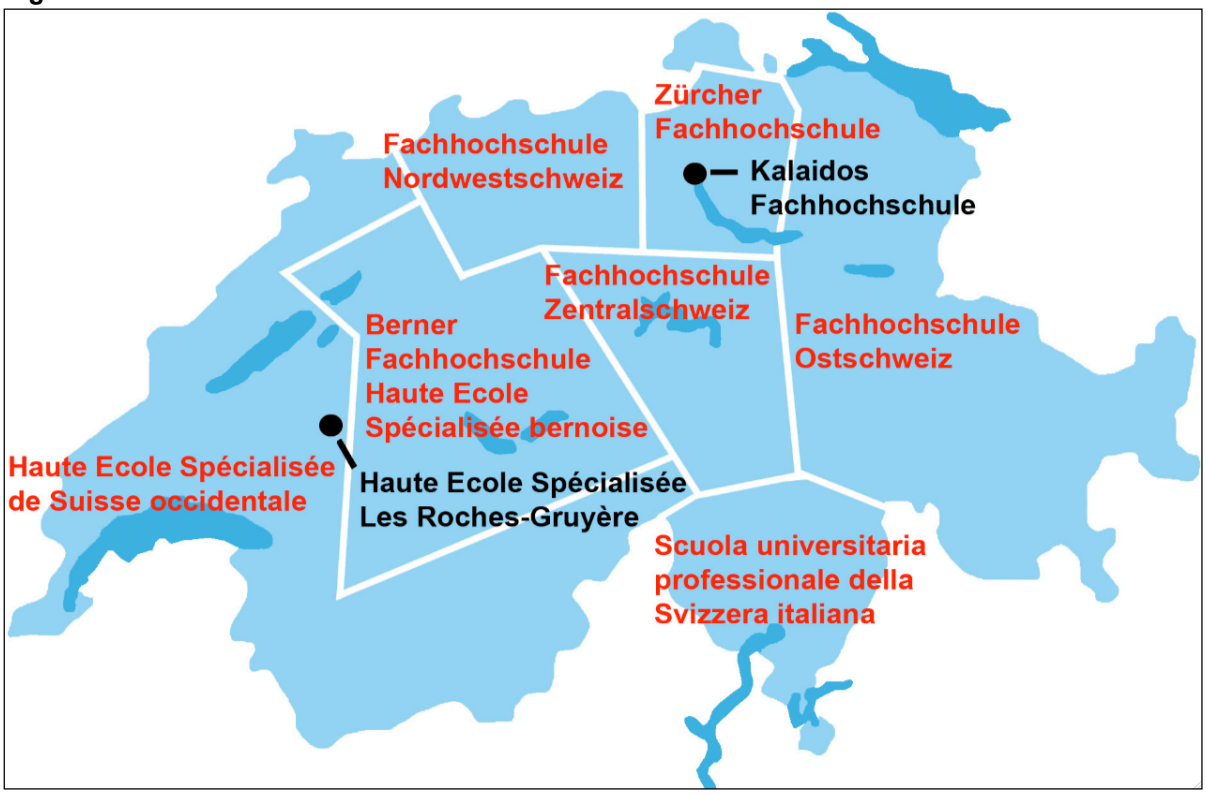
[3] A list of the experts consulted can be found in the appendix of the complete version of this report.

2. Universities of Applied Sciences UAS

2.1. Structure, size and orientation

The seven public UAS in Switzerland are the result of the merger of existing PET colleges. Some of these PET colleges were grouped together, others were transformed into new structures. A typical feature is the linguistic distribution of the seven UAS. Four of the seven public-law UAS are sponsored by several cantons.

Figure 1: The UAS in Switzerland



Source: OPET

UAS colleges with different levels of autonomy

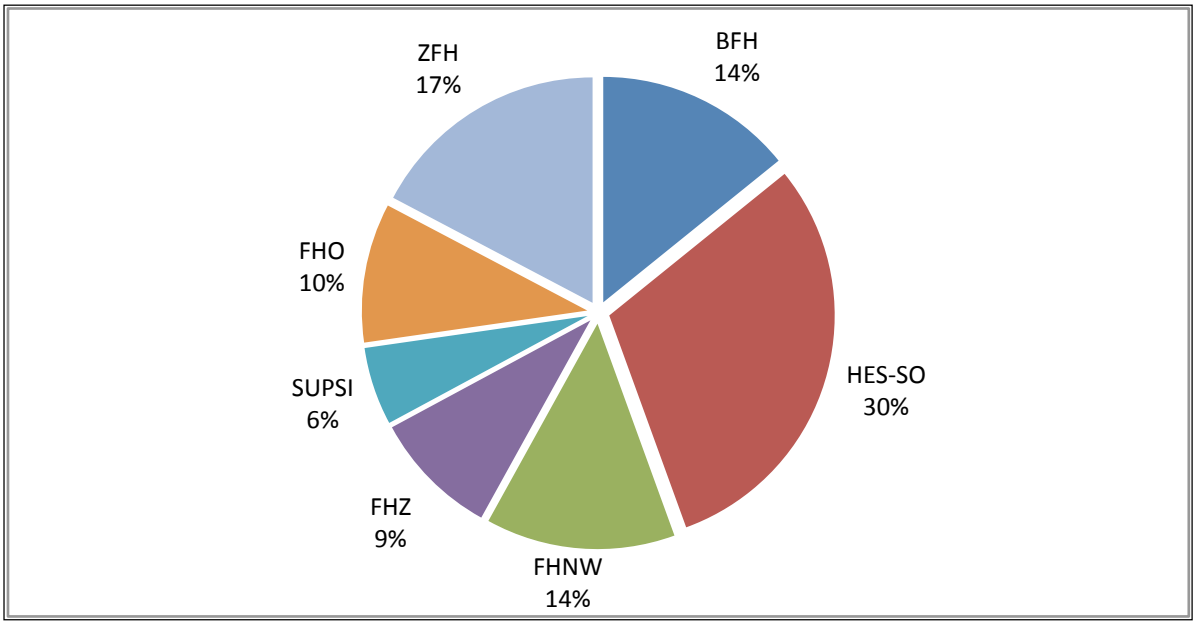
The general conditions governing R&D activities at UAS are highly dependent on the level of autonomy retained by the original PET colleges after they became UAS colleges. Among other things, the level of autonomy determines whether directors of UAS colleges are able to coordinate R&D activities. UAS are also structured differently: some take the form of "holding institutions" (e.g. FHO and HES-SO, which give greater autonomy to their UAS colleges); others are centrally coordinated structures (e.g. BFH, FHNW, FHZ/HSLU and SUPSI). Finally, the ZFH is comprised of three public UAS colleges: ZHAW, ZHdK and PHZH, all of which enjoy high levels of autonomy while their constituent divisions do not).[4] Centrally coordinated UAS find it easier to establish rules and coordinate R&D activities (interdisciplinary or otherwise) than UAS based on a decentralised "holding" structure.

[4] BFH: Berner Fachhochschule; HES-SO: Haute école spécialisée de la Suisse occidentale; FHNW: Fachhochschule Nordwestschweiz; FHZ: Fachhochschule Zentralschweiz; SUPSI: Scuola Universitaria Professionale della Svizzera Italiana; FHO: Fachhochschule Ostschweiz. The Zürcher Fachhochschule ZFH is comprised of the ZHAW (Zürcher Hochschule für Angewandte Wissenschaften), the ZHdK (Zürcher Hochschule der Künste) and the PHZH (Pädagogische Hochschule Zürich).

Different research volumes

Research volumes at the seven public UAS (total funding in absolute figures in 2009: CHF 329.9 million) vary considerably: The research volume of the largest UAS (HES-SO) is five times greater than the research volume of the smallest UAS (SUPSI).[5]

Figure 2: Volume of R&D funding in % by UAS in 2009



Source: OPET

Back in 2004, the "Master Plan 2004-2007" set the policy objective, which has now been almost fully reached, of bringing the research portion of total costs and income of UAS to 20%[6] for all seven of the public UAS. Nevertheless, it is important to note that UAS vary not only in size but also in terms of the branches of study that they offer.

UAS offer different branches of study

All seven public UAS offer the following four branches of study: "Architecture/ Construction/ Planning"; "Engineering/IT"; "Economics/Services"; and "Social Care". Only some of the UAS offer the following branches of study: "Chemistry/Life Sciences"; "Health"; "Design"; "Music, Theatre and Other Arts". Only ZFH offers "Applied Linguistics"; only ZFH and FHNW offer "Applied Psychology".[7]

R&D orientation, five salient features

The orientation of R&D activities at UAS is characterised by five salient features.

Frame of reference

While some R&D activities cater mainly to economic markets ("external clients"), other R&D activities seek to address social problems and issues and gain academic recognition. In addition, the ability to use findings for teaching ("internal client approach") is also important.

Geographical focus

As provided for in the UAS Act, each UAS retains a regional focus. Nevertheless, UAS are increasingly orienting R&D activities along national and international lines.

Definition of research and cooperation fields

Here the main focus is on individual disciplines and specialisation.

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5 The costs and funding are not congruent. Detailed figures can be found in the final report.

6 See FDEA/OPET and EDK - Draft Master Plan for UAS, by the Confederation and the cantons; Master Plan for UAS 2004 –2007, Final Report. Bern, 26 April 2004. The other three activities carried out by UAS are degree programmes, the provision of services and continuing education and training.

7 With the exception of some tables, both "Agriculture and Forestry" and "Sport" are excluded in this study.

Type of research

UAS do not share the same understanding of what their mandate to conduct R&D activities includes. Depending on the branch of study, the distinction between R&D and services becomes blurred. In addition, the new category *use-inspired basic research* used by the Swiss National Science Foundation (SNSF), which is also expressly open to UAS, underscores the fact that the distinctions between applied research (i.e. R&D) and basic research are not clear cut.

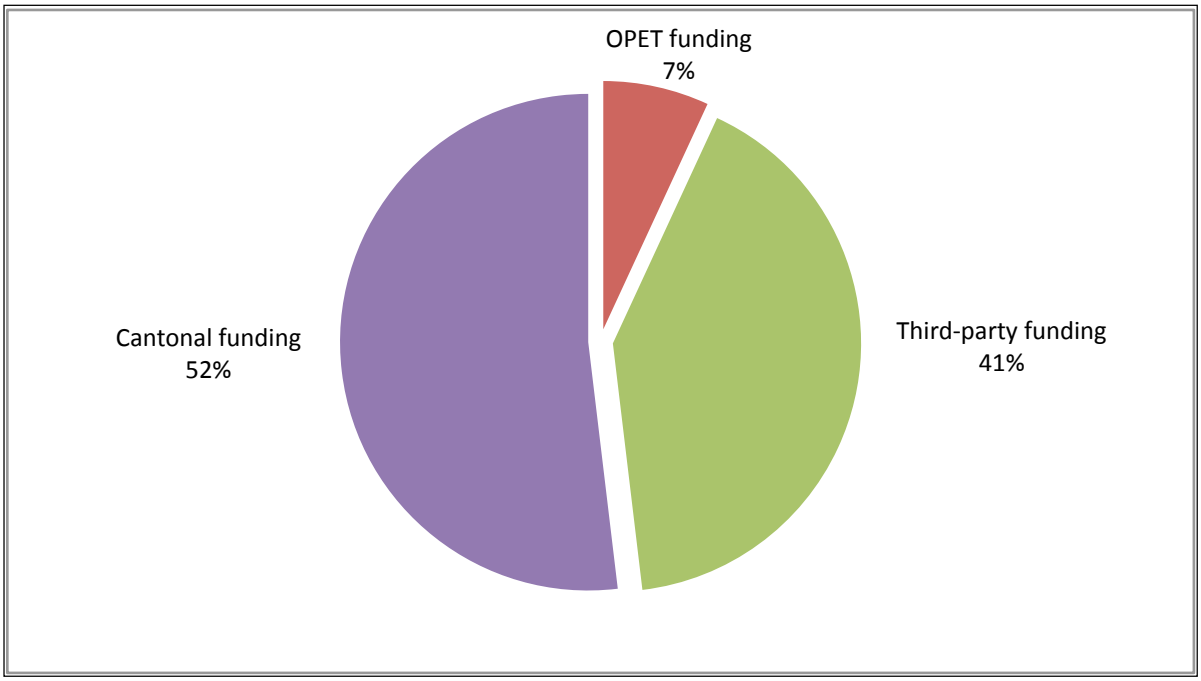
Quality criteria

Depending on the structure and priorities of the UAS – or rather, those of the individual branches of study – different criteria will be used to assess the quality of research. All things considered, there is no generally accepted series of quality indicators applying to all UAS and all branches of study. With the *practical motive orientation*, the sum of acquired third-party funding and customer feedback (level of satisfaction) are the main quality criteria. With the *scientific motive orientation*, publications and citations are important (to build reputation) along with securing grant funding and peer reviews. The branch of study "Music, Theatre and Other Arts" constitutes a departure from both the profit and scientific motive orientation in that quality is also determined on the basis of reputation built through awards, distinctions, invitations, praise, scholarships or work-years.

2.2. R&D funding at UAS

R&D funding for all seven public UAS may be broken down as follows (2009):

Figure 3: R&D funding, 2009



Source OPET

OPET funding:

According to the UAS Ordinance (SR 414.711, status on 1 May 2009), 60% of the Confederation's contribution is used to cover the wage costs of UAS personnel whose workweek percentage is at least 50% and where at least 20% FTE of working time is devoted to teaching and R&D. The remaining 40% is awarded on a cumulative basis, depending on the amount of third-party funding that the UAS is able to draw.

Third-party funding

Third-party funding mainly comes from the private sector (private companies), the public sector (government agencies) and grant funding institutions (particularly CTI and SNSF). For UAS, SNSF's Do Research (DORE) programme has been a major source of R&D funding since 2004. Back in 1999, the DORE programme was created explicitly for the purpose of promoting "new branches of study in health, social care and art". The DORE programme will reach completion in 2012.

CTI and SNSF award grant funding on the basis of entirely different innovation criteria: CTI bases itself on whether the R&D project will produce a product or service that is "economically competitive"; SNSF focuses on scientific innovation. CTI does not view itself as a grant funding institution but rather as an institution that promotes the Swiss economy. A clear distinction should therefore be drawn between these two institutions.

Cantonal funding

The remaining funding comes from the cantons that have authority over the UAS. This funding is provided through different procedures and instruments and the amount of funding varies. Funding levels range from around one-fourth to nearly two-thirds, with the average being 52%. There are two models that apply in this case:

(a) *Cumulative model:* cantonal funding is proportional to the amount of third-party funding obtained

(b) *Selective model:* cantonal funding is awarded on the basis of thematic priorities set by the sponsoring canton or UAS management. Internal calls for research proposals are issued and eligible R&D projects are awarded start-up funding.

In the first model, the UAS refrains from setting priorities with regard to content, leaving it up to the market and grant funding institutions to determine the orientation of R&D. In the second model, UAS attempt to set priorities in order to raise their own profiles.

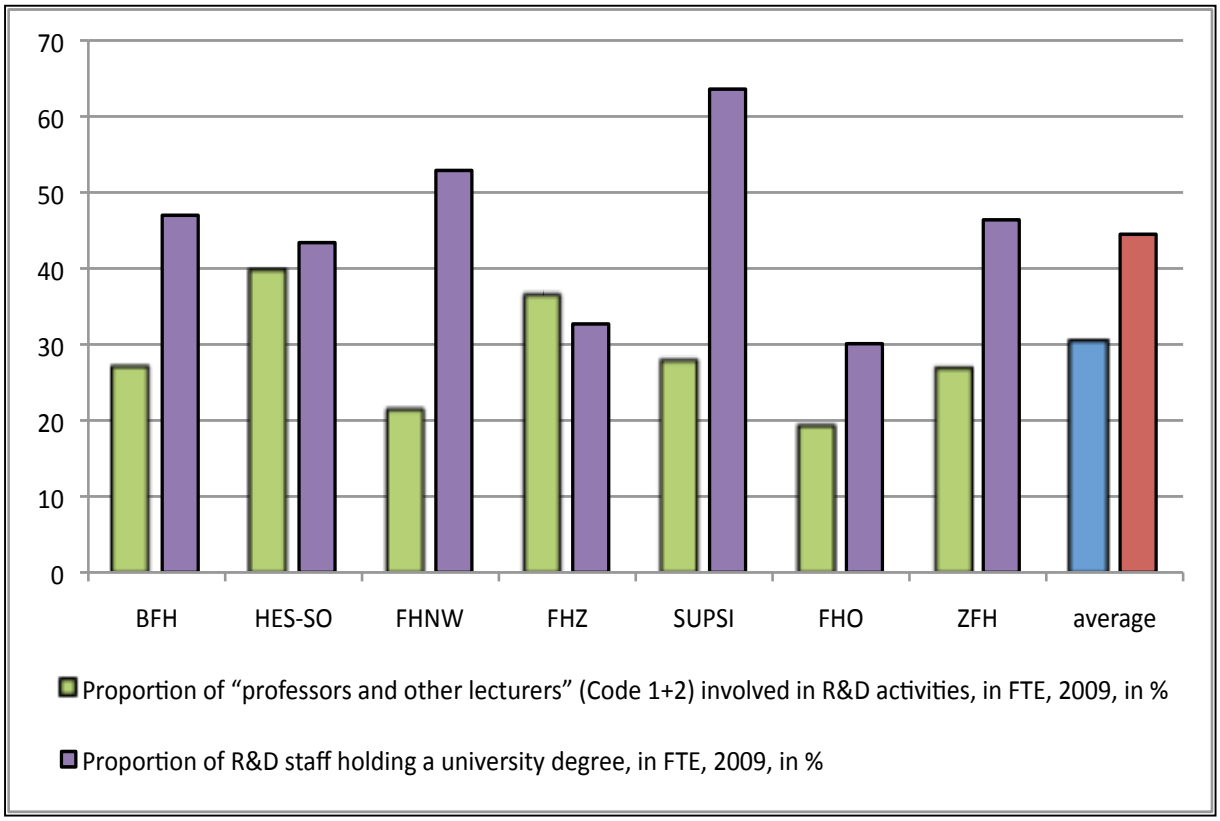
On the whole, basic funding of R&D activities at UAS is generally lower than that of traditional universities. This is partly due to the greater pressure to obtain third-party funding (which was the intention of the UAS Act to ensure that UAS would retain its "applied sciences" orientation) and partly due to the cost accounting model where research projects incur direct and indirect costs). SNSF-sponsored research projects at UAS, for example, have cost overruns for most part because SNSF funding is based on different calculations.

2.3. R&D staff at UAS

Recruitment of R&D staff is a major concern at UAS. It has been observed that some UAS tend to recruit R&D staff from traditional universities while others tend to hire experienced professionals. The proportion of R&D staff who hold a higher education qualification (university degree) varies from one-third to two-thirds (with major differences between branches of study). The issue of recruitment should not be isolated from the highly controversial topic of R&D careers. Specifically, the question is whether UAS should offer a "third cycle" (PhDs). Along this line, several cooperation projects have been launched with traditional universities.

The following chart shows that the proportion of "professors and other lecturers" involved in R&D activities (measured in full-time equivalents) varies from one UAS to another, sometimes being over twice as high.

Figure 4: R&D staff by UAS, 2009



Source: Federal Statistical Office, Statistics on staff at higher education institutions

2.4. Two R&D policy orientations at UAS

The following typology covers the previously mentioned dimensions along with a few new ones. We have observed two R&D policy orientations that co-exist in the UAS landscape. Of course there are hybrid forms between these two extremes and decision-making may take place at entirely different levels: UAS management (top-level), affiliated UAS college (mid-level), UAS college department/ institute (bottom-level).

Type A orientation
Scientific motive (orientation towards academic system) or desire to address social problems
Objective: set priorities to raise UAS profile

With this orientation – which is diametrically opposed to the one adopted by UAS based on a decentralised "holding" structure – the UAS has a strong centralised control of policies and sets strategic fields and priorities that often cover several branches of study often require a cross-disciplinary approach. For UAS that have many different branches of study, this approach is seen as opening up opportunities. This orientation involves corresponding performance agreements and variable budgets. For funding, cumulative instruments are used alongside other forms of funding that are tied to specific priorities, incentives and compensation. Quality criteria include: no. of publications, reputation within academic system or among peers and recognition within the profession.

With this policy orientation, the following aspects are important: - Content-driven research - Orientation considers not only individual economic aspects but also social issues, recognition, reputation of the UAS within the academic community - Development of cooperative capacities within the UAS - Encouraging interdisciplinary research - Building competencies in research fields, which may include applied research (i.e. R&D) - Reaching a specific critical mass
Therefore, the policy is intended to achieve the following: - Work with traditional universities, including those outside of Switzerland - Raising the profile of the UAS within the academic system
In terms of management, the following developments are likely: - Relatively low influence of traditional UAS stakeholders from the private sector and the region - High degree of influence/autonomy of top level (i.e. UAS management or UAS Council) - Possibly also a relatively high degree of academic autonomy - Creation of an intermediary research body (e.g. to coordinate research activities)

The type A orientation is typically found in UAS and affiliated UAS colleges that offer health, social care and art.[8]

[8] For a description of R&D activities at UAS, see Chapter 3 below.

Type B orientation
Practical motive (orientation towards economic markets)
Objective: increase the proportion of third-party funding

The practical motive is a typical feature of UAS that are based on a decentralised "holding institution" structure with multiple UAS colleges that enjoy high levels of financial autonomy, represent regional political interests and often compete with one another. Funding policies are typically geared towards increasing third-party funding by accumulating contributions; market success is the main indicator used to determine quality.

With this policy orientation, the following aspects are important: - Creating a strong position on the economic market - Focusing on regional/national economic markets - Achieving greater flexibility, adaptability and adopting a service-oriented mindset - Reaching a certain size (critical mass)
Therefore, the policy is intended to achieve the following: - Promote cooperation with internal and external partners - Raise the UAS profile on economic markets
In terms of management, the following developments are likely: - Relatively large influence of traditional UAS stakeholders from the private sector and the region (incl. KTT activities, CTI consortiums) - Low degree of influence/autonomy of top level (i.e. UAS management or UAS Council) - Relatively high degree of influence/autonomy of mid level (UAS colleges) and bottom level (UAS departments/institutes and research groups) - Relatively low degree of academic autonomy

The type B orientation is typical of UAS (or UAS colleges or departments) that are specialised in branches of study relating to engineering and business.[9]

The type B orientation can be seen as adhering to the general framework established by policymakers for R&D activities at UAS. The type A orientation can be seen as an attempt to pursue alternative approaches to R&D within the established general framework (see chapter 5 for more details).

[9] For a description of R&D activities at UAS, see chapter 3 below.

Common features of both orientations

Despite the differences between type A and type B, the two orientations share common features:

Reduction of (direct and indirect) federal/cantonal funding and therefore: cost pressure

Both orientations seek to limit or reduce the amount of funding provided by the Confederation and the cantons: the type B orientation seeks to do so by directly increasing the proportion of third-party funding; the type A orientation seeks to do so by encouraging priority themes – since this should improve the ability of the UAS to secure medium- to long-term third-party funding.

Delegation of quality control to external bodies and therefore: dependencies

- In the type A orientation, it is mainly scientific criteria used by SNSF to award grant funding, external audits and market success; in the type B orientation, economic factors are the main criteria used by CTI when awarding grant funding .

  This means that all changes to policies and orientations of grant funding institutions (mainly CTI, SNSF, European framework programmes) will have a direct impact on the criteria and hence the orientation of R&D activities at UAS, regardless of the strategic decisions reached by UAS sponsors and OPET. The more independent grant funding becomes, the less constant the grant funding policy, the more research activities will depend on decisions taken outside of strategic management channels. In other words: the externalisation of quality criteria creates tensions between state bodies. However, these state bodies have different roles to play and therefore place different demands on R&D activities at UAS. All things considered, external bodies exert a disproportionally high degree of influence.

The common features of type A and type B, cost pressures and dependencies are not only major concerns for R&D activities at UAS. These concerns are felt here to an even greater extent than at traditional universities, which are based on a different framework, receive higher levels of basic funding and therefore enjoy greater autonomy.

3. Branches of study

3.1. Institutional origin, orientation and position within higher education sector

The various branches of study are of different sizes, have different research traditions and hold different positions within the higher education system. This has a direct impact on current R&D activities.

"Old" and "new" branches of study with different research traditions and orientation

Five of the ten branches of study considered fall into the "old" category since they were already under the authority of the Federal Office for Professional Education and Technology (OPET) before UAS were established. As part of the Federal Department of Economic Affairs (FDEA), OPET gives a more economic meaning to the term "innovation". The "old" branches of study are referred to as "Engineering, Economics and Design" (a collective term that includes architecture, construction and planning, engineering, IT, chemistry, life sciences, economics, services and design).

The "new" branches of study used to be under cantonal authority or were developed entirely from scratch (health). Here, economic considerations are not the main drivers of innovation activity. The "new" branches of study are referred to as "Health, Social Care and Art" (a collective term that includes health; social care; music, theatre, art; applied psychology and applied linguistics).

Depending on their history, both "old" and "new" branches of study will have different research traditions.

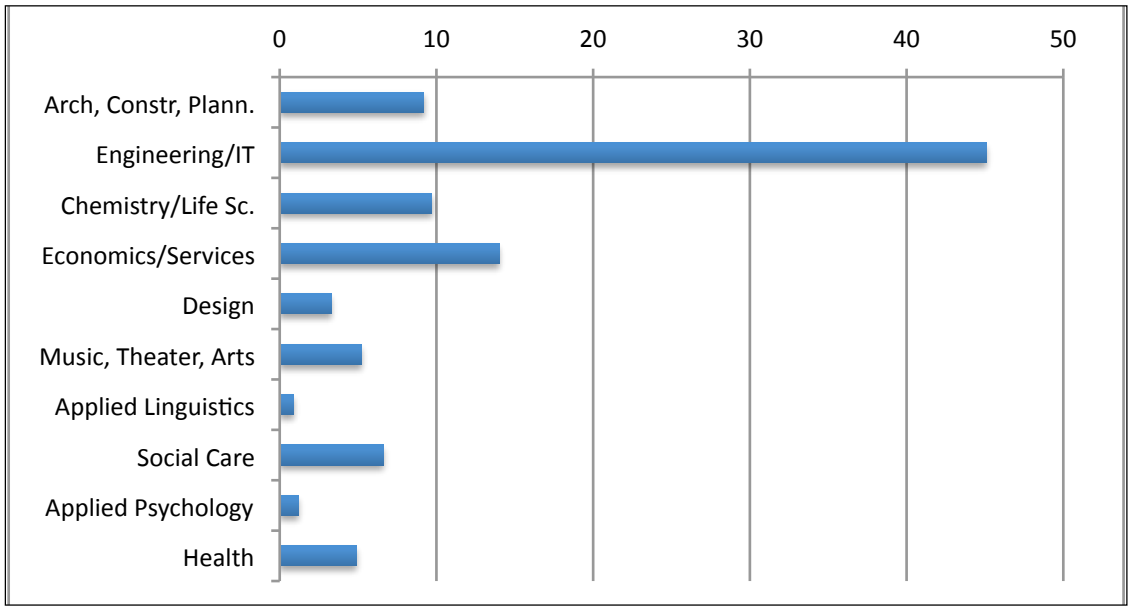
Position of branches of study within higher education sector

A second important aspect in determining the direction of R&D is the position that the branch of study holds within the Swiss higher education sector. Branches of study are either *complementary to one other with competitive features* (e.g. "Engineering/IT"), *compete heavily with one another* (e.g. "Economics/Services") or *enjoy a de facto monopolistic situation* (e.g. "Music, Theatre and Other Arts"). For branches of study that are complementary to one another, expectations and cooperation structures are rather stable. For branches of study that enjoy a *de facto* monopolistic situation, the aim is not only to apply specialised knowledge but also to establish and develop this knowledge in order to set themselves apart from other disciplines and consolidate professions.

3.2. Research volume and third-party funding

Nearly half (45%)[10] of R&D expenditure at UAS is devoted to the branch of study "Engineering/IT". As Figure 5 shows, the research volume for this branch of study is 3.2 times greater than that of the second largest branch of study "Economics/Services" (14%).

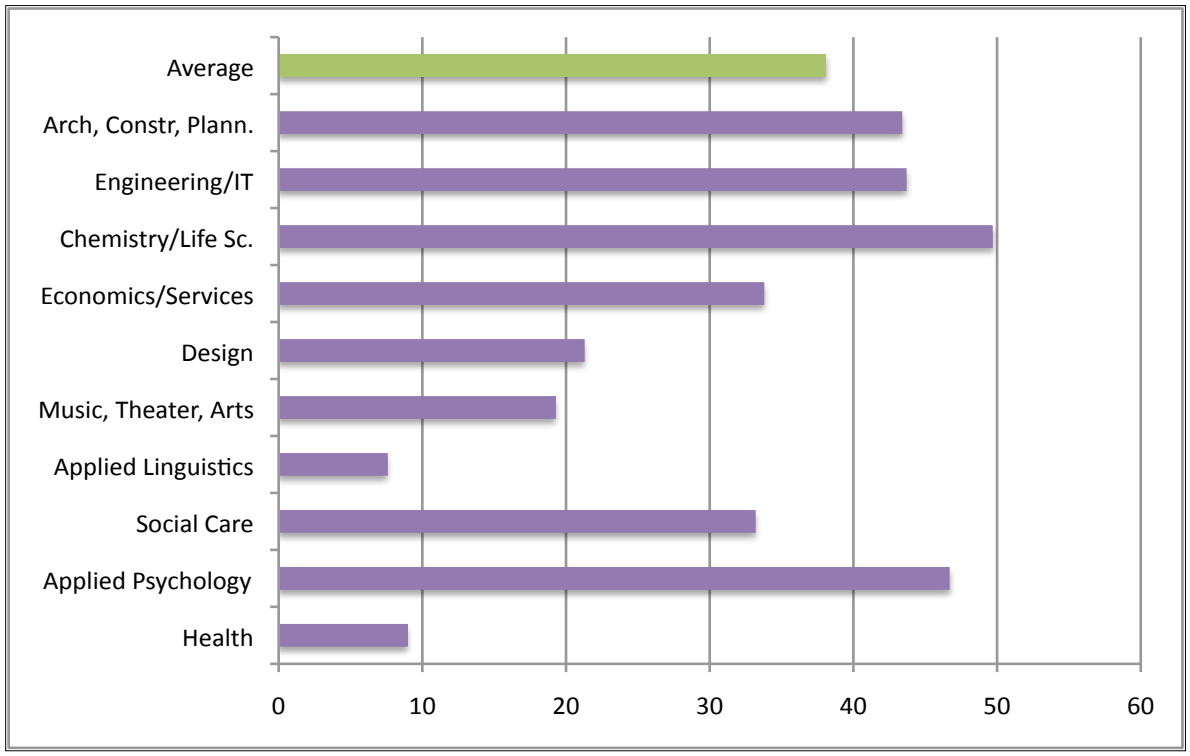
Figure 5: R&D expenditure by branch of study in %, 2009



Source: OPET

There are also major differences from one branch of study to another in terms of the proportion of third-party funding. The range varies from 8% (applied linguistics) to 50% (Chemistry, Life Sciences).

Figure 6: Proportion of third-party funding in R&D expenditure in %, 2009



Source: OPET

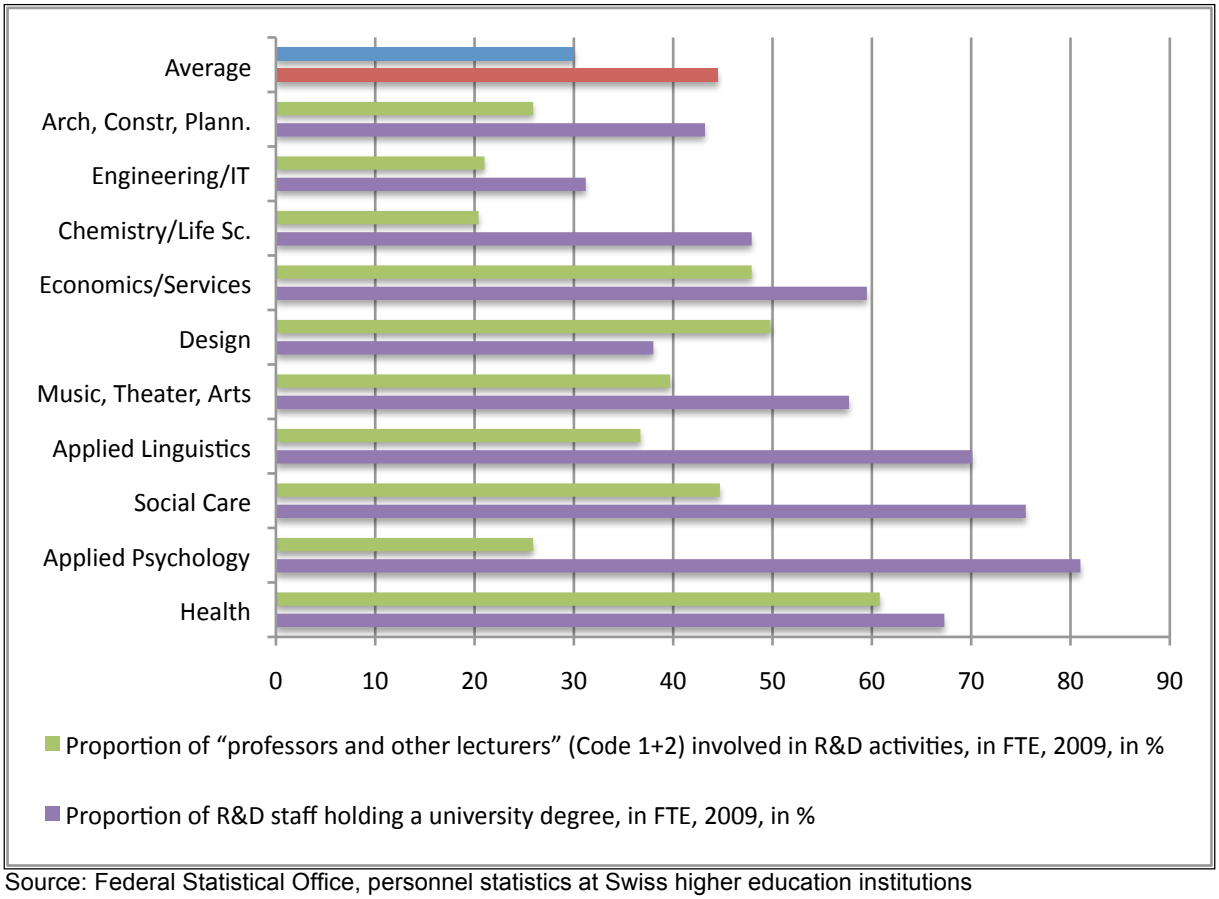
[10] The costs and funding are not congruent. The reasons for this cannot be discussed here. When examining the components of funding, e.g. third-party funding, costs serve as a more precise measurement than the levels of funding. Detailed figures can be found in the final report.

3.3. R&D staff

Large proportion of teaching staff

"Professors and other lecturers" account for about one-third (total of 30% in full-time equivalents) of UAS R&D staff.[11] The proportions vary sharply from one branch of study to another (Figure 7, upper, green bars): ranging from 20% in "Chemistry, Life Sciences" to 61% in "Health". Here we find that more technically-oriented branches of study and "Applied psychology" have a considerably lower than average proportion. All other branches of study have an above-average proportion.

Figure 7: R&D staff by ranch of study, 2009



Source: Federal Statistical Office, personnel statistics at Swiss higher education institutions

Large proportion of holders of higher-education qualifications

Nearly half of all R&D staff (45%, in full-time equivalents) holds a higher-education qualification, 18% (so 40% of all holders of higher education qualifications) have a PhD or postdoctoral qualification (Figure 7, lower, purple bars). The largest proportion of holders of higher education qualifications can be found in the following branches of study: "Applied Psychology", "Social Care", "Applied linguistics" and "Health" – all "new" branches of study – followed by "Economics/Services" as well as "Music, Theatre and Other Arts". The lowest proportion of holders of higher education qualifications was in "Engineering/IT", followed by the other two technically oriented branches "Architecture, Construction and Planning" and "Chemistry/Life Sciences".

3.4. Conclusion

There is considerable variety among the branches of study in terms of research tradition, orientation of R&D activities, R&D funding and personnel. This variety is partly due to the different positions that branches of study hold within the Swiss higher education sector and partly due to the different aims of research, which are also highly correlated with this positioning.

[11] A direct comparison with traditional universities is difficult since the tasks of professors and lecturers at traditional universities differ from those performed by professors and lecturers at UAS.

4. In-depth analysis of the four branches of study

To conduct more in-depth analysis, two UAS and four branches of study were selected for closer examination.[12] Data for the analysis were gathered from interviews with experts and examination of documentation. The results are summarised below:

4.1. R&D relating to Engineering/IT

Engineering/IT is the dominant branch of study for R&D at UAS in Switzerland in terms of research volume (45% of total research volume), research intensity and research tradition. This branch of study is economically successful, generating a high share of third-party funding as well as a high share of revenues from economic markets. R&D in this branch of study serves as a model for all R&D. Relations with Switzerland's two federal institutes of technology (ETH in Zurich and EPF in Lausanne) have been described as pragmatic, well-rehearsed and "complementary" – although these relations also include highly competitive aspects. The purpose of R&D is to produce marketable goods and services or procedures for economic markets. As a result, CTI provides massive support for R&D in this branch of study.

The most important consideration is linking this orientation to the organisational form or management approach used for R&D activities: according to the opinions expressed, demand for R&D in a highly competitive environment can only be satisfied by an offer made of institutions who themselves successfully compete with one another. As a result, R&D cannot be managed at the top level of UAS since market competence lies at the bottom level where the research institutes and researchers operate. These actors exchange knowledge with companies. In addition, the boundaries between UAS and companies are very permeable as far as the understanding of research, the flow of knowledge and careers are concerned. For this reason, the experts consulted in each branch of study viewed their UAS less as an education institution, but rather as a company or a holding company. Accordingly, they viewed affiliated UAS colleges as smaller independent companies involved in the production of knowledge. The experts therefore favoured the greatest possible level of autonomy for affiliated UAS colleges and research institutes in setting their own research policies. Likewise, they favoured the same level of autonomy in setting bonus systems to provide incentives to secure third-party funding on the markets.

4.2. R&D relating to Economics/Services

Unlike "Engineering/IT", there is not much of a research tradition relating to "Economics/Services". At the same time, the boundary between research activities conducted at UAS and at traditional universities is very blurred. It is difficult to draw a clear distinction between basic research, applied research, experimental development and services. Traditionally, emphasis has been placed on degree programmes, CET and services. Even today, research intensity is below average. At the same time, the understanding of research in "Economics/Services" is not as clear as for other branches of study as for "Engineering/IT". As a result, research is less focussed, the spectrum ranges from basic research to consulting, from a client orientation to "academic orientation".

Within the two UAS considered, there is also major competition and very little cooperation. As a result, there is greater pressure to stand out in a major field between traditional universities (which are also increasingly becoming involved in (applied) R&D) and private companies. The lesser degree of focus and the lack of recognised and justified indicators to gauge the success of research favours dispersion of research. Compared to other branches of study, R&D relating to "Economics/Services" is guided more by persons and their networks.

Like "Engineering/IT", representatives of "Economics/Services" see the importance of maintaining a high level of entrepreneurial autonomy for institutes and professors. Unlike "Engineering/IT", "Econom-

[12] The following UAS and branches of study were chosen: Engineering/IT: FHO/Hochschule für Technik Rapperswil HSR and HES-SO/Haute Ecole d'ingénierie et de gestion du canton de Vaud (HEIG) in Yverdon; Economics/Services: HES-SO/Haute Ecole de Gestion HEG in Fribourg and FHZ/Hochschule Luzern Wirtschaft HSLU-W; Social care: FHNW/Hochschule für Soziale Arbeit HSA and FHZ/Hochschule für Soziale Arbeit FHZ/ HSLU-S; Music, Theatre and Other Arts: ZFH/Zürcher Hochschule der Künste ZHdK and BFH/ Hochschule der Künste Bern HKB. In addition, one chapter of the final report discusses the special situation of the UAS SUPSI and the Università della Svizzera Italiana USI in the Italian-speaking region of Switzerland.

ics/Services" has difficulty securing grant funding from CTI and is excluded from SNSF's DORE programme despite the fact that research is still partly in the development phase. The structure of human resources can also be interpreted as caused by the lack of clarity: an above-average proportion of holders of higher education qualifications (including PhD and postdoctoral qualifications) and professors/other lecturers – and hence a lower proportion of assistant teachers and researchers. The same features can be found in the remaining two branches of study considered, namely: "Social Care" and "Music, Theatre and Other Arts".

4.3. R&D relating to Social Care

Social care in the Swiss higher education sector enjoys a *de facto* monopolistic situation as far as training options are concerned. In contrast, research is mainly in the field of social sciences. Researchers at UAS consider that the social sciences research that they do is different from equivalent research done at traditional universities because it focuses more on the profession itself. Unlike "Engineering/IT" and "Economics/Services", R&D is conducted not so much to fulfil externally imposed requirements but rather to develop their own profession and create professional problem handling capabilities for social "cohesion" and "development".

The third-party funding proportion of research funding is below average compared to other branches of study. Although R&D relating to "Social Care" covers the full spectrum of themes considered in the field and profession as well as the provision of services, individual UAS have very different profiles. The two UAS colleges considered in this study approach R&D either by working very closely with professionals in the field (FHZ) or by taking a very academic view (FHNW). Due to these two diametrically opposed approaches, the two UAS colleges adopt different criteria when judging success and quality. Likewise, they have a different understanding of what constitutes "innovation". They also perceive grant funding institutions differently. These differences are also reflected in the personnel structure, recruitment policies and different revenue structures.

In contrast, the experts at both UAS colleges agreed that adequate basic funding was absolutely essential for conducting research and fostering junior researchers (third cycle). Although "Social Care" has a long research tradition, the research intensity is relatively low.

4.4. R&D relating to Music, Theatre and Other Arts

Like "Social Care", "Music, Theatre and Other Arts" enjoy a monopolistic situation in the Swiss higher education sector. Nevertheless, this branch of study is characterised by strong international exchange and correspondingly high levels of competition. Like R&D activities relating to Social Care, R&D activities relating to "Music, Theatre and Other Arts" are not guided by an aim of meeting the demands of an external party. R&D activities are mainly oriented towards "artistic practice" and are described as "experimental", "exploratory", "searching for new forms of perception", "artistic" and "reflective". R&D often takes place in a transdisciplinary fashion, often with cooperation and comparison with other disciplines. Research is often applied but nevertheless not in a commercial sense. Success and quality criteria are therefore quite different from those used in the other three branches of study considered. Reputation is measured less in terms of customer satisfaction, successful problem solving, acquired third-party funding or scientific publications but rather in terms of gaining recognition in the form of awards, distinctions, artistic scholarships, invitations, public attention. Assessment is mainly performed by experts and *peers*. The notion of "research" is vague and heterogeneous and lacks a binding paradigm. Although R&D relating to "Music, Theatre and Other Arts" enjoys a long tradition, ("the experimental artist"), it remains very young at the same time and is still in the early stages of development. As a result, research intensity in this branch of study is far below-average and research is funded to an above-average extent by the sponsoring cantons. The proportion of third-party funding is relatively small, coming mainly from SNSF, particularly from the DORE Programme. In addition to contributions from the sponsoring Cantons, public research grants are very important. Given the specific understanding of research, there are concerns regarding access to funding. At the same time, it has been argued that specific requirements need to be met in order to foster the development of junior researchers (third cycle, PhDs). All things considered, this branch of study enjoys a special position within the various UAS: in many cases, the exception tends to be the rule.

4.5. Consolidation

Comparison of the four branches of study reveals common features, but mainly major differences. The results of the study clearly show that the dichotomy between “old” branches of study (“Engineering, Economics and Design”) and “new” ones (“Health, Social Care, Art) does not really apply. It is more accurate to say that "Engineering/IT" is the dominant branch of study and the one upon which the management and funding of UAS is explicitly or implicitly based. The other branches of study are different variations of this general framework.

5. Conclusion and implications

A single general framework...

The design, management and funding of R&D activities at UAS are based on a *general framework established by policymakers*, which is set forth in the UAS Act and which finds its expression in the funding patterns adopted by the Confederation and CTI (and adapted in SNSF’s research funding programme DORE). Concretely, this means that research at UAS must be “applied” in nature. Economic markets are the main consideration in determining whether R&D activities are applicable or useful. Unlike traditional universities, UAS receive little in the way of basic funding for R&D and are therefore forced to seek third-party funding. The willingness on the part of business partners to contribute funding is a strict condition in order to qualify for CTI or DORE funding. Even individual UAS colleges have strong incentives to obtain third-party funding, since the acquisition of third-party funding is financially rewarded. The bottom level (i.e. UAS colleges, departments or institutes) enjoys a high degree of autonomy because of the conviction that corresponding partnerships, market proximity and market success are better handled at the bottom level than at the top (i.e. UAS management). The general framework is therefore more than merely a funding model because it is associated with concepts and terms such as “success”, “profit”, “markets” or “innovation”.

... and various organisational models

Together with the sponsoring cantons, individual UAS apply the general framework established by federal legislation but adapt their organisational models to suit the given context. This leads to different management approaches, sponsorship, internal structures, branches of study, objectives and strategic orientation. Of the four branches of study considered, only “Engineering/IT” matches the established general framework.

Within the homogenous framework, there are heterogeneous spaces in which R&D activities at UAS develop. The general framework allows for the existence of alternative organisational models. However, these require deliberate policies. This is also true with regard to coordination between higher education institutions, which is not explicitly encouraged by the general framework (with seven regional UAS).[13]

Moreover, it is entirely possible that the organisational model adopted by the UAS departs from the organisational models adopted by its affiliated UAS colleges or departments. In some cases, these organisational models may be diametrically opposed. In summary, it becomes clear that management of R&D activities at UAS is far more complex than what is usually assumed.

[13] One exception is joint coordination of the Master’s degree programmes by several UAS, which is normally done for the purpose of reaching the “critical mass” required by the Confederation: For each Master’s degree programme, the Confederation requires a minimum number of students and a minimum volume of R&D expenditure.

Implications

The present study clearly shows that R&D activities at UAS cannot be placed into a single category nor do all R&D activities focus on the "applied" or the “development” part of the equation. Therefore, "applied" cannot serve as a common denominator for all branches of study. Depending on the branch of study, the distinctions between basic research, applied research, experimental development (and corresponding services) can, and do, become blurred. Likewise, each branch of study will perceive the practical motive and scientific motive orientations differently, leading to different approaches to R&D. This diversity creates problems for such things as funding, since standard, undifferentiated approaches to funding do not work with all branches of study. The general framework established by policymakers to fund R&D activities is intended primarily for engineering fields, particularly “Engineering and IT”, where most of the R&D funding volume (45%) flows. In other words, “Engineering and IT” is both the template and illustration for the general framework of R&D funding. The other branches of study do not really fit into this general framework. This mainly applies to branches of study that lack a tradition of deriving economic benefit from their research; are unable to find financially strong project partners; or follow alternative innovation concepts; or apply different criteria in assessing success.

The most important conclusion to be drawn from this study is that assessment of R&D activities at UAS requires a better understanding of the specific features of the various branches of study, including...

- the function of research for the economy and society;
- differences in the corresponding (economic) markets and
- the importance of R&D in achieving established objectives (e.g. professionalisation).

It is also important to better define the terms “innovation” and “economic benefit” and to differentiate between the various branches of study.

Based on the foregoing, a decision should be made as to whether such differentiation should be taken into account in research mandates, designing grant funding systems or deciding quality criteria. “Critical mass” and “coordination incentives” also need to be considered. In addition, decisions need to be made on the level of autonomy that each protagonist within the research system should be given.

These implications are inteded as discussion points and do not necessarily reflect the opinions of OPET or EFHK.

Abbreviations

BFH	Berner Fachhochschule
CTI	Commission for Technology and Innovation
DORE	DO REsearch, a grant funding instrument used by SNSF
FHG	Fachhochschulgesetz
FHNW	Fachhochschule Nordwestschweiz
FHO	Fachhochschule Ostschweiz
FHZ/HSLU	Fachhochschule Zentralschweiz
FTE	Full-time equivalents
HES-SO	Haute école spécialisée de la Suisse occidentale
KTT	Knowledge and Technology Transfer
OPET	Federal Office for Professional Education and Technology
R&D	Research and Development
SNSF	Swiss National Science Foundation
SUPSI	Scuola Universitaria Professionale della Svizzera Italiana
UAS	University of applied sciences
ZFH	Zürcher Fachhochschule
ZHAW	Zürcher Hochschule für Angewandte Wissenschaften
ZHdK	Zürcher Hochschule der Künste

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