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THE HIGHER EDUCATION AND RESEARCH SYSTEM IN SWITZERLAND

A COUNTRY PROFILE FOR AWTI



The Advisory council for science, technology and innovation (AWTI) has commissioned this report as a background study for the AWTI advisory report *Het stelsel op scherp gezet. Naar toekomstbestendig hoger onderwijs en onderzoek* ('Shaking up the system. Towards a future-proof higher education and research system'). This background study has been carried out by Technopolis Group. This publication and AWTI's advisory report may be found at www.awti.nl.

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The Higher Education and Research System in Switzerland

A Country Profile for AWTI

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1 Introduction

This country profile forms part of a deliverable package to the Advisory Council for Science, Technology and Innovation (AWTI) in the Netherlands and covers Switzerland's higher education system.

The main research methods include literature review and secondary data analysis undertaken by means of desk research, and a set of phone interviews conducted as part of primary research (full list in chapter 7).

2 Higher education and research landscape in Switzerland

The Swiss higher education and research system is shaped by more than 500 years of history of higher education¹ that is deeply rooted in and influenced by the Swiss federal system of governance. The federal system of governance – designed to balance the interests of Cantons and the Confederation as a whole – reflects the heterogeneity of a state, that is not only geographically diverse, but also in regard to language and culture.² Today and overall, according to the current federal strategy on HE and research, Switzerland is content with the performance of its HE and research system.³

In the past decade, the legal framework of the Swiss higher education and research system was changed considerably, starting with a referendum in 2006 changing the constitution and the subsequent legal steps in 2009 and 2015. All types of HE institutions were integrated into one single HE system of equal, but different players. The most important changes were the harmonisation of the governance across all types of higher education institutions – with the Confederation in a coordinating role – and shared rules for accreditation and funding for all higher education institutions (HEI). To be accredited as an organisation of higher education in Switzerland, organisations have to provide education and to conduct research.⁴

In Switzerland, most publicly funded fundamental research is carried out by the conventional universities, while universities of applied sciences focus mainly on applied research and development to serve the needs of the private sector, culture and the public sector. Research in the public sphere is therefore mainly connected to HE institutions, with the exception of four affiliated research institutes⁵. The private sector is responsible for 63,5% of the R&D expenditure in Switzerland in 2015.⁶

2.1 Types of Higher Education qualifications

In Switzerland, the most important tertiary education qualifications are the Bachelor's degrees, the Master's degrees as well as the PhD Doctorates. A particularity of the Swiss tertiary education system is that some vocational education and training (VET) degrees are also tertiary. Thus, various types of VET Diploma have the same ISCED level as the Bachelor's degree (see also the following Figure 1). In this case study, we focus on the "Bologna" degrees Bachelor, Master and PhD Doctorates. In 2017/2018, in

¹ SERI (2017): Education, Research and Innovation in Switzerland: Timeline

² Especially the latter shapes also the way education and higher education is organised, e.g. with vocational education and training being organised in one region more similar to France and in another more similar to Germany.

³ See e. g. the BFI Borschchaft 2017-2020 the Confederation's principle strategy document for the HE and research sector, p.3093: „Das BFI-System, die Organisationen und die Instrumente funktionieren gut. Die bisherige ausgewogene Entwicklung ist fortzuführen.“

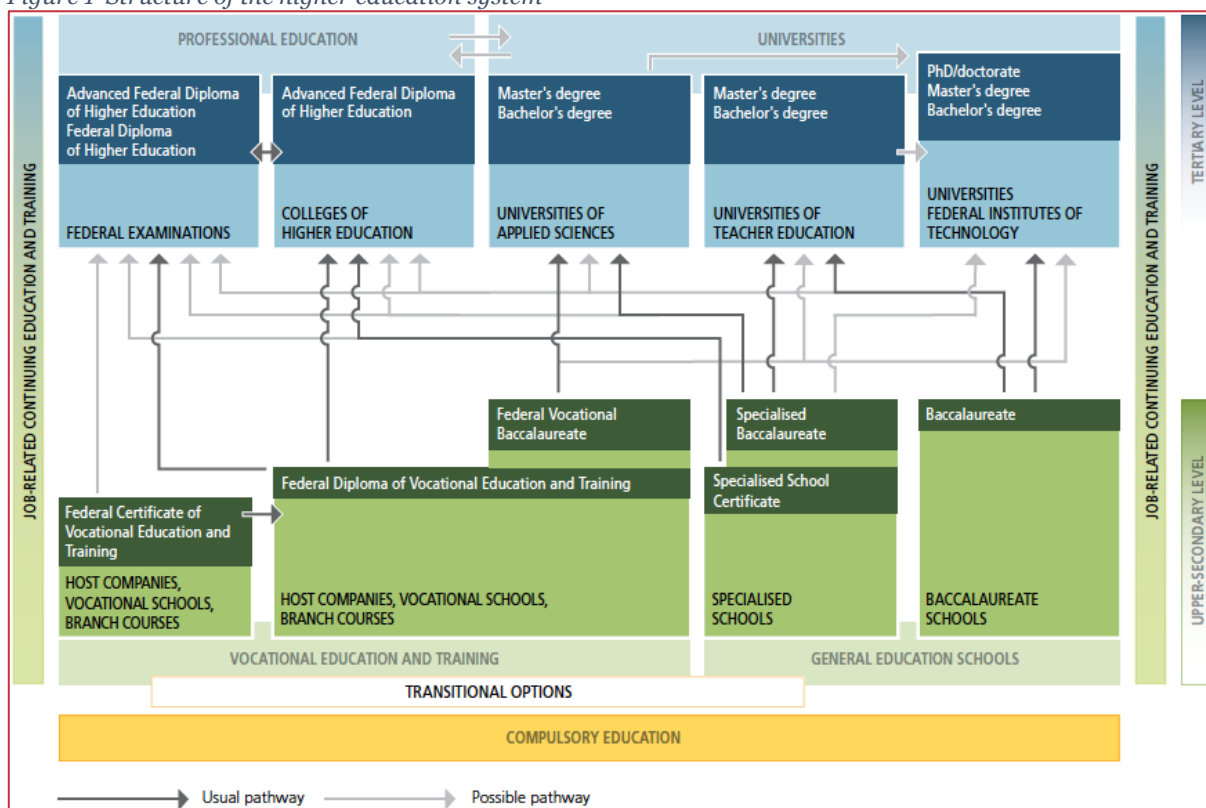
⁴ See e. g. Akkreditierungsverordnung, Chapter 2.

⁵ Those are the Paul Scherrer Institute, the largest research facility for natural sciences and engineering in Switzerland that also provides unique research infrastructure; the Swiss Federal Institute for Forest, Snow and Landscape Research WSL; the Swiss Federal Laboratories for Materials Science and Technology Empa; and the Swiss Federal Institute of Aquatic Science and Technology Eawag.

⁶ See SERI (2018): Higher Education and Research in Switzerland, p25. For more details on R&I in Switzerland see Sabo et al (2016): Forschung und Innovation in der Schweiz 2016.

total, about 250,000 students were enrolled at Swiss institutions of higher education pursuing such a degree (see Table 2 in the appendix).

Figure 1 Structure of the higher education system



Source: Higher Education and Research in Switzerland, p.58.

The Swiss higher education system is highly differentiated. Only universities offer the full circle of tertiary education from a Bachelor's degree over a Master's degree to a PhD Doctorate. Universities of applied sciences (UAS) and universities of teacher education (UTE) offer Bachelor and Master studies but focus on the former. In 2017, Swiss institutes of HE awarded overall around 35,000 Bachelor's degrees, of which around 17,000 were awarded by UAS. Around 14,500 were awarded by a university. In the same year, universities awarded 14,000 Master's degrees and UAS 4,300. UTE awarded 3,300 Bachelor's degrees and 1,200 Master's degrees (see Table 1). In 2015, about 14% of the respective age group achieved a university degree and about 16% a degree of a UAS.⁷

The data illustrates that at the UAS, the typical qualifying degree is the Bachelor's and that the majority of UAS graduates enter the labour market with this degree. At conventional universities, most students continue to study a Master's programme. At the UTE, the choice for Bachelor's or Master's programme mainly depends on which type of school a teacher-to-be wants to teach. Teachers at upper secondary level typically need a Master's degree.

2.2 Types of higher education & research providers: ETHs, Universities, UAS and UTE

Since the introduction of the shared legal framework for all HE institutes, the HE system operates according to the principle "*gleichwertig, aber andersartig*" – i.e. that the types of institutions in the

⁷ Federal Statistical Office data: <https://www.bfs.admin.ch/bfs/de/home/statistiken/bildung-wissenschaft/bildungsindikatoren/bildungssystem-schweiz/themen/abschluesse/abschlussquote-hs.html>

Swiss HE system are of *equal value but of different character*. The Swiss HE system knows three different types of institutions⁸ (see again Figure 1 above):

- Ten cantonal universities and two federal institutes of technology (better known as ETHs), jointly referred to as “conventional universities”
- Sixteen universities of teacher education (UTE)
- Eight universities of applied sciences (UAS)

Each of these types of HEI fulfil a specific role. The diversity of the system has developed historically and is a continuation of the distinctions at upper-secondary level between the general/academic educational sector and the vocational sector. Maintaining this diversity and the differentiation between the types of institutions has been declared a joint policy objective of the Confederation and the cantons and is also stated explicitly in the Hochschulförderungs- und Koordinationsgesetz of 2015 (HEdA).⁹

Conventional universities: Cantonal universities and federal institutes of technology (ETHs)

The cantonal universities and the ETHs, labelled as ‘Tertiary level A institutions’, currently have about 150,000 students in total (see Table 2 in the appendix). For the federal institutions ETH Zurich and the EPF Lausanne (the ETHs), the federal government provides both the funding and sets their strategic objectives (see also the following chapters). The cantonal universities are funded by the cantons, but also receive secondary federal funding.¹⁰ While the universities are committed to research and education, a majority of their staff time is allocated to R&D-activities (see also Figure 2 in the appendix).

Both **ETHs** are internationally renowned both for teaching and research (see also Table 3 in the appendix); their thematic focus is on science, engineering, mathematics and architecture. They are the only conventional universities in Switzerland that offer courses in engineering. The ETHs teaching staff is highly international: nearly 70% of professors have a foreign passport (in comparison to the UAS and UTE, but also in comparison to the cantonal universities with about 45%; see Figure 3 in the appendix). The ETH Zurich is consistently ranked the top university in continental Europe. In 2016, it had about 19,800 students¹¹ of which about 30% were female and about 38% were from abroad. The university had also been home to 21 Nobel laureates. The Ecole polytechnique fédérale de Lausanne (EPFL)¹² has about 11,000 students of which 28% are female and 53% foreign. According to interviewees, the EPFL has become more visible especially due to its increased research performance in the past two decades.

Most **cantonal universities** offer degree programmes in a full range of disciplines (but not in engineering). Only a few universities have a narrower profile, for example the University of St. Gallen which is a business university. The group of cantonal universities in itself is heterogenous: there are very old and larger institutions like the University of Basel founded in 1460 with today over 12,000 students and very young ones like the University of Lucerne founded in 2000 with today 2,900 students or the Università della Svizzera italiana (USI) founded in 1996 with today about 2,800 students. The diversity is also reflected in international university rankings (see Table 3 in the appendix): Especially the universities of Zurich and Genève are performing very well, followed by the universities of Basel and

⁸ Higher education institutes being defined as institutes providing education and conducting research, and thus excluding the higher VET institutes professional education and training colleges (more than 150 in Switzerland).

⁹ Chancen optimal nutzen. Erklärung 2015 zu den gemeinsamen bildungspolitischen Zielen für den Bildungsraum Schweiz. See: https://www.edudoc.ch/static/web/aktuell/mediennett/erklaerung_18052015_d.pdf. In HEdA, see especially Art. 3 “objectives”, here chapter b (“Schaffung eines Hochschulraums mit gleichwertigen, aber andersartigen Hochschultypen;”) and c (“Förderung der Profilbildung der Hochschulen”). See <https://www.admin.ch/opc/de/classified-compilation/20070429/index.html>.

¹⁰ See also SERI (2018): Higher Education and Research in Switzerland, p.18.

¹¹ Incl. PhD students see SERI (2018): Higher Education and Research in Switzerland.

¹² For a short profile see SERI (2018): Higher Education and Research in Switzerland, p.38.

Bern. Other universities do not appear among the top ranks. According to interviewees, they are more of regional importance.

The Fachhochschulen or Universities of Applied Sciences (UAS) and the Universities of teacher education (UTE)

The Swiss Fachhochschulen or Universities of Applied Sciences (UAS) were established in the mid-1990s to provide tertiary practical education for the national labour market in order to make Switzerland more internationally compatible with countries that already had UAS in place. Moreover, UAS were established to meet the growing demand for people with advanced education, and to perform applied research for and together with users of the research results, mainly in Switzerland.¹³ The UAS were not established from scratch, but resulted from a transformation of existing higher, cantonal schools of practical education. The cantons mostly aggregated these existing schools to become one UAS with a number of schools or centres, often at different locations within a UAS region (see Figure 4). That also means that UAS were and are regionally rooted: their prime focus is the regional economy and regional initiatives.¹⁴ In addition to the seven public UAS in Switzerland, there is also a private UAS, founded in 2005. As public UAS, private ones also have to be institutionally accredited.¹⁵

The typical qualifying degree awarded by UAS is the Bachelor (see Table 1) and students can choose among courses of engineering, IT, architecture, construction and planning, chemistry, life sciences, agriculture and forestry, business and services, design, health, social work, music, theatre, applied psychology, applied linguistics and physical education. UAS aim at their students developing the ability to apply scientific knowledge and methodologies in practice and, in some cases, make use of artistic abilities. In fact, the Swiss HE system does not know universities of art. Due to their position between practical training and academic knowledge, UAS are supposed to play an important role as drivers of innovation. Therefore, UAS conduct research that accounts for about 25% of the total operating costs of the institutions.¹⁶

In regard to research, historically, some of the engineering schools that became UAS were already conducting applied research in collaboration with the industry. For most other schools, conducting research was a substantial innovation.¹⁷ Since 2004, the UAS expenditures for applied R&E increased overall from 15% to 22% of total expenditures in 2014 (accompanied by a similar increase in the share of staff conducting research).¹⁸ The expansion of research activities concerned all fields, but especially the technical fields (see Figure 5). While applied research is an objective of UAS, it is expected that this R&D is mostly from private funds and thus following users' demand. This is difficult in fields where possible users of R&D results are not companies but public bodies or non-profit organisations, e.g. in the social sciences, healthcare, or arts. UAS can apply for public funding for R&D activities, typically for collaborations with e.g. users (mainly companies), granted by *innosuisse*¹⁹. Some cantons also match private funds with public funds and foster R&D activities in this way.²⁰

¹³ See Lepori, Müller (2016), p.28.

¹⁴ See Lepori, Müller (2016), p.43.

¹⁵ The UAS in question was established in 2005 and thus prior to the introduction of the HEdA. At the time, among others, a Peer-Review was conducted to control if the UAS adheres to the standards. Today, requirements for an accreditation are a quality assurance system, to offer research, education and services in more than one disciplines and to guarantee that the institution remains operational permanently (see HEdA Art. 30). The HEdA further details especially the quality assurance system that among others must guarantee high quality of research, education and services, adherence to admission rules stated in HEdA for the respective type of institute, but also having a working leadership or fostering equal opportunities. If these requirements are fulfilled, the organisation can ask the Swiss Agency of Accreditation and Quality Assurance AAQ (or another agency listed by the responsible Ministry) for an institutional accreditation. Private institutions need to provide coverage for direct and indirect costs of about CHF 60,000. See: <http://aaq.ch/akkreditierung/institutionelle-akkreditierung/>.

¹⁶ See SERI (2018): Higher Education and Research in Switzerland, p.20.

¹⁷ See Lepori, Müller (2016), p.10.

¹⁸ Ibid., p.9 (table 2).

¹⁹ <https://www.innosuisse.ch>.

²⁰ Ibid., p.12 – 16.

The **Universities of Teacher Education** were created in 2001 following the example of the UAS by emphasizing both practical training and applied research. There are 14 autonomous universities of teacher education. Two UTEs are integrated into universities of applied sciences. UTEs also offer continuing education and training courses and provide services to third-parties. UTEs are funded by the cantons. The vast majority of teachers working in compulsory and post-compulsory education receive their training at UTEs. In 2017/2018, about 20,000 students were studying at a UTE (of which 73% were women and 10% foreign; see Table 2).

2.3 The role of the Confederation and the cantons in the governance of the Swiss higher education system

As stated, the governance of the Swiss HE system was systematically changed beginning with the accepted 2006 referendum on the new “Bildungsverfassung” (education constitution), i.e. on a change of those articles of the constitution related to education. The new education constitution harmonised several aspects of the education system (including e.g. age of school entry, duration of school education as well as objectives of education levels). For HE, most importantly, since 2006 the Confederation and the Cantons are to **jointly** provide for a “high quality and permeability of the educational area Switzerland”. Moreover, a new article specifically dedicated to higher education in the Swiss constitution (Art. 63a) details the tasks of the Confederation. This constitutional assignment is the basis for the new Federal Act on Funding and Coordination of the Higher Education Sector (Hochschulförderungs- und Koordinationsgesetz; HEdA) on federal level and to the adoption of the Higher Education Concordate on the side of the cantons. This agreement between the Confederation and the cantons on cooperation in the field of higher education sets the scope for the two elements of the legislative framework, declares the aims of the HEdA as joint objectives and creates the basis for the joint governing organs of the HE system. With the HEdA, the governance of the system has been simplified and since 2015, the HE system is governed by the following three institutions: ²¹

- The Swiss University Conference (SUC) is Switzerland’s highest institution of higher education policymaking and is responsible for coordinating the activities of the Confederation and the cantons in the higher education sector. The Conference has regulatory competences and can issue recommendations and position papers. It is also responsible for the coordination tasks and allocation of certain project related funds in particularly cost-intensive fields. The Confederation holds the presidency of the SUC and is responsible for its management and operation.
- The Rectors’ Conference of the Swiss HEIs (swissuniversities) brings together the rectors of the universities, UAS and UTEs²². It is responsible for coordination and cooperation among HEIs. It strengthens and enhances collaboration among Swiss higher education institutions and represents the Swiss higher education area with one voice. Interviewees indicated that within swissuniversities, now all types of HEI need to cooperate more closely than before. To this end, swissuniversities is organised as a matrix with certain HEI-type specific topics being dealt with by the respective chambers, while overarching topics, e.g. internationalisation or HE politics, are jointly dealt with across the different types of HEI.
- The Accreditation Council is an independent expert body with representatives from higher education and employers. It reaches decisions on accreditation at institutional and programme levels, which are then enforced by the Accreditation Agency. Since 1 January 2015, the relevant accreditation procedures have been run by the Swiss Agency of Accreditation and Quality Assurance AAQ²³. All Swiss HE institutions, i.e. universities, UAS and UTE, need to be accredited institutionally in order to have the right to call themselves “University”, “Fachhochschule” or

²¹ For the three organs, see Wolter et. al. (2018): Swiss Education Report 2018, p.173 and SERI (2018): HE&R in CH, p.22.

²² In other words, the former rectors’ conferences of universities (CRUS), UAS (KFH) and UTE (COHEP) were merged.

²³ The AAQ is a publicly funded, but independent organisation. It is governed by the Swiss Accreditation Council which is a body of the cantons and the federation. The council is not subject to governmental instructions. See: <http://akkreditierungsrat.ch/en/accreditation-council/>, as well as http://akkreditierungsrat.ch/download/Akkreditierungsrat/OReg-AAQ_DE.pdf.

“Pädagogische Hochschule”, to be eligible for federal funding, and to award degrees according to the Bologna declaration. The institutional accreditations of the existing HE have to be completed within eight years of the commencement of the HEdA 2015²⁴. The accreditation of study programmes is voluntary (with the exception of selected programmes in the area of health).²⁵ For the UAS, institutional accreditation means that they have greater autonomy in creating and organising their study programmes, as they had to have each study programme accredited individually prior to the HEdA 2015.

Further to these three institutions, overall responsibility for the system lies on federal level with the **State Secretariat for Education, Research and Innovation (SERI)**. Among other things, the SERI is responsible for higher education, science, research and space affairs. SERI’s tasks include promoting high-quality teaching and research at universities and UAS, increasing the international competitiveness of Swiss HE and research, and helping Swiss HEI to join European and international cooperation networks.

This federal responsibility is matched by the cantons with the **Swiss Conference of Cantonal Ministers of Education (EDK)**. In principle, the cantons are responsible for education policy. The EDK coordinates the cantonal efforts to find national solutions for important issues. Typical examples of matters handled by the EDK are a national agreement on key education indicators, on exchange programmes or on the recognition of qualifications. In the area of HE, the EDK pursues intercantonal agreements on funding and mobility to ensure equal access to higher education throughout Switzerland and a sharing of the financial burden among the cantons. The sharing of responsibilities between Confederation and cantons is also reflected in the funding structure of the HE system (see chapter 4 below).

The implementation of certain aspects of the new HEdA is still ongoing: In relation to the accreditation processes, all institutes of the HE system need to be accredited by the end of 2022. By now, two UAS and three UTEs have already been accredited. The process is especially new to the universities. For these institutions, and in contrast to the UAS, accreditation was optional before the new HEdA.²⁶ Moreover, the allocation of state funding to universities and UAS (see also chapter 4) has been changed with the HEdA and the transformation from the previous to the new system is done stepwise from one four-year funding period to the next.

2.4 The performance of the higher education system

Our interviewees state that the Swiss HE and research system is performing very well overall and across the different pathways of the “academic/general education” and of higher VET and VET, assessed against study completion rates, study duration and employment rates. According to our interviewees, success factors of the system are a strong and stable basic funding, a strong VET and higher VET system allowing the universities to focus on excellence, as well as an efficient division of roles between the different types of HEI.

The HEI sector in Switzerland also plays a key role as research performer: HEI-based researchers published 71% of all scientific papers²⁷. In the period 2011-2015, Switzerland produced 1% of worldwide publications and it ranks in the top 20 countries of all sizes for the number of scientific articles, and it ranks first if the number of publications is compared to the size of the population. In terms of thematic focus, 26% of Swiss publications are in the Life Sciences, 24% in Clinical Medicine, and 23% Physical,

²⁴ HEdA, Art. 75

²⁵ A prerequisite of the accreditation of a study programme is the institutional accreditation of the HEI. To date, according to the Swiss Accreditation Council, one study programme is accredited. See <http://akkreditierungsrat.ch/akkreditierungsentscheide/programmakkreditierung/>.

²⁶ Accreditation is also new for the UTE, for which accreditation was not possible under the old legal framework. The new accreditation guidelines can be found here: <https://www.admin.ch/opc/en/classified-compilation/20151363/index.html>.

²⁷ All figures in this paragraph: SERI (2017): Scientific publications in Switzerland 2010-2015 – A bibliometric analysis of scientific research in Switzerland

Chemical and Earth Sciences. An analysis of the scientific impact of Swiss publications using citation data shows that Switzerland also ranks among the top countries overall as well as within most fields of research apart from arts and humanities (see Figure 6 in the appendix). Moreover, Swiss research is highly international: 84% of all jointly written papers resulted from international collaboration.

According to interviewees, although “excellence” is considered a desirable characteristic of the HE system and its institutions, is not a key issue in the policy discourse in Switzerland in comparison to e.g. Germany with its “Exzellenzinitiative”. As stated above, Swiss policy maker seem content with the performance and development of the system and see no need to further stimulate excellence with additional policy measures. In fact, providing favourable conditions for teaching and research of high quality is the first objective of the new HEdA (Art. 3, lit. a), and accordingly, it is generally considered important to fund the HEI adequately in order to allow them to fulfil their specific objectives within the system and in accordance with the principle of HEI being “*gleichwertig, aber andersartig*” (chapter 2 above). In addition to institutional funding, competitive funding of research projects is provided by the Federation, mainly through the Swiss National Science Foundation (SNF) for basic research (i.e. mainly used by conventional universities) and innosuisse for applied research (i.e. mainly used by UAS, followed by ETH).

In the discourse about “excellence”, international rankings have become popular, and some interviewees pointed out that approx. 70% of all university students in Switzerland are enrolled at one of the top 200 universities (see Table 3). While ETHs are performing a little better in these rankings compared to cantonal universities, some of these also consistently rank highly, especially Basel, Genf, and Zurich, but also Bern and Lausanne. Moreover, it is important to keep in mind that in Switzerland only the two ETHs are providing research and education in engineering and that these rankings tend to have a field bias towards technical fields and sciences. In other words, there is less of a systematic difference in performance between ETH on one side and cantonal universities on the other, but rather between certain larger cantonal universities and the ETHs of international visibility and rank, and other, more regionally oriented and / or younger cantonal universities.

The key indicators for HEI’s performance mentioned by interviewees are in detail:

- In 2016, **rates of completion** (see Figure 7) were between 74 and 95%. The completion rates at HE institutions varied between degrees, disciplines and types of education. With only a few exceptions, Master’s degrees are completed more often than Bachelor’s degrees. Between types of organisations, at universities less students complete their Bachelor’s degree than at UAS (76.1% against 82.2%), while Master’s degrees are completed more often at universities than at UAS (95.2% at universities in comparison to 89.2% at UAS).
- A comparison of study durations reveals that students in general study longer than intended both for Bachelor’s and for Master’s degrees. For a BA degree, students need between .9 and .5 years longer than intended. For MA degrees, students need between .2 and .4 years longer than intended (see Table 4). The most interesting difference between types of organisations is that at universities, students need 30% more time than intended for BA degrees and only 16% more time than intended for MA degrees. At universities of applied sciences, students need only 10% more time for their BA degree while 20% more time for a MA degree (see Table 4 and Figure 8).
- Today, employment rates²⁸ are between 87% for universities and 97% for UTEs. In the last decade, the rates of graduates of universities, UAS or universities of teacher education have always been above 85% (measured one year after completion of studies). Between types of universities, it seems that it was easiest for graduates from universities of teacher education to find a job with rates around 95%, while graduates from UAS were successful to more than 90%. Universities followed with around 87% (see Figure 9).

²⁸ Employment rates as shown in the respective Figure 9 in the annex refer to people in employment, but do not assess whether the people are working in a position that is adequate to their level of education. This is taken into account in Figure 17. See also chapter 6 below.

3 Access to higher education in Switzerland

With the exception of medicine and sport science at some locations, Switzerland has open university access.²⁹ Qualification for attending a HEI is a secondary general/academic degree or a VET degree. The HE system is mostly organised in pathways (see Figure 1 above) – a more academic pathway on the one hand, and a more professionally oriented pathway on the other. This is based on a differentiated school system at the upper secondary level, where a certain type of secondary school degree directly qualifies for a certain HEI.³⁰ Students have to meet additional criteria if they want to move from one path to the other (“Passerellen” – bridging qualifications). The principle selection between the pathways takes place after 9 school years. In comparison to other HE systems, the pathways to HEIs are comparatively stringent (see Figure 10):

- The general baccalaureate qualifies to access a conventional university, and the vast majority (77%) of the holders of this qualification chose to attend a university (data of 2016; 2014 cohort) and a further 8% attend a university of teacher education. 10% choose to attend a UAS, which requires practical training in addition to the general baccalaureate. In 2015, a general baccalaureate was acquired by about 20% of the reference group.³¹
- The federal vocational baccalaureate is achieved through attending vocational education and training and qualifies for immediate access to a UAS. 52% of VET graduates choose to do so (2016; 2014 cohort). Holders of this qualification rarely study at conventional universities or universities of teacher education. They do however often start studying at a UAS in the longer term, i.e. after several years of working, which is not reflected in the data at hand.³² In 2015, about 15% of the reference group had a federal vocational baccalaureate.³³
- Another qualification to attend a UAS or a university of teacher education is the Specialised Baccalaureate or the Specialised School Certificate that is received by attending upper secondary specialised schools. 50% of holders of these are transitioning to UAS and another 28% to universities of teacher education. In 2015, such specialised baccalaureates were acquired by about 15% of the reference age group.³⁴

Next to the default pathways from general/academic secondary education to a university and from a specialised baccalaureate or VET to a UAS it is also possible to move between these standard paths, e.g. from the VET system to a general university or from general secondary school to a UAS, provided the “missing” part of the degree is acquired in a specific procedure (“Passerelle”, i.e. additional qualifications). This means that to attend a general university with a VET baccalaureate, students need to complement their education with the general/academic part that they did not learn in the VET pathway. Similarly, students with a general/academic secondary school degree that want to attend a UAS have to complement their education with the practical part. Since the “Passerellen” require considerable additional effort by the students, transitions between the pathways at entering the tertiary level occur less often.

The “Passerellen” are considered important by most of our interviewees: On the one hand, they enable access to any tertiary education for all graduates of an upper secondary education, on the other hand they help to maintain the specific profile of the different HE institutions, especially differentiating

²⁹ Universities are allowed to ask for – in international comparison – moderate studying fees. See chapter on funding.

³⁰ The exception being medical studies of German-speaking universities that require a combination of a certain grade and/or passing an admission test.

³¹ See FSO data: <https://www.bfs.admin.ch/bfs/de/home/statistiken/bildung-wissenschaft/bildungsindikatoren/bildungssystem-schweiz/themen/abschluss/maturitaetsquote.html>. Reference group is defined as the resident population in the age of typically acquiring such a degree.

³² A detailed overview on UAS access can be found here; Swissuniversities (2015): Zulassung zum Bachelorstudium an Fachhochschulen. Best Practices.

³³ See again FSO data above.

³⁴ Ibid.

between the more practical orientation of UAS and UTE and the more academic orientation of conventional universities.

The pathways of the Swiss HE system prevail in regard to access to Master's degrees. In 2015³⁵, at universities, only about 4% of MA students had a qualification from a HEI other than a university. At UAS, the same share is about 6%. Only for UTE, it seems more common that students of Master's programmes are coming from another type of institution with about 12% (see Figure 11). To change type of institutions between BA and MA study programmes may require additional qualification regardless of the type of institution that issued the BA degree. Typically, the missing ECTS requirements need to be accounted for within the first year of studying.

4 Financing of higher education in Switzerland

Generally, stable and strong basic funding of the Swiss higher education institutions through the cantons and the Confederation is considered a strength of the system that contributes to excellence in education and research. The higher education sector (including research) takes around one third of the public spending on education. In 2015, of the almost CHF 11 billion expenditure on HE, the Confederation and cantons contributed around 40% each (with the remaining share contributed by private sources).³⁶

Federalism is reflected in the institutional funding of the higher education system

The structure of governance described above is also reflected in the funding of the HEI in Switzerland. In short, the Confederation funds the ETHs, the cantons and the Confederation jointly fund the cantonal universities and the UAS, and the cantons fund the UTE. For all four, private sources contribute between 10% (ETHs) and 20% (cantonal universities and UAS) to the funding (see also Figure 12). The 4-year payment framework for institutional funding is presented by the Federal Council for the approval of parliament. Under the HEaA, basic institutional funding from the Confederation is complemented by contributions to specific projects of national importance (e.g. to support a group of HEIs in establishing a centre of competence), and by investments in construction. Competitive research funding is provided for fundamental research by the Swiss National Science Foundation (SNSF) and for applied research by Innosuisse, both of which are funded federally according to the Forschungs- und Innovationsförderungsgesetz.

Swiss universities have introduced tuition fees that are moderate in comparison with e.g. some UK universities. In 2017/2018, the fees at most universities are between CHF 1,000 and 1,700 per year. It is only the University of Italian-speaking Switzerland that charges considerably more with fees of CHF 4,000.³⁷ Additional fees might apply for foreign students, with considerable additions requested by the universities of St. Gallen with some additional CHF 3,500 annually and the University of Italian Switzerland with additional CHF 4,000. The level of tuition fees is set by cantons for cantonal universities and UAS and by the federation for the ETHs.

First steps towards steering via (performance based) indicators

Switzerland has taken first steps in allocating institutional funding based on performance indicators. According to interviewees, in the recent years, the institutions and governance organs trained the use of these metrics to steer the respective HEI. Today, first steps to a more comprehensive use are taken.

Therefore, performance-based criteria are used to distribute the basic funds of the Confederation, taking into account the different institutional profiles. This means that the performance of a HEI is measured

³⁵ Data for the 2013 cohort, see also Figure 10 in the appendix.

³⁶ See Wolter et. al. (2018): Swiss Education Report, p.176. For education in general, the share of the Cantons is even larger with about 51,2%. See e.g. BFS (2018): Bildungsfinanzen. Ausgabe 2018.

³⁷ See Wolter et. al. (2018): Swiss Education Report p. 219.

against that of all other institutions of the same type to create a competitive structure. Assessment of funding according to performance in teaching uses data such as the number of students and number of qualifications awarded.³⁸

The federal institutional funding for cantonal universities and UAS is allocated through two “pots”, based on indicators related to teaching and research respectively; the shares of these “pots” differ according to the type of institution. For cantonal universities, 70% of the federal institutional funding is allocated according to teaching criteria and 30% based on research-related criteria. For UAS, proportions are 85% for teaching and 15% for research (Article 7 of the HEdA Ordinance). This federal funding is matched by cantonal funding and both are substantial contributions to the HEI’s overall budget. The overall budget is then spent by each HEI to autonomously fulfil their tasks. This means that the formula used to allocate federal funds does not necessarily reflect a HEI’s cost structure.

A particularity of the Swiss system is that between the cantons, contributions are paid to the HEI not only by the canton governing the HEI, but also by the canton where the student is originally from.

5 Internationalisation of higher education in Switzerland

As stated in Switzerland’s federal international strategy for education, research and innovation, international cooperation and competition are integral to the Swiss policy in these areas.³⁹ The vision stated in the strategy is for Switzerland to remain among the top countries in education, research and innovation. According to interviewees, since research and higher education (and to a lesser extent also innovation) are perceived *per se* as internationally oriented, the shares of international students or international staff are seen as an asset rather than as a problem. Nevertheless, the attitude in the general public is less open and consequently the mass immigration initiative of 2014⁴⁰ has caused a number of challenges for the Swiss R&D system (e.g. regarding participation in EU research programmes).

The internationalisation strategy itself is founded on the principle that activities in education, research and innovation in general need to take place *bottom-up* and not *top-down* and stakeholders in these areas act autonomously. According to the principle of subsidy, the federation only aims to maintain the attractiveness of the fields and to continue to set optimal framework conditions for the relevant stakeholders.

On organisational level, internationalisation is an important topic. The degree of internationalisation varies between the types of institutions: ETHs and universities are more internationalised than e.g. UAS or UTEs. The degree of internationalisation varies also between HEI of the same type.

Internationalisation of Swiss HEI

The agreements with the European Union are important framework conditions for Switzerland in terms of internationalisation (both participation in Horizon 2020 and in Erasmus+). From 2017, full membership of the Horizon 2020 framework programme provides the country’s researchers with the possibility of participating in the EU’s research programmes without restriction again. In regard to Erasmus+, Switzerland lost its full membership status in February 2014. As part of a transition solution, study mobility is still being supported by direct funding of outgoing and incoming mobility at tertiary level (via SEMP, the “Swiss Implementation of Erasmus”). However, in contrast to the situation under full membership, the strategic partnerships and cooperation projects, as well as the political collaboration options are vastly reduced or impaired. Furthermore, Swiss HEIs now have to manage a large administrative effort since bilateral agreements must be negotiated with each individual foreign partner university. However, at least the outcoming student numbers seem to be largely unaffected by

³⁸ See Wolter et. al. (2018): Swiss Education Report p. 175/176.

³⁹ See Swiss Confederation (2018): Internationale Strategie der Schweiz im Bereich Bildung, Forschung und Innovation. Strategie des Bundesrates.

⁴⁰ <https://www.bk.admin.ch/ch/d/pore/vi/vis413.html>

these difficulties, while for incoming students, the data seems inconclusive (see Figure 13). According to interviewees, future participation in Erasmus+ is still debated. Participation in the programme is deemed especially important for those cantonal universities of less international visibility.

Between the different types of HEI, the institutions with the most international student bodies are the universities (see Table 2): In 2017/2018, about 30% of students enrolled at a university were not Swiss citizens and about 25% had a non-Swiss university qualification. The corresponding shares for UAS were about 20% of non-Swiss citizens (18.5% with a non-Swiss qualification) and about 10% (8%) for UTEs. In the past decades, both shares have been rising. Universities (and again especially the ETHs) also have a considerably higher share of foreign professors (see Figure 3) than UAS and UTE. As shown above, one reason for the attractiveness of the Swiss universities to students and researchers from abroad in general is that many universities are highly visible (see Table 3) internationally, which is especially true for the ETHs.

Outcomes of internationalisation

For Switzerland, internationalisation in research and HE seems to have mostly positive effects: Switzerland is competing like every other country for global talent, but data shows that between 60% and 70% of foreigners having completed their HE in Switzerland are part of the Swiss labour market one year after graduation. Five years after graduation, this is still true for at least 50% of the foreign graduates (see Figure 15). An indicator used in the Swiss education report to assess brain gain and brain drain is the number of migrated patent holders between a number of countries (see Figure 14), according to which in the last decade, a high share of patent holders in Switzerland were foreigners.⁴¹

Some unintended effects pertain to the access to universities. Due to the high international visibility of the Swiss universities, the fact that many of the organisations' teaching language is German, French or Italian⁴², some Swiss HEI are of high attractiveness to students especially from these large countries. For some study programmes, e.g. for medicine or dentistry, Switzerland has thus introduced a "numerus clausus" to control university access. While Switzerland currently suffers a shortage of qualified staff in some sectors (especially medicine and health), there is no strong incentive for universities to attract international students apart from the general notice that education, research and innovation are per se international (see strategy above).⁴³

6 Links between the Swiss higher education system and the labour market

All Swiss institutions perform well as indicated by employment rates over 85% in 2015 (see Figure 9 and Figure 17 regarding degree adequate employment). Between the institutions, students of UTEs seem to be absorbed best by the labour market followed by UAS and then universities. Due to their regional rooting and their focus on practical education and applied research, interviewees consider UAS well linked to the Swiss labour market.

High graduate employment across HEI

⁴¹ However, since Switzerland has also a strong private research sector (see chapter 2.2 above), it is unclear to which degree these can be attributed to the level of internationalisation of the HE sector. Additionally, patent data is difficult to interpret because it is unclear to which degree differences between *inventors* and *applicants* were reflected in the analysis of the data at hand. If the data referred to the patent holders (in contrast to the *inventors*), this numbers also included companies that might choose Switzerland for their patent application due to tax reasons. While the research paper cited refers to inventors, the chart is inconclusive in regard to which data category they refer to.

⁴² There are also English study programmes. According to a search via the study programme portal of swissuniversities, about 25% of all study programmes are taught in English (on BA level: about 9%, on MA level about 33%, on PhD level 42%).

⁴³ One share of the federal institutional funding is allocated according to the number of international students. This is however also a compensation for funding that otherwise would be received from the home canton of Swiss students.

As stated above, in 2015, more than 85% of all graduates of Swiss HEI found employment. The shares differ between types of HEI: students of UTEs seem to be absorbed best by the labour market followed by UAS and then universities: In 2015, one year after completion of studies, about 95% of UTE graduates were in employment, 90% of UAS graduates and 87% of university graduates. Over the last decade, employment rates for the UAS and the universities were roughly following general economic trends: in 2003, with a decrease in GDP, only 85% of UAS graduates and 83% of university graduates found employment one year after completion of studies.

According to the Swiss education report 2018, the employment rates are mirrored by International Labour Organisation data on unemployment, with unemployment rates among graduates of UAS tending to be lower than among conventional university graduates. This might be explained by the fact that many conventional university courses do not prepare their students for a specific job. At the same time, graduates of conventional universities have on average less work experience than their counterparts from UAS, making it more difficult for them to enter the labour market. On the other hand, graduates of conventional universities are more frequently engaged in a job that requires a university degree than their counterparts who graduated from UAS (see Figure 17).⁴⁴

In terms of shortages of qualified labour, considering professions that require a tertiary education, there are not only very different tensions in labour markets between different professional fields, but also in some cases within specific professional fields. For example, in the natural science professions, a recent study established a lack of chemists, mathematicians and statisticians, but sufficient numbers of biologists, geographers and meteorologists.⁴⁵ Interviewees further suggested that there is a lack of professionals in the health sector (also regarding physicians, as further evidenced by the current BFI Botschaft 2017-2020⁴⁶). Interviewees also pointed out that a crucial limitation when trying to gear higher education towards the labour market needs is that it is difficult to influence school graduates' study choices.

UAS as an important link between higher education system and the labour market

As stated, the UAS perform slightly better than universities when it comes to employment rates, but graduates often work in jobs that do not require a tertiary degree. Still, as also pointed out by our interviewees, UAS are well linked to the labour market because of the following reasons:

- UAS are “the top of the VET pathways within the HE system”. This means that UAS students need to show practical experience already when entering the institution, and those UAS Bachelors who decide to enrol in a Master programme often deepen their practical experience between the completion of their BA degree and enrolling in a Master’s programme. Many of the UAS curricula train for specific lines of work⁴⁷.
- UAS and their preceding organisations were traditionally practically oriented and connected to the labour market. This is also reflected in the employment rates of UAS graduates by study programme:⁴⁸
 - In engineering, most graduates immediately find a well-paid job in a leading role adequate to their qualification. The UAS BA is accepted by the market. An exception are graduates of chemistry and life sciences, who reported finding it hard to find permanent employment.

⁴⁴ See also BFS (2017): Studien- und Lebensbedingungen an den Schweizer Hochschulen. Hauptbericht der Erhebung 2016 zur sozialen und wirtschaftlichen Lage der Studierenden.

⁴⁵ Degen et al (2016): Fachkräftemangel in der Schweiz. Indikatorensystem zur Beurteilung der Fachkräftenachfrage.

⁴⁶ See Swiss Confederation (2016): BFI Botschaft 2017-2020, p.3093.

⁴⁷ Although this is considered a key characteristic of UAS as opposed to conventional universities, it is certainly true that in a literal interpretation of that definition, some typical university courses should actually be taught at UAS, e.g. in medicine or economics. This illustrates that despite the fairly clear institutional identities in the Swiss HE system, tradition also shapes the system.

⁴⁸ See Lepori, Müller (2016), p. 37.

- Business graduates perform similarly well – especially with a MA degree. Since these UAS graduates are competing with university graduates, UAS focus their programmes on practical applicability, i.e. focus on competences that can immediately be used in a job.
 - Graduates of social work or health also find adequate and long-term employment, often in the public or semi-public sectors.
 - Lastly, and in contrast to the other fields, graduates of music, theatre and other art programmes are less successful in finding employment. These graduates are often working part-time, in jobs not adequate to their qualification and have lower income.
- To provide job-relevant education, in comparison to universities, UAS teachers have a more practical background than teachers at universities. This can also be seen in comparison between the HEIs (see Figure 16), were especially at UAS but also UTEs either lecturers with management responsibilities (about 20%) and “other staff” (about 80%) are responsible for teaching.
 - Research at universities of applied sciences is supposed to be applied and practically relevant and should usually be conducted in close cooperation with applying partners or interested parties⁴⁹. While in reality, at UAS there are also differences between the fields in regard to how much their research leans towards applied research, it can be said that projects are mostly undertaken with partners that are typically located in the respective region. This also means that the goal of the research is concerted with the interests of the regional economy.⁵⁰ This is even more relevant against the goal of the UAS to educate for the regional labour market.

⁴⁹ See Fachhochschulverordnung, Article 7: <https://www.admin.ch/opc/de/classified-compilation/19960463/index.html>.

⁵⁰ See Lepori, Müller (2016), p. 38.

7 Interviewees

Name	Function, organisation
Marco Scruzzi	Staatssekretariat für Bildung, Forschung und Innovation, SBFI / Hochschulen / Hochschulpolitik
Axel Marion	Swissuniversities /Hochschulrektorenkonferenz / Hochschulpolitik
Madeleine Salzmann	Schweizerische Konferenz der kantonalen Erziehungsdirektoren (EDK), Leiterin Koordinationsbereich Hochschulen
Claudia Acklin	Schweizer Wissenschaftsrat/Leitung der Geschäftsstelle
Barbara Haering	econcept AG

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⁵¹ If not stated otherwise, sources accessed on 27th of August, 2018.

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Appendix A – Tables and figures

Table 1 Number of degrees awarded by HE institutions in 2017

Degree	Universities	Universities of applied sciences	Universities of teacher education	Total
Bachelor's degrees	14,473	16,922	3,328	34,723
Master's degrees	13,981	4,367	1,225	19,537
PhD Doctorates	4,151	-		4,151

Source: BFS - STAT-TAB. Studierende und Abschlüsse der Hochschulen 2017: <https://www.bfs.admin.ch/bfs/de/home/statistiken/kataloge-datenbanken/tabellen.gnpdetail.2018-0168.html>.

Table 2 Number of students of Swiss HE institutions, 1990/91, 2000/01, 2010/11, 2017/2018

	1990/91	2000/01	2010/11	2017/18
Universities	85,940	96,673	131,494	150,672
% Women	38,8%	45,6%	50,3%	50,6%
% Students of foreign nationality	19,0%	20,0%	27,1%	30,4%
% Students with foreign study qualification	13,1%	14,5%	22,3%	25,3%
Universities of applied sciences	0	25,137	60,930	76,504
% Women	-	25,9%	44,9%	46,5%
% Students of foreign nationality	-	14,9%	18,5%	19,0%
% Students with foreign study qualification	-	8,3%	12,1%	12,4%
Universities of teacher education	0	0	14,105	20,729
% Women	-	-	76%	73%
% Students of foreign nationality	-	-	8%	10%
% Students with foreign study qualification	-	-	5%	5%
Total	85,940	121,810	206,529	247,905
% Women	39%	42%	51%	51%
% Students of foreign nationality	19%	19%	23%	25%
% Students with foreign study qualification	13%	13%	18%	20%

Source: BFS - SHIS-studex. Studierende der Hochschulen, 2017/2018: <https://www.bfs.admin.ch/bfs/de/home/statistiken/bildung-wissenschaft/personen-ausbildung.gnpdetail.2018-0164.html> and <https://www.bfs.admin.ch/bfs/de/home/statistiken/bildung-wissenschaft/personen-ausbildung/tertiaerstufe-hochschulen.html>. Numbers for universities include PhD-students as well as students in continuous education and training and others.

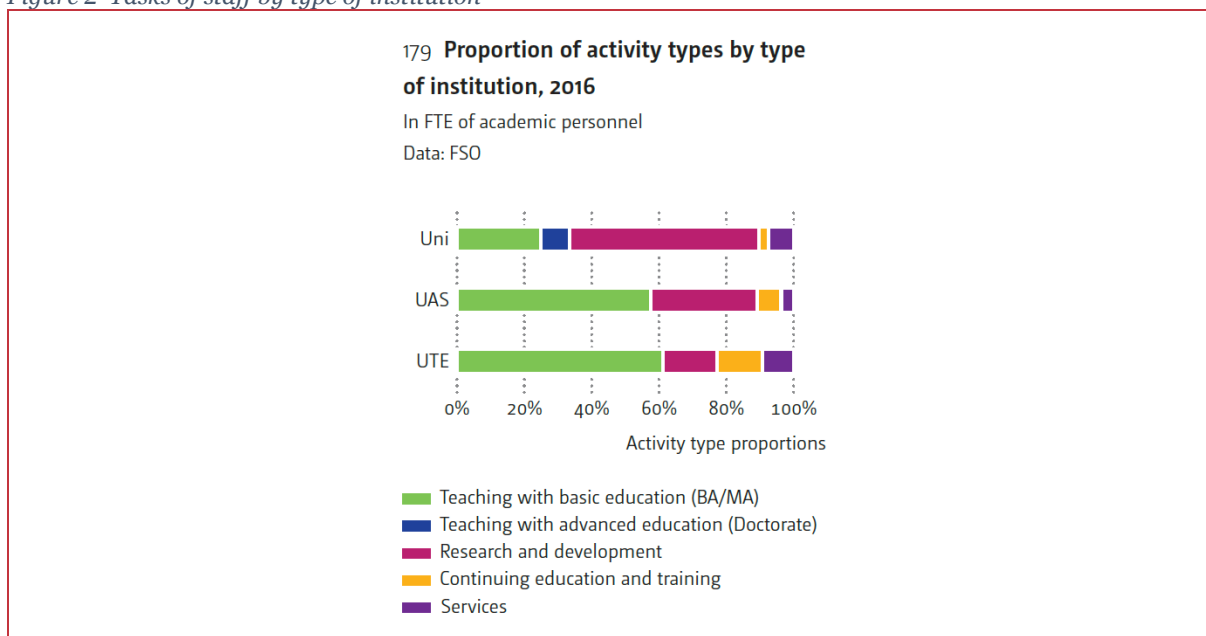
Table 3 Position of Swiss universities in international ranking lists

	EPFL	ETHZ	Basel	Bern	Fribourg	Genève	Lausanne	Neuchatel	St. Gallen	Zürich
Shanghai Ranking 2017 (Top 500)	76	19	95	101-150	401-500	60	151-200	601-700		58

	EPFL	ETHZ	Basel	Bern	Fribourg	Genève	Lausanne	Neuchatel	St. Gallen	Zürich
QS Ranking 2018 (Top 500)	12	10	149	167	501-550	98	146		372	73
Times Ranking 2018 (Top 980)	38	10	95	105	201-250	130	152	401-500	401-500	136
Leiden Ranking 2017 (Top 842)	18	20	53	176		63	83			60

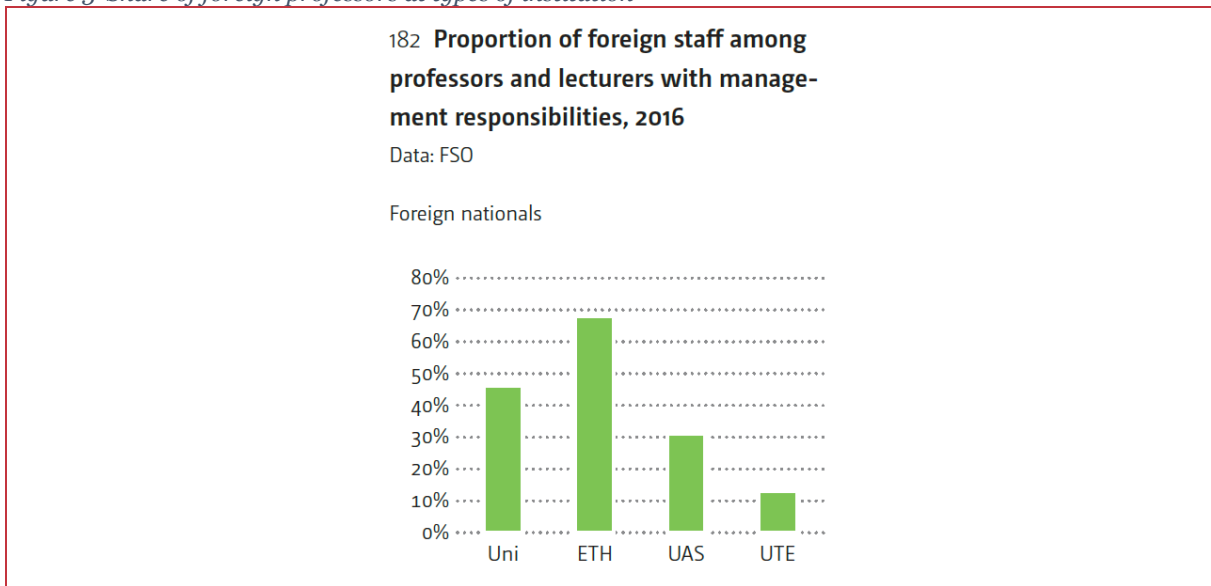
Source: Quoted from HE&R CH, p.15. Only universities which appear in at least one of the rankings are shown).

Figure 2 Tasks of staff by type of institution



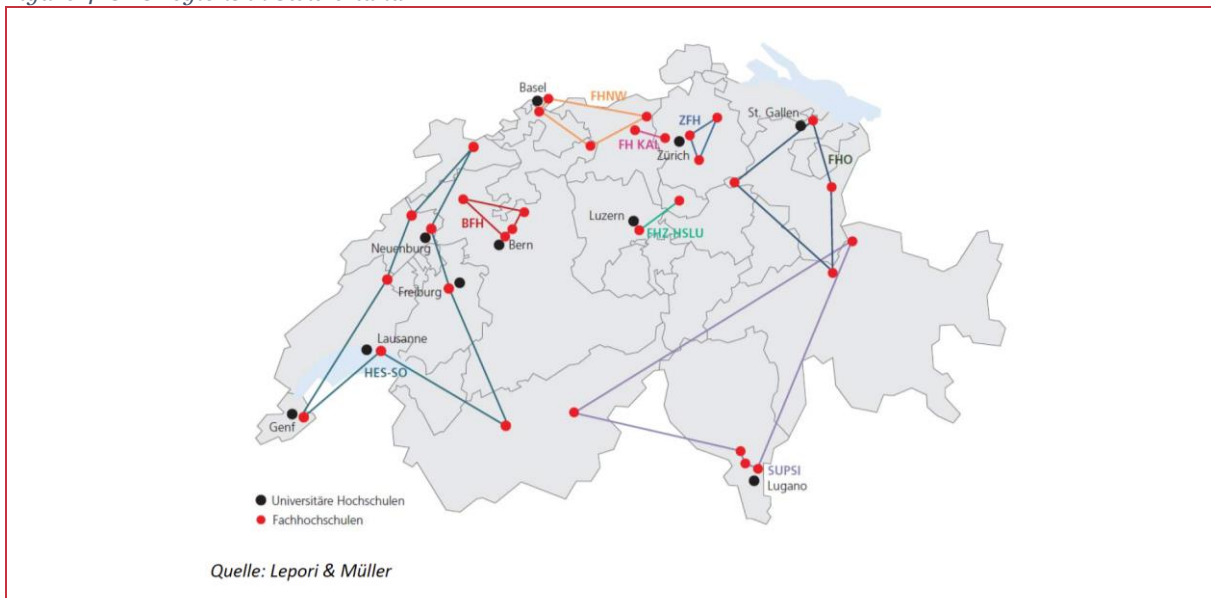
Source: Swiss Education Report 2018, p. 174.

Figure 3 Share of foreign professors at types of institution



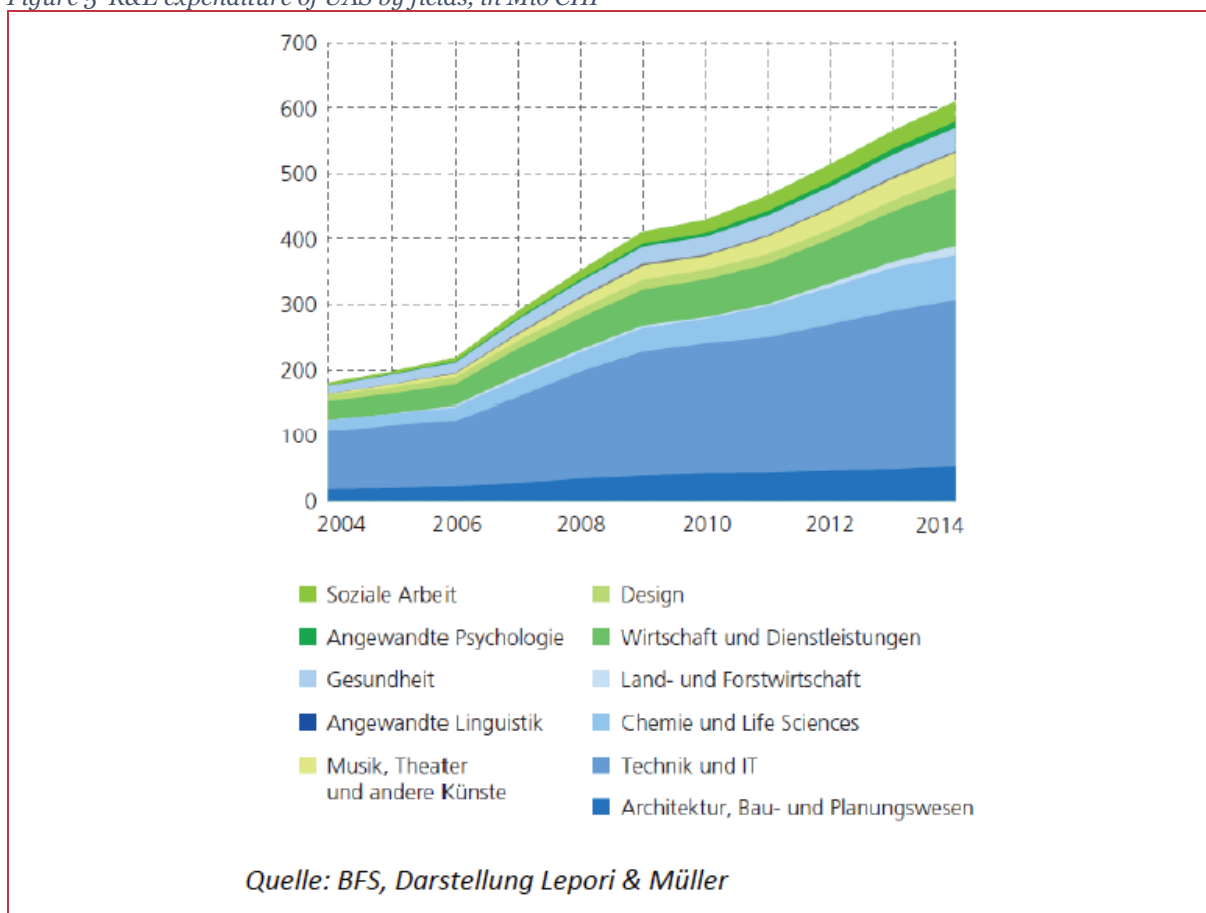
Source: Swiss Education Report 2018, p. 175.

Figure 4 UAS regions in Switzerland



Source: Lepori, Müller (2016), p. 8.

Figure 5 R&E expenditure of UAS by fields, in Mio CHF



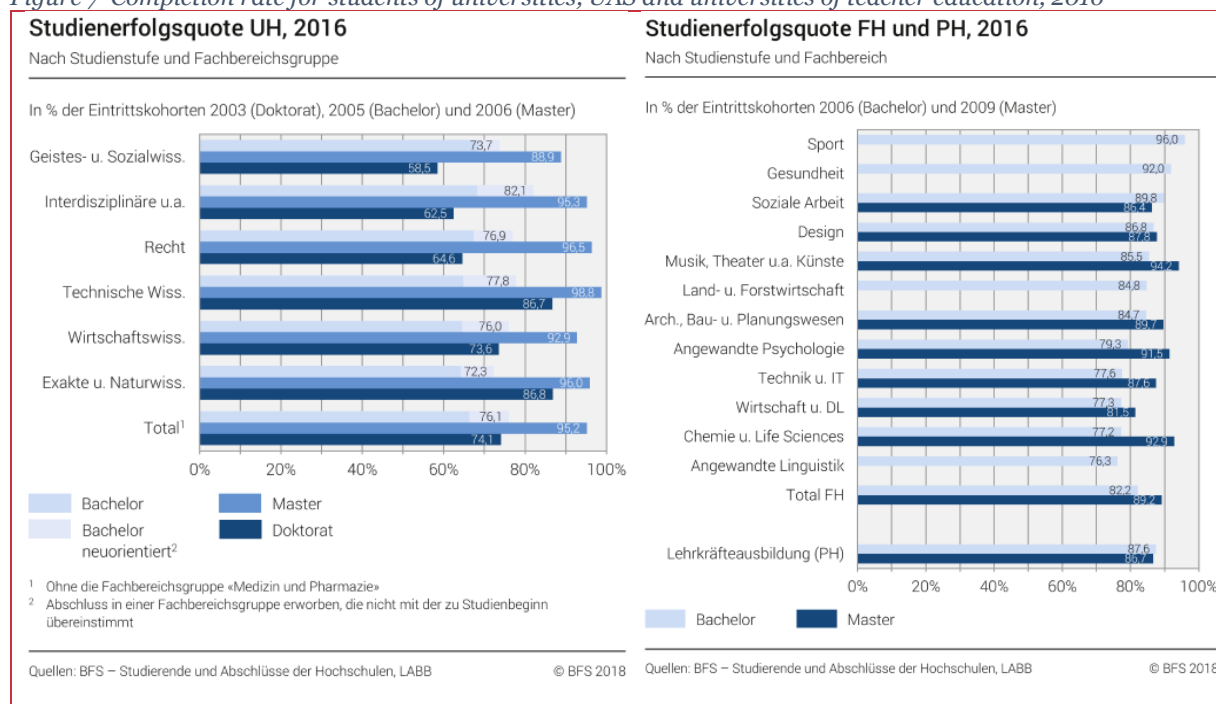
Source: Lepori, Müller (2016), p. 10.

Figure 6 Classification of the top 10 countries according to their impact in the research field (2010-2015)

Engineering, Computing and Technology	Physical, Chemical and Earth Sciences	Agriculture, Biology and Environmental Sciences	Life Sciences	Clinical Medicine	Social and Behavioural Sciences	Arts and Humanities
Singapore	Singapore	USA	USA	USA	USA	Australia
Australia	USA	Switzerland	UK	Finland	UK	UK
Switzerland	UK	UK	Switzerland	Sweden	Denmark	Netherlands
USA	Switzerland	Denmark	Finland	UK	Netherlands	USA
UK	Australia	Australia	Australia	Denmark	Switzerland	Canada
Denmark	Germany	Ireland	Singapore	Switzerland	Sweden	China
Greece	Ireland	France	Ireland	Norway	Canada	Belgium
Canada	Denmark	Norway	Germany	Canada	Norway	Germany
Belgium	Greece	Germany	Canada	Australia	Belgium	Italy
France	France	Canada	Denmark	Netherlands	Singapore	France

Source: SERI (2017): Scientific publications in Switzerland 2010-2015 – A bibliometric analysis of scientific research in Switzerland

Figure 7 Completion rate for students of universities, UAS and universities of teacher education, 2016



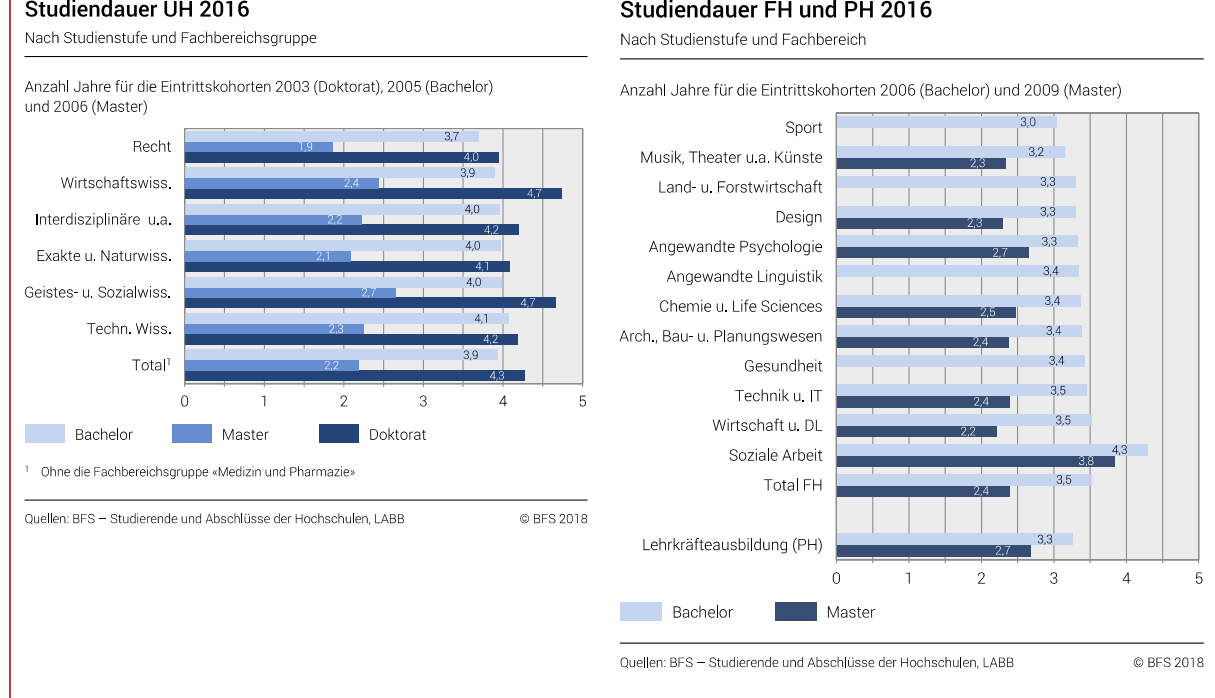
Source: Federal Statistical Office via <https://www.bfs.admin.ch/bfs/de/home/statistiken/bildungswissenschaft.assetdetail.5566556.html> and <https://www.bfs.admin.ch/bfs/de/home/statistiken/bildungswissenschaft.assetdetail.5566549.html>

Table 4 Comparison of duration of BA and MA degrees between types of HE institutions

		Duration Bachelor's Degree	Duration Master's Degree
Target	Absolute	3 years	2
	Relative	100%	100%
2016 Total Universities	Absolute	3,9 years	2,2 years
	Relative	130%	110%
2016 Total UAS	Absolute	3,5 years	2,4 years
	Relative	116%	120%

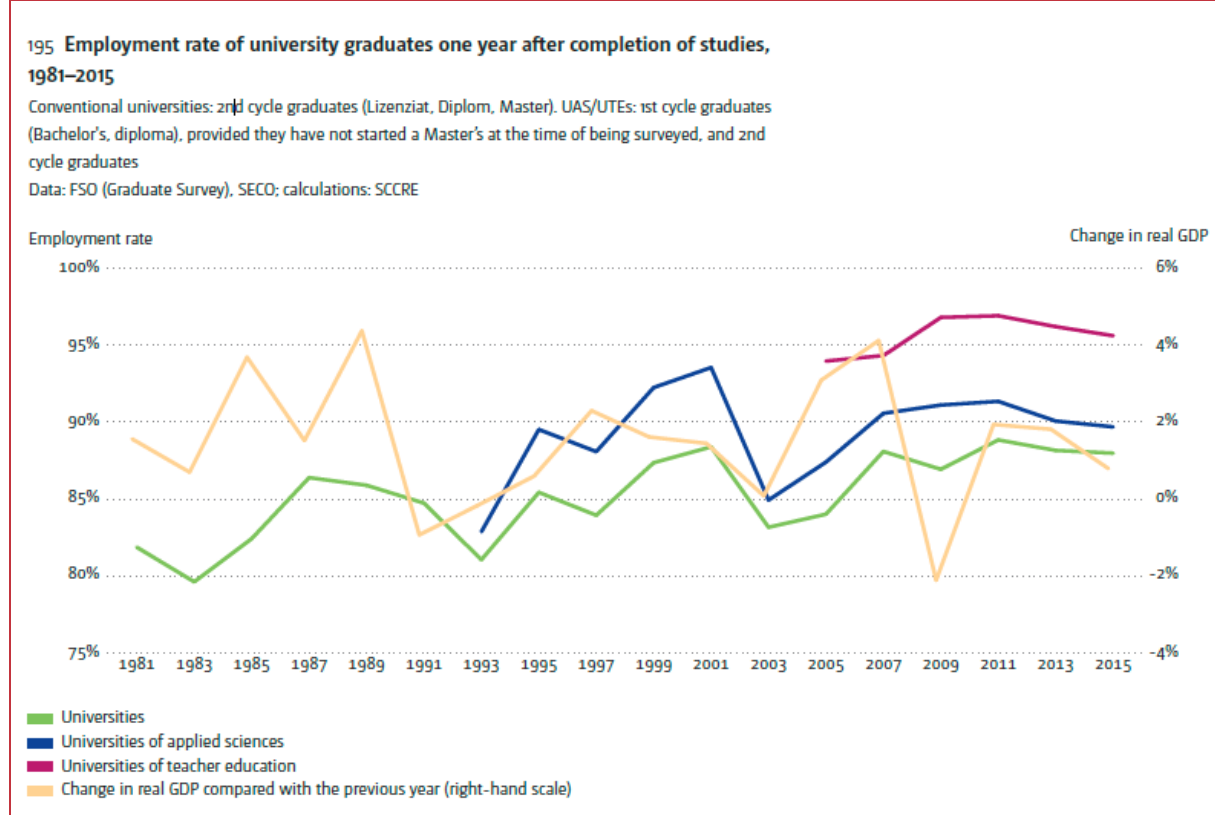
Source: Federal Statistical Office.

Figure 8 Duration of studies at universities and at UAS and universities of teacher education, 2016



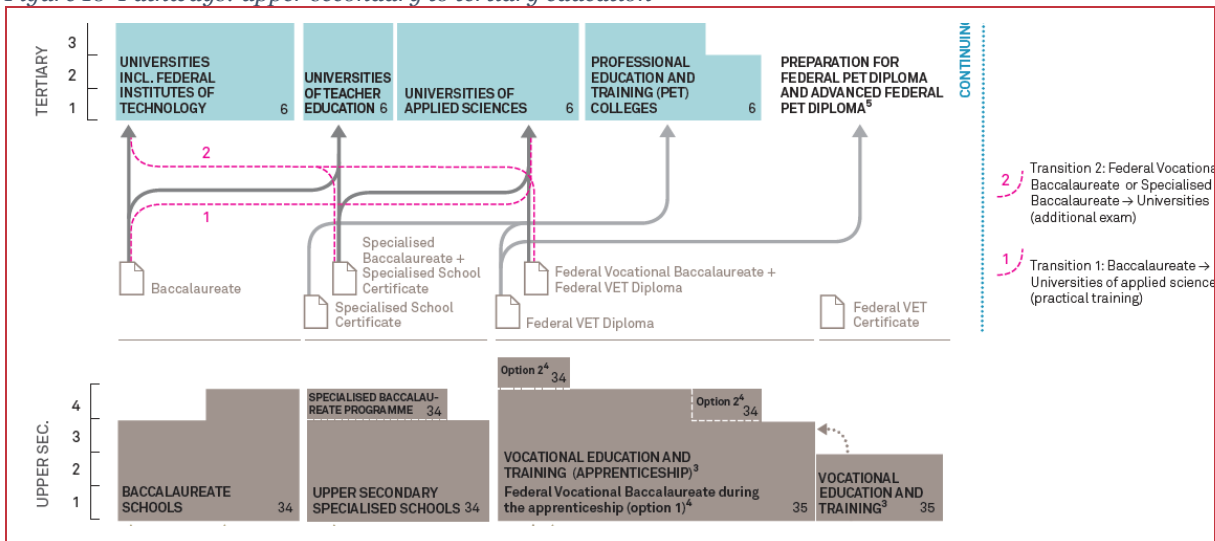
Source: Federal Statistical Office via <https://www.bfs.admin.ch/bfs/de/home/statistiken/bildungswissenschaft.assetdetail.5566558.html> and <https://www.bfs.admin.ch/bfs/de/home/statistiken/bildungswissenschaft.assetdetail.5566543.html>

Figure 9 Employment rates of university graduates, 1981-2015



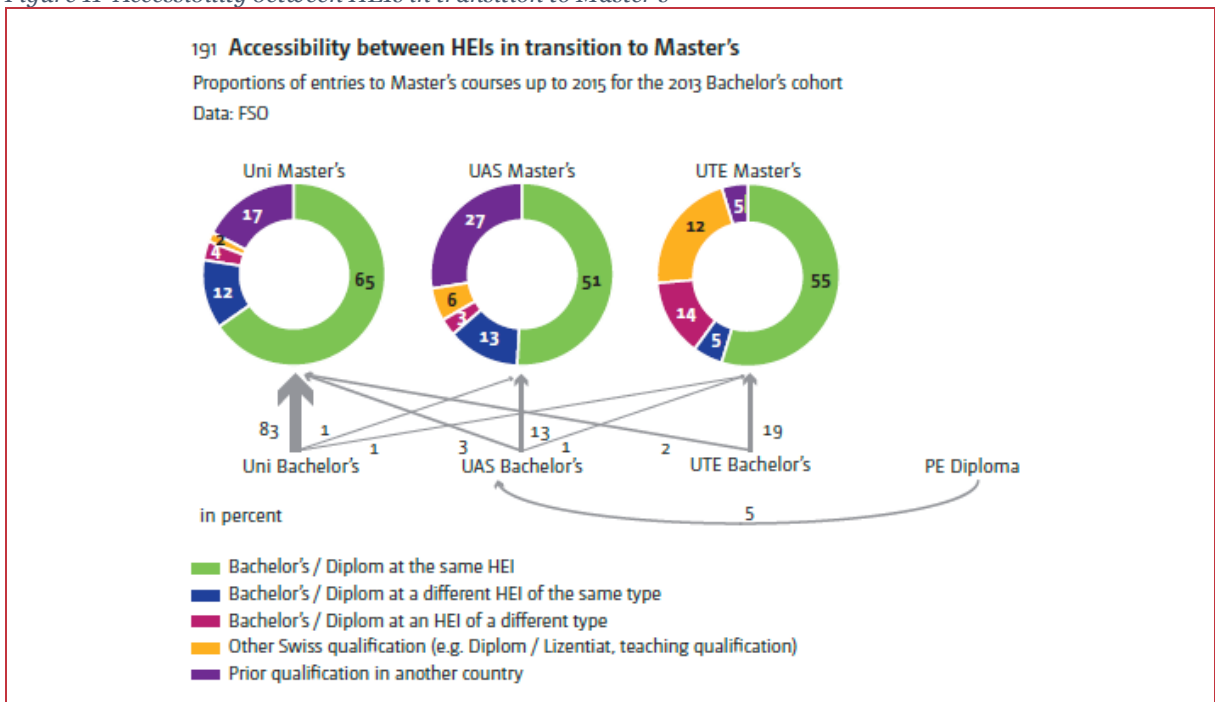
Source: Swiss Education Report 2018, p.185

Figure 10 Pathways: upper secondary to tertiary education



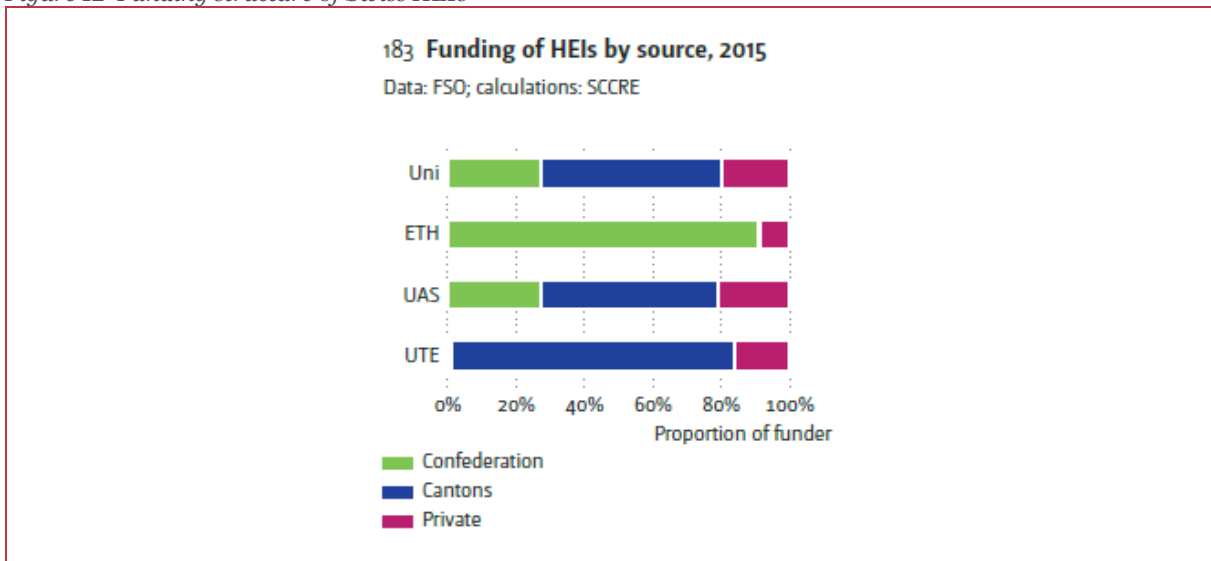
Source: Swiss Education Report 2018, p.5.

Figure 11 Accessibility between HEIs in transition to Master's



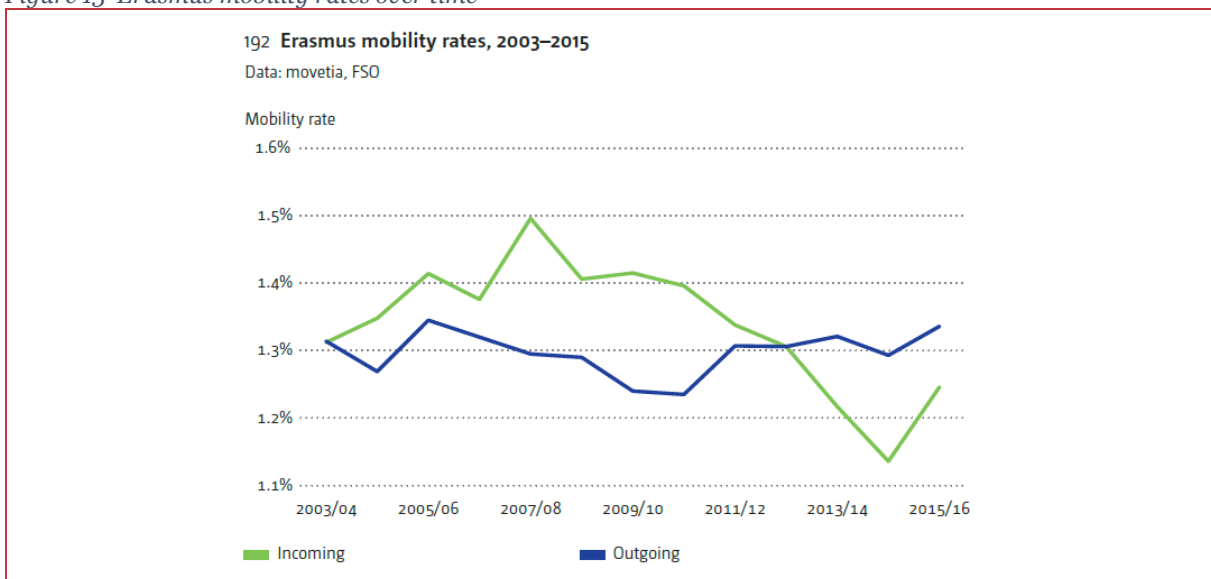
Source: Swiss Education Report 2018.

Figure 12 Funding structure of Swiss HEIs



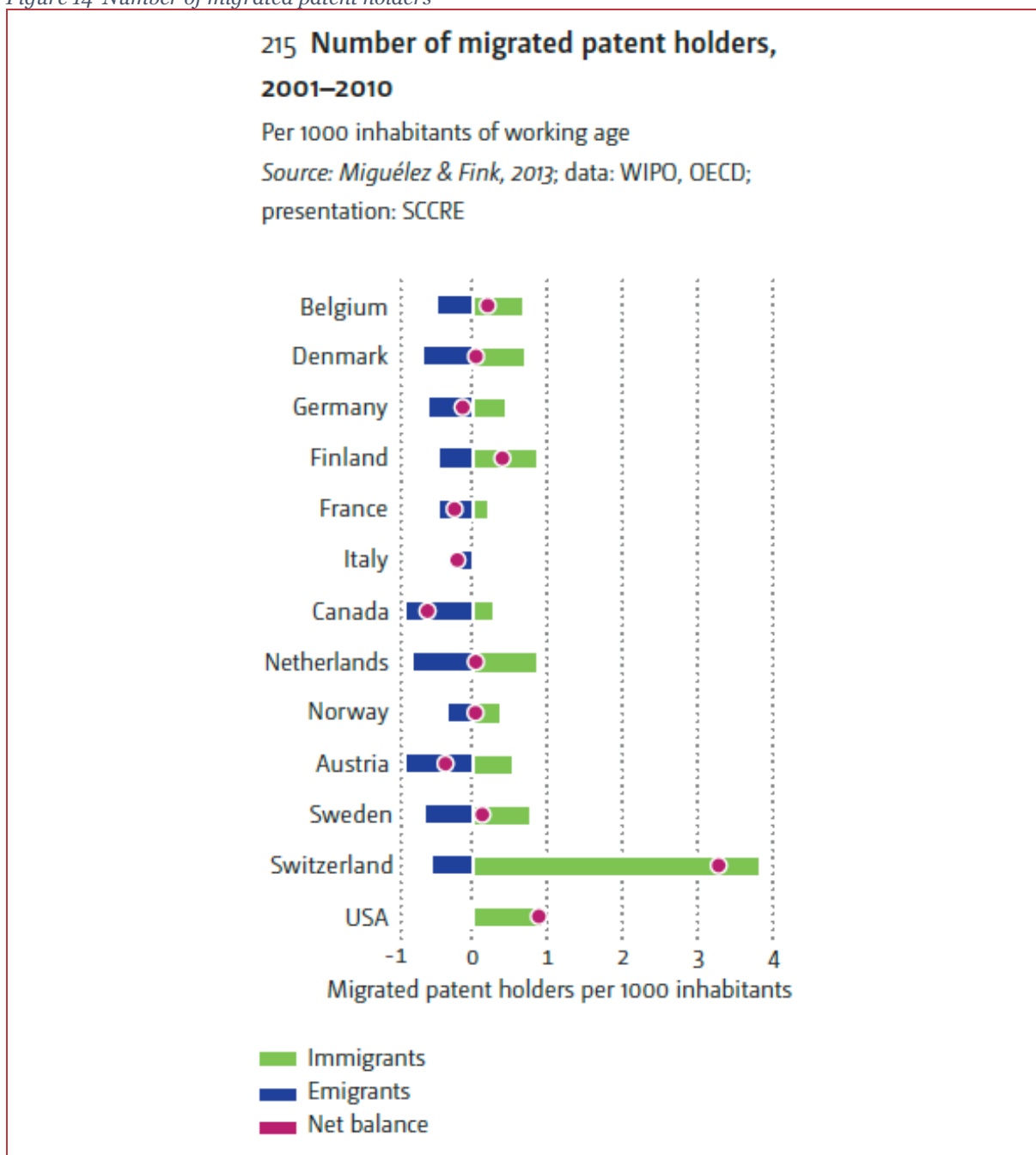
Source: Swiss Education Report 2018.

Figure 13 Erasmus mobility rates over time



Source: Swiss Education Report 2018, p.182.

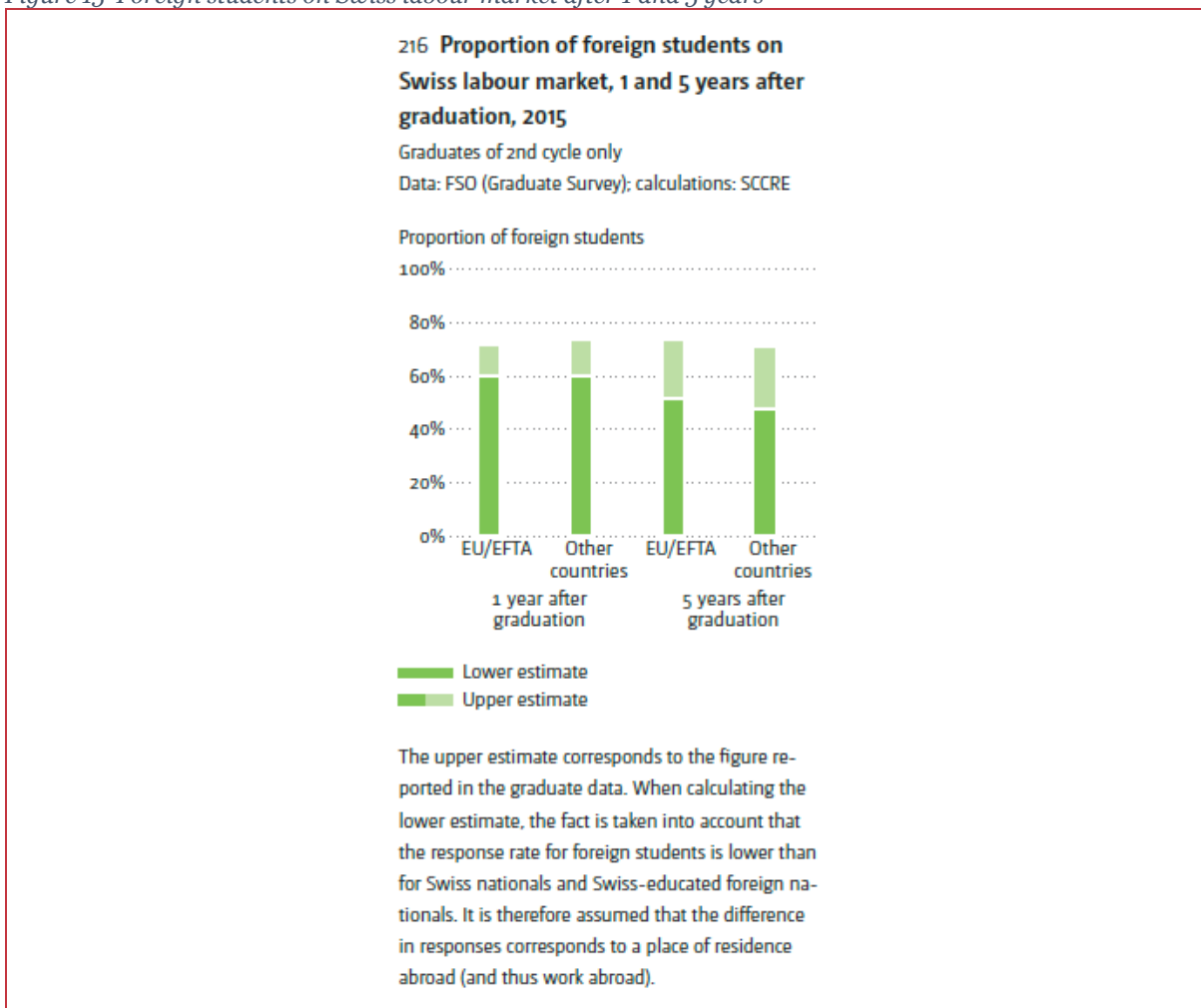
Figure 14 Number of migrated patent holders



The migrated patent holder indicator is based on data relating to patents filed with the international patent system (PCT) of the World Intellectual Property Organization (WIPO). The chart shows the number of patent applicants, the nationality of whom does not correspond to the country of residence, per 1000 inhabitants of working age (15 to 64-year-olds, as at 2010).

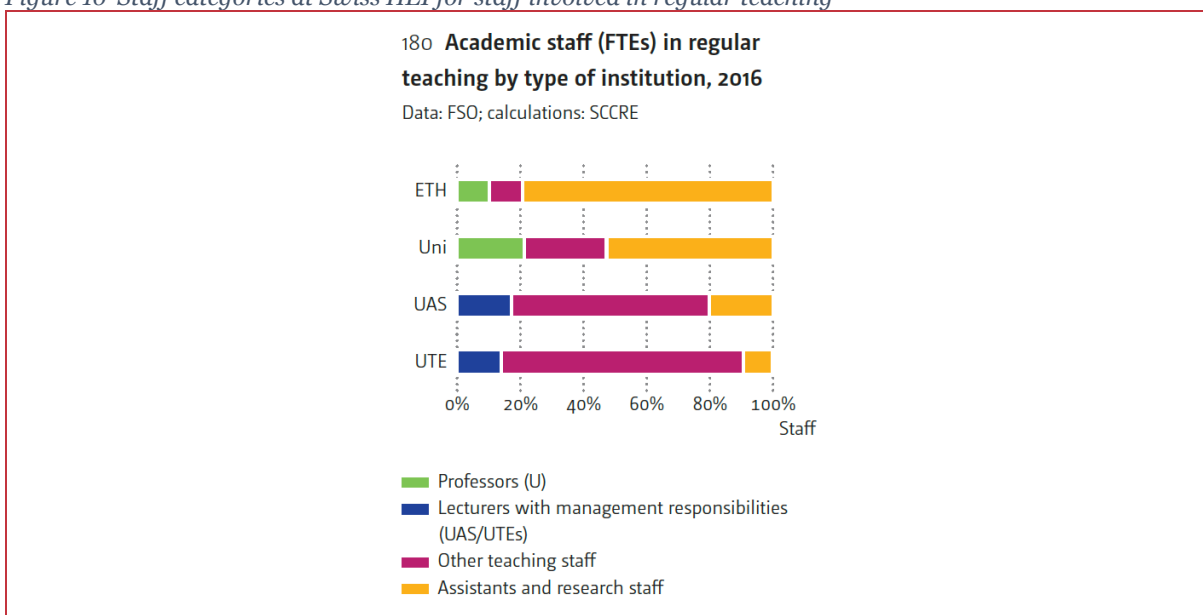
Source: Swiss Education Report 2018, p.200.

Figure 15 Foreign students on Swiss labour market after 1 and 5 years



Source: Swiss Education Report 2018, p.201.

Figure 16 Staff categories at Swiss HEI for staff involved in regular teaching



Source: Swiss Education Report 2018, p. 174.

Figure 17 Labour market situation 1 year after graduation, 2015, universities (top) and UAS (bottom)



Source: Swiss Education Report 2018, p. 209 & 232.

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