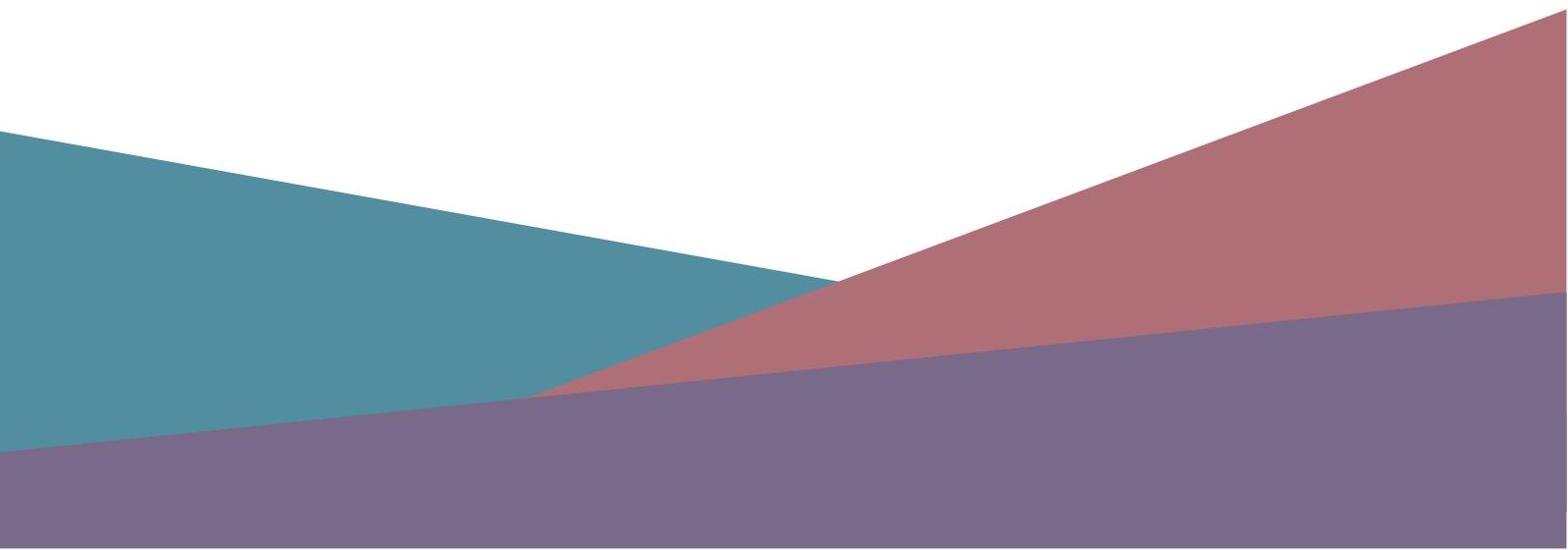


STRATEGY REGARDING THE DEVELOPMENT OF STUDENT NUMBERS IN THE ETH DOMAIN

Ensuring top-quality education in
the context of a growing student
population



Context

Engineering, IT and science experts are in very high demand on the Swiss labour market. Engineering and IT occupations ranked top in the skills shortage list in Switzerland in 2021¹ and forecasts predict that Switzerland would have to train 35,800 additional ICT professionals between 2020 and 2028 to meet the demand.² Previous studies have revealed similar trends in the demand for engineers in the long term.³ In this context, it is very positive that the ETH Domain was able to attract an increasing number of students and doctoral students in these disciplines over the past decade (+108% in ICT and +44% in Engineering Sciences over the period from 2012 to 2021). The growth of the student and doctoral student population in these fields –and to a lesser extent in Exact and Natural Sciences – is the main reason for the overall increase in student and doctoral student numbers at ETH Zurich and EPFL (+33% between 2012 and 2021⁴, see also fig. 1, p. 8). The growth of the ETH Domain student population thus reflects the high demand in Switzerland for professionals in STEM fields. Similarly, the numbers of Bachelor’s and Master’s projects as well as doctoral theses co-supervised by the four ETH Domain research institutes have increased by 36% and 8% between 2012 and 2021, respectively.⁴ The growth in the student population also reflects the national and international attractiveness of the ETH Domain, which provides a top-quality education –as mandated by the Federal Council in its Strategic Objectives for the ETH Domain⁵– and excellent professional prospects for graduates. 97.5% of ETH Zurich and EPFL graduates of 2020 were employed one year after obtaining their Master’s degree or doctorate⁶, demonstrating that they are in high demand in the labour market (see also fig. 4, p. 9).

Until now and despite this significant growth, the quality of education has been maintained (as measured by internal surveys, the employment rate of graduates⁶, institutional evaluations and accreditations and university rankings⁴). However, the growth of the student population has had a substantial impact on space and staff requirements (e.g. 122 additional professors hired between 2012 and 2021; +15.9% in headcount). The gap between the increase in student numbers and professor numbers has driven up the number of students per professor and other staff involved in supervision. Furthermore, the increase in federal funding for the ETH Domain is not commensurate with the growth in the student and doctoral population. The measures aimed at compensating for this discrepancy are limited. They include a higher teaching load within ETH Zurich and EPFL, a wider distribution of the teaching assignments, involving other staff members in teaching as well as external lecturers, the introduction of new tools in education and administration and, finally, use of the infrastructure capacity margin that had been planned in the past. The involvement of the research institutes (PSI, WSL, Empa, Eawag) in teaching and training has been essential for ensuring high-quality education and supervision. In this context, it is also worth noting that education in engineering, exact and natural sciences and medicine – disciplines taught in the ETH Domain – are more costly as compared to other fields.

¹ [Swiss Skills Shortage 2021](#)

² [ICT-Fachkräftesituation: Bedarfprognose 2028](#)

³ [Die Fachkräftesituation bei Ingenieurinnen und Ingenieuren, 2017, economiestudien](#)

⁴ [Annual Report of the ETH Board on the ETH Domain 2021](#)

⁵ [Strategic Objectives of the Federal Council for the ETH Domain 2021-2024 \(D/E\)](#)

⁶ [FSO Graduate Survey \(EHA\); results \(D/E\)](#)

The student and doctoral student population is expected to continue growing; ETH Zurich and EPFL remain very attractive in Switzerland and abroad as they offer an education of very high quality and in fields that are in high demand on the labour market. Furthermore, according to the FSO⁷, the number of Swiss Matura graduates will increase in the coming years. In concrete terms, ETH Zurich and EPFL estimate a growth of around 3.5% of Bachelor and Master students per year in the period 2025–2028.⁸ While educating an increasing number of students is coherent with the effort of counteracting the shortage of skilled employees, it puts great pressure on an ETH Domain that is confined within the current budgetary limits. Consequently, continuous growth in the student population could in the long run jeopardise the quality of education (e.g. due to lack of capacity and infrastructure, or less support for students). The ETH Board has thus developed the present strategy together with the ETH Domain institutions to provide guidance and propose measures to mitigate the risks that an increase in student numbers may pose to the quality of education in the long term.

Only by continuing to attract talented students domestically and from abroad will Switzerland be able to effectively counteract the shortage of experts. Surveys from the FSO⁹ show that more than 69% of foreign-educated foreign Master's and doctoral students from ETH Zurich or EPFL were residing in Switzerland one year after their graduation (2020 graduates cohort; see also fig. 5, p. 9). Even though these numbers must be viewed with caution (i.e. surveys may reach graduates living in Switzerland more effectively than other groups, and thus overrepresent them), they show that a large number of these graduates actively contribute to Switzerland's economy and society after their studies, and that they are indeed sought-after in the Swiss labour market.

The ETH Domain does not see it as necessary to specifically manage or regulate the numbers of doctoral students since this mainly depends on the development of the numbers of professorships and high-level senior scientific staff, access to laboratories, equipment and space, and their success in acquiring third-party funding. Therefore, while all ETH Domain institutions are strongly committed to the highest standards of supervision of their doctoral students, the present strategy is not focusing on them.

The strategy is based on a set of guiding principles agreed upon by the ETH Domain (see below) and aims to fulfil the Strategic Objectives set by the Federal Council for the period 2021–2024¹⁰. While the development of the student population concerns the entire ETH Domain, the individual ETH Domain institutions – given the autonomy granted to them – take the actions that best match their respective situations and plans for strategic development. To this end, they develop solutions and implement measures along the three fields of action described in the present overarching Strategy.

⁷ [FSO Scenarios for upper secondary level – Students and qualifications](#)

⁸ [Strategic Plan 2025–2028 of the ETH Board for the ETH Domain](#)

⁹ [FSO Graduate Survey \(EHA\); results \(D/F\)](#)

¹⁰ [Strategic Objectives of the Federal Council for the ETH Domain 2021–2024 \(D/F\)](#)

Guiding Principles

The ETH Domain has agreed on **a set of guiding principles** to elaborate the present Strategy. The first priority of the ETH Domain is to **maintain an excellent quality of education** when measured internationally, and to **educate future experts** in disciplines that are vital to Switzerland's society and economy. Bearing that goal in mind, the education of Swiss-resident and Swiss-educated students is a key priority. In view of its substantial contribution to alleviating the shortage of experts in technical, engineering and related fields in Switzerland, the ETH Domain, as part of the public higher education system, has no intrinsic motivation to limit the numbers of students that it admits. According to the needs of the Swiss labour market, **access to international students is also essential** for ensuring that sufficient experts are educated to respond to Switzerland's long-term needs. Providing an education in an international environment benefits all students. The estimated increase in the numbers of Bachelor and Master students both from Switzerland and abroad continues to **require favourable framework conditions**, including sufficient human resources and infrastructure. **Limits on student admissions should be considered only as a last resort**, and only if the quality of education cannot otherwise be maintained.

Requirements and challenges

- The expected growth in student numbers plus the developments in teaching and research are boosting demand for human resources, space, infrastructure and support resources that may be difficult to meet in the medium to long term, especially if there is only a limited increase in the budget. Moreover, modern educational techniques require more resources than they save, as discussed later in this section. In light of these developments, fulfilling the strategic objective set by the Federal Council for the ETH Domain in terms of maintaining a stable student/ professor ratio is difficult. The resulting deficit can only be partially compensated by organisational measures, adaptation of teaching methods, and flexibility of real estate and workspace use.
- Ensuring excellence in education requires an understanding of the elements that influence the quality of education as well as regular assessments. Moreover, capacity thresholds in education, whether they relate to space, infrastructure, supervision or funding, must be clearly identified. Only then can the institutions develop a reliable early warning system and make adjustments as soon as necessary.
- Digitalisation and online courses offer some potential for optimising space capacity, partially making up for the increasing numbers of students per faculty. However, these solutions have their limits as they are not applicable to all programmes – especially those relying heavily on practical and experimental work – or to all examination processes. While hybrid solutions should continue to be explored, recent experiences – especially from the coronavirus pandemic – suggest that wholly online courses adversely affect student and teaching staff satisfaction and may impact the quality of education.
- ETH Domain institutions are committed to innovation in education. This includes the use of digital tools, but also more interdisciplinary, hands-on and interactive

approaches to teaching, such as project-based learning, peer teaching and flipped classrooms. However, innovation in education requires more time investment from supervisors, and possibly more funding, as well as flexibility in the use of real estate and workspace.

- Access to international students is critical for satisfying the expected demand for specialists in Switzerland and for fostering diversity at all levels. Enabling and encouraging students educated in Switzerland to remain here after their studies, independently of their origin, is vital if Switzerland is to benefit fully from the investment in their education.
- The attractiveness of the ETH Domain institutions also depends on infrastructure and resources that are not directly linked to education and research (such as affordable and accessible housing, social stipends, individual support, etc.). These elements, too, should be taken into account when considering education quality and accessibility.
- Solutions can only be found and implemented if stakeholders within the institutions have a common understanding of the issues at stake and are aware of the existing framework conditions, especially the challenges linked to the different rates of growth in the student population and federal funding.

Strategic approaches and measures

The strategic approaches and measures presented in the current strategy can be divided into three fields of action.

1. Identification and definition of quality and capacity thresholds
2. Implementation of measures to ensure quality and capacity in the long term
3. Limits on student admissions as last resort

1. Identification and definition of quality and capacity thresholds

- 1.1. ETH Zurich and EPFL evaluate the indicators and criteria used to assess the quality of education and implement additional ones if necessary. This includes the employability of graduates (outside and inside academia) and their satisfaction. Special attention is given to digital teaching offers and examinations. Indicators are monitored on a regular basis and results are communicated through existing institutional reporting systems. These feed back into the institutions' strategies.
- 1.2. ETH Zurich and EPFL determine capacity thresholds for their own institution (in terms of space, infrastructure and teaching staff). These thresholds can be specific to each study programme and level (Bachelor and Master).
- 1.3. The institutional accreditations of ETH Zurich and EPFL continue to play a major role in ensuring that the quality assurance systems at both institutions remain adequate. The responses of the institutions' governing bodies to the experts' recommendations are implemented promptly and appropriately. The regular evaluations of the institutions' units (departments for ETH Zurich, schools for

EPFL, research divisions for PSI and the institutions as a whole for Empa, WSL and Eawag) also address the topic of education.

2. Implementation of measures to ensure capacity and quality in the long term

- 2.1. The ETH Domain and its institutions give the highest priority to research-based teaching in their strategic development. Prioritisation of teaching requires a strong engagement by faculty and scientific staff, whose teaching activities should be incentivised and supported professionally. Institutions are also encouraged to reserve sufficient resources for education and the expansion of teaching capacity. Cooperation and coordination between ETH Zurich and EPFL and the research institutes should enable existing resources to be used most effectively to accommodate increased demand for teaching capacity.
- 2.2. ETH Zurich and EPFL each commit to implement measures to manage the student population growth and to integrate the growing student numbers into higher education planning while upholding quality in education. Management of the student population's growth is incorporated in the overall strategies and development plans of each institution and is ultimately reflected in the overall spatial and financial management concepts. ETH Zurich and EPFL will confer on successful measures and share best practices.
- 2.3. ETH Zurich and EPFL will continue to implement measures to ensure excellence in education – to be highly competitive nationally and internationally as educational institutions and to enable students to be successful in their studies. This includes:
 - **Advocating a strong Swiss Matura.** The ETH Board and the ETH Domain institutions are committed to the principle of maintaining open access to all holders of the Swiss Matura. Together with swissuniversities, they continue to advocate a strong and comparable Matura in all Swiss cantons so that students have a solid basis for succeeding in their studies. The ETH Board will use the political, legal and communication tools at its disposal to that end.
 - **Managing expectations and providing education support for prospective students.** ETH Zurich and EPFL will continue to inform prospective students about study requirements, address their expectations and offer them additional educational support to strengthen the competencies required for successful studies and graduation, e.g. the “Brückenkurs” at ETH Zurich and the “CMS” (preparatory year) and “MAN” (preparation for successful completion of first year) at EPFL. The ETH Domain institutions continue to be active in outreach activities addressed to a younger public and prospective students.
 - **Advocating internationality.** Access to international students is not only important to counteract the shortage of experts in technical, engineering and related fields in Switzerland, it also allows the student population to be diverse, which is recognised as being key to excellence both in education and research. Furthermore, international students who leave Switzerland

after their studies are important ambassadors for Switzerland. The institutions of the ETH Domain offer a variety of measures to facilitate the best possible integration of international graduates into university life and later into the Swiss labour market (such as mentoring and coaching offers, scholarship programmes or language courses and housing). In addition, the ETH Board advocates good framework conditions at the political level.

- **Ensuring good teaching, mentoring and supervision skills of lecturers and supervisors.** All institutions strongly advise their lecturers and supervisors to develop their teaching, mentoring, supervision and management skills, especially by taking up the training opportunities offered by the institutions. All the teaching staff linked to professorships (“Mittelbau”/corps intermédiaire, including doctoral students and postdoctoral researchers, teaching assistants in the case of ETH Zurich and MER at EPFL) are key to ensuring teaching quality. Recognising the contribution of researchers and scientists to teaching in performance and promotion assessments is considered as an incentive to reach this objective.
- **Ensuring that students are well equipped to meet the requirements of the scientific world, the economy and society.** The institutions take into account the aspects of interdisciplinarity, critical thinking, sustainability, ethics, digitalisation, computational thinking and self-organisational skills while developing their curricula. They foster entrepreneurship among their students and provide them with the skills required to become the main actors of knowledge and know-how transfer between academia and society. Additional external teaching expertise (e.g., professors of practice) is explored, beyond the already well-established external lecturers.

2.4. ETH Zurich and EPFL seek to exploit and value their resources optimally, pursuing synergies between units and other institutions (in terms of infrastructure and human resources).

- This includes collaborations and co-appointments with PSI, WSL, Empa and Eawag, as well as with other public and private partners. This objective requires an appropriate recognition of the contribution of adjunct faculty to teaching and standardisation of the conditions for their engagement.
- ETH Zurich and EPFL also make use of internal staff potential by involving more senior staff, postdoctoral researchers and Master’s and doctoral students in teaching and supervision. However, caution should be taken to avoid overloading the intermediate-level staff with teaching activities, especially doctoral students and postdoctoral fellows.
- The institutions take advantage of the possibilities offered by digitalisation and innovation to increase the capacity of study programmes wherever possible and relevant.

2.5. ETH Zurich and EPFL hire additional professors to the extent allowed by the federal contributions received in order to ensure continuity in teaching and thus to keep up with the intense international competition and the increase in student numbers. The consequent pressure on space and infrastructure is taken into account in the institutions’ financial and professorship planning.

2.6. The ETH Domain institutions use the overall spatial and financial concepts (“Räumliche und finanzielle Gesamtkonzepte”, RFGK; “Schémas généraux des espaces et du financement”, SGEF) to efficiently plan their infrastructure in the long term. Feedback loops between projected student and faculty numbers and overall management of space and finances are essential and must be a focus for the institutions’ individual strategies.

3. Limits on student admissions as last resort

The ETH Domain is first and foremost committed to fulfilling its mandate under the ETH Act to educate students in scientific and technical fields. In this context, limits on student admissions may seriously compromise the efforts made by the ETH Domain institutions to counteract the shortage of experts needed for Switzerland’s society, economy and administration, as well as their efforts to attract more women.

In this context, limits on student admissions should only be considered if the quality of education cannot be ensured because capacity thresholds are exceeded, and only once all other options have been exhausted (see Field of action 2). They can be applied to the specific study levels or fields of study or to the total number of study places available. Processes leading to the imposition of limits need to be carefully thought out, with due consideration of all possible legal and political consequences. Limiting the admission of students requires selection procedures before the actual start of the study programme and may deter some applicants from proving their abilities in the study programme.

According to Article 16a of the ETH Act (revision of 2017), the admission of students with higher education entry qualifications from abroad may be limited if capacity problems exist (e.g. if infrastructure is insufficient to absorb the growth in student numbers). This does not apply to students with a Swiss Matura or another appropriate Swiss qualification.

Requests for admission restrictions from ETH Zurich or EPFL can be submitted to the ETH Board only in accordance with the current legal framework (nationally and internationally), should also be clearly substantiated (for example in the case of limited potential for infrastructure expansion or compromised financial sustainability) and be agreed and coordinated between the two institutions. If limits have to be applied to a specific field or the whole institution, all stakeholders must be involved in the discussion, including partners in tertiary education. The institutions would then submit a request to the ETH Board, which (as per Art. 16a) is ultimately responsible for the necessary decisions.

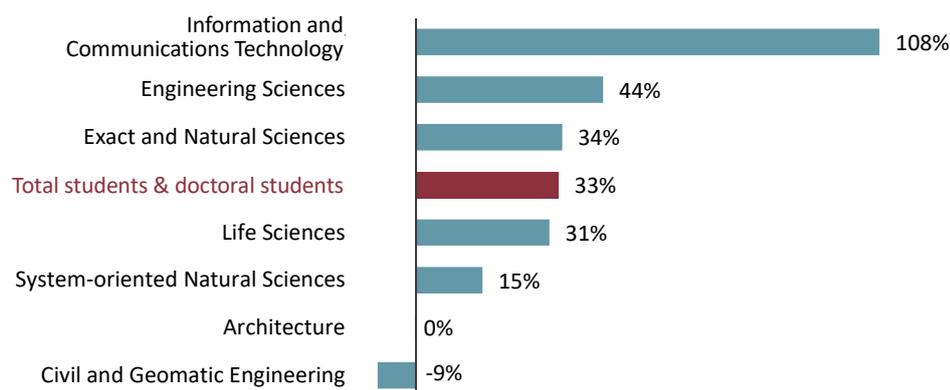
The ETH Board regularly assesses the current legal framework to ensure that it supports the ETH Domain in managing the student/doctoral student population.

Figures

Fig. 1: Student and doctoral student numbers in 2012 and 2021*

| | 2012 | 2021 |
|---|---------------|---------------|
| Total students and doctoral students | 27,087 | 36,110 |
| Engineering Sciences | 6,816 | 9,795 |
| Exact and Natural Sciences | 4,780 | 6,412 |
| Information and Communications Technology | 2,367 | 4,929 |
| Life Sciences | 3,708 | 4,864 |
| Architecture | 3,177 | 3,169 |
| Civil and Geomatic Engineering | 2,900 | 2,641 |
| System-oriented Natural Sciences | 2,201 | 2,542 |
| Management, Technology, Economics | 870 | 962 |
| Humanities, Social and Political Sciences | 268 | 485 |
| Human Medicine | - | 311 |

Fig. 2: Student and doctoral student growth between 2012 and 2021*



* The numbers of students and doctoral students included visiting students (incoming) in 2012 but not in 2021 (around 1000 in total) due to a change in the definition of the indicator as of 2021. Figure 1 includes all the disciplines offered at ETH Zurich and EPFL, while only the disciplines with more than 1000 students/ doctoral students are taken into account for figure 2.

Fig. 3: Skills shortage ranking in Switzerland in 2021

| Rank | Occupations affected by skills shortage |
|------|--|
| 1 | Engineering occupations |
| 2 | IT occupations |
| 3 | Technicians |
| 4 | Medicine and pharmaceuticals occupations |
| 5 | Trust business occupations |
| 6 | Technical specialists |
| 7 | Technical draughting jobs |

Fig. 4 Employment rate of ETH Zurich and EPFL graduates by degree level (one year after graduation)

| Graduation year | 2012 | 2014 | 2016 | 2018 | 2020* |
|------------------|-------|-------|-------|-------|-------|
| Master | 93.7% | 95.7% | 94.8% | 95.5% | 97.3% |
| Doctorate | 96.1% | 95.6% | 94.8% | 95.5% | 98.3% |

* Survey questions were revised in 2020. This must be taken into account when comparing previous years.

Fig. 5: Proportion of graduates of ETH Zurich and EPFL residing in Switzerland after graduation, by degree level

| Graduation year | | 2012 | 2014 | 2016 | 2018 | 2020 |
|------------------|--|-------|-------|-------|-------|-------|
| Master | Swiss and Swiss-educated foreign nationals | 93.8% | 93.8% | 92.6% | 94.1% | 94.6% |
| | Foreign-educated foreign nationals | 70.0% | 68.9% | 68.6% | 65.8% | 68.7% |
| Doctorate | Swiss and Swiss-educated foreign nationals | 81.9% | 87.9% | 83.7% | 85.0% | 86.8% |
| | Foreign-educated foreign nationals | 65.9% | 68.0% | 68.6% | 64.4% | 69.8% |

Sources: – Annual report of the ETH Board for the ETH Domain 2021
 – Swiss Skills Shortage Index 2021
 – Federal Statistical Office, Graduate Survey (Information: absolventen@bfs.amin.ch)

Acknowledgements to the working Group:

Wendy Altherr (ETH Zurich)

Isabelle Cahour (EPFL)

Ines Günther (PSI)

Catherine Brun (ETH Board staff)

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ETH Board

Board of the Swiss Federal Institutes of Technology

Zurich:

Händeliweg 15
8092 Zurich

Bern:

Hirschengraben 3
3011 Bern

www.ethboard.ch