1848–1855: Polytechnical Realization of an Old Dream

On February 7, 1854 the federal councilors enacted the law on the “federal polytechnical school in association with a school for higher education in the exact, political and humanistic sciences”. In autumn 1855, the Polytechnic opened its doors.

The vision of the national educational establishment has its roots in the 18th century.

The constitutional law was a new beginning but it also marked the conclusion of a lengthy debate. Back in the 18th century, enlightened thinkers such as Isaak Iselin had nurtured patriotic dreams of higher education for their fellow-countrymen. During the Helvetic Republic, around 1800, Minister Philipp Albert Stapfer drew up the concept of a university for the whole of Switzerland. The founding of the Federal State in 1848 gave fresh impulse to these ideas. In its second session, the new Parliament argued at great length about whether there should be a national university alongside the existing cantonal ones. Higher education thus became an issue in the difficult relations between cantonal authorities and the Federal State.
Several committees of experts tackled the question but it took years of negotiations before a solution was found. The bill was an extremely controversial one because of Switzerland being a multilingual country. Furthermore, the Catholic and the rural cantons wanted to avoid a cultural dictatorship on the part of the Protestant urban centres of Geneva, Berne, Basle and Zurich, who in turn were worried about the competition from a national university as they already ran their own cantonal ones. The project only managed to secure a majority when it was altered to focus on technical subjects.
So the founding of the Polytechnic in 1854 can undoubtedly be described as the political realization of the old Helvetic dream of a national university. Dispensing with the classical range of subjects of a university was not simply the essential prerequisite for getting the project off the ground. It also tuned in with the mood of the modern era of technology and industry. The federal polytechnic was intended to generate the knowledge required to build up a national infrastructure for the future. It was also intended to provide an unequalled range of courses that would make the national elite more professional and improve their career opportunities.

The major debate on the founding of the Polytechnic had three immediate effects: Firstly it organised the project in such a way that it retained traditional features thus ensuring that the somewhat unpretentious polytechnical institute had the reputation of being a university before it even opened its doors. Secondly, the relatively narrow institutional framework between foreign role models, cantonal guidelines, professional aspirations and the claims of industry and trade within which the founding of the school had to take place was studied in great depth. Thirdly, the debate laid down a syllabus, which was so well adapted to all sorts of federalistic constraints, that the training of engineers at the Polytechnic could finally become a reality.

Some dates

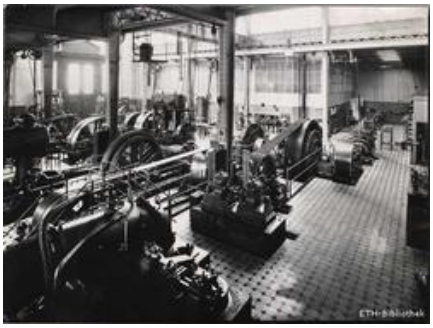
1848	Founding of the Swiss Federal State
1851	Setting up of a commission under federal councillor Stefano Franscini
1854	February 7: Law on the founding of a “federal polytechnical school in association with a school for the advanced study of the exact, political and humanistic sciences”
1855	October 16: Classes begin in various premises in the city of Zurich

1855–1904: Between School, Factory and Laboratory

After the stormy debate on the founding, the new institution entered on a stable era of consolidation. By the turn of the century, it had found its place in the political and economic landscape of Switzerland, pledging to build up and sustain forward-looking national infrastructures.

Plan of the completed Chemistry building, with well-equipped workplaces for students.

The Polytechnic acquired and secured knowledge, placing it at the disposal of a wide variety of objectives. It was a matter of carefully weighing the requirements of the running of the school, the needs of industry and the growing interest in research. Teaching the body of theoretical knowledge and instructing the students in practical questions were two goals which proved difficult to combine.
Syllabuses had to be worked out, professors brought in and students recruited. In its early years, the Polytechnic benefited from the repressive atmosphere prevailing in Polytechnic schools in other European countries. Attracted by the newly appointed professors, including such renowned figures as Kinkel, de Sanctis, Vischer, Cherbuliez, Clausius, Culmann, Reuleaux and Semper, students came to Zurich from all over Europe.
However, the establishing of norms and standards took quite a long time. For example, in 1879, the diploma, which could have documented the fulfilling of a norm, was acquired by barely one third of the students.



Not a factory but a classroom and research place. The mechanical engineering laboratory around 1913.

What was the focal point to be in the working out of the syllabuses? Technical drawing, measuring, mathematics or the practical matters of industrial production? The generating, securing and, not least, the applicability of the knowledge at the Polytechnic all depended on how these questions were answered.

Teachers such as Reuleaux had some success in formalizing the practical construction activity which they saw in industry. When the laboratories were rebuilt in the 1880s and 1890s, an attempt was made, in the interests of better teaching, to deepen this fund of theoretical knowledge in scientific experimentation. At the same time, it was important to make abstract forms of knowledge adaptable to industrial practice. The construction programme in the first stage of the history of the Poly bears testimony to this balancing act between school, factory and laboratory.

Some dates

1864	Occupation of the main building designed by Gottfried Semper
1866	Introduction of the course of study for teachers of mathematics and natural sciences
1869	Founding of the society of former Polytechnic students (GEP)
1871	Founding of the department for agriculture
1878	Introduction of military sciences
1880	Opening of the Federal Institute for the Testing of Building Materials (later known as EMPA) as an annex of the Polytechnic
1886	Opening of the new chemistry building
1888	Founding of the department for cultivation technology
1890	Opening of the new physics building
1900	Opening of the mechanical engineering laboratory

1904–1911: From Polytechnic to University

In 1911 the Polytechnic changed its name to the Federal Institute of Technology. This brought to an end a debate that had been going on since 1905.

The name “Polytechnic” had become very popular and in fact for a long time afterwards people continued to refer to it affectionately as the “Poly”. But it had become something of a handicap. Any Polytechnic wishing to be seen as progressive had to adopt the German model and call itself a “Technische Hochschule”. The change of name actually did justice to the new direction in which the school was moving, something which had been discussed for years and which brought about three decisive changes:

Firstly, in the separation contracts of 1905 and 1908, the ETH became a separate entity from the University, the City and the Canton of Zurich. Premises, collections and equipment which had hitherto been used and administered jointly were now scrupulously split off, with an ensuing reallocation of responsibilities. The simplification of the legal situation enabled the School Council to embark on long-cherished building projects.

After a series of administrative reforms, work could finally begin on the extension of the Main Building in 1911.

Secondly, the ETH set about a fundamental reorganization of the study programme. From 1908 on, so-called normal study plans were developed for each subject with the idea of making a course of study as effective as possible. These guidelines were not as binding as the previous timetables and allowed for a certain flexibility. The Poly students became fully-fledged university students.

Thirdly, in the same year, 1908, the ETH became entitled to award doctorates, which paved the way for it to become a centre for academic research. Chemistry in particular benefited from this innovation, having always been very much in favour of it. As early as 1909, six chemistry students were awarded a doctorate.

Some dates

1904	The School Council submits a proposal to the Federal Council for reorganizing the School
1905	Robert Gnehm is the first professor to become president of the School Council
1908	Separation contract between Confederation, Canton and City of Zurich comes into force
1908	Reorganisation of the School and introduction of normal study plans. Right to award doctorates
1909	Awarding of the first doctorates (six chemists, two mechanical engineers and a natural scientist)
1911	Renaming of the Federal Polytechnical School to the “Eidgenössische Technische Hochschule” ETH

1911–1968: The Flagship of National Science

As a technological university, the ETH achieved a large degree of autonomy, thanks to which it was able to build up steady and stable cooperation with the state and the economy. The key to the new relationship of the School with the outside world was the successful combination of theoretically formulated and experimentally tested knowledge.
Applied research and fundamental research became increasingly important compared to teaching. This shift meant that an indispensable factor in the scientific success of the Institute was the acquisition of state-of-the-art equipment, which in turn called for new forms of financing.

The physics professor Paul Scherrer (1890–1969) established a reputation for his ability to impart scientific facts.

At the same time, the ideal of a unity of all the sciences was more and more contested. It was not just the natural sciences and the humanities but also individual disciplines in natural sciences and technology that seemed to grow further and further apart as they became increasingly specialized. As it became impossible to generalise standards as regards methods and procedures, the response was to come up with the idea of linking together various forms of knowledge. According to one ETH Rector in the period between the wars, this chain led from mathematics via crystallography and materials science to the nation’s economic and cultural interests.
This chain called for great organizational skills and imagination. After the First World War, the ETH intensified the work with industry via mixed financed institutes. For example, the Laboratory of Hydraulics and Hydrology VAW (1930) or the Department for Industrial Research AFIF (1937) linked the ETH into a corporative security net made up of external connections with federal, cantonal and industrial bodies.

Working models in the Laboratory of Hydraulics and Hydrology around 1938.

At the National Exhibition in Zurich in 1939, the ETH was omnipresent, not just physically in terms of apparatus but also ideologically in terms of scientific ideas. Since 1936 it had been involved in the “national education system” as part of what was known as the “intellectual national defence programme” (Geistige Landesverteidigung). At the same time the President of the ETH, Arthur Rohn, developed and pursued an innovative idea that indirectly led to the setting up of the Swiss National Science Foundation in 1952.

All in all, the ETH sailed along as the scientific flagship of the Federal State, backed by a specific mixture of patriotic pride, national defence interest and the want for a harmonious form of democracy. Economic growth was transformed into academic growth – with the constant reminder of its great significance for the prosperity of all.

In all of this, the ETH performed the role of a national information centre, carefully registering what was going on in the world of science and in society at large. For example, in the 1950s it monitored local modernisation problems such as water pollution and at the same time successfully entered the sphere of international research projects. But in the early 1960s it gradually became clear that what had hitherto worked so successfully was no longer keeping pace with the passage of time.

Some dates

1918	Completion of the dome on the Main Building
1929	Opening of the Laboratory of Hydraulics and Hydrology (VAW)
1929	Opening of the Scientific Management Institute (BWI)
1933	Opening of the Institute for Physical Engineering (technische Physik)
1937	Opening of the Department for Industrial Research (AFIF)
1937	Eugen Böhler compiles the first economic reports at the Institute for Business Cycle Research (KOF)
1942	First attempt to create a Swiss National Science Foundation by ETH President Rohn. The plan was rejected by the cantons
1952	Founding of the Swiss National Science Foundation
1961	First phase of the building of the ETH Hönggerberg
1965	Approval of 444 million francs credit for extending the ETH

1968–1973: Problems of Participation

The events of 1968 and the ensuing crisis in the years up to 1973 affected the ETH on several levels. Disciplinary orientation, institutional growth and academic structure were put in question. New forms of teaching, and new contents for courses of study were items on the agenda, as were new regulations and laws.

In 1968, the Federal Councillors passed a new ETH law that paid due regard to the takeover of the Lausanne Ecole Polytechnique by the federal government. However, as the wording of the law left much of the question of participation in abeyance, the students resorted to the referendum. In June1969 the bill was rejected at the polls.

In the Department of Architecture, there were intensive discussions around 1968, for example with the writer Paul Nizon.

The result of the election had many consequences for the ETH. It brought to the fore the backlog of reforms that Max Imboden had diagnosed as the “Helvetic Malaise” in 1964.

The very launching of the referendum campaign by the students was regarded as a blatant insult by the political-academic establishment of the day. The students’ victory showed that the position “of the ETH” in no way coincided with that of the School Counsil. Instead it became clear that participation was a problem. Furthermore, after the surprise rejection of the law, a whole series of provisional regulations were necessary just to ensure that the federal institutes of higher education remained operative. The federal policy on education broadened its scope and abandoned its hitherto exclusive fixation with the ETH.

This series of crises was followed by a realignment that was marked by both the desire for and frustration with discussion. Nevertheless, new ideas were quickly adopted, albeit under extremely difficult conditions from the point of view of staffing policy. The general cutbacks on staff imposed by the Federal Council in the early 1970s meant that structural problems could only be solved by redistribution rather than growth.

Some dates

1968	October 4: The Federal Councillors pass the new ETH law. The students resort to the referendum
1969	June 1: The ETH law is rejected by 65.5% of those who voted
1969	The Ecole Polytechnique Universitaire de Lausanne becomes a Federal Institute of Technology
1970	The provisional regulations for the ETH come into force
1973	Heinrich Ursprung becomes President of the ETH Zurich

1973–2005: Retooling the Entrepreneurial University

The last quarter of the 20th century saw a dramatic increase in the flexibility of economic structures as well as individual life plans. It is the age of computerized data processing and of globalization. Every institute of higher education was affected by these processes – almost every one was involved in the changes and benefited from them.

Keeping fit to face the challenges of the future. Fitness training in the ASVZ (Academic Sports Association of Zurich) in the 1980s.

At the ETH in Zurich, the development was carried out in three steps. First of all there were the institutional reforms and experiments of the 1970s, which tried out a process of making the normal study plans more flexible. Then – which initially came as a shock to many in the 1980s – analogies were made between schools of higher education and business companies. Finally, a new ETH law that came into force in 1993 made it possible for the gradually acquired budgetary autonomy of the school as a whole to be passed on in stages to the individual departments.

The studies carried out by the firms Hayek Engineering AG and Häusermann + Co. AG had a catalystic effect on this process of increasing the flexibility of the organisation. As a result, the ETH was newly integrated into a matrix structure that was also common in industry at the time. New Departments which organized research were combined with the existing administrative units which were responsible for the teaching. This made for a more flexible system of assigning the chairs to the different departments. It was an innovation which reflected the growing importance of research in the academic culture as well as in the budget of the School.

Inside the building for Computer Science, 1988.

But it was precisely in the 1980s that there was also an increase in the organizational requirements in teaching. Three new courses of study (computer science, materials science, environmental science), several post-diploma courses and further education courses, a reorganization of the Natural Sciences Department, together with the reforms in the normal

studies syllabus, made it clear that in higher education, too, people had to adapt to change management in teaching.

Although the matrix structure started to be abolished in 1993, its introduction in 1987 led to major changes in the power structure in the ETH, and it had a lasting effect from the standpoint of flexibility.

Some dates

1976	Project-oriented teaching (POST) in the Department for Natural Sciences
1981	Founding of the Departments for Computer Sciences and Material Sciences
1985	Analysis of the ETH by Hayek Engineering AG
1987	Introduction of Einvironmental Sciences
1989	Founding of the Department for Scientific Management
1989	Reorganisation of the ETH according to a matrix structure
1993	New ETH law in force
1996	Old adiminstrative units are replaced by departments
2004	Revised ETH law introduces budgetary autonomy

2005: ETH Today

Wherever flexibility is introduced, alternative forms of security must also be created. The ETH achieved this security by giving its networks more global moorings, improving its information technology and gradually transforming itself into a university of natural sciences and technology.

The ETH Hönggerberg.

Since the 1970s there has been a clearly perceptible growth in internationalisation in the appointment of professors, both men and women. The ever-growing number of evaluations and rankings since the late 1980s have established the ETH on the international scene, and since the end of the 1990s a common European basis for university studies is being built up (Bologna Reform programme).

This globalization is also reflected in the fact that the ETH is involved in the international competition for outstanding doctoral candidates. Nor should one underestimate the pressure

for standardization – in every respect – that has been going on for decades in the world of scientific publications.

This increasing introduction of more computer-based flexibility in structures and the new atmosphere prevailing at the ETH have certainly led to new ways of dealing with day-to-day life there. In recent years the ETH has become a university for natural sciences and technology, where people are very familiar with the laws of supply and demand. They know where the markets for information are most readily accessible, and how they can perform as experts in self-management or change-management.

In so doing, they are paving the way for the future of the ETH in a much more radical way than the founders of the Polytechnic would ever have dreamt possible. Top-level decisions are more far-reaching and more geared to the future than ever before, be it in the working out of study programmes or in the appointment of professors. This has to do with the fact that there must be a clear distinction between university research and the practical approach of other institutes. More and more university research and teaching deals with things that only in an increasingly distant future will prove viable in industry.

At the same time – and this is new – planning (for the future) and reporting (on the past) are increasingly found side by side in change management; in other words, the future is bound more and more to the present. Not for nothing does the ETH of today “welcome” its visitors to the world of “tomorrow”. The sensors of the university seem to be so finely tuned that they can pick up today even tiny changes which might prove to be relevant in the future.

This fine tuning in real time, this coordinating, computer-based ability to analyse is, however, delicately balanced against the diametrically opposed principle of what used to be called “leadership”, i. e. the right to issue directives.

The book on the history of the ETH

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