

Intermediate Evaluation of the ETH Domain 2019

Report of the Expert Committee

19 April 2019

Authors

Prof. em. Felix Gutzwiller, MD , MPH, DrPH
Chairman of the Expert Committee

Prof. Dominique Arlettaz, PhD

Geneviève Berger, MD, PhD

Prof. em. Jean-Pierre Bourguignon PhD, Dr. h.c. mult.

Prof. Robert Calderbank, PhD

Moritz Lechner, PhD

Dr. iur. Matthias Leuenberger

Prof. em. Marja Makarow, PhD, Dr. h.c. mult.

Prof. em. Jürgen Mlynek, PhD, Dr. h.c.

Dr. sc. techn. ETH Suzanne Thoma

Prof. em. Jeffrey Ullman, PhD, Dr. h.c. mult.

Thomas Marty, PhD, MBA
Rapporteur of the Expert Committee

Version: 1.0 final

Date: 19/04/2019 22:52

Document Name: IE19 Expert Committee Report

Table of Contents

Authors	2
1. Introduction.....	4
1.1. Acknowledgements	4
1.2. Mandate of the Evaluation.....	4
1.3. Methodology of the Evaluation.....	5
2. General Assessment of the Expert Committee	6
2.1. Strengths and Unique Positioning.....	6
2.2. Potential for Development and Upcoming Challenges	6
2.3. General Remarks Regarding the Evaluation.....	7
3. Recommendations of the Expert Committee.....	9
4. Conclusions.....	23
Annex 1. Mandate of the Intermediate Evaluation of the ETH Domain	25
Annex 2. Members of the Expert Committee	30
Annex 3. Documentation.....	33
Annex 4. Stakeholder Meetings	34

1. Introduction

1.1. Acknowledgements

The Expert Committee wishes to acknowledge the important contributions of all the persons implicated in the Intermediate Evaluation of the ETH Domain 2019, notably the members of the ETH Board, the top management of the institutions of the Domain (in particular ETHZ and EPFL who hosted the Expert Committee), the representatives of the School Assemblies, as well as the delegates of the stakeholders.

A special thanks goes to the staff of the ETH Board for the excellent preparation and organisation of the evaluation, particularly the well appreciated support during the site visit.

As the Intermediate Evaluation 2019 fell into an uncharacteristic transition period, the experts wish to thank the former as well as the present Federal Councillor, Head of the Federal Department of Economic Affairs, Education and Research, and the former as well as the present State Secretary for Education, Research and Innovation; the former for entrusting them with the task of evaluating the ETH Domain, the latter for their favourable reception of the experts' recommendations.

1.2. Mandate of the Evaluation

The Expert Committee, composed of the authors, was mandated by the Head of the Federal Department of Economic Affairs, Education and Research to perform the Intermediate Evaluation of the ETH Domain, as stipulated by Art. 34a of the ETH Act. Such an evaluation of the strategic objectives of the ETH Domain is performed half-way into the usual four-year performance period (hence intermediate) and its results are an input to the proposal for the next funding period (ERI Dispatch) to the Parliament. The primary objective of the Intermediate Evaluation is thus to address systemic questions detailed in the mandate of the Intermediate Evaluation (see Annex 1 "Mandate of the Intermediate Evaluation of the ETH Domain"), rather than on the achievement of objectives by the institutions of the ETH Domain, the latter being assessed annually by the Federal Council.

The current evaluation mandate, as detailed in Annex 1, focuses on the following three main aspects:

- A. The importance of the ETH Domain for Switzerland and its optimal positioning in the Swiss higher education landscape;
- B. The most important factors for the successful implementation of the ETH Domain's basic mandate (as indicated in Art. 2 of the ETH Act);
- C. The potential and current organisational and thematic implementation of the strategic focus areas set for the period 2017-2020, namely Data Science, Advanced Manufacturing, Personalised Health and Related Technologies and Energy.

The aspects above are detailed in the Terms of Reference of the evaluation mandate in the form of questions to be addressed by the Expert Committee during the evaluation. Whilst the evaluation is primarily intended to examine these aspects in the Swiss context, the "interplay between the national role and international competitiveness of the ETH Domain" should be fully considered during the evaluation.

1.3. Methodology of the Evaluation

For the purpose of the evaluation, the Expert Committee received a very substantial documentation ahead of the site visit (see Annex 3 “Documentation”), including a self-assessment report of the ETH Domain expressly compiled for the Intermediate Evaluation. This report details the facts and data related to the Terms of Reference of the evaluation mandate, as well as a general assessment by the ETH Board on the questions of the Terms of Reference. Together with the information provided during the site visit, the self-assessment report served as the main basis for the assessment and recommendations of the Expert Committee.

Prior to the site visit of the Expert Committee, the Chairman and the Rapporteur had the opportunity to visit the Research Institutes of the ETH Domain, in order to get a direct glimpse on the unique research infrastructures located at these Institutes, which are a national resource used by all institutions of the ETH Domain.

During the site visit, which took place from 24 to 29 March 2019, the Expert Committee visited the two Federal Institutes of Technology (ETHZ in Zurich and EPFL in Lausanne) and met with the Directors and other key personnel of the four Research Institutes of the ETH Domain (PSI, WSL, Empa and Eawag) and with representatives of the School Assemblies of ETHZ and EPFL. In stakeholder meetings divided in three thematic groups, “Research and Innovation Policy and the Innovation Value Chain”, “Higher Education Coordination” and “Regional Development and Society”, the experts discussed the positioning of the ETH Domain in these aspects with delegates from several cantons as well as with a broad range of associations and organisations from both the public and the private sector (see Annex 4 “Stakeholder Meetings”).

After an initial round of internal discussions amongst the experts, the Committee met again with the senior management of the institutions of the ETH Domain (ETHZ, EPFL, Research Institutes), as well as with the President and one external member of the ETH Board, in order to verify first hypotheses and receive the leadership’s view on some initial findings and sensitive issues.

The Expert Committee then drafted their conclusions and recommendations and presented the latter on Friday 29 March to Federal Councillor Guy Parmelin, Head of the Federal Department of Economic Affairs, Education and Research, and to State Secretary for Education, Research and Innovation Martina Hirayama, as well as to the ETH Board and the top management of the institutions of the ETH Domain. The recommendations presented there are an integral part of this report; their wording has not been modified. The Expert Committee followed the questions of the Terms of Reference in its work; its recommendations are thus also structured along the Terms of Reference.

2. General Assessment of the Expert Committee

In the course of its discussions, the Expert Committee undertook a general assessment of the ETH Domain within the Swiss and international context, whose main elements are summarized below.

2.1. Strengths and Unique Positioning

The Expert Committee wishes to emphasize the extraordinary quality of the institutions in the ETH Domain. These institutions, and notably ETHZ and EPFL, rank amongst the top institutions in their field of comparison in Europe and the rest of the world. In the experts' opinion, they are playing in the same league as institutions like Stanford, Berkeley, Harvard, MIT, Cambridge or Oxford, and should thus be compared with these institutions when defining the level of expectations.

The Expert Committee's overall opinion is that the ETH Domain is recognised at world level as a remarkable reference for high quality research, teaching and innovation and has proved able to attract some of the best experts on a broad variety of topics. Some of the research topics of the ETH Domain are unique in their orientation and often have successfully developed a multidisciplinary approach. The ETH Domain is further host to a unique combination of research infrastructures that provide scientists of the entire ETH Domain with a competitive advantage in regard to their peers.

The Expert Committee concludes that Switzerland, with its relatively small population base, is fortunate to host such institutions of an internationally recognized quality, allowing this small country to attract and retain some of the most talented scientists and students from abroad. This leads to a mixture of global talent within the ETH Domain comparable to the aforementioned Anglo-Saxon institutions.

The ETH Domain developed efficient models of interaction with industry, giving ample evidence of the value of the new research and innovation paradigm which does not separate basic and applied research but promotes a more fruitful model that maximises synergies between theory and application through feedback loops and short-circuits (sometimes referred to as the "circular model").

All these strengths give the ETH Domain a unique positioning, not just within the Swiss research and higher education landscape, but also globally. The institutions of the Domain are capable of catalysing the added value of higher education and problem-oriented research in an incomparable way, by creating an ecosystem with related higher education institutions (universities, universities of applied sciences, universities of teacher education), small and medium sized enterprises and industry, that serves as nurturing ground for the creation and development of high tech start-ups and the experimentation of innovative business models by industry enterprises, as well as technology transfer or co-innovation with these enterprises. The ETH Domain thus acts as an important innovation hub for Switzerland by bringing talent, research collaborations and spin-offs into the Swiss economic fabric.

2.2. Potential for Development and Upcoming Challenges

Notwithstanding the excellence of the ETH Domain in the core areas of its basic mandate, and the strong potential of its value-added knowledge transfer activities, the Expert Committee identified some areas where the experts see potential for further development, or upcoming challenges that will have to be answered by the institutions of the ETH Domain.

Indeed, the aforementioned “circular model” of innovation and the concomitant multidisciplinary approach to research and development require a fluid organisation of higher-education institutions and an open approach in their relations with the external world, be it industry, government or citizens. Taking a long view and being prepared for novelties in terms of topics to be researched, studied and taught is critical for a continuing success, and requires developing an appetite for change that needs to be permanently nurtured. As the world experiences continuous change, the ETH Domain should also continuously experiment with its own way of functioning. The overall structure of the ETH Domain should be considered with such an approach to consolidate the high level of recognition it has gained.

Therefore, the cooperation amongst institutions of the ETH Domain, while already well in place, should be further developed, without the institutions of the ETH Domain losing their own strengths. In that sense, the added value of being under the common umbrella of the ETH Domain should be fully exploited by the individual institutions. For example, joint experiments by ETHZ and EPFL should be encouraged. The experts acknowledge that autonomy is paramount for the development of the institutions of the Domain; through adequate incentives, cooperation and alignment of efforts should be encouraged by the ETH Board.

The remarkable growth of the ETH Domain (especially ETHZ and EPFL) in numbers of students, researchers and faculty, demand appropriate leadership by the management of these institutions. With increasing numbers of staff and students, the professors are more and more confronted with leadership and management tasks, for which they are often ill prepared. The current efforts of the top management of the institutions of the ETH Domain to develop the leadership and management skills of their leading scientists should thus be fully supported, while keeping in mind that their focus must be in research and teaching.

Cooperation and coordination within the Swiss higher education sector remains a challenge, both at the level of individual cooperation between institutions, as well as coordination in the context of the Higher Education Act. The coordination within the entire Swiss higher education sector is still in the process of finding its form, under the governance of the Confederation and the Cantons, and thus needs to be actively stewarded in order to take advantage of the best education and research skills within all institutions of the Swiss higher education landscape.

Finally, as a critical strength of the ETH Domain, its openness and attractiveness should be further enhanced, be it for women to embrace a career in STEM fields, for international students and scientists to join its institutions, or for the opportunity of multilateral international cooperation, for example in the context of EU Research and Innovation Programmes. The institutions of the ETH Domain should make every effort possible to communicate the importance of a full association to Horizon Europe to members of Parliament and to the general public.

2.3. General Remarks Regarding the Evaluation

In addition to the general assessment above, the Expert Committee wishes to comment on methodological aspects of the Intermediate Evaluation itself.

In particular, the experts would like to express some criticism regarding the provided self-assessment report. Whilst this document provides a wealth of information and data regarding the ETH Domain, the experts found it difficult to derive an assessment of the facts and data provided, as they are not put in relation to either set objectives or comparison values. A more benchmarked report, for example towards key performance indicators or reference institutions, would allow the experts to derive better conclusions from the provided information.

Moreover, the general assessment by the ETH Board provided in each section of the self-assessment report is perceived by the experts as too self-complacent. There is no clear indication on the level of ambition of the ETH Domain, and an outlook on future challenges and possible improvements is generally missing. The self-assessment report should be forward-looking, taking into account the primary objective of the Intermediate Evaluation (see Annex 1) to focus on systemic questions instead of on the achievement of objectives. As a result of this critical view, the experts have formulated a recommendation that encourages the ETH Domain to be more candid about their challenges, goals and reference values in future Intermediate Evaluations.

3. Recommendations of the Expert Committee

This section details the recommendations of the Expert Committee to further improve the positioning of the institutions of the ETH Domain, grouped under the Terms of Reference from the evaluation mandate each recommendation refers to. The text of the recommendations, as presented at the debriefing on 29 March 2019 (see Section 1.3), is indicated in boxes. Each recommendation is preceded and followed by a short paragraph outlining the background and the remit of the recommendation.

In certain areas, the recommendations intentionally go beyond the general assessment of the previous section. This is in line with the methodology of the evaluation (see Section 1.3), which from the onset focused on the Terms of Reference, and on the questions thereof. The recommendations thus represent the answer of the Expert Committee to the Terms of Reference in the evaluation mandate (see Annex 1).

A Basic mandate of the ETH Domain and coordination of the entire Swiss higher education sector

A.1 *What role does the ETH Domain play in a national context, particularly in the core areas of its basic mandate: teaching, research and knowledge and technology transfer, and in further areas (national tasks, research infrastructure, public relations, etc.)?*

As mentioned in the previous section, the teaching, research and knowledge and technology transfer in the ETH Domain are generally found to be of high quality. Notwithstanding the excellence of the institutions of the ETH Domain, the Expert Committee formulates five recommendations in relation to the core areas of their mandate and in further areas, in order to enhance the role these institutions play in the national context.

Recommendation 1: Quality of Teaching

Beyond the efforts made so far, and in consideration of the achievements that it acknowledges, the Expert Committee strongly encourages that further steps be taken to measure and improve the quality of teaching at ETHZ and EPFL.

For the benefit of the Swiss economy, it is paramount that graduates of the two Federal Institutes of Technology (ETHZ and EPFL) contribute to the Swiss industry's health, growth and future. The ongoing demand from the Swiss industry for qualified graduates will be reflected in a continued increase in the number of students, particularly those with a STEM profile.

Whilst the Expert Committee appreciates the position taken by the two Federal Institutes of Technology to concentrate on the higher levels of scientific and technical training (i.e. doctorate), it stresses the importance of providing high quality teaching at all levels. Therefore, dedication for teaching should be strongly considered in tenure and appointment decisions; in general, good teaching should be rewarded and bad teaching should have consequences.

In this context, the Expert Committee stresses the importance of relevant metrics for teaching quality. The current digitalisation offers new opportunities not just in the course format (online vs. offline), but also in the teaching methodology itself and in the metrics to measure learning. Digitalisation (measurement) provides opportunity to make students more successful by aligning what they are learning at one time with what they need to learn at a future time. The Expert Committee therefore encourages ETHZ and EPFL to fully exploit the impact of digitalisation in teaching and learning.

The experts appreciate the efforts undertaken by both ETHZ and EPFL to improve student success, which was a central recommendation of the previous Intermediate Evaluation; however, this cannot be the only key measurement for teaching outcomes. As important is an optimized transmission of the skills relevant for the future STEM workforce, including digital literacy (see below).

On the other hand, practical experience should be a core element of training at an Institute of Technology, which makes internships in research labs and in companies a valuable component of STEM education. Efforts to make these more widely available, including to foreign students, are therefore to be encouraged.

Recommendation 2: Continuing Education

The Expert Committee anticipates a substantial increase in the demand for continuing education; ETHZ and EPFL should further their efforts in providing continuing education of high quality.

Besides the initial training of STEM graduates required by the Swiss industry, the Expert Committee foresees an increasing demand for retraining more senior workforce in digital skills. As a result, continuing education of high quality will become an important component of the training system, in which the Federal Institutes of Technology are to play an important role by upgrading the initial training of their former graduates.

Adequate measures to face the increasing demand coming from more varied backgrounds are needed, including funding streams and business models in adequation with the legal requirements (i.e. no market distortion by public cross-financing). Considering the large drop-out rates of purely online courses, different forms of continuing education, including presence programmes, should be developed.

Recommendation 3: Teaching New Skills

Innovation in course offerings should be continued, in order to combine basic science and engineering courses with computational skills.

Whilst ETHZ and EPFL already display an increasing capacity to innovate in their course offering, these efforts should be continued and further developed. Indeed, the nature of engineering is changing at a rapid pace, with digitalisation and interdisciplinarity becoming pervasive in all classical engineering topics.

However, this should not lead to a reduction of basic science courses. Proven engineering competences should rather be combined with new digitalisation skills for the advantage of the industrial sector.

Recommendation 4: Research and Research Infrastructures

The Expert Committee expects substantial translational impact from multidisciplinary research; it therefore encourages the ETH Domain to maintain and further develop its effort in this type of research, including internationally competitive research infrastructures and technology platforms.

As mentioned in the general assessment (see Section 2), the Expert Committee considers that the ETH Domain is given a competitive advantage by the synergy between theory and applications. Nowadays, it becomes more and more apparent that practical problems can shed light on undetected frontiers of basic knowledge, and that research at the frontiers between

disciplines has the most potential to lead to scientific breakthrough. Therefore, in accordance with the “circular model” mentioned in Section 2, multidisciplinary research should be further strengthened. The Expert Committee recognizes that the ETH Domain, with its two higher education institutions and four research institutes, has an unrivalled capacity to develop multidisciplinary research approaches. This capacity is further supported by the large research infrastructures and technology platforms hosted by the ETH Domain, and by the substantial track record of the institutions of the Domain in the development of interdisciplinary approaches.

Recommendation 5: Communication

Communication remains of utmost importance, in particular with the general public; efforts should be continued to convince the general public of the societal value of investments in science.

Extending to further areas in the remit of the ETH Domain, the Expert Committee acknowledges the efforts undertaken in recent years to improve the communication and dialogue with the general public. These efforts also build upon recommendations implemented after the last Intermediate Evaluation and seem to bear fruit. The experts stress the importance of continuing the efforts in trying to convince the general public of the value of the investments in science and of the various ways in which they in the end impact society, as there still is a perceived misconception about its importance for the success of Switzerland.

It should also be clearly explained that the choice of new orientations in teaching and research should correspond to the main economic and political challenges that Switzerland must face.

In the context of the recent surge of fake news, scientists of the ETH Domain should develop a reputation for providing support in evidence-based decision-making. It seems paramount to the experts that science be given a face in this time of highly personified political debates. As a result, scientists themselves should be trained and supported in engaging personally with the press and the public.

A.2 *To what extent does the ETH Domain contribute to promoting economic development and job creation and attracting companies to set up and increase activities in Switzerland? To what extent does the ETH Domain foster the creation of successful spin-offs? To what extent is the ETH Domain successful in attracting national and international talent (from students to professors), especially women?*

The Expert Committee would like to note that innovation happens both through start-ups and through innovation in established companies, through the right mindset of graduates working for the society and the economy, as well as through cooperation with companies.

The ETH Domain is very well positioned and prepared to further contribute to economic growth and job creation in Switzerland. Both ETHZ and EPFL provide the Swiss economy with extremely well-trained graduates, especially in the STEM subjects. The institutions of the ETH Domain foster a strong culture of innovation and knowledge & technology transfer in their activities, provide a nurturing environment for high tech startups, and facilitate the transfer of knowledge and innovation to small, specialized SMEs and large multinationals alike, as witnessed by the R&D build-up of tech companies in Switzerland.

Recommendation 6: Fostering Innovation

The ETH Domain should continue to drive world-class innovation. The policies and practices to foster the creation and growth of start-ups require further consideration.

The Expert Committee encourages the ETH Domain to continue its efforts in driving world-class innovation. The above recommendation focuses on a detailed aspect of the policies and practices related to the creation and growth of start-ups in the context of the institutions of the ETH Domain. The experts note that there is a very strong system in place that should be continued; as a rule, support in the first phase should have priority over supporting low performing start-ups over a long phase.

A possible improvement concerns the administrative and financial aspects of start-up creation. In particular, the rules and regulations of the Technology Transfer Offices of the institutions of the Domain put a heavy burden on start-ups, which often do not have the capacities to sustain protracted contract negotiations. Furthermore, the current practice of asking license fees from start-ups building on technologies developed within the institutions should be reconsidered, when appropriate; a participation in form of shares would have a more beneficial effect on the further growth of such spinoffs.

Furthermore, the Expert Committee regrets the lack of venture capital for so-called “B-series” funding in Switzerland, leading to an unwanted exodus of both growth companies and capital from Switzerland. However, the experts acknowledge that this policy matter is clearly outside the remit of the ETH Domain.

Finally, the Expert Committee encourages the institutions of the ETH Domain to further develop cooperation with local companies, as these have the dual effect of bringing value to the local economy and ensuring local political support.

Recommendation 7: Attracting Women to STEM Disciplines

The ETH Domain should develop a teaching and research programme to inspire more women to choose careers in STEM disciplines.

In order to answer to the increased demand in STEM graduates by the Swiss economy mentioned above, the ETH Domain must contribute to the attractiveness for women of STEM studies and fully tap into the reservoir of women who are interested in pursuing a career in these fields, foremost Swiss women.

Whilst the previous Intermediate Evaluation placed a strong emphasis on policies, incentives and targets, the members of the current Expert Committee place the emphasis on institutions of the ETH Domain, and especially ETHZ and EPFL, creating a culture and an environment that attracts women. The Expert Committee suggests that such an environment be organized around the idea that relationships, mentorship, hands-on experience, and working in teams make the difference in recruiting, retaining and promoting women in technology fields. In particular, the experts see value in connecting students with internships in order to bridge classroom to industry, and to enable students to imagine the possibilities offered by STEM disciplines. Besides the content-related aspects, rebranding of course subjects to underscore their usefulness to society could make these seemingly theoretical subjects more attractive to female students.

The Expert Committee recognizes that a substantial increase of the proportion of women in the ETH Domain can only be achieved if the interest of young women in STEM topics can be improved. Besides increasing the attractiveness of STEM study programmes for women, ETHZ and EPFL therefore should proactively collaborate with universities of teacher education to increase and maintain the fascination of female ground and middle school pupils for STEM subjects. This should also include the Communication departments of the ETH Domain institutions telling stories about STEM subjects that appeal to high school students.

A.3 *Are the current areas of activity appropriate in the context of the coordination of the entire Swiss higher education sector and in meeting the needs of the economy and society? To what extent would it make sense to focus certain activities? The questions in this field are as follows:*

A.3.1 *Are there areas in which overlaps exist with other higher education institutions or research institutes and where, from a national perspective and from the viewpoints of efficiency and efficacy, it would make sense to share tasks, or leave certain tasks entirely to another institution? Are there processes in place that allow the institutions and the ETH Board the identification of such areas?*

A.3.2 *Is it possible to identify selective fields within the ETH Domain which contribute only indirectly to the fulfilment of the basic mandate, and which could if necessary be dispensed with, so as to free up resources for new fields of activity or others of higher strategic value? Are there processes in place that allow the institutions and the ETH Board the identification of such areas?*

In the course of the evaluation, the Expert Committee did not identify areas that can simply be dropped or transferred by the ETH Domain, as suggested by the above Terms of Reference. Nevertheless, the experts see the permanent redefinition of coordination and cooperation within the Swiss higher education sector as an indispensable task for the management of the institutions of the ETH Domain, without losing the actual assets and strengths of the institutions of the ETH Domain.

Recommendation 8: Collaborations with other Higher-Education Institutions

Institutions in the ETH Domain should focus on creating value for Switzerland. This should be achieved by identifying competencies in other Swiss higher-education institutions, and by developing a strategy that takes advantage of the combined strengths.

The Expert Committee notes the improvement in the cooperation of the institutions of the ETH Domain with the Universities of Applied Science. This collaboration was a strong focus of the previous Intermediate Evaluation. Whilst the recommendations were generally implemented, the members of the current Expert Committee still see room for further improvement. However, such collaborations should be driven by need or added value and not forced to accommodate political wishes.

The experts strongly believe that the focus should be on value creation as a starting point and be driven by a clear long-term strategy that takes advantage of synergies. The Expert Committee therefore does not see the need for an additional institutionalized process to identify areas of overlap or duplication, but rather recognizes a change of culture leading to more transparency, and to a more collaborative spirit towards the other institutions in the higher education sector.

For instance, when the institutions of the ETH Domain want to develop new teaching or research programmes, they should identify the best competencies existing in other Swiss higher education institutions and try to induce the most fruitful collaborations with them.

Recommendation 9: Collaborations in the Healthcare Field

The ETH Domain, in collaboration with the medical faculties of the universities and with industry, should focus on research and education that will infuse multidisciplinary, digital and technological competencies, necessary to sustain and improve health outcomes for Switzerland and the world.

In line with the previous Intermediate Evaluation, the experts welcome the increasingly successful involvement of ETHZ and EPFL into the healthcare field. They especially welcome the bridges built with clinical institutions, in order for the ETH Domain to imbed multidisciplinary, digital and technological competencies (including medical technology) into the research and the training of the medical profession. For this purpose, the institutions of the ETH Domain should ensure access to clinicians and patients through building strong collaborations with the medical faculties of the universities, with large research-focused hospitals and with the relevant industry.

Moreover, to realize the strongly needed synergies in this field, the ETH Domain should maximally leverage the cooperation between ETHZ and EPFL; the efforts currently undertaken seem somewhat “disconnected” to the experts. As new players in the healthcare field, ETHZ and EPFL should here join efforts rather than focus too much on their autonomy.

A.4 *What is the assessment of structures and cooperation within the ETH Domain, as well as with external institutions with which it maintains strategic alliances, from the viewpoints of efficiency and efficacy? Is there potential for optimisation?*

The Expert Committee sees it as a basic principle that the structure of the ETH Domain and its institutions be aligned with the challenges it faces. The experts acknowledge the already high level of internal collaboration, as exemplified in the joint professorships and the training of doctoral students at the Research Institutes. Notwithstanding the manifold collaborations, the Expert Committee proposes to rethink the current set-up, with two Federal Institutes of Technology and four Research Institutes of varying size, towards a structure that increases flexibility and agility, while maintaining the high level of internal collaboration, e.g. in the training of doctoral students.

Recommendation 10: Structure of the ETH Domain

The effort initiated by the ETH Board to rethink the structure of the ETH Domain, currently with two large technical universities and four research institutes of varying size, is fully supported. The aim of this effort should be to enable flexibility and agility and to allow the evolution of the Domain in order to address the needs of the future.

The Expert Committee was informed on the current structural reflections by the ETH Board and supports the initiated effort. As the actual division in the four current institutes seems mainly historical, the experts propose that the ETH Board develop a long-term vision and strategy on what the future need for specific Research Institutes would be. The ETH Board should also consider how the future Research Institutes, as resulting from the structural reflections, could avoid redundancy and better interact with the other institutions of the ETH Domain.

Recommendation 11: Cooperation within the ETH Domain

Cooperation between the ETHZ and EPFL should be emphasized. Budget mechanisms should be considered that encourage multidisciplinary institutional cooperation within the Domain.

The Expert Committee notes that cooperation within the ETH Domain works well in general; especially the Research Institutes have excellent collaborations with both Federal Institutes of Technology. The experts consider that multidisciplinary should permeate the culture of all institutions of the ETH Domain and overcome institutional boundaries.

The experts recognize that the success of EPFL has encouraged ETHZ to greater efforts, and vice-versa, and understand that the need to develop research at the highest level in the two institutions naturally lead to competition. On the other hand, the Expert Committee welcomes

the fact that the level of collaboration between ETHZ and EPFL has recently increased. Although it is finally the task of the ETH Board to strike an adequate balance between cooperation and competition within the ETH Domain, cooperation should prevail as an end result. The experts thus encourage the ETH Board to promote cooperation even more strongly; budgetary incentives for further collaboration across scientific fields and between the institutions of the ETH Domain should be considered. In particular, synergies in the sharing of costly infrastructure should be fully realized, the necessary efforts for such sharing should be further accelerated.

Notwithstanding the good cooperation within the ETH Domain, the experts identify further potential for synergies and cooperation with the cantonal universities (see A.3 above).

A.5 *What is the assessment of the ETH Domain's cooperation efforts with various cantons, which have been expanded in recent years? Is the cost-benefit ratio (finances, steering, autonomy, academic responsibility, etc.) positive for the ETH Domain? What is the assessment of these cooperation arrangements in the context of the coordination of the entire Swiss higher education sector and the needs of the Swiss economy and society?*

In the context of the stakeholder meetings, the Expert Committee examined the coordination with the cantons from two points of view: first, at the level of the higher education sector, and second at the level of economic and regional policy. The experts share the view that the focus should be on added value rather than on duplication or even competition for the same funding.

Recommendation 12: Institutional Coordination under the HEdA

The ETH Domain should seek an active participation in the context of the Higher Education Act (HEdA / HFKG / LEHE) and contribute to the coordination and development of the entire Swiss system of higher education.

As mentioned in the general assessment (see Section 2.2), the institutional coordination of the Swiss higher education sector under the relatively recent Higher Education Act (HEdA / HFKG / LEHE) is in a formative stage, and the means and forms of the coordination still need to be determined. In this context, the Swiss Higher Education Conference (Schweizerische Hochschulkonferenz), where both the Confederation and the Cantons are represented, and especially the Higher Education Council (Hochschulrat), have a major role to play.

On the interinstitutional level, the new Swiss rectors' conference, swissuniversities, brings together the leadership of all higher education institutions, including the two Federal Institutes of Technology. The coordination at this level seems to work but could still be improved.

In the opinion of the Expert Committee, the position of the ETH Domain as a whole, and especially that of the ETH Board, in the general governance of the Swiss higher education sector remains elusive; it is not clear to the experts in what regard the decisions of the institutions involved in the coordination under the HEdA (i.e. SHK, Hochschulrat) are binding also for the ETH Domain, and at what level the strategic alignment between the ETH Domain and the other academic institutions is considered. Therefore, it seems paramount for the Expert Committee that the ETH Domain involves itself as much as possible in this coordination by maximizing its agility and flexibility. Such a coordination should also be beneficial for the optimisation of interinstitutional cooperation at local level and focus on win-win situations.

Recommendation 13: Cooperation with Cantons

a. The ETH Domain should develop a strategic framework for regional cooperation and not mainly act opportunistically. This strategy must imply a strong coordination.

b. While some cantons see value in diffusion of the ETH Domain through decentralised sites, other models of cooperation should be considered in order to retain critical mass in the main sites of the Domain.

The Cantons have different opinions regarding the optimal form of cooperation with institutions of the ETH Domain. While the positive impact e.g. on the local economy is most welcome, the support of ETH activities by the Cantons could imply a distribution of their funds away from cantonal universities, universities of applied sciences and universities of teacher education. As mentioned under Recommendation 12, appropriate coordination with different cantonal authorities as well as local higher education institutions should be ensured when opening new decentralized sites.

For the Expert Committee, it is paramount that a critical mass be retained at the main sites of the Domain's institutions. In that sense, other models of cooperation with the Cantons should be privileged over decentralisation. The experts stress that decentralised sites should primarily derive from a strategic framework for regional cooperation at the level of the ETH Domain, rather than be the result of selective opportunities taken by individual institutions of the Domain. Presently, such a strategic framework does not appear to be in place, merely criteria restricting individual actions by the institutions. A critical evaluation of the present "extensions" (decentralised sites), with a view on the long-term outcomes should be undertaken before new sites are considered, or present ones increased in size or breadth, and be the basis for a future strategic framework.

Finally, funding by the Cantons for hosting decentralised sites should be carefully weighed; for the experts, scientific reasons or impact rather than financial or political incentives should prevail for the establishment of such sites. It is not in the spirit of the aforementioned coordination of the Swiss higher education sector that the institutions of the ETH Domain rely on a regular, secondary funding stream by the Cantons while being fully supported by the Confederation, especially if this additional funding comes at the cost of a reduced support for the cantonal higher education institutions.

B Conditions for the successful execution of the basic mandate

B.1 *The ETH Board has, in agreement with international findings and confirmed by the 2015 Intermediate Evaluation, identified the following key factors for the future success of the ETH Domain: autonomy of the ETH Domain and its institutions, stable and reliable funding, international openness and networking. How are these factors to be assessed and how well are they ensured? What further internal and external factors are important?*

Through its evaluation, the Expert Committee confirms that the key factors identified by the ETH Board and reiterated by the 2015 Intermediate Evaluation are central for the future success of the ETH Domain. The experts accordingly defined the importance of these factors in three corresponding recommendations. They further identified two additional criteria that, in the light of recent developments, seem paramount to ensure the future success of the institutions, namely: leadership and human resource management as well as diversity. Thus, next to the already identified legal, political and financial factors, the Expert Committee of the current

Intermediate Evaluation would like to emphasize the importance of the human factor in the future development of the ETH Domain.

Recommendation 14: Autonomy of the Institutions

To take full advantage of autonomy, review governance to ensure that the principle of subsidiarity is followed wherever possible, in order to empower the responsible functions to fulfil their role.

The Expert Committee asserts that the principles of dual autonomy and subsidiarity should govern the ETH Domain. In that sense, the responsibilities of the Board should focus on strategic (strategy, finances) and oversight (control, arbitration) functions, rather than operational issues.

In that context, the experts were surprised to find that all personnel, and particularly the faculty, can appeal to the ETH Board directly, as the Domain takes final responsibility for matters of human resources (employment, salaries, etc.). The legislation in place seems rather complex and does not support the agility of the Domain; therefore, the boundaries of autonomy between the different actors (Federal Authorities, ETH Board, leadership of the individual institutions) should be clearly redefined to ensure full adequation between competence and responsibility. Subsidiarity is necessary if institutional leadership is not to be overtaken by events. In that spirit, the experts recommend to delegate certain current responsibilities of the Board to the institutions (for example the appointment of professors to the presidents of the Federal Institutes of Technology), in order to allow the responsible management positions to fulfil their leadership role. This empowerment would concomitantly come with full leadership responsibility, as outlined in the recommendation below.

Recommendation 15: Leadership and Human Resources Management

The current efforts to develop leadership skills at all levels and to ensure adequate human resources management within the ETH Domain should be encouraged. The measures proposed for this transition by the management of the institutions should have the full support of the ETH Board.

On the positive side, the Expert Committee salutes the recent efforts made by the institutions to develop leadership skills at all levels and to ensure adequate human resources management. The experts are aware that changing the culture of an organisation takes time and requires sustained efforts; the measures proposed by the institutions' management for the transition should have the full support of the ETH Board.

The Expert Committee is concerned by the recent cases of misconduct at institutions of the ETH Domain. They reveal a degraded situation that is unacceptable in quality institutions and shed a negative light on the entire ETH Domain. Recognizing that improper behaviour unfortunately exists in most large organisations, the Expert Committee nevertheless has identified a certain lack of policies and practices that has only recently been identified and remedied by the senior management of the institutions. The experts would thus like to underscore the importance of adequate leadership and human resources management for such world-class institutions.

While it is the duty of the senior management in the institutions to handle the incidents, the experts see it as a responsibility of the ETH Board to ensure that an adequate process is in place, and to approve and monitor the process. Standard measures of human resources management should apply to all employees, irrespective of their rank and position. Moreover, good practices should be more systematically and pro-actively shared within the whole ETH Domain.

Concerning additional measures to improve human resources management, the experts would find it appropriate to develop a common framework for career development of all staff and doctoral students for all institutions of the Domain; particularly, support for career development should fully include postdoctoral researchers. Diversity, including gender balance, must be addressed and monitored appropriately (see below).

Recommendation 16: Funding

a. Stable and reliable funding is essential and should be protected from yearly budget cuts. In view of the growing challenges and the transition to a knowledge society, the funding of the ETH Domain should steadily increase.

b. Like some other parts of the federal budget, the ETH expense should be handled as fixed contributions (“gebundene Ausgaben”)

Attractiveness of Switzerland as an environment where science and industry can thrive depends on long-term commitment for research and higher education. Stable and reliable funding is necessary for the institutions of the ETH Domain to satisfy the demand for STEM graduates and high-quality research that leads to knowledge and technology transfer with industry and the creation of high-tech start-ups. In view of the growing challenges and the current transition to a knowledge society, the Expert Committee encourages the political authorities that fund the ETH Domain to steadily increase the funding of the ETH Domain.

On the contrary to the latter, for which the federal contribution is now handled as legally binding spending based on the new Higher Education Act, the budget of the ETH Domain is at the mercy of yearly budget cuts. The experts therefore recommend to equally ringfence the budget of the ETH Domain as a legally binding spending (“gebundene Ausgaben”).

Moreover, the Expert Committee sees an urgent need to increase research and education in the field of digital transformation, as the experts expect a strong lack of skilled workforce in that field. Additional funding might be required to handle the digital transformation, as was already recognized by the Federal Council, which freed up extra funds for this transition in 2018.

Recommendation 17: Strategic Funds

The reserve funds of the ETH Domain should be used for strategic growth initiatives, and not diverted to the running budget as compensation.

The ETH Domain currently has about CHF 2 billion, of which half are dedicated to a specific purpose, and half are so-called “free” reserves, accumulated at different organisational levels within the institutions of the Domain. Regarding the “free” reserves, ETH Domain should have a concept for their use as strategic funds, for example for a strategic acceleration in the field of digital transformation mentioned above, followed by a rebalancing with other fields. The Expert Committee strongly advises the political authorities against using these strategic reserves to compensate for reductions in the running budget.

Recommendation 18: International Openness

International openness is essential for global competitiveness. International multilateral cooperation can be complemented, but not replaced, by bilateral research collaborations.

The Expert Committee, with its members coming from all over Europe and further afield, would like to stress that multilateral cooperation in research is paramount and cannot be replaced by bilateral activities. The experts therefore highlight the importance for the ETH Domain that

Switzerland be fully associated to the next EU Research and Innovation Framework Programme (i.e. Horizon Europe). Furthermore, the experts encourage the ETH Domain to take an active role in communicating to the Swiss population the importance of international openness and of the research agreements with the EU.

Recommendation 19: Diversity

The ETH Domain should commit to goals for representation of women and develop evidence-based strategies for recruitment and career development to support achieving these goals.

As already mentioned in Recommendations 7 and 15, an adequate diversity amongst the faculty, researchers, staff and students of the institutions of the ETH Domain is a cornerstone of success. As the percentages of foreign staff and students are already well above average, the diversity challenge concerns mainly gender distribution, where the institutions of the ETH Domain still have efforts to make, as already pinpointed by the previous Intermediate Evaluation in 2015. The Expert Committee of the current evaluation reiterates the need for quantitative targets and commitment to attain them (e.g. the target numbers set forth in the SHE-report of the EU), as well as monitoring and publishing the results. Furthermore, the experts recommend developing evidence-based strategies for the recruitment and career development of women (e.g. benchmarking with comparable institutions to reveal opportunities, run experiments to identify new ways of recruiting etc.) Some institutions of the ETH Domain (i.e. Eawag) have successfully developed a whole set of measures to retain and promote women; surprisingly, such measures did not experience a full rollout within the whole Domain.

Although devising measures is not in the remit of the Intermediate Evaluation, the experts would like to propose here a few actions that might help establish a more adequate gender balance:

- An evidence-based approach should be taken regarding advertisement and selection procedures during recruitment, and selection committees should include a diversity of perspectives;
- To maximise opportunity, dual career actions should be undertaken in cooperation with the other institutions of the Domain, or even with other, local universities;
- As mentioned in Recommendation 7, a welcoming and collaborative environment should be put in place according to an evidence-based approach;
- Providing access to child care, and helping mothers to reintegrate the research environment can help retain successful women in the STEM field;
- While being careful not to overload women scientists with administration, special attention should be given to the career development of women, to allow more women to attain leadership positions.

B.2 *What internal and external factors do the experts consider to have contributed most to the successful national and international positioning of the two ETHs and the four research institutes?*

The question of the above Term of Reference seems to allude to the period between the past (2015) and the current (2019) Intermediate Evaluations. The key success factors of the ETH Domain that seem crucial to the experts have already been mentioned under term of Reference B.1. As mentioned in the general assessment (see Section 2.3), in regard to the data and information provided during the evaluation, the Expert Committee feels ill-equipped to identify specific factors that would have “contributed the most to the successful national and international positioning of the two ETHs and the four research institutes.” Instead, and in the

light of the provided material, and especially the self-assessment report, the experts recommend that the ETH Domain, together with the political authority that funds it, develop its own indicators of success.

Recommendation 20: Measuring Impact

The recommendations of the Expert Committee related to the Term of Reference B.1 mention the most important success factors; for better assessment of impact in the future, the Domain should consider the further development of indicators of success.

For the Expert Committee, better systems are needed to measure the impact of the ETH Domain on Swiss economy and society. Focusing on rankings, bibliometric indicators, or patent quality, does not do justice to the wealth of positive effects the ETH Domain has on the economy. Moreover, the specificities of the different scientific fields are only poorly reflected in the usual bibliometric studies: as an example, the contribution of publications in computer science would be unusually small, as conference proceedings poorly integrated into bibliometric assessments have much more impact in this field than in other disciplines. Other countries have developed indicators of impact that may serve as a reference (e.g. Research Excellence Framework in the UK).

When asking about the level of ambition of the ETH Domain, the experts were told that the Domain must strike a delicate balance between international competitiveness (i.e. with top European, US and Asian universities) and the national tasks assigned to an institution largely funded by the Swiss Confederation. Rankings and h-factors were developed to measure scientific excellence alone, without any connection to the hosting environment, and are therefore more suited for mainly privately funded institutions that concentrate on global competition. On the other hand, the excellent positioning of the two Federal Institutes of Technology in the international rankings are paramount to the attractiveness for excellent students and researchers from all over the world and thus contribute in a major way to the success of these institutions.

Therefore, the ETH Board should develop its own key indicators of success that fit the dual mission (excellence as well as national impact) of its institutions and give a better indication about the engagement with industry and the connections to other drivers of the Swiss economy. These indicators should possibly be benchmarked with other institutions with a remit similar to those of the ETH Domain.

C Strategic focus areas for research 2017-2020

C.1 *The strategic focus areas in the ETH Domain for the period 2017-2020 are as follows: Data Science, Advanced Manufacturing, Personalised Health and Related Technologies and Energy. How should the potential of these focus areas be gauged in the context of the coordination of the entire Swiss higher education sector, international scientific trends and the needs of the Swiss economy and society, as well as their organisational and thematic implementation to date?*

The Expert Committee assessed the choice of the strategic focus areas based on the material and information provided for the evaluation and on its own knowledge of the international scientific trends. On this basis, the experts strongly support the choice of these strategic focus areas, as those seem to be relevant in many other countries, but insist that the potential and impact of these strategic focus areas needs to be more precisely and properly gauged in the context of the coordination of the entire Swiss higher education sector, international scientific trends and the

needs of the Swiss economy and society, as mentioned in the Terms of Reference. Moreover, the experts recommend performing a specific evaluation of the organisational impact be done in order to achieve a good and flexible enough implementation.

Specific comments on the individual strategic focus areas include that Data Science will have a very broad impact, while Advanced Manufacturing will allow reattracting industrialized jobs to Switzerland. Regarding the focus area on Energy, nobody currently knows which energy mix will be dominant in the next twenty years, making it difficult to set research targets. Finally, Personalised Health and Related Technologies should not be too narrowly focused, as digitalisation and technology will be pervasive in the entire medical field, not just regarding Personalised Medicine.

Recommendation 21: Strategic Focus Areas

The Expert Committee strongly supports the choice of these strategic focus areas. Beyond that, the institutions of the ETH Domain should develop the mechanisms to anticipate research needs and to respond quickly to major challenges.

Finally, this being a central recommendation regarding the future of the strategic focus areas, the experts stress that the ETH Domain and its institutions should develop and expand the mechanisms to anticipate future research emerging fields and needs, e.g. through foresight studies and the development of a long-term vision for the Domain. This could be achieved by running pilot experiments and use the outcomes to guide future choices.

On the other hand, having strategic focus areas in place should not prevent the institutions of the Domain from being able to respond quickly to new major challenges and opportunities that might come up during a strategic period. Acting both on long- and short-term issues requires mechanisms and procedures that allow the proper imbrication of these two views and should permeate funding decisions as well as appointments of faculty and research staff.

C.2 *In view of the ongoing process of digitalisation, the institutions of the ETH Domain have a special role to play in terms of the early identification and adoption of related trends in science for Switzerland as a centre of knowledge and industry. What strategies are already in place in the ETH Domain to enable the institutions to play a leading and driving role for Switzerland? Do the prevailing framework conditions in the ETH Domain allow them to exercise this function?*

The Expert Committee stresses that digital transformation starts with imagining the opportunities that are created by unprecedented access to data and to computing. Data arrive in many forms, but when they are translated to a form that can be queried and opened up to computing, it becomes possible for very different disciplines to engage and to accomplish together what could not be accomplished separately. In that sense, digitalisation is a very multidisciplinary endeavour by nature, with data and computer science permeating all classical science and engineering fields in a transformative way.

Some of the most effective cross-pollinators are fundamental researchers who are inspired by specific problems but who work freely across domain boundaries, because their data analysis and computational expertise transcends any one problem. In the experts' opinion, significant investment is needed to develop this advance guard in ways that will amplify their success.

Recommendation 22: Digitalisation

The ETH Domain should develop a digitalisation strategy that maximizes translational impact and organize research and teaching to support diffusion of computational thinking into science and engineering.

Such a digitalisation strategy should not just focus on increasing competencies in data and computer science, but act across traditional scientific disciplines (Biology, Physics, Engineering etc.) to leverage the power of these new technologies in all fields of science and engineering.

Such disruptive knowledge transfer across scientific fields would happen in teaching and learning, as set forth in Recommendations 1 - 3 but also in the core area of research, where new ways of working might have to be devised. In essence, the involvement of data scientists with scientists from other fields should be maximal and might have to happen at the level of single research groups. The aforementioned strategy could ensure that a matrix-like collaborative structure can be put in place and fully supported across the institutions of the ETH Domain, to maximally leverage the benefits of digital competencies within those institutions.

4. Conclusions

With its general assessment and detailed recommendations, the Expert Committee of the Intermediate Evaluation 2019 hopes to serve the best interest of the ETH Domain, and of the Swiss research, education and innovation landscape as a whole. Considering the strong position of the institutions in this system, and in the world, the experts do not doubt that the ETH Domain will continue to provide the Swiss economy with skilled graduates, technological breakthroughs, innovative business models and start-ups, and will go on holding a top position amongst similar institutions in Europe and the world. Their recommendations aim chiefly at enabling the ETH Domain not only to retain its strong position, but to further develop it to the extent of its possibilities; in this spirit, the experts are confident that the ETH Domain will find good guidance and use in their recommendations.

With their signature, the members of the Expert Committee agree with the above recommendations



Dr. iur. Matthias Leuenberger



Prof. em. Felix Gutzwiller, MD , MPH, DrPH

Chairman



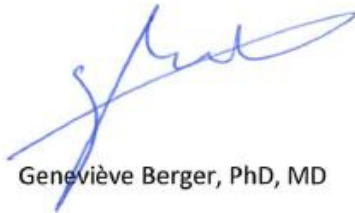
Prof. em. Marja Makarow, PhD



Prof. Dominique Arlettaz PhD



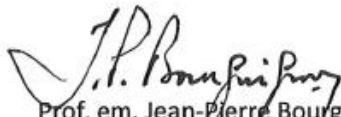
Prof. em. Jürgen Mlynek, PhD



Geneviève Berger, PhD, MD



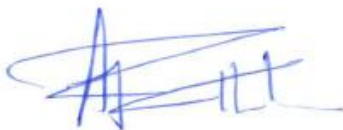
Dr. sc. techn. ETH Suzanne Thoma



Prof. em. Jean-Pierre Bourguignon PhD, Dr.
h.c. mult.



Prof. em. Jeffrey Ullman, PhD



Prof. Robert Calderbank, PhD



Moritz Lechner, PhD



Thomas Marty, PhD, MBA

Rapporteur

Annex 1. Mandate of the Intermediate Evaluation of the ETH Domain



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER

Intermediate Evaluation of the ETH Domain

Mandate

from

Johann N. Schneider-Ammann,
Federal Councillor,
Head of the Federal Department of Economic Affairs, Education and Research

to the Expert Committee:

Felix Gutzwiller (chairperson)

Dominique Arlettaz

Geneviève Berger

Jean-Pierre Bourguignon

Robert Calderbank

Moritz Lechner

Matthias Leuenberger

Marja Makarow

Jürgen Mlynek

Suzanne Thoma

Jeffrey Ullman

Bern, 23 February 2018

1. Background

The Federal Council (Swiss government) governs the ETH Domain through strategic objectives, established at four-year intervals, and a corresponding global budget. The owner of the ETH Domain is the Swiss Confederation. The ETH Domain is affiliated to the Federal Department of Economic Affairs, Education and Research (EAER). The strategic leadership for the ETH Domain is delegated to the ETH Board.

The ETH Domain comprises the two Federal Institutes of Technology in Zurich (ETH Zurich) and Lausanne (EPFL) as well as the four research institutes PSI, WSL, Empa and Eawag. The ETH Board, the strategic authority of the ETH Domain, is responsible for implementing the strategic objectives of the Federal Council for the ETH Domain. The autonomy of the ETH Domain as a whole as well as of the six institutions mentioned is guaranteed by law.

The ETH Domain institutions form part of a differentiated system of higher education in Switzerland, which comprises different types of higher education institutions (Federal Institutes of Technology, cantonal Universities, cantonal Universities of Applied Sciences and Universities of Teacher Education) and is organised within the federal structure. The ETH Domain institutions enjoy an excellent international reputation as places of research and education. As strong players both in the Swiss tertiary education system and in the international academic community, they make a significant contribution to the economic and innovative success and to the social development of the country.

In March/April 2019, the EAER will conduct an intermediate evaluation of the ETH Domain with the participation of external experts. Since 2012 the achievement of objectives in the ETH Domain is assessed annually by the Federal Council based on a report produced by the ETH Board and Parliament is duly informed. The primary focus of the intermediate evaluation, as with that in 2015, is therefore not on the achievement of objectives by the institutions of the ETH Domain, but on specific systemic questions.

The Federal Act on the Funding and Coordination of the Higher Education Sector (HEdA) came into full effect on 1 January 2017. The Act stipulates that the Confederation and the cantons through the Swiss Conference of Higher Education Institutions should ensure the coordination of the entire Swiss higher education sector and the division of tasks in particularly costly areas. This joint planning approach, which involves all institutions of all types in the higher education sector, should lead to the setting of sensible priorities and portfolio streamlining in the Swiss higher education system to improve its efficiency and efficacy. Against this backdrop, the main focus of the intermediate evaluation should be on the importance of the ETH Domain for Switzerland and its optimal positioning in the domestic higher education landscape. In addition, the expert group should address the question of the most important factors in the successful implementation of the ETH Domain's basic mandate. Lastly, it should also consider the potential and current organisational and thematic implementation of the strategic focus areas set for the domain for the period 2017-2020. This focus will also enable interesting comparisons to be made with the 2015 study, which addressed similar questions in some areas. Despite the fact that the evaluation report is primarily intended to examine the subject from a Swiss

context, the interplay between the national role and international competitiveness of the ETH Domain should be taken into account throughout.

The expert committee's report is one of the elements in the reporting on the ETH Domain made available to the Confederation. The Federal Council will submit the report to Parliament together with the response of the ETH Board. These documents will also be taken into account when the next strategic objectives are drafted.

The present document commissions the independent experts to draw up an evaluation report at their own discretion and outlines the terms of reference.

2. Terms of Reference

The objective of the intermediate evaluation in 2019 is to assess the role and contribution of the ETH Domain in the following areas and to reflect on future improvements:

A Basic mandate of the ETH Domain and coordination of the entire Swiss higher education sector

- A.1 What role does the ETH Domain play in a national context, particularly in the core areas of its basic mandate: teaching, research and knowledge and technology transfer, and in further areas (national tasks, research infrastructure, public relations, etc.)?
- A.2 To what extent does the ETH Domain contribute to promoting economic development and job creation and attracting companies to set up and increase activities in Switzerland? To what extent does the ETH Domain foster the creation of successful spin-offs? To what extent is the ETH Domain successful in attracting national and international talent (from students to professors), especially women?
- A.3 Are the current areas of activity appropriate in the context of the coordination of the entire Swiss higher education sector and in meeting the needs of the economy and society? To what extent would it make sense to focus certain activities? The questions in this field are as follows:
 - A.3.1 Are there areas in which overlaps exist with other higher education institutions or research institutes and where, from a national perspective and from the viewpoints of efficiency and efficacy, it would make sense to share tasks, or leave certain tasks entirely to another institution? Are there processes in place that allow the institutions and the ETH Board the identification of such areas?
 - A.3.2 Is it possible to identify selective fields within the ETH Domain which contribute only indirectly to the fulfilment of the basic mandate, and which could if necessary be dispensed with, so as to free up resources for new fields of activity or others of higher strategic value? Are there processes in place that allow the institutions and the ETH Board the identification of such areas?

- A.4 What is the assessment of structures and cooperation within the ETH Domain, as well as with external institutions with which it maintains strategic alliances, from the viewpoints of efficiency and efficacy? Is there potential for optimisation?
- A.5 What is the assessment of the ETH Domain's cooperation efforts with various cantons, which have been expanded in recent years? Is the cost-benefit ratio (finances, steering, autonomy, academic responsibility, etc.) positive for the ETH Domain? What is the assessment of these cooperation arrangements in the context of the coordination of the entire Swiss higher education sector and the needs of the Swiss economy and society?

B Conditions for the successful execution of the basic mandate

- B.1 The ETH Board has, in agreement with international findings and confirmed by the 2015 Intermediate Evaluation, identified the following key factors for the future success of the ETH Domain: autonomy of the ETH Domain and its institutions, stable and reliable funding, international openness and networking. How are these factors to be assessed and how well are they ensured? What further internal and external factors are important?
- B.2 What internal and external factors do the experts consider to have contributed most to the successful national and international positioning of the two ETHs and the four research institutes?

C Strategic focus areas for research 2017-2020

- C.1 The strategic focus areas in the ETH Domain for the period 2017-2020 are as follows: Data Science, Advanced Manufacturing, Personalised Health and Related Technologies and Energy. How should the potential of these focus areas be gauged in the context of the coordination of the entire Swiss higher education sector, international scientific trends and the needs of the Swiss economy and society, as well as their organisational and thematic implementation to date?
- C.2 In view of the ongoing process of digitalisation, the institutions of the ETH Domain have a special role to play in terms of the early identification and adoption of related trends in science for Switzerland as a centre of knowledge and industry. What strategies are already in place in the ETH Domain to enable the institutions to play a leading and driving role for Switzerland? Do the prevailing framework conditions in the ETH Domain allow them to exercise this function?

Any other observations made by the experts in the selected topic areas or recommendations for the future development of the ETH Domain are welcome. The expert committee is also free to address any other issues falling within the mandate of the ETH Domain under Article 2 of the ETH Act and the strategic objectives of the Federal Council for the ETH Domain 2017-2020.

3. Principles of action for the intermediate evaluation

- The intermediate evaluation conducted by the expert committee is based on a self-assessment report. The self-assessment report is directed by the presidency of the ETH Board and covers all six institutions and the Domain as a whole including the ETH Board. In the first part of the report, the above questions focusing on the evaluation from the viewpoint of the ETH Board are addressed. This provides a basis upon which the external experts can make their assessment. The second part reports on the extent to which the experts' recommendations made in the 2015 intermediate evaluation were implemented. If a recommendation was disregarded, reasons for this should be given. Moreover, the report will contain a bibliometric analysis. The president of the ETH Board should send the self-assessment report to the expert committee by the end of 2018.
- The expert committee can organise their evaluation as they wish. An audit will be arranged from 24 March to 29 March 2019. Enough time will be allowed for presentations and discussions with representatives of the institutions, according to the wishes expressed by the experts.
- The expert committee will write an evaluation report for the attention of Federal Councillor Johann N. Schneider-Ammann no later than 20 April 2019.
- Organisational support will be provided by the ETH Board staff (e.g. accommodation, trips, etc.). Financial support for secretarial assistance will be provided by the ETH Board, if needed.
- The ETH Board will cover all of the experts' expenses. In addition, the experts will be granted a fee of CHF 1,000 per day based on their individual engagements.
- Experts will have to sign a confidentiality agreement, as the owner of the report will be the Head of the Federal Department of Economic Affairs, Education and Research (EAER).

Annex 2. Members of the Expert Committee

Chairman



Prof. em. Felix Gutzwiller, MD , MPH, DrPH

Felix Gutzwiller was Director and Full Professor of Preventive Medicine at the Institute of Public Health at the University of Zurich from 1988 to 2013. In addition, he has been Chairman of the Board of the Swiss Tropical and Public Health Institute in Basel from 1999 to 2015. He is now chairing the Foundation Council of the Swiss Institute of Bioinformatics. Prof. Dr. Gutzwiller was elected to the Parliament of Switzerland in 1999 and served as a member of the Swiss National Council up to 2007. In 2007, he was elected to the Swiss Council of States representing the Canton of Zurich. He served on the Standing Committee of Social Affairs, and was chairperson of the Standing Committee on Science, Education and Culture (2012/2013) and of the Standing Committee on Foreign Affairs (2014/2015). He was a colonel in the Swiss Army and headed its biological defense division over a ten-year period. From 1983 to 1988, he served as Director of the Institute of Public Health at the University of Lausanne. Prof Dr Gutzwiller was a member of the Swiss National Science Council (1990–98) and a lecturer at the Swiss Federal Polytechnic Institute (ETH Zurich). Furthermore, he is on the boards of numerous foundations in the fields of charity, science and public health. He has received many honors and awards over the years in the health profession.

Committee Members



Prof. Dominique Arlettaz PhD

After earning a Doctorate in Mathematics from the ETH in Zürich in 1983, Dominique Arlettaz occupied several research and visiting professor positions at Northwestern University in Evanston (USA), at Ohio State University in Columbus (USA) and at McMaster University in Hamilton (Canada), before he was hired as a Professor of Mathematics at the University of Lausanne in 1988. He served as President of the Mathematics Department (1996-2000), Dean of the Science Faculty (2000-2003), Vice-Rector (2003-2006) and then as Rector of the University of Lausanne (2006-2016). He was also member and President of the joint Executive Board of the University of Lausanne and of the University Hospital – CHUV (2003-2016). Since 2009 Dominique Arlettaz was Vice-president of the Rectors' Conference of the Swiss Universities and later swissuniversities, and then President of the Chamber of universities (2015-2016). He was also member of the Board of Directors of the Venice International University (2014-2016). Since 2016, Dominique Arlettaz is President of the Board of the Hôpital du Valais.



Geneviève Berger, MD, PhD

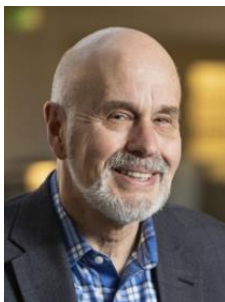
Chief Research Officer of Firmenich SA and member of the boards of AstraZeneca and Air Liquide. She was Chief R&D Officer, Executive of

Unilever plc & NV between 2008 and 2015. Geneviève Berger holds a PhD in Physics and Biology and is a certified physician. She was General Director of CNRS between 2000 and 2003. She acted as President of the Health Council at the European Commission between 2006 and 2008.



Prof. em. Jean-Pierre Bourguignon PhD, Dr. h.c. mult.

Professor Jean-Pierre Bourguignon is the President of the European Research Council. He was the Director of the Institut des Hautes Études Scientifiques (IHÉS) from 1994 till 2013. A mathematician by training, he spent his whole career as a fellow of the Centre National de la Recherche Scientifique (CNRS). He held a Professor position at École polytechnique from 1986 to 2012. From 1990 to 1992, he was President of the Société Mathématique de France and President of the European Mathematical Society from 1995 to 1998. He is a former member of the Board of the EuroScience organisation (2002-2006) and served on EuroScience Open Forum (ESOF) committees since 2004. Professor Bourguignon received prestigious awards and is member of several scientific societies. In 2008, he was made Doctor Honoris Causa of Keio University, Japan, and, in 2011, Doctor Honoris Causa of Nankai University, China.



Prof. Robert Calderbank, PhD

Robert Calderbank is the Charles S. Sydnor Professor of Computer Science at Duke University. Before moving to academia in 2004, he was Vice President for Research at AT&T. At the start of his career at Bell Labs, Dr. Calderbank developed voiceband modem technology that was widely licensed and incorporated in over a billion devices. He also developed the mathematical framework for error correction in quantum computers. Later, he developed space-time codes that improve the speed and reliability of wireless communication, and are included in a broad range of 3G, 4G and 5G wireless standards. Dr. Calderbank was elected to the National Academy of Engineering in 2005, and to the National Academy of Inventors in 2015. He received a PhD in Mathematics from the California Institute of Technology.



Moritz Lechner, PhD

Moritz Lechner is entrepreneur and studied physics at the ETH in Zurich and at the EPFL in Lausanne. He did his Ph.D. in Elementary Particle Physics at the Budker Institute of Nuclear Physics in Novosibirsk (Russia) and at the Paul Scherrer Institute in Villigen (Switzerland). In 1998, Moritz Lechner and Felix Mayer started Sensirion AG as a spin-off of the ETH. He managed Sensirion as Co-CEO for 18 years before handing over in 2016 and becoming Co-Chairman of the Board.

Sensirion has grown to over 750 employees and nowadays is one of the leading sensor companies for flow and environmental sensors solutions, employing people in the USA, South Korea, Japan, China, Taiwan and Germany.

Moritz Lechner is a member of the Board of Directors of Dectris (spin-off PSI), 3db (ETH Zürich); IRsweep (ETH Zürich). In addition, he is a Member of the Advisory Council Digital Transformation for Federal Councillor Schneider Amman and Federal Councillor Doris Leuthard.



Dr. iur. Matthias Leuenberger

Matthias Leuenberger is Country President of Novartis in Switzerland. In this function, he serves as Chairman of the Executive Committee of Novartis Switzerland, is responsible for the company's political relations in Switzerland and represents Novartis in the business associations Interpharma, scienceindustries, economiesuisse and HKBB (Chamber of Trade and Commerce for Basel-Stadt and Baselland). Dr. Leuenberger studied law at the University of Bern, passed his bar exam in 1993 (Fürsprecher / Rechtsanwalt) and was promoted to Dr. iur. in 1995. His first employment in 1995 was with the Boston Consulting Group (BCG), where he stayed 9 years in total – 6 in Zurich and 3 in Tokyo, Japan. 2004 he joined Novartis in Basel where he started as a senior Director of Strategic Planning in Pharma. In 2006, he assumed responsibility for the vaccines business in the region of Africa, Middle East, Southeast Asia, Australia/NZ and Japan. In 2011, Dr. Leuenberger assumed responsibility for the Chairman's Office and in 2014 for Switzerland.



Prof. em. Marja Makarow, PhD, Dr. h.c. mult.

Marja Makarow is former Vice-President for Research (2003-20007) and Professor of biochemistry and molecular biology (2003-2012) of the University of Helsinki, Chief Executive of the European Science Foundation in Strasbourg France (2008-2012), and Vice-President of the Finnish Research Council Academy of Finland (2012-2016). Prof. Makarow earned her PhD degree in biochemistry in the University of Helsinki in 1979 and accomplished her post-doctoral research at the EMBL in Heidelberg, before moving to the University of Helsinki in 1983. Prof. Makarow was President of the European Molecular Biology Conference EMBC in 1999-2007. She served as founding Board Chair of the Institute for Molecular Medicine Finland FIMM in 2008-2012. As Vice-Chair (2007-2012) she established with the Board the new Aalto University in Finland, and as Board Chair laid the foundations of the new Tampere University to be launched in January 2019. She is former Member of the Finnish Prime Minister's Research and Innovation Council, Director of Biocenter Finland, Chair of Technology Academy Finland, Executive Member of the Governing Board of the European Institute of Innovation and Technology EIT and Member of the Comité d'Orientation Strategique of the University of Geneva. Marja Makarow is also member of Academia Europaea and the Finnish Academy of Science and Letters. She is Commander of the Order of the White Lion, Finland, and Chevalier dans l'ordre de la Légion d'honneur, France.



Prof. em. Jürgen Mlynek, PhD, Dr. h.c.

Jürgen Mlynek, an experimental physicist, is a Professor Emeritus of the Humboldt University of Berlin. After his PhD at the Leibniz University Hannover, he worked as a Post-Doc at the IBM Research Laboratory in San José/CA and then as Assistant Professor at the ETH Zurich before he became a full Professor at the University of Konstanz/Germany.

From 1996 until 2001, he acted as Vice-President of the German Research Foundation (DFG) and from 2000 to 2005 as President of the Humboldt-Universität in Berlin. In 2015 he became for 10 years President of the Helmholtz Association of German Research Centres.

For his own research, Mlynek was awarded the prestigious Gottfried Wilhelm Leibniz Prize and many other scientific accolades. He holds several member- and chairmanships as the Chairmanship of the Board of Trustees of the Falling Walls Foundation



Dr. sc. techn. ETH Suzanne Thoma

Dr. Suzanne Thoma has been CEO of BKW Group since 2013. She joined BKW in 2010 as Head of the business unit networks and a member of the Executive Board. She is guiding BKW through a successful transformation process from a traditional energy company to an international energy and infrastructure service provider. Over the past few years, she has

steered the company from a difficult situation to a financially strong position with excellent future prospects, laying significant strategic foundations and effectively repositioning the business. As part of this process, BKW has developed innovative business areas. BKW's share price has risen by around 250% since 2014.

Dr. Thoma has a PhD in chemical engineering from ETH Zurich. She worked at Ciba Spezialitätenchemie AG (today BASF AG) for about 10 years in a variety of management roles both in Switzerland and abroad. As CEO of Rolic Technologies AG, she headed a start-up specialised in high-tech materials and technology licences. Before joining BKW, she led WICOR Group's international automobile supply business in Rapperswil.



Prof. em. Jeffrey Ullman, PhD, Dr. h.c. mult.

Jeffrey David Ullman is the Stanford W. Ascherman Professor of Engineering (Emeritus) in the Department of Computer Science at Stanford and CEO of Gradiance Corp. He received the B.S. degree in Engineering Mathematics from Columbia in 1963 and the PhD in Electrical Engineering from Princeton in 1966. Prior to his appointment at Stanford in 1979, he was a member of the technical staff of Bell Laboratories from 1966-1969, and on the faculty of Princeton University between 1969 and 1979. From 1990-1994, he was chair of the Stanford Computer Science Department.

Prof. Ullman was elected to the US National Academy of Engineering in 1989, the American Academy of Arts and Sciences in 2012, and has held Guggenheim and Einstein Fellowships. He is the recipient of numerous awards and prizes. He is the author of 16 books, including books on database systems, data mining, compilers, automata theory, and algorithms

Rapporteur



**Thomas Marty, PhD, MBA
Rapporteur**

Holding a PhD in Genetics from University of Basel, Thomas Marty performed basic research for almost 10 years at different academic institutions, including New York University and ETH Zurich. He then obtained a Science Policy Fellowship working for the Swiss Parliament, before spending five years as a European Advisor at Swisscore, the Swiss contact office for research, education and innovation in Brussels. He then joined Berinfor, a consulting firm specializing on higher education institutions, where he was a Partner and Member of the Board of Directors. Since 2018, he is the owner of his own consultancy, SCIROC, advising the upper management of science and research institutions in strategy and organization.

Annex 3. Documentation

The Expert Committee had access to the following documents:

- Intermediate Evaluation 2019 of the ETH Domain - Self-Assessment Report (ETH Board, 12/13 December 2018) (Language: En)
- Federal Act on the Federal Institutes of Technology (ETH Act) of 4 October 1991 (Status as of 1 May 2017) (Languages: En / De / Fr)
- The Federal Council's Strategic Objectives for the ETH Domain for the Period 2017–2020 (Dated 5 April 2017; status as 25 April 2018) (Languages: En / De / Fr)
- Strategische Planung 2017–2020 des ETH-Rats für den ETH-Bereich (ETH-Rat 2014) (Languages: De / Fr)
- Strategic Planning 2017-2020 of the ETH-Board for the ETH Domain (Factsheet in English)
- 2017 Annual Report of the ETH Board on the ETH Domain (2017; languages: En / De / Fr)
- Strategic Planning 2021–2024 of the ETH Board for the ETH Domain (ETH Board, February 2019, language: En)

Annex 4. Stakeholder Meetings

	R&I policy and the innovation value chain 26.03.2019 (15:30-18:00)	Higher Education coordination 27.03.2019 (8:00-10:00)	Regional development and society 27.03.2019 (10:00-12:00)
Objective	Assess the role of the ETH Domain in the shaping of research and innovation policies and on the transformation of research results into innovation and application, with a focus on the international competitiveness of the Swiss system.	Assess the coordination of the actors in the Swiss Higher Education landscape based on the new Higher Education Act (HFKG/LEHE), with a focus on the role of the ETH-Domain in this coordination.	Assess the impact of the activities of the ETH Domain on regional development and civil society, as well as the importance of subject-based collaborations with actors in the regions (cantons).
Stakeholders (participants)	- Avenir Suisse (<u>Matthias Ammann</u>, Fellow) - Swiss National Science Foundation (<u>Katharina Fromm</u>, VP National Research Council) - Innosuisse (<u>André Kudelski</u>, President of the Board) - Scienceindustries (<u>Stephan Mumenthaler</u>, Director general) - Swissmem (<u>Anton Demarmels</u>, President Research Commission) - Economiesuisse (<u>Roger Wehrli</u>, Deputy Head General Economic Policy and Education) - Swiss Federal Office of Energy SFOE (<u>Benoît Revaz</u>, Director) - Federal Office for the Environment FOEN (<u>Marc Chardonnens</u>, Director)	- Swiss Conference of Cantonal Ministers of Education (EDK) (<u>Madeleine Salzmann</u>, Head of division Higher Education) - Department of Education of the Canton of Zurich; Office of Universities (<u>Sebastian Brändli</u>, Head of Office) - Department of Education, Youth and Culture of the Canton of Vaud; Office of Higher Education (DGES) (<u>Chantal Ostorero</u>, Head of Office) - Swissuniversities (<u>Michael Hengartner</u>, President; <u>Astrid Epiney</u>, Vice-President of the Chamber of Universities; <u>Crispino Bergamaschi</u>, President of the Chamber of Universities of Applied Sciences; <u>Hans-Rudolf Schärer</u>, President of the Chamber of Universities of Teacher Education)	- Office of Economy and Tourism Canton Graubünden (<u>Eugen Arpagaus</u>, Head of the Office) - Department of Finance and Economy, Economics Affairs Division Canton Ticino (<u>Stefano Rizzi</u>, Head of Division) - Office for Employment and Economic Affairs, Canton Basel-City (<u>Nicole Hostettler</u>, Head of Office) - Switzerland Innovation (<u>Ruedi Noser</u>, President ; <u>Raymond Cron</u>, Director) - University Hospital Zürich (<u>Gregor Zünd</u>, CEO) - Geneva University Hospitals (<u>Bertrand Levrat</u>, Director general)

	R&I policy and the innovation value chain	Higher Education coordination	Regional development and society
Questions (based on ToR)	<i>Regarding the basic mandate of the ETH Domain and coordination of the entire Swiss higher education sector:</i> • What role does the ETH Domain play in a national context, particularly in the core areas of its basic mandate: teaching, research and knowledge and technology transfer, and in further areas (national tasks, research infrastructure, public relations, etc.)? (A.1) • To what extent does the ETH Domain contribute to promoting economic development and job creation and attracting companies to set up and increase activities in Switzerland? To what extent does the ETH Domain foster the creation of successful spin-offs? To what extent is the ETH Domain successful in attracting national and international talent (from students to professors), especially women? (A.2) <i>Regarding the conditions for the successful execution of the basic mandate:</i> • The following key factors for the future success of the ETH Domain ETH Board have been identified: ○ autonomy of the ETH Domain and its institutions, ○ stable and reliable funding, ○ international openness and networking.	<i>Regarding the basic mandate of the ETH Domain and coordination of the entire Swiss higher education sector:</i> • What role does the ETH Domain play in a national context, particularly in the core areas of its basic mandate: teaching, research and knowledge and technology transfer, and in further areas (national tasks, research infrastructure, public relations, etc.)? (A.1) • Are the current areas of activity appropriate in the context of the coordination of the entire Swiss higher education sector and in meeting the needs of the economy and society? To what extent would it make sense to focus certain activities? The questions in this field are as follows: ○ Are there areas in which overlaps exist with other higher education institutions or research institutes and where, from a national perspective and from the viewpoints of efficiency and efficacy, it would make sense to share tasks, or leave certain tasks entirely to another institution? (A3.1) ○ Is it possible to identify selective fields within the ETH Domain which contribute only indirectly to the fulfilment of the basic mandate, and which could if necessary be dispensed with, so as to free up resources for	<i>Regarding the basic mandate of the ETH Domain and coordination of the entire Swiss higher education sector:</i> • What role does the ETH Domain play in a national context, particularly in the core areas of its basic mandate: teaching, research and knowledge and technology transfer, and in further areas (national tasks, research infrastructure, public relations, etc.)? (A.1) • To what extent does the ETH Domain contribute to promoting economic development and job creation and attracting companies to set up and increase activities in Switzerland? To what extent does the ETH Domain foster the creation of successful spin-offs? (A.2) • What is the assessment of the ETH Domain's cooperation efforts with various cantons, which have been expanded in recent years? What is the assessment of these cooperation arrangements in the context of the needs of the Swiss economy and society? (A.5) <i>Regarding the conditions for the successful execution of the basic mandate:</i> • The following key factors for the future success of the ETH Domain ETH Board have been identified: ○ autonomy of the ETH Domain and its institutions, ○ stable and reliable funding,

	How are these factors to be assessed and how well are they ensured? What further internal and external factors are important? (B.1) • What internal and external factors do you consider have contributed most to the successful national and international positioning of the two ETHs and the four research institutes? (B.2) <i>Regarding the Strategic focus areas for research 2017-2020 of the ETH-Domain:</i> • The strategic focus areas in the ETH Domain for the period 2017-2020 are as follows: Data Science, Advanced Manufacturing, Personalised Health and Related Technologies and Energy. How should the potential of these focus areas be gauged in the context of the coordination of the entire Swiss higher education sector, international scientific trends and the needs of the Swiss economy and society, as well as their organisational and thematic implementation to date? (C.1)	new fields of activity or others of higher strategic value? (A3.2) • What is the assessment of structures and cooperation within the ETH Domain, as well as with external institutions with which it maintains strategic alliances, from the viewpoints of efficiency and efficacy? Is there potential for optimisation? (A.4) • What is the assessment of the ETH Domain's cooperation efforts with various cantons, which have been expanded in recent years? What is the assessment of these cooperation arrangements in the context of the coordination of the entire Swiss higher education sector? (A.5) <i>Regarding the conditions for the successful execution of the basic mandate:</i> • The following key factors for the future success of the ETH Domain have been identified: ○ autonomy of the ETH Domain and its institutions, ○ stable and reliable funding, ○ international openness and networking. How are these factors to be assessed and how well are they ensured? What further internal and external factors are important? (B.1) • What internal and external factors do you consider have contributed most to the successful national and international positioning of the two ETHs and the four research institutes? (B.2)	○ international openness and networking. How are these factors to be assessed and how well are they ensured? What further internal and external factors are important? (B.1) • What internal and external factors do you consider have contributed most to the successful national and international positioning of the two ETHs and the four research institutes? (B.2) <i>Regarding the Strategic focus areas for research 2017-2020 of the ETH-Domain:</i> • The strategic focus areas in the ETH Domain for the period 2017-2020 are as follows: Data Science, Advanced Manufacturing, Personalised Health and Related Technologies and Energy. How should the potential of these focus areas be gauged in the context of the coordination of the entire Swiss higher education sector, international scientific trends and the needs of the Swiss economy and society, as well as their organisational and thematic implementation to date? (C.1)
--	--	--	---