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ETH Domain: Role and Impact

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Overview

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- Role of the ETH Domain in the Swiss University Landscape
- Bibliometric impact of ETH Domain
- Econcomic impact of ETH Domain in Switzerland
- Quality of ETH Domain patents

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ETH Domain in the Swiss University Landscape

(excl. Universities of Applied Science)

ETH zürich · EPFL · Paul Scherrer Institut PSI · WSL · Empa Materials Science and Technology · eawag aquatic research

ETHZ and EPFL in the Swiss University Landscape: Anchor Positions

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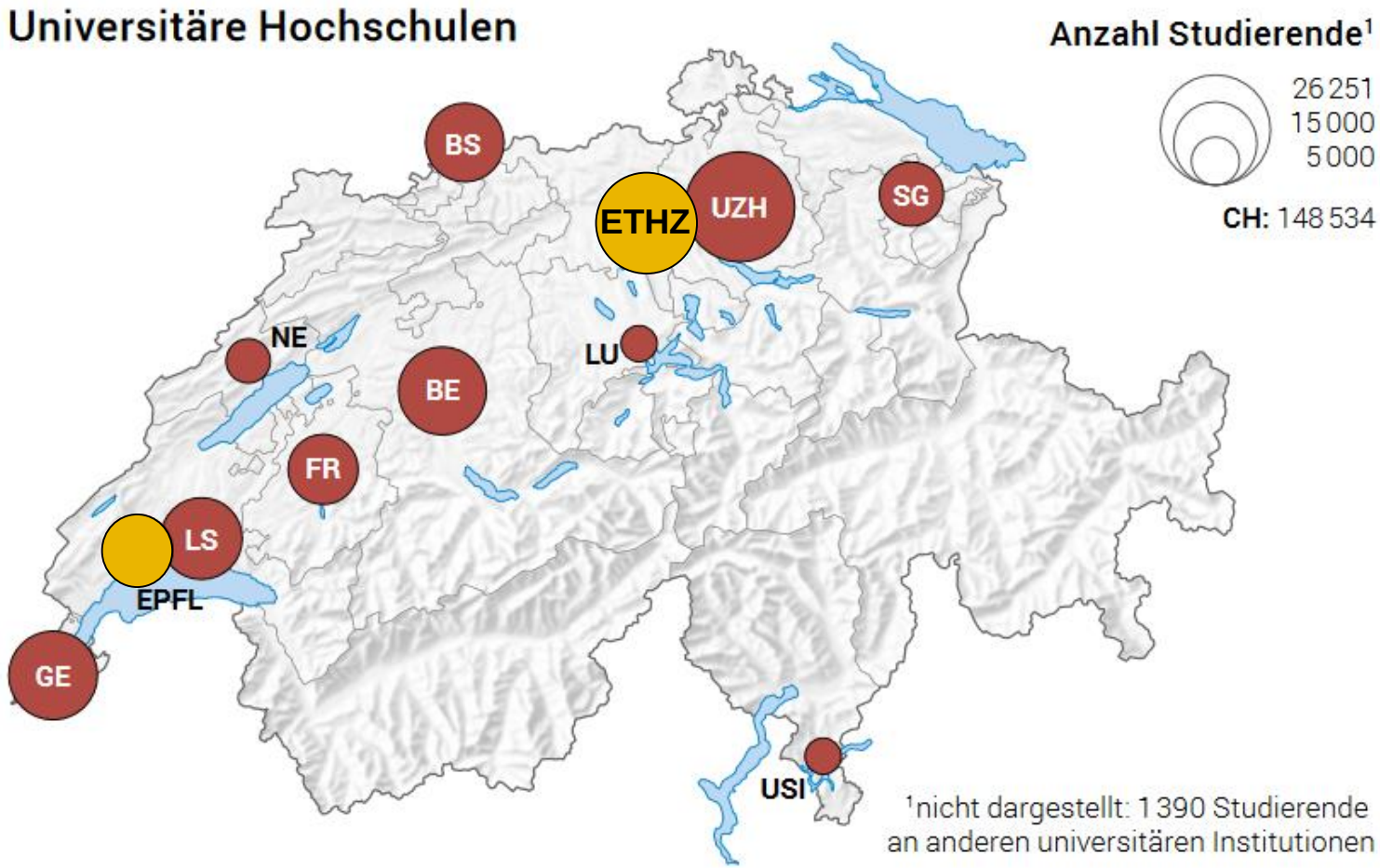

Students at Swiss universities» in 2016 / 2017

Switzerland: Students 2017-2018

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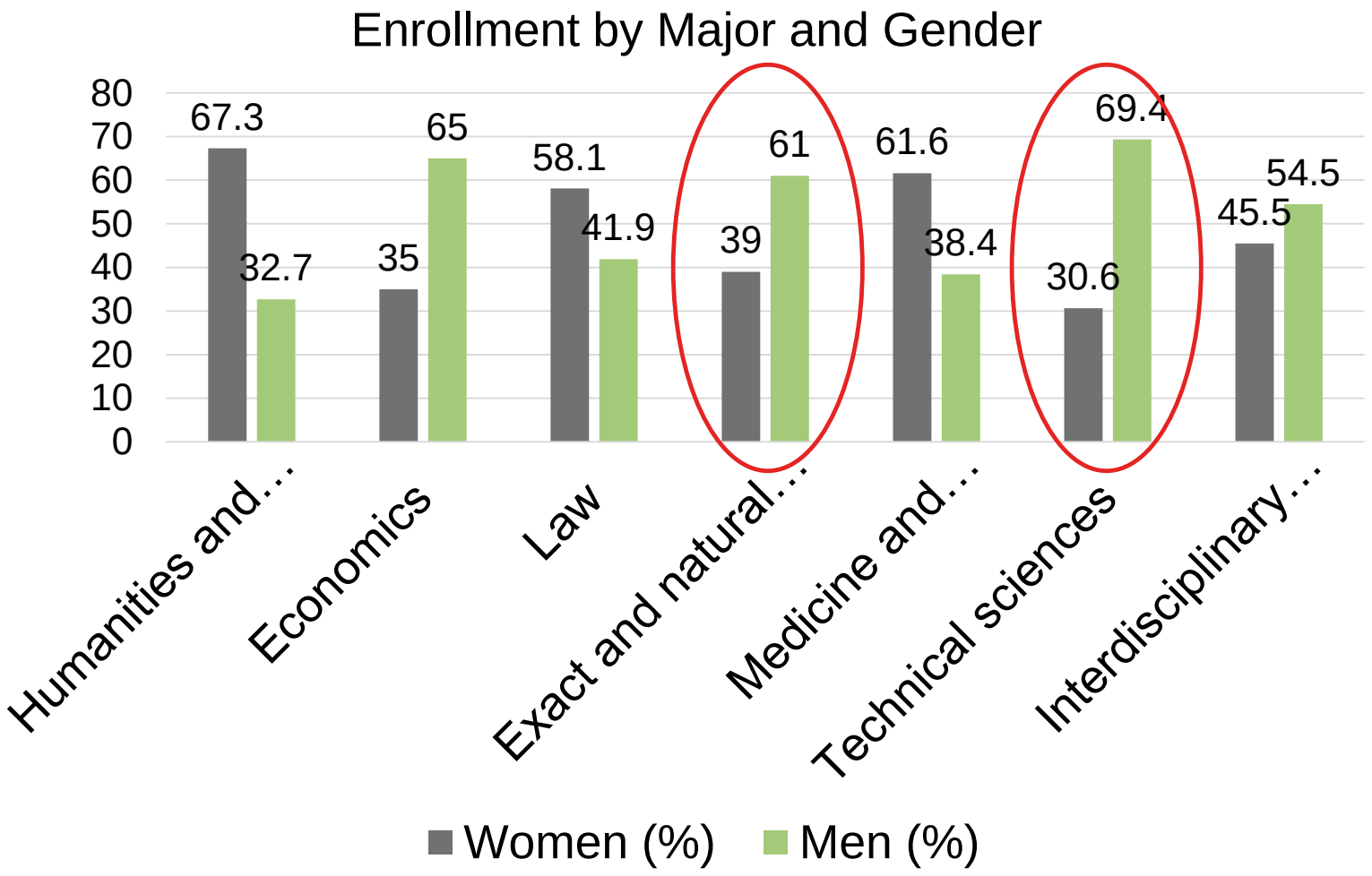

MINT Majors @ Swiss Universities

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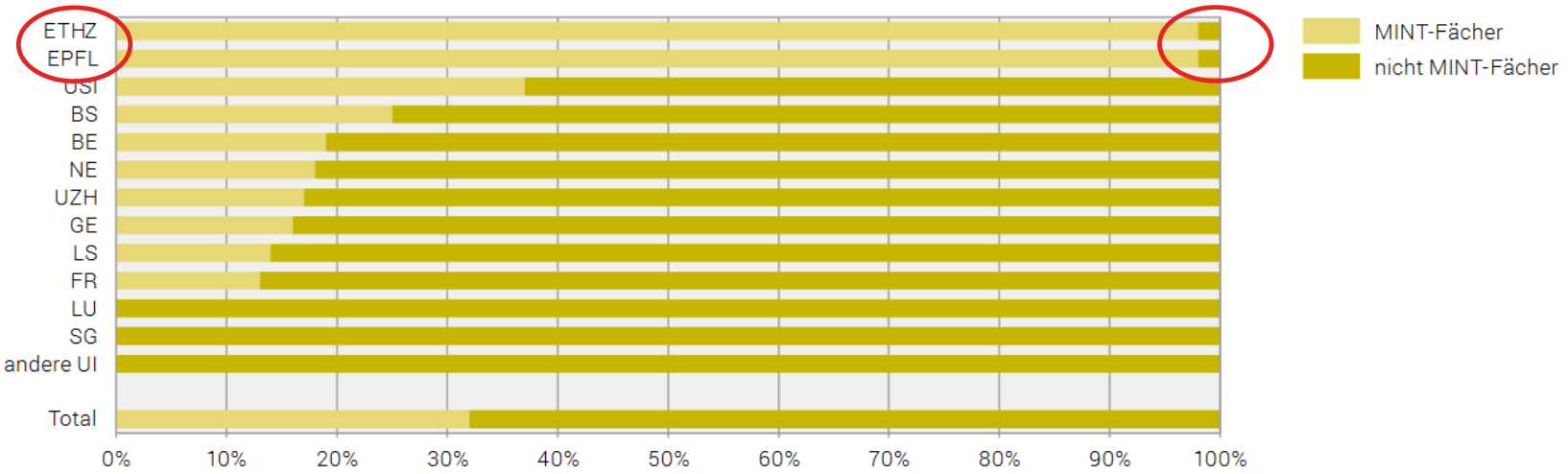
- Students enrolled in MINT majors 2015/16

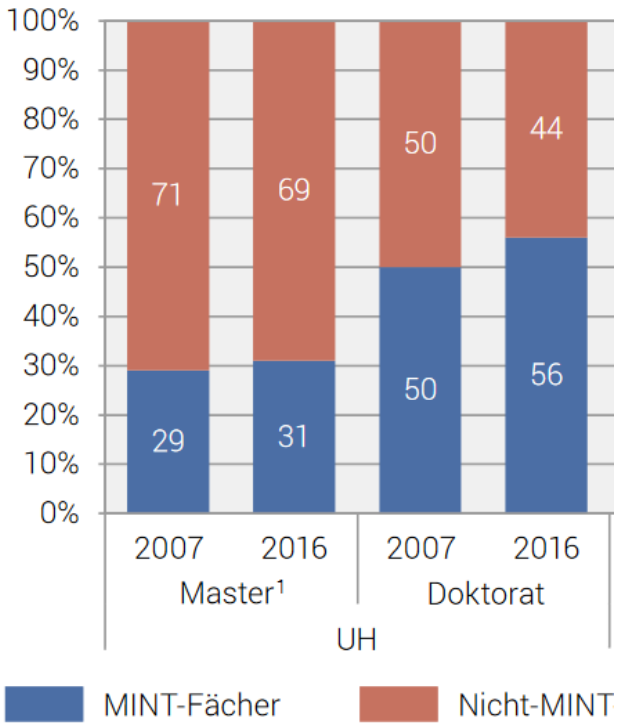


Quelle: BFS – SHIS

- ETHZ and EPFL: 98% of students in MINT majors
- Cantonal universities: 13-25% of students in MINT majors

Source: BFS (2017). Studierende und Abschlüsse der Hochschulen in den MINT-Fächern.

MINT vs. Non-MINT Diplomas



[1] Lizenziate/Diplome inbegriffen
[2] Diplome inbegriffen

- Increasing percentage and importance of MINT-PhDs
- Increasing importance of the ETH Domain at Doctoral level

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Bibliometric Impact of ETH Domain Institutions

Bibliometric Impact of ETH Domain

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Background and Methodology: The Center for Science and Technology Studies (CWTS) at Leiden University, NL measured bibliometric performance of six ETH Domain institutions.

- Articles and reviews published in the WoS database between 2007 – 2016, citations taken into account until and including 2017 (no conference proceedings)

Results: The analysis confirms the excellent performance of ETH Domain in terms of publications.

- Constant increase in output and impact
- Impact of publications is high for most active research fields
- MNCS and PP are larger than world average
- Clear link between int. collaboration and impact of output

Bibliometric Impact: Overview

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Indicators	ETHZ	EPFL	PSI	WSL	Empa	Eawag
Output						
Articles	50,383	25,193	9,602	3,047	4,988	3,231
Impact						
Amount of citations	1,011,156	594,826	166,933	62,670	90,083	72,383
Citations/ publication (average)	20.07	23.61	17.39	20.57	18.06	22,40
MNCS	1.56	1.63	1.37	1.38	1.46	1.7
PP	18%	19%	15%	16%	17%	21%
Scientific Collaborations						
Percentage of publications produced with some level of collaboration	78%	77%	89%	88%	85%	91%
Impact of international collaborations	Highest	Highest	Highest	Highest	Highest	Highest
Budget of Institution (Mio. CHF)	1850	1051	413	88	193	83

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Impact of ETH Domain Institutions on Switzerland‘s Economy

A Simple «Theory of Change»!

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- What politics would love to see!

Incomes	Input	Implementation	Output	Outcome	Impact
Scientific curiosity	CHF	Research: Autonomy	Great research	Researchers: – Careers	Increasing insights
Grand challenges	Intelligent people	Politics: Control	Great teaching	Students: – Successful studies – Successful careers	Grand challenges addressed
Economic challenges	Infrastructure		Successful transfer to economy , society	Institutions HE – Rankings – Attractiveness for best faculty and students	Increasing GDP Pursuit of happiness!

What a simple Theory of Change!

Limits to the «Theory of Change»

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- System boundaries, time lag, external factors and the question of additionality set limits to a simple theory of change!
  - **System boundaries:** Where do we set system boundaries? And how do we assess impacts beyond these boundaries?
  - **Time lag:** How long does it take until outputs eventually lead to outcomes? And how long until impacts are achieved?
  - **External factors:** How can we identify and measure external factors impacting societal and economic developments?
  - **Additionality:** How can we distinguish impacts of research and higher education on societal and economic developments from the effects of external factors?

Economic Impact Analysis 2017

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- **Economic Impact Analysis 2017** BiGGAR Economics, Edinburgh, Scotland in view of assessing the impact of the ETH Domain on Switzerland's economy:
  - Estimation of the extent of economic contribution of the ETH Domain
  - Identification of the range of impacts
  - Demonstration of the return on private and public investment
  - Explanation of benefits and positive impacts of institutions

➢ Quantifiable economic impact

➢ Non-quantifiable economic impact

Quantifiable Economic Impact

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- Every CHF invested in the ETH Domain generates more than 5 x its value – and each job in the ETH Domain supports almost 4 other jobs in Switzerland (2016).
  - CH: estimated CHF 13.3 bn of GVA
  - CH: employment equivalent to 98’700 jobs (headcount)
  - Globally: estimated CHF 16.5 bn of GVA
  - Globally: employment equivalent to 123’800 jobs (headcount)
- **Direct Demand:** Total of CHF 6.5 bn in GVA or 49 % of total contribution to GVA generated.
- **Indirect increase in performance and competitiveness:** Approximately CHF 6.74bn or 51% of total contribution to GVA generated.

Non-quantifiable Impact

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- **Attractiveness and international reputation** in education, research and innovation increase the international exchange of experience, business ties, supply of highly qualified workforce, cultural exchange, mutual understanding.
- **Cooperation with international companies:** Google & Disney Research, Nestlé Institute of Health Sciences, IBM, ABB, Novartis and Roche.
- **Cooperation with cantons and cantonal institutions** in line with strategic objectives.
- **Provision of public goods & KTT:** Supporting public administrations and contribution to improving ecological situation in many fields (health, natural hazards, water etc.).

Attracting Talent and Women

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- Attracting national and international talents at student, doctoral and postdoc level:
  - Student numbers are up 54% since 2008
  - Doctoral student numbers are up 29% since 2008
- Attracting talented women at professorship level:
  - 686 Full and Associate Professors: **12.8% female**
  - 109 Assistant Professors TT: **22.0 % female**
  - 55 Assistant Professors: **27.3 % female**

➔ **14.9 %** of professors at ETHZ and EPFL are female

➔Women go for MINT +!

Impact of ETH Domain Spin-offs

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- **Turnover and Employers:** All 659 spin-offs active in 2016 generated est. CHF 1.6bn turnover and employ 6,600 employees in Switzerland
- **Success:** Every year, ETH Domain spin-offs are among winners of TOP Swiss start-up rankings & frequently awarded prices. As a consequence, they are increasingly attracting attention of big corporates as acquisition targets
- The ETH Domain applies a comprehensive set of instruments to identify, foster, promote and mature entrepreneurial aptitudes of students and collaborators.

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Patent Portfolio of ETH Domain Institutions

Background and Methodology

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- Study done by **BAK Economics AG** with a new, big-data approach to evaluate the strength of each individual patent worldwide.
- The study assessed patents of ETH Domain and compared them to other research institutions, to the industry in Switzerland and to a selection of ten international research institutions (in 17 specifically defined technologies).
- Patent strength depends on:
  - **Patent activity:** market coverage as self-assessment
  - **Patent quality:** references and citations by third party as competitor's assessment of relevance of technology

ETH Domain Nationally Top

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- ETH Domain in first place in 8 / 17 technologies compared to Swiss technologies and other research institutions and in top 5 in six additional technologies.
- ETH Domain owns most world-class patents in wide range of technologies compared to Swiss companies and other research institutions in Switzerland.
- One third of all analyzed ETH Domain patents are world-class (i.e. belong to the 10% of the highest rated).

ETH Domain Internationally Top

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- ETH Domain shows the third-highest patenting efficiency – after Harvard and MIT and ahead of other European institutions in relation of institutions selected for this study.
- ETH Domain is among leaders in more than one third of all technologies analyzed and very active in joint research projects with industry or other research institutions:
  - 376 co-owned patents stem from joint research projects
  - Joint research for additional 479 patents owned by partner
  - 1’945 companies and research institutions worldwide cite ETH Domain in 5’041 third-party patents
  - 3’081 company patents list at least one inventor who had previously worked and patented for ETH Domain