ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Schweizerischer Wissenschafts- und Innovationsrat
Conseil suisse de la science et de l'innovation
Consiglio svizzero della scienza e dell'innovazione
Swiss Science and Innovation Council

What are the reasons behind the Swiss success as the most innovative country?

Dominique Foray
EPFL and SWIR

DFiR Conference – Sept. 5, 2017

World Class Innovation

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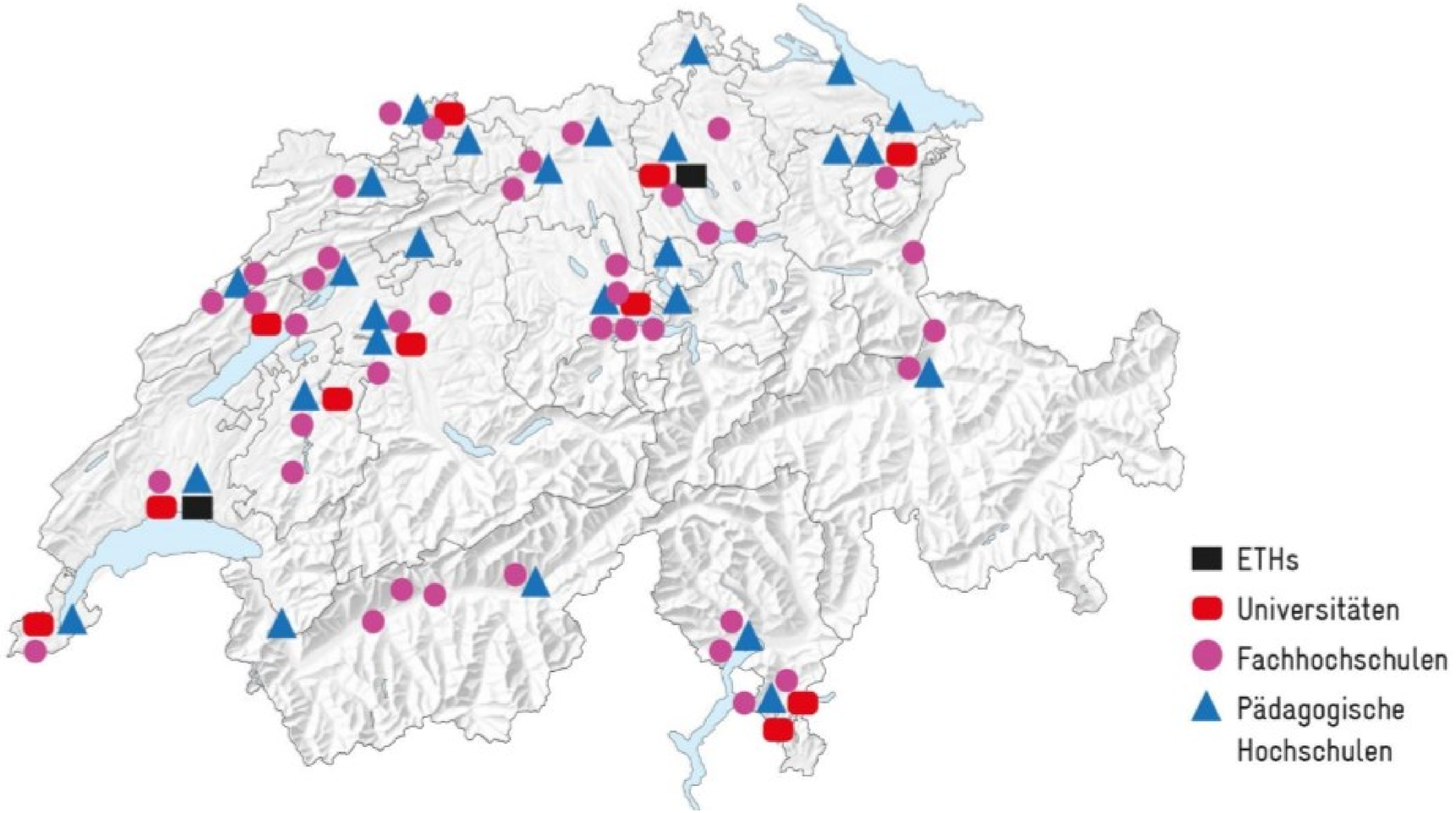
Stratégies de Spécialisation Intelligente

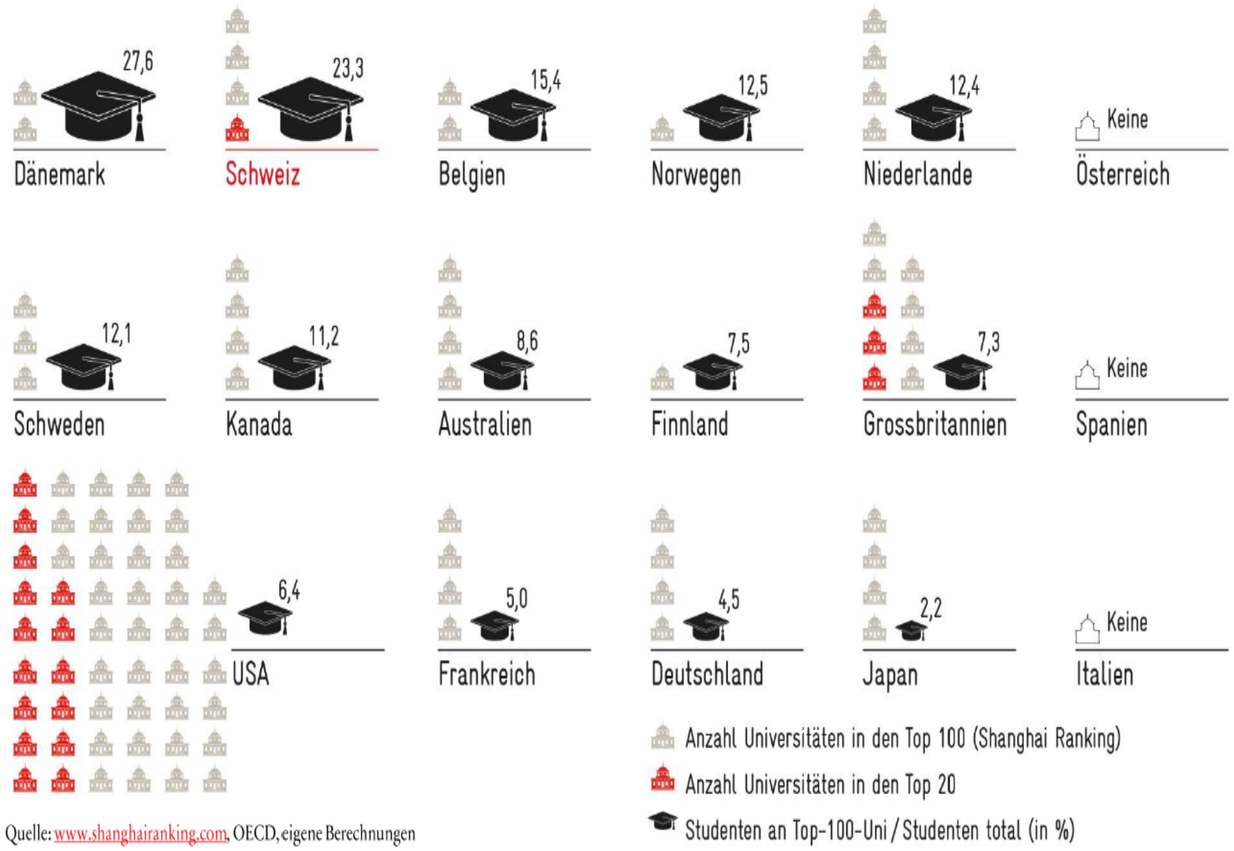
- Knowledge and human capital
- Institutions supporting dynamism and vitality (entrepreneurship)
- Collective actions (SMEs and transfer of knowledge)

Standorte der Schweizer Hochschulen



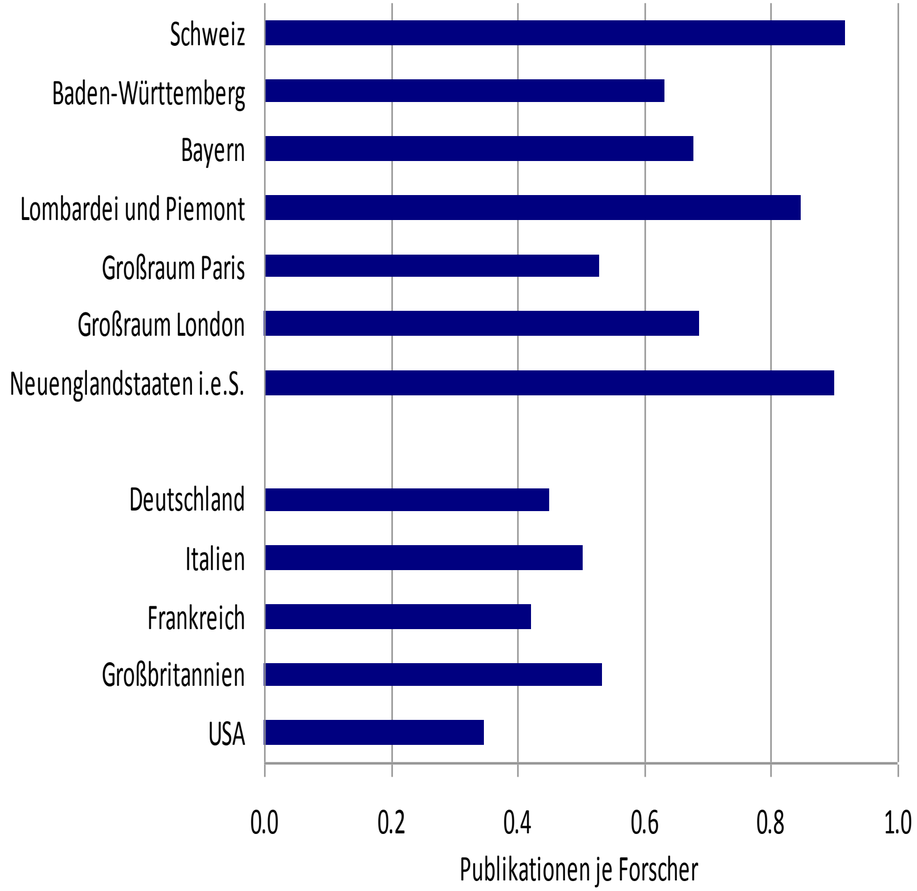
Top science and top high education

Studenten an Top 100 Universitäten (2015)



Quelle: www.shanghairanking.com, OECD, eigene Berechnungen

Source : avenir suisse



Source: SBFI

The economics of multi-sided platform - 1

- Switzerland works as a platform to connect star scientists to great students
- A multi-sided platform recruits participants belonging to two (or more) different groups and ‘sells’ each group of participants access to the other group of participants
- A system with positive feedback – star scientist and great students
  - Star scientists are disproportionately important in terms of building a strong research agglomeration
  - Great students are a factor of attractivity for and are attracted by star scientists
- Get momentum, build critical mass on both sides, reach the tipping point

- Attracting star scientists:
- Great research infrastructures
- Generous support packages
- Efficient competitive grant system (SNF, ERC)
- High salaries
- Languages
- University leaderships and autonomy to recruit and experiment
- Private sector contribution and interactions
- Location (close to.., quality of life)
- Society's value
- Great students….

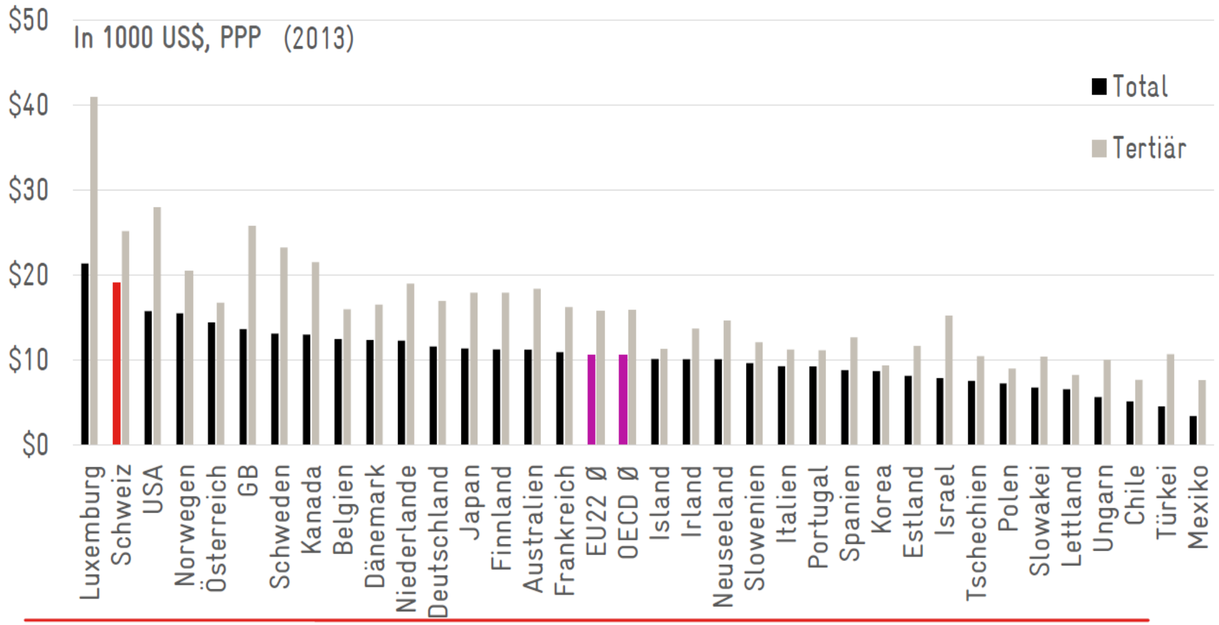
- …attracting great students : a model offering top educational services (Universities'reputation) for negligible fees at the center of Europe

The economics of multi-sided platform - 2

- Successful multi-sided platforms violate the rules of pricing that every beginning econ student learns. They can sell their services to one group for less than cost
- In case of Switzerland as a platform to connect scientists and students, services are sold to one group for less than cost (typically *students*) and the platform pays high price to recruit participants of the other group (typically *star scientists*) – the goal is to reach critical mass on both sides
- Not many countries can play this game
  - Simply not able to produce/attract enough star scientists
  - Countries – with a large sector of PRO (basically mass of scientists with no student) – obviously can't play the platform game (one exception : USA) because the platform cannot sell to «students» the access to a large fraction of the scientific community
  - In Switzerland the PRO sector is negligible

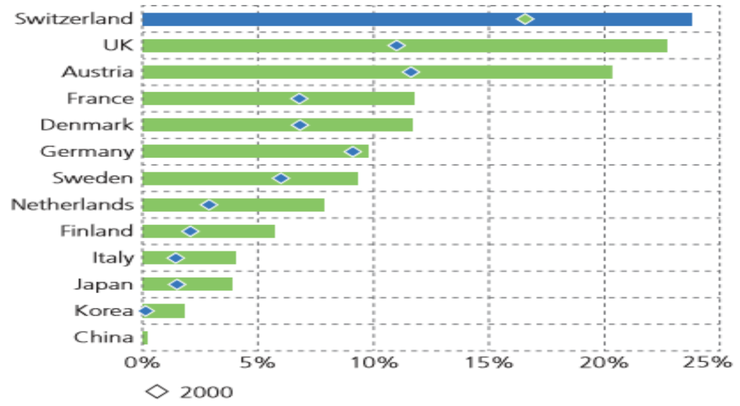
Implications – costs and internationalisation

Bildungsausgaben pro Schüler und Student



Source : avenir suisse

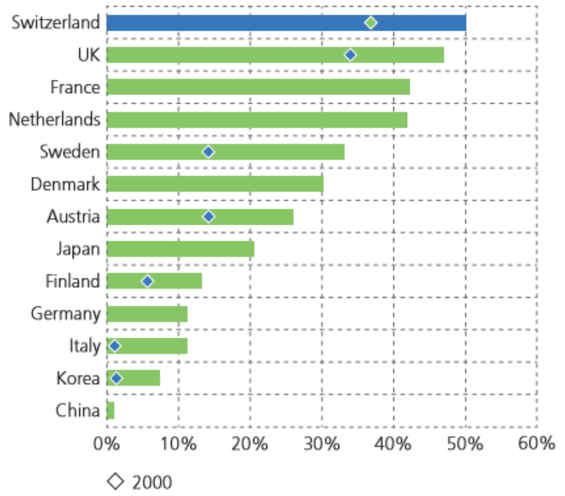
Figure B 2.5: Share of foreign students among all students at tertiary level, 2012



No data available: USA
Source: OECD, KOF calculations

Source : SBFI

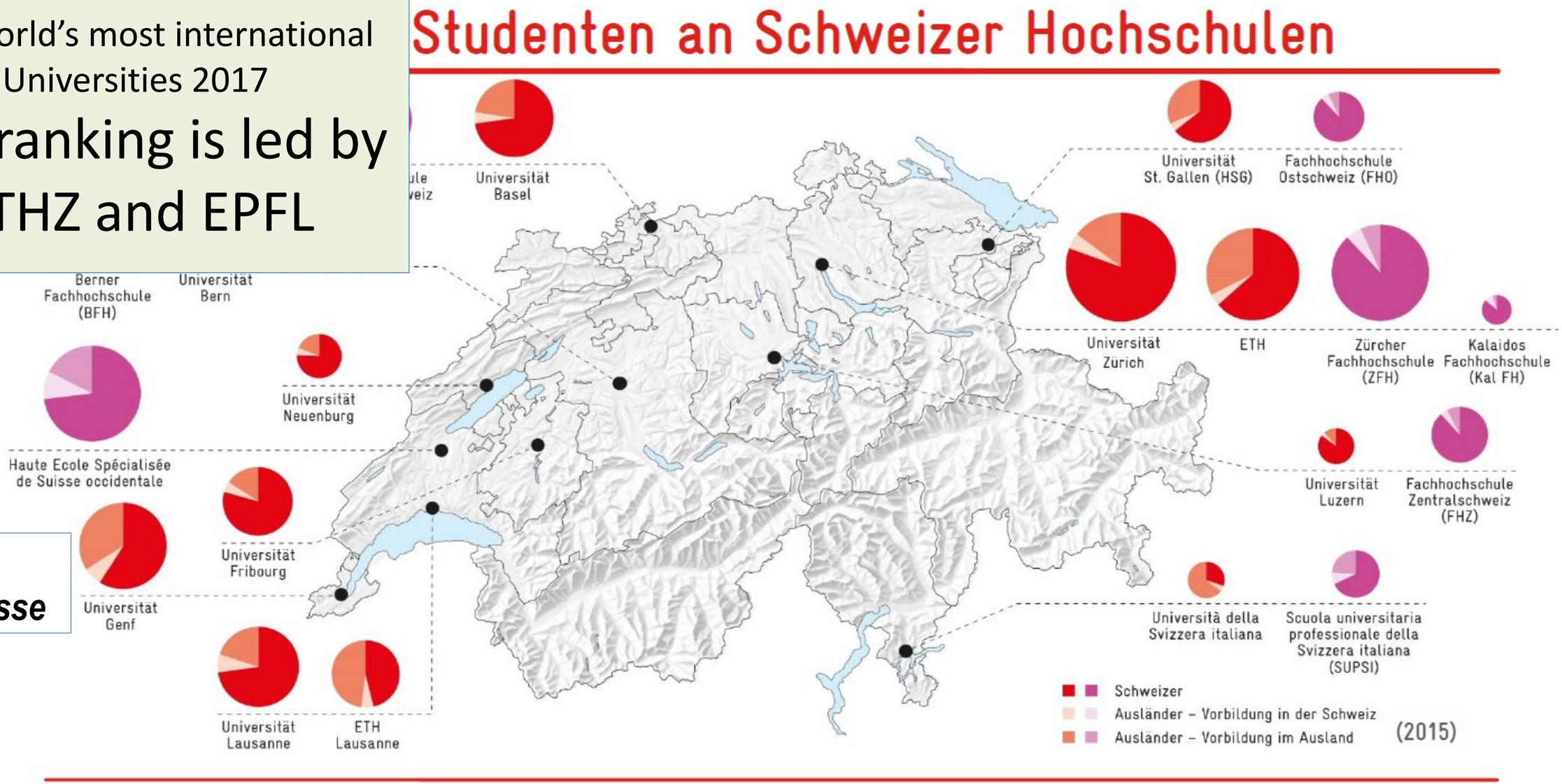
Figure B 2.6: Share of foreign doctoral students among all doctoral students, 2012



No data available: USA
Source: OECD, KOF calculations

The World's most international Universities 2017

THE ranking is led by ETHZ and EPFL



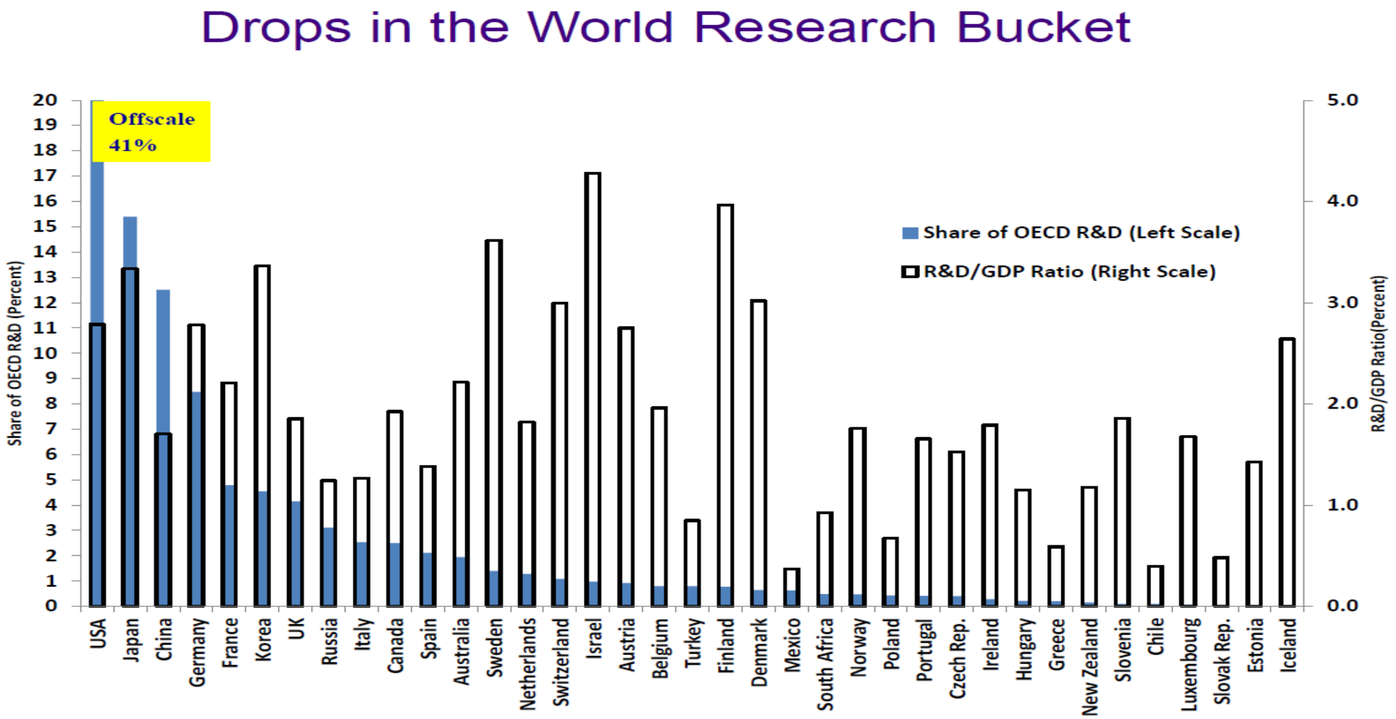
Source : avenir suisse

Returns for Switzerland?

- Top public research? Yes!
  - but as all small countries, Switzerland is investing in research despite the reality that it is a drop in the world research bucket ..
  - If research were a pure global public good, this would make no sense!
  - Rationale – absorptive capacities, unique research needs, local innovation

- But not optimal to try to do everything the US does but just do it at smaller scale

- Division of labour, co-specialization



Returns for Switzerland?

- Top public research
- Access to a great diversity of talents – but .. many then will leave
  - *Gone but not forgotten?*
  - Can Switzerland keep the best students?
    - Many factors do not help – academic job market is small and difficult – migration policy (for non EU)
- Is *platform economics* a sufficient rationale?
- Risk of loosing connection with the Swiss economy & society both in terms of size of the academic system and content «*Unis:*
  - «*Wenig Interesse an der Schweiz*», «*Schweizer zahlen, Ausländer kassieren*», «*Und was ist mit unseren Problemen?*»
- Connection to the country is crucial –
  - Public research - responding to unique research needs and to local innovations
  - High education – who will stay?

Scientists

Students

Universities and Polytechnics

Platform economics

Costs and internationalisation

Returns?

Risk of disconnection?

Theoretical knowledge

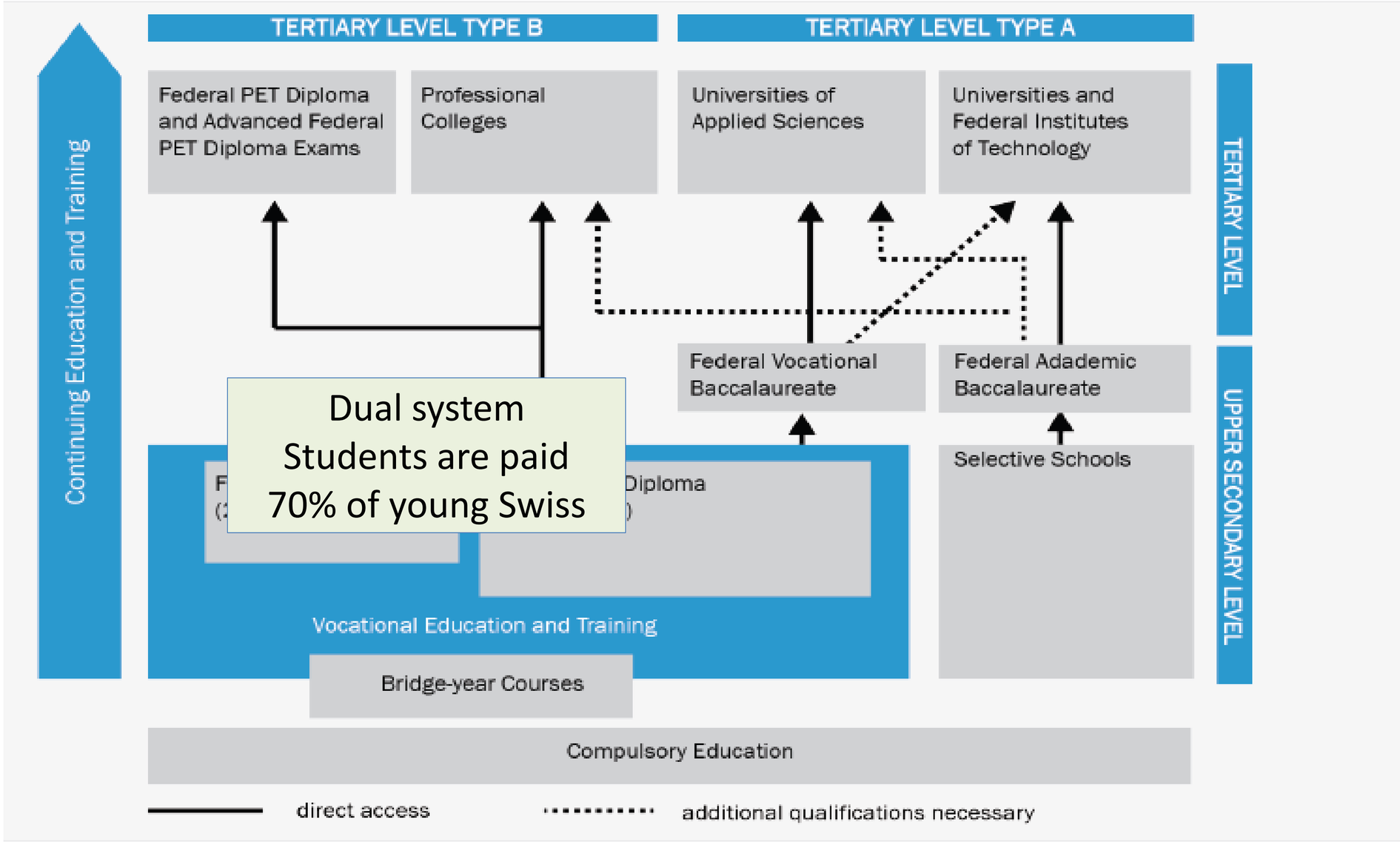
Practical knowledge

?

Top applied science and top vocational education

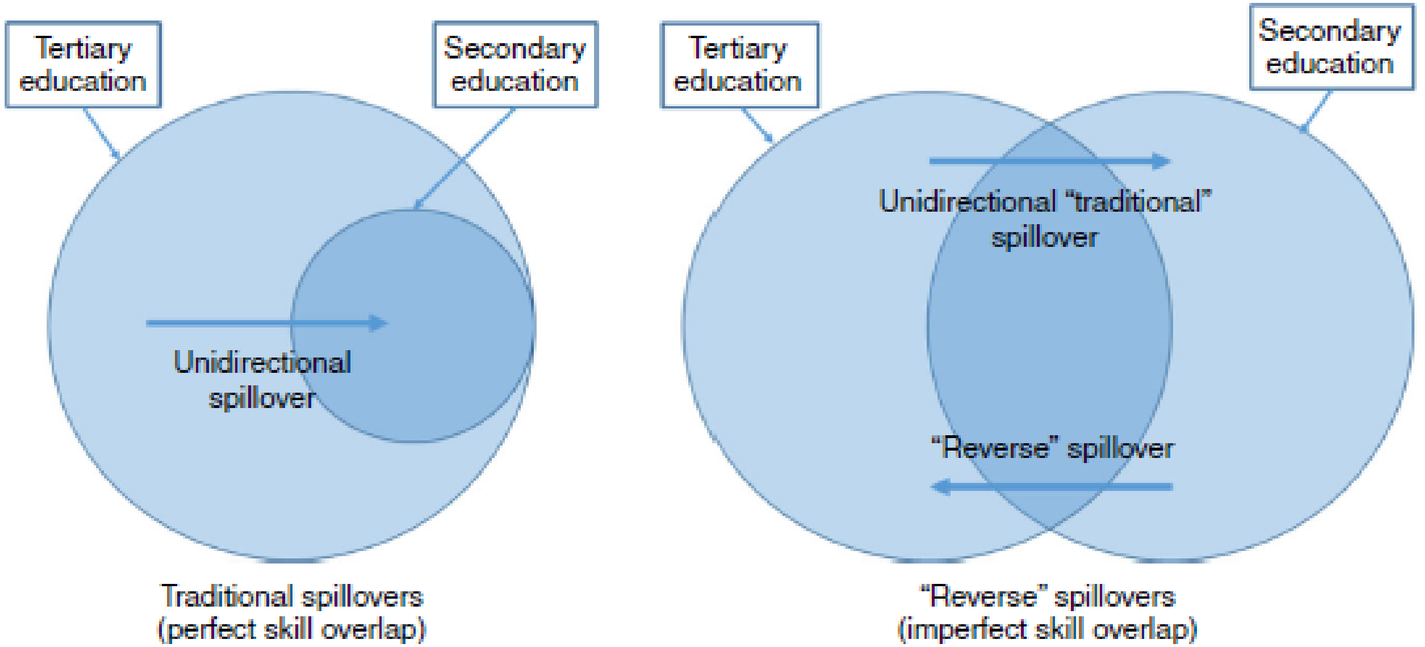
- The UAS reform in the 1990s
  - To provide apprenticeship graduates from the dual vocational edu and training system with a career perspective by offering then an opportunity to earn a 3-year bachelor's degree in addition to their apprenticeship degree
  - To foster regional innovation activities
- The Swiss UAS are a system of campuses spread out over different regions
- All disciplines are covered with a strong emphasis on applied research and professional training

FIGURE 1: THE SWISS EDUCATION SYSTEM



Reverse educational spillovers

- Traditional spillovers go from highly educated workers to lower educated workers and assume that lower educated workers have no additional skills or knowledge that could be relevant for high-educated workers – they have just a bit less of everything
  - In many countries there is a system with one strong type of edu (i.e. academic edu), and lower educated workers have just spent less time in universities (or no time at all) – they have just acquired less knowledge
- In countries with more than one type of edu – including a strong VET providing different type of training and edu, students acquire skills and knowledge *that are different from but relevant to* a formally higher educated worker
- Reverse spillovers occur in such case – positive impact on productivity goes in both directions



Source: Backes-Gellner et al., 2016

« *In the US you have the same brillant innovators in research and development that we Swiss do, but here the lab technician can make prototypes to specification that are higher in quality than anywhere in the world* »

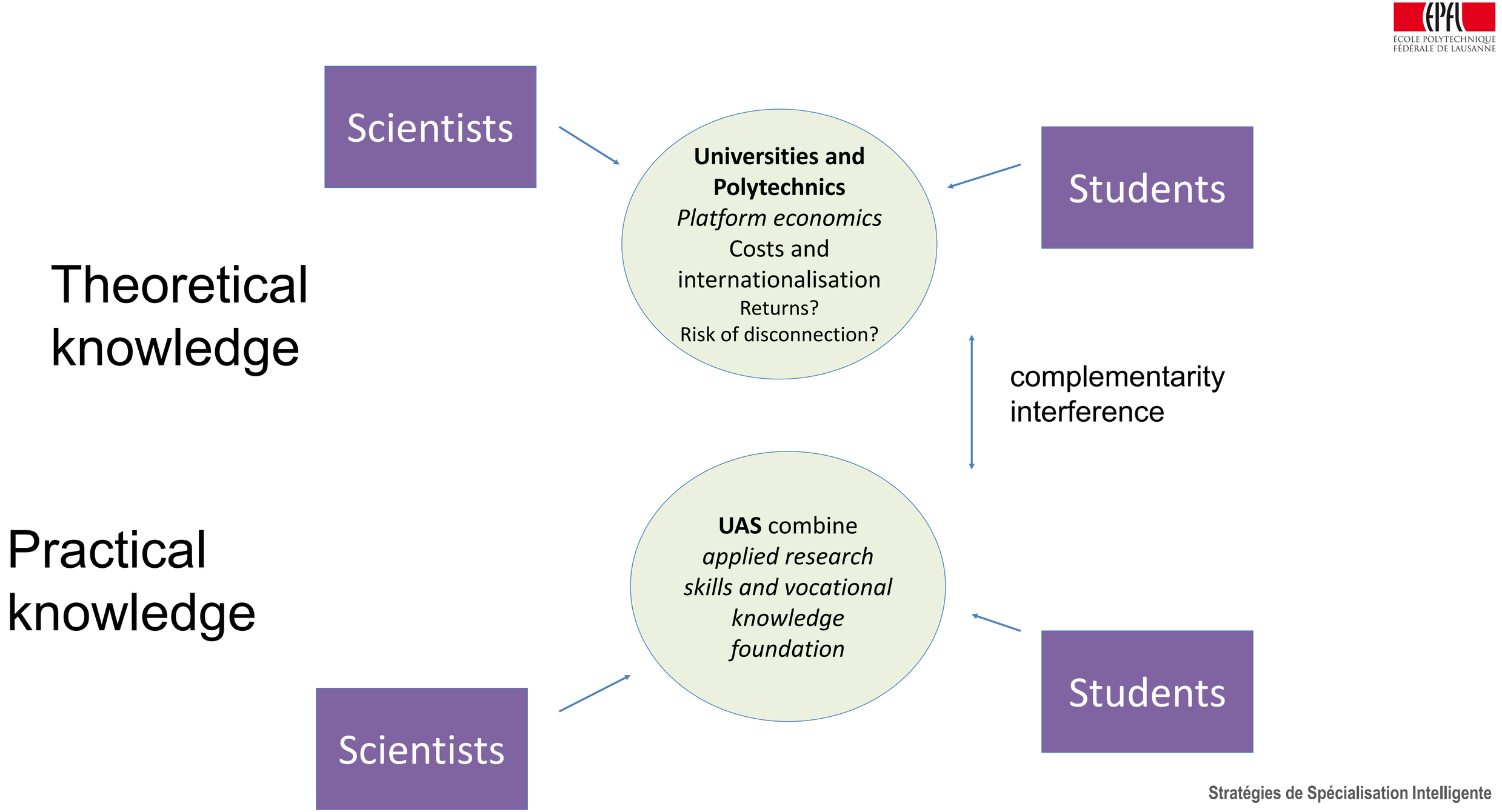
Pr. Lino Guzzella, President of ETHZ

Evidence for reverse spillovers

- A strong VET system which provides a distinctive type of knowledge allows for reverse spillovers and enhance productivity and innovation performance at firm level
- This is clearly the case for Switzerland – econometric evidence (Backes Gellner et al., 2016)
- Number of workers with VET degrees has a positive impact on productivity of workers with tertiary education
- Policy implications – unlike Aghion et al. (they wrote: *countries at the frontier need to increase tertiary education*), it pays to keep a balanced mix with vocationally educated workers (as opposed to unqualified)

Regional innovation

- The UAS reform (including a mandate to do applied research in relation with regional economies – co-specialisation) has a causal effect on innovation (8.4 to 14% increase in regional patenting)
  - Evidence from Pfister et al., 2017
- The applied research undertaken at UAS as an essential driver, through:
  - UAS graduates entering local labour market
  - Public private cooperation and parnerships
- The effect is strong in regions outside major centers of commercial innovation
- Policy implication: supporting applied research at UAS (incl. PhDs programs) while keeping its unique research identity (not evolving towards academic research)


Scientists
Universities and Polytechnics
Platform economics
Costs and internationalisation
Returns?
Risk of disconnection?
Students
Theoretical knowledge
complementarity
interference
Practical knowledge
UAS combine
applied research
skills and vocational
knowledge
foundation
Scientists
Students

- Knowledge and human capital
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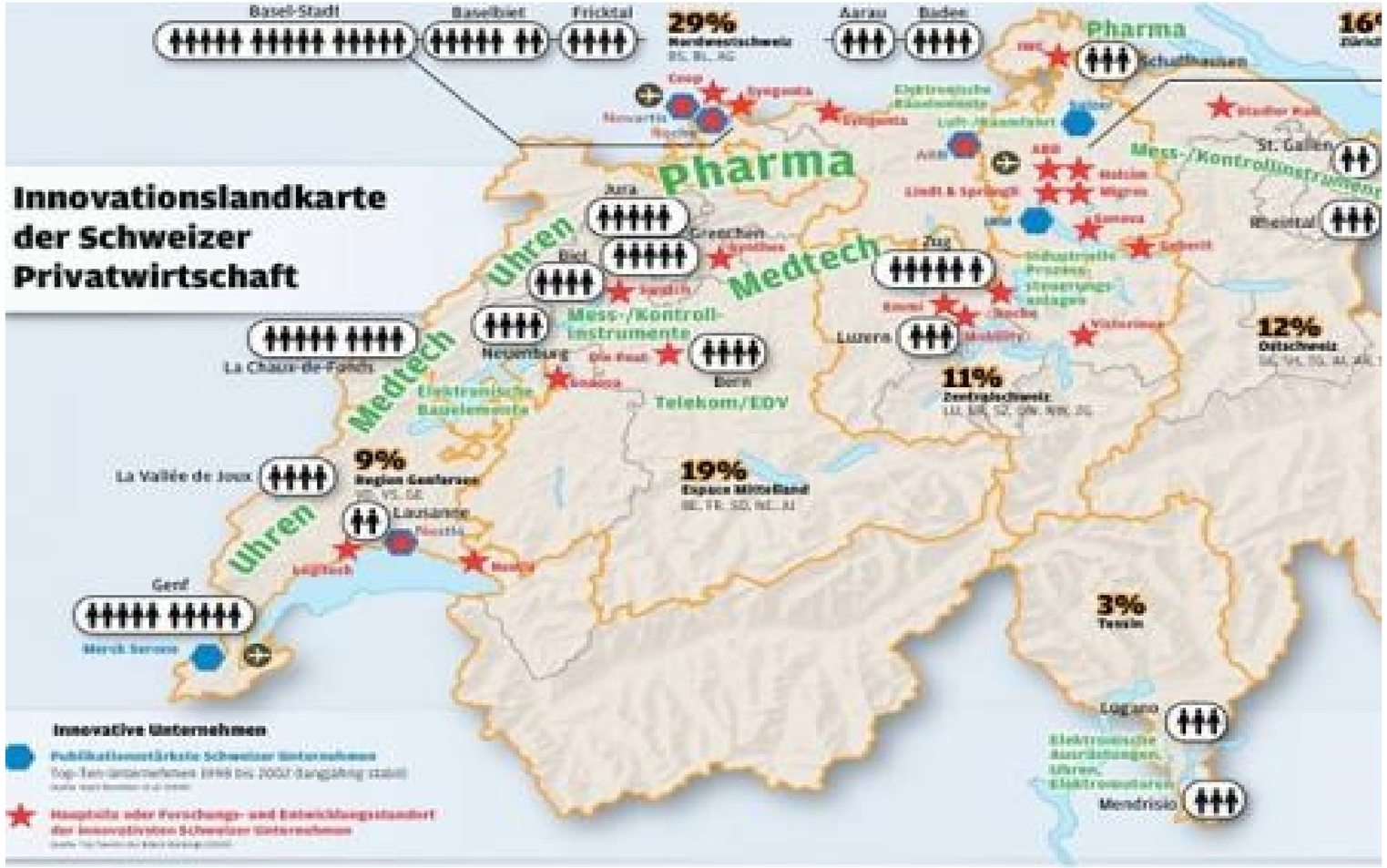
Collective actions and the wealth of local eco-systems



- In many eco-systems one important failure deals with the provision of ***complementary capabilities*** that most SMEs need to innovate but cannot produce in house
  - Basic/applied R&D, services, training, new equipments
- Collective action problem
- In many cases the lack of such capabilities is a real problem.
  - *Firms are home alone* (Berger)
- Government policies to provide these collective goods are needed but in many cases very expensive and uneffective.
  - The risk for the State is to pile up a great number of institutions which poorly address the specific capabilities needed by firms

- Another mechanism involves the creation of private institutions by the firms themselves in order to solve the collective action problems raised by the provision of specific public goods
  - From Coase : the existence of externalities and opportunities for collective actions induce the creation of institutions by the private agents themselves (instead of relying on the classical Pigou or Samuelson solutions)
- Virtues of Coasean economics: firms are in a better position to decide about the needed capacities and capabilities; opportunity cost of public funding is minimized
- The case of Switzerland

The New Growth Theory and Coasean Economics: Institutions to Capture Externalities

By

Rolf Weder and Herbert G. Grubel

Contents: I. Introduction. – II. The Role of Externalities in the New Growth Theory. – III. Institutions to Capture Externalities. – IV. A Case Study of Swiss and Japanese Institutions. – V. Summary and Policy Implications.

- The Swiss laboratory for Horological Research
- Synthes (medical technologies)
- The watch industrial association
- The Swiss Centre for Electronics and Microtechnology
- Inspire AG (machine tool, mechanical engineering) *next slides*

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ETHZ

Maschinenbau
Mechanical eng.

Academic missions rewards

Many good reasons to fail! Even if the University TTO makes its best!

SMEs
Industry 4.0

Short term scepticism

Spin-offs

Inspire was initiated by two SMEs

ETHZ

Maschinenbau
Mechanical eng.

Inspire

9 research groups – 50 empl.
Researchers, engineers
Not ETH Prof.
But ETH graduates
+ PhDs and Post Doc
(about 25)

SMEs
Industry 4.0

Academic missions rewards

Reputation
Inspiration
Supervision
6 Prof.
25% time

50 KTT projects
Quick & dirty
Services
Easy contracts

Short term scepticism

Training addressing both directions

Federal funding – 2.5 Mio
CTI & other projects and services
ETH *in kind* contribution

A structural form which will become of wider relevance for KTT in the digital era

SMEs capacity to produce the private institutions to solve collective action problems

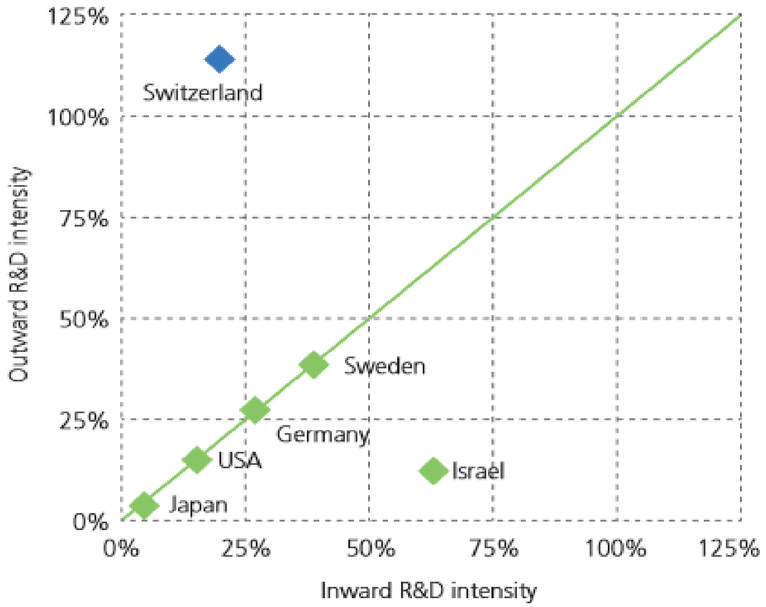
The small firms *coordinated* among themselves to enable *collaboration* with ETHZ

Summary

- Top science and top high edu – platform economics
  - Risk of disconnection? Public research co-specialisation? Do the best (foreign) students stay?
- Top applied science and top VET – as a strong determinant of innovation (reversed spillovers, regional innovation)
- Institutions for economic dynamism
- Collective actions and local ecosystems

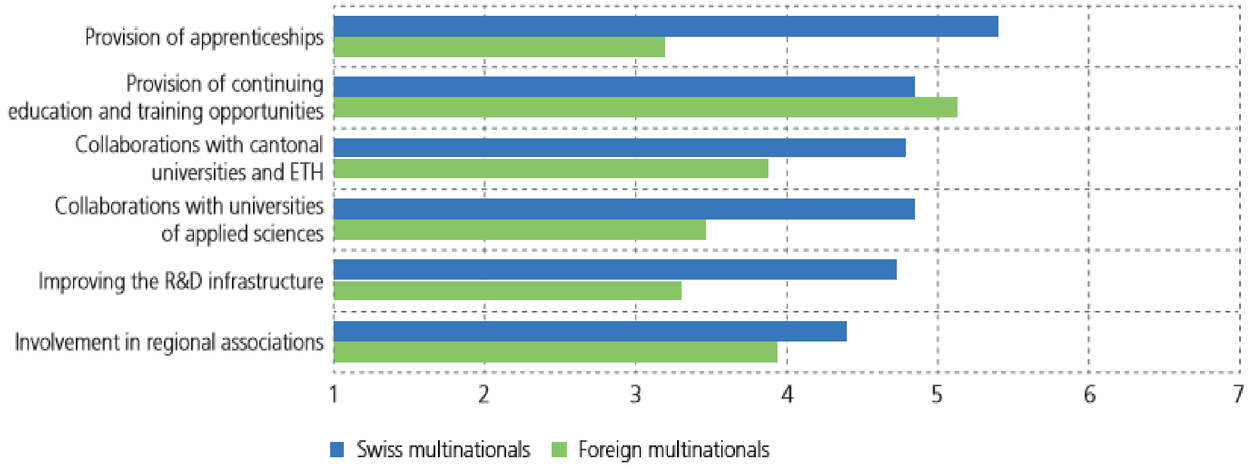
- Management capabilities : to understand how collective or coordinated actions can boost innovation and profitability

Figure C 2.1: Inward R&D intensity (inward BERD / total BERD) vs. outward R&D intensity (outward BERD / total BERD)



Source: OECD and FSO, SERI illustration (in keeping with Dachs et al., 2012)

Figure C 2.5: Commitment to education, continuing education and training and collaborations with universities as well as regional commitment (self-assessment by multinationals)



Likert scale from 1: far fewer than other firms through 4: the same as other firms to 7: far more than other firms
Source: Survey by the University of St. Gallen (ITEM-HSG) (n=46)