

Inspiration – Transpiration – Innovation

Was braucht es damit Innovation gedeihen kann?

Prof. Dr. Gian-Luca Bona





Smart Electronically Climatized Clothing System (SECC)

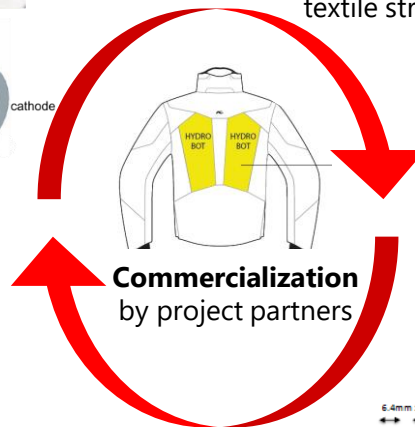
Vision: Active control of clothing microclimate for increased wearing comfort

Development of Electro-Osmotic Membrane

Conductive yarns and polymer films with defined pore sizes



Membrane engineering:
incorporation of membrane in textile structures

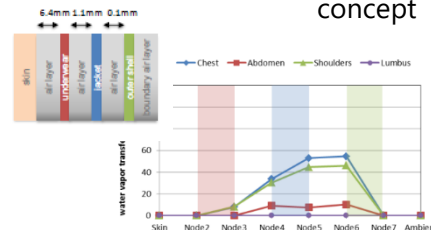


Commercialization
by project partners

Numerical simulation of heat and mass transfer in clothing systems for the development of garment concept



Proof of concept
and near to practice validation on thermal manikin



Evolution and Change: Materials meet Life: Smart Textiles

From Materials to monitor body functions

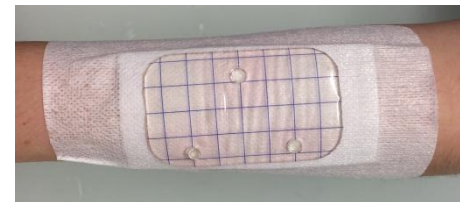
Coffin for Apnea prevention



Luminous clothing for light therapy



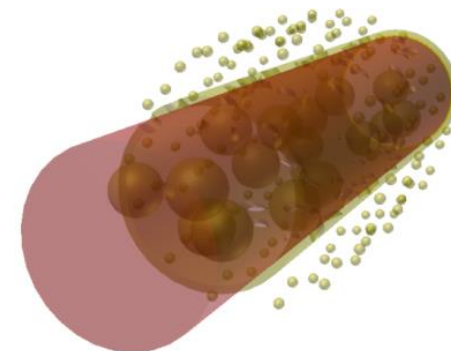
Drug release and wound healing



Currently:
Injection by syringe



Future:
Sticking plaster activated
by UV-light



With partners:

ETH zürich

csem



University Hospital
Zurich

Digital twins for drug delivery

Forecasting loop to
predict future state

Specific
patient

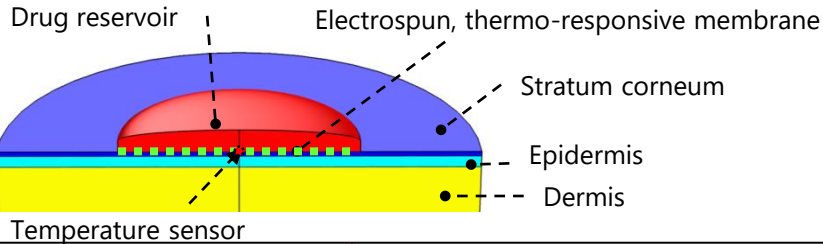
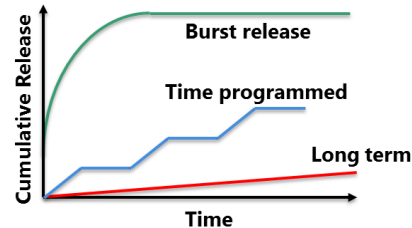


Target
drug level

Sensing
biomarkers

Responsive TDD patch

RELEASE



*Simulation-suggested response = Change in
membrane permeability*

Pharmacologically-aware digital
twin

UPTAKE



Material properties via
Molecular Dynamics

Successful Knowledge and Technology Transfer starts with Scientific Excellence



ETH zürich

Swiss Federal
Institute of
Technology Zurich

50%



Swiss Federal
Institute of
Technology
Lausanne

25%

PAUL SCHERRER INSTITUT



Paul Scherrer Institute

13%



The Swiss Federal
Institute for
Forest, Snow and
Landscape Research

3%



Empa

The Swiss Federal
Laboratories for
Materials Science and
Technology

6%

eawag
aquatic research

The Swiss Federal
Institute of
Aquatic Science and
Technology

3%

% = funding

Benefit for Swiss society



- **Broad cutting-edge research and specific beacon projects**

Competence Centers for collaboration and Research and technology Transfer Platforms



- **Practical relevance in teaching**

Collaboration between practice and teaching of interdisciplinary competencies, continuous education



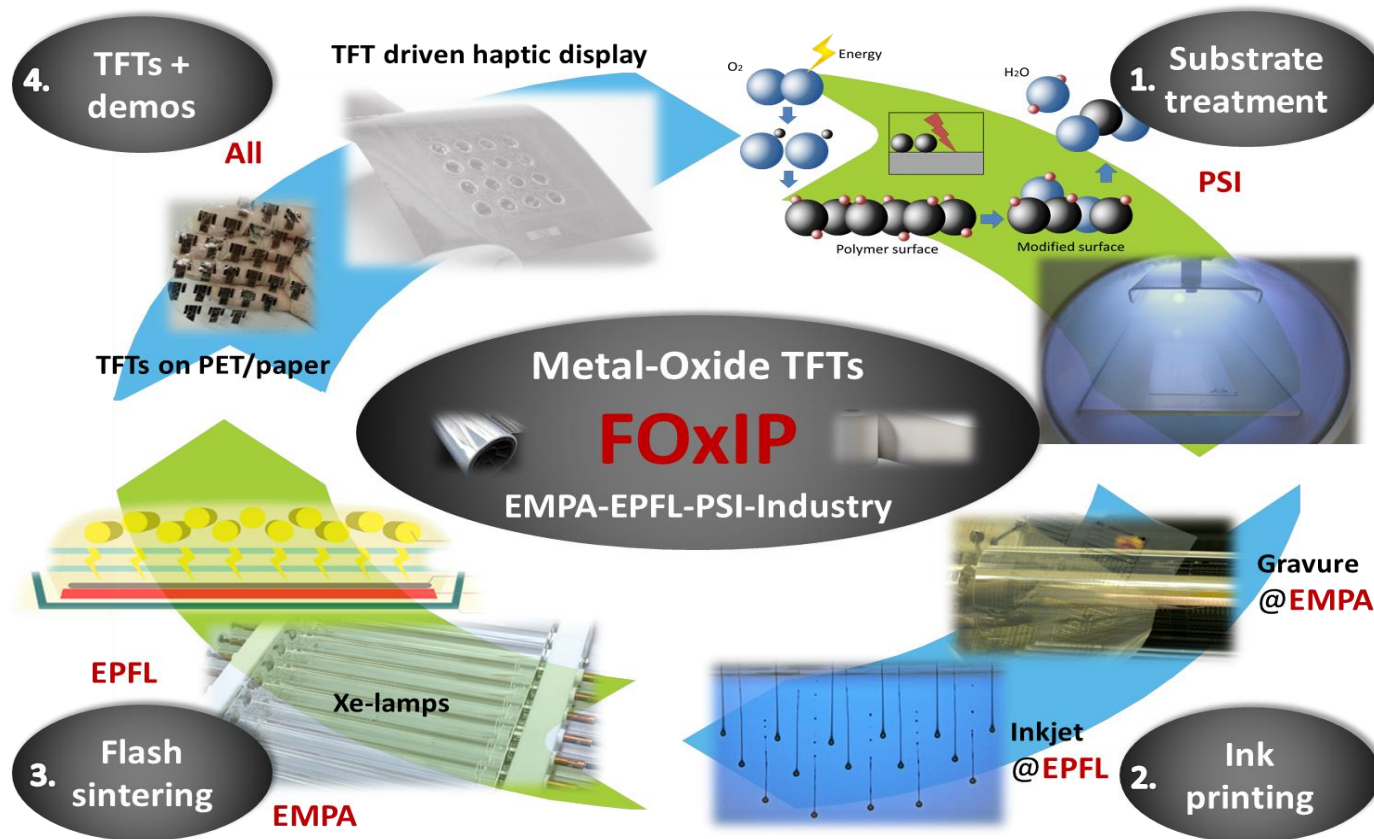
- **Increasing Knowledge and Technology Transfer (KTT)**

Incubators for start-ups, Swiss Innovation Parks as well as direct collaborations with public and industrial partners

Partnership leads to successful projects

(engage in win – win situation)

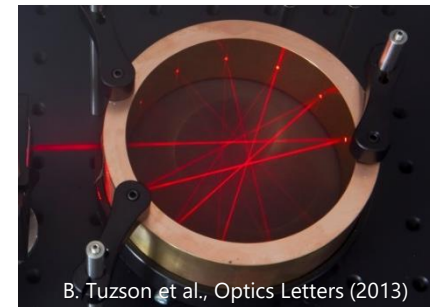
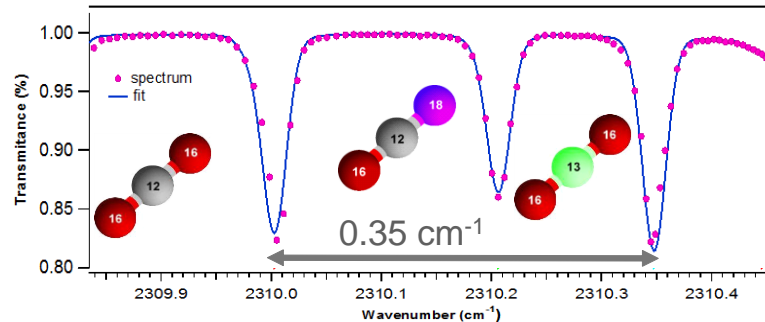
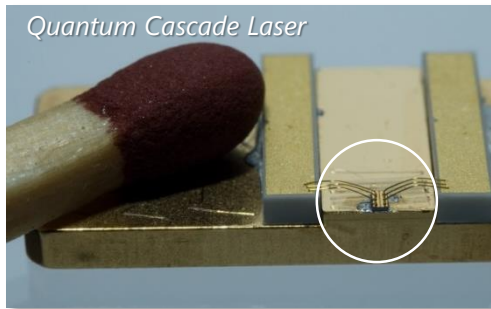
Printed oxide electronics collaboration: Empa-EPFL-PSI



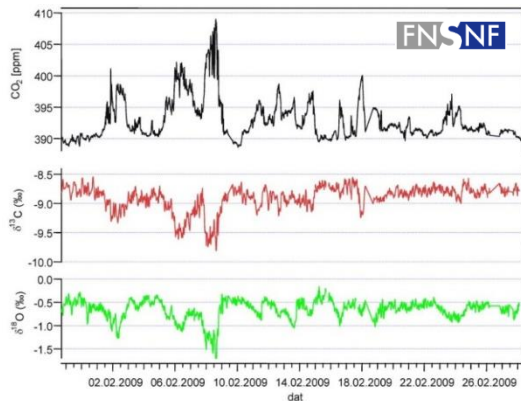
Goal: Fully printed Thin Film Transistors TFTs on flexible substrates with low T_g

Large R&D Diversity – a Strength of Empa

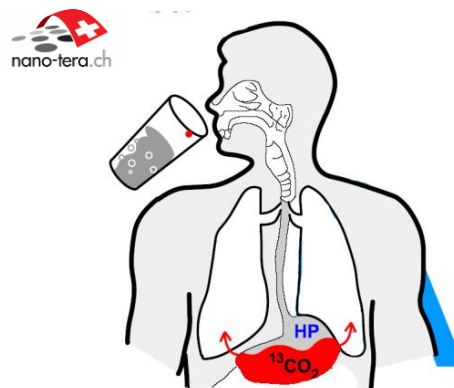
Example: From Greenhouse Gas Monitoring to Medical Applications ...



Worldwide first continuous measurement of CO₂-isotopes



Human breath analysis (Empa, EPFL, ETHZ)

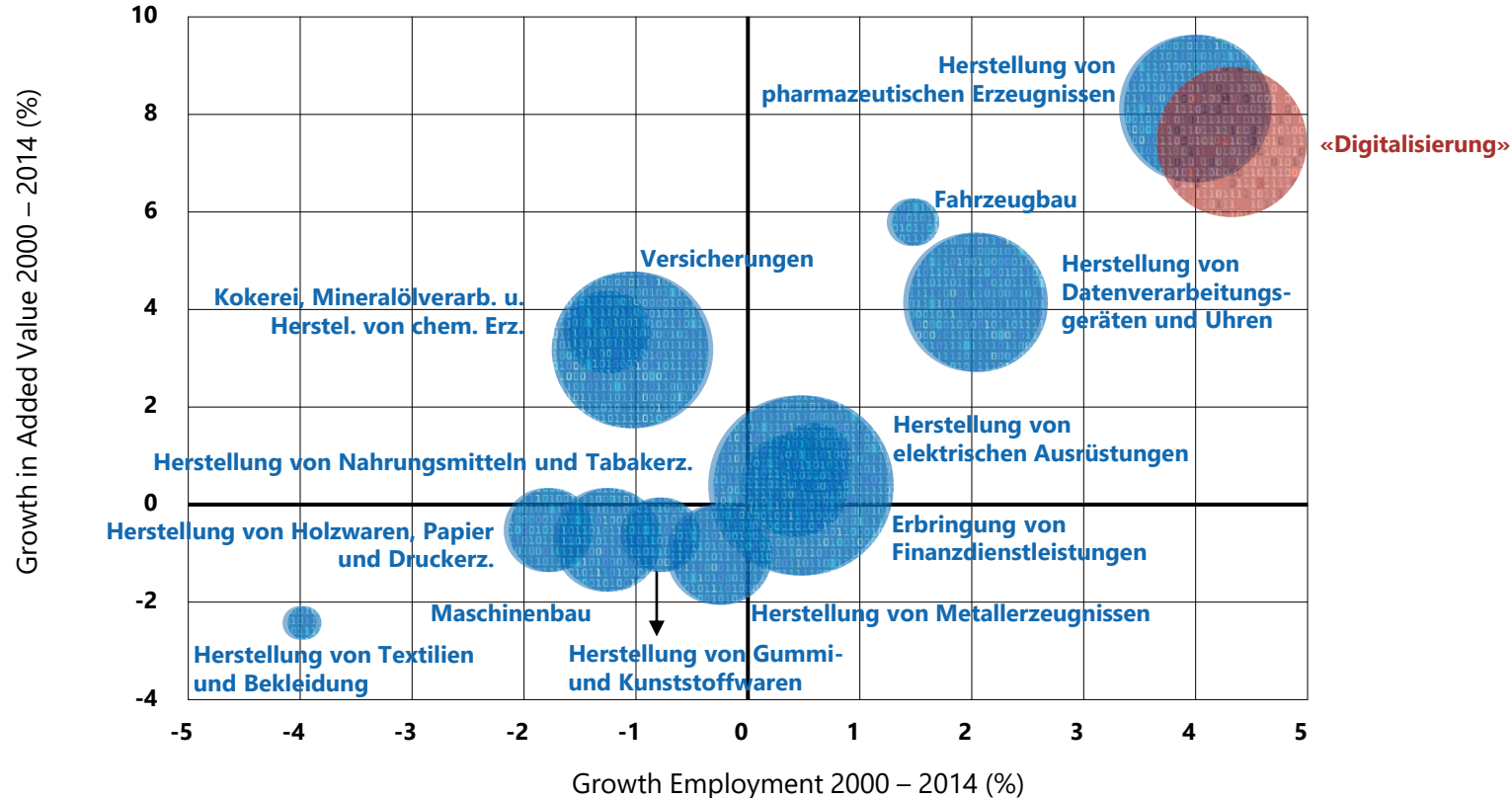


Ultrafast leak detection of aerosol cans

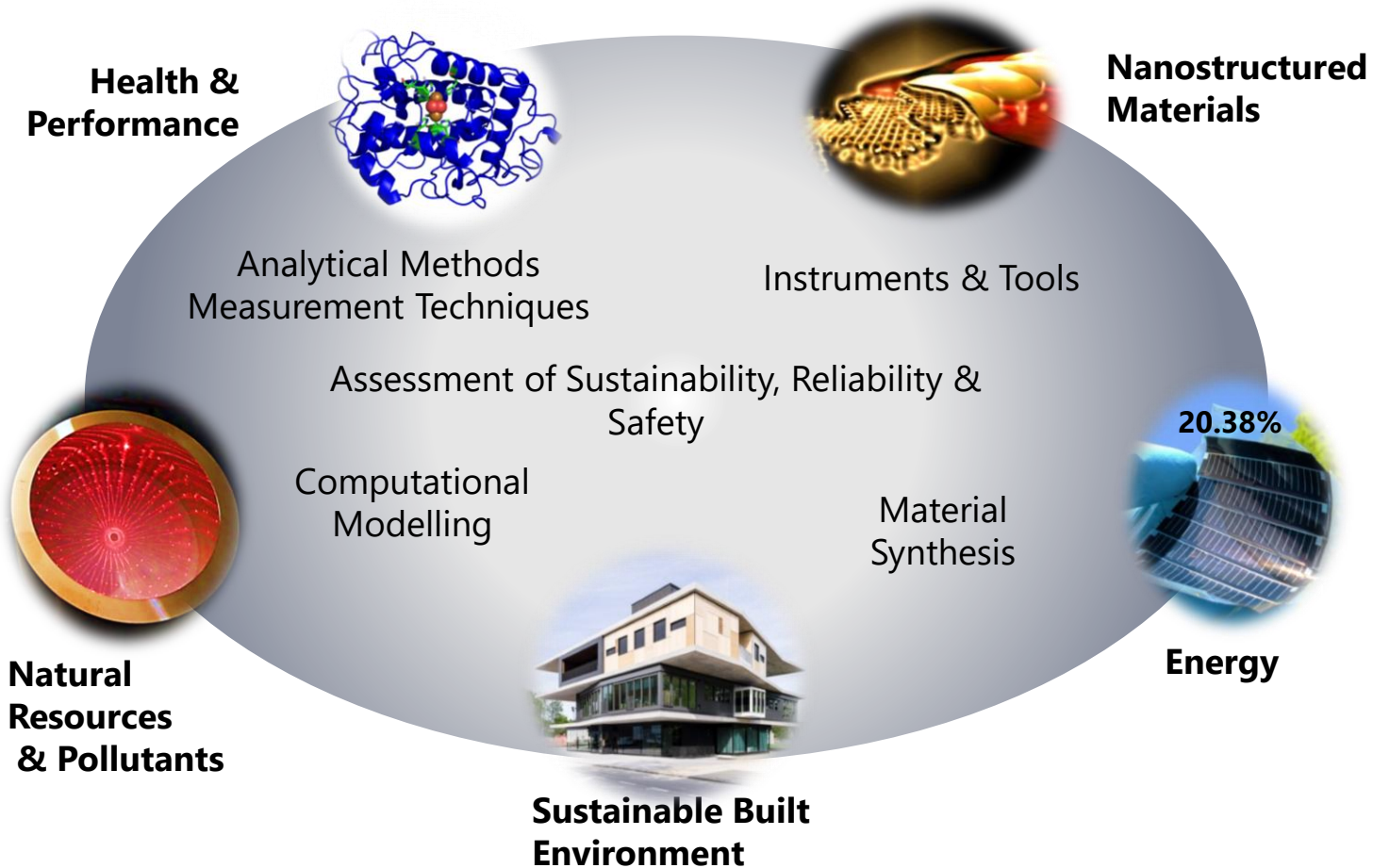


Top down guidance & Bottom-up inspiration

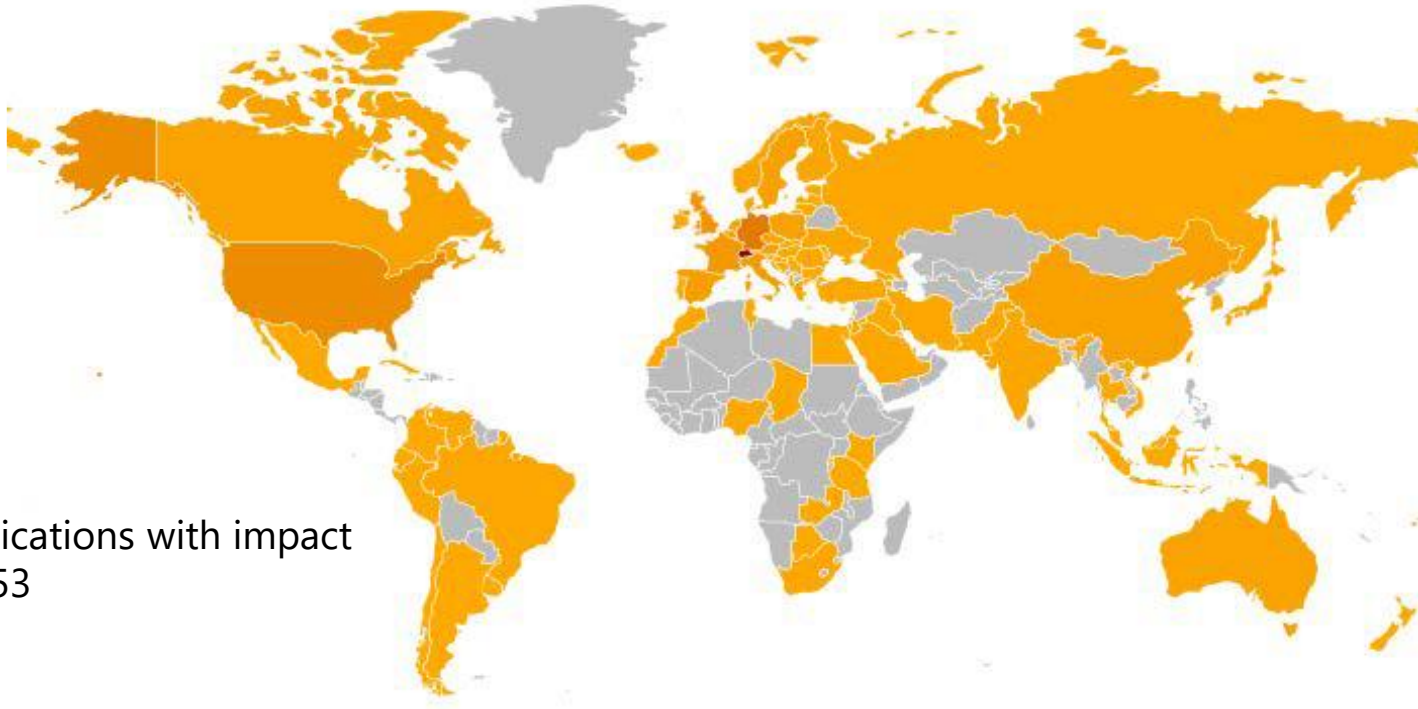
Evolution of Swiss Economy



Empa's Research Focus Areas



Publications with international partners 2014-2018

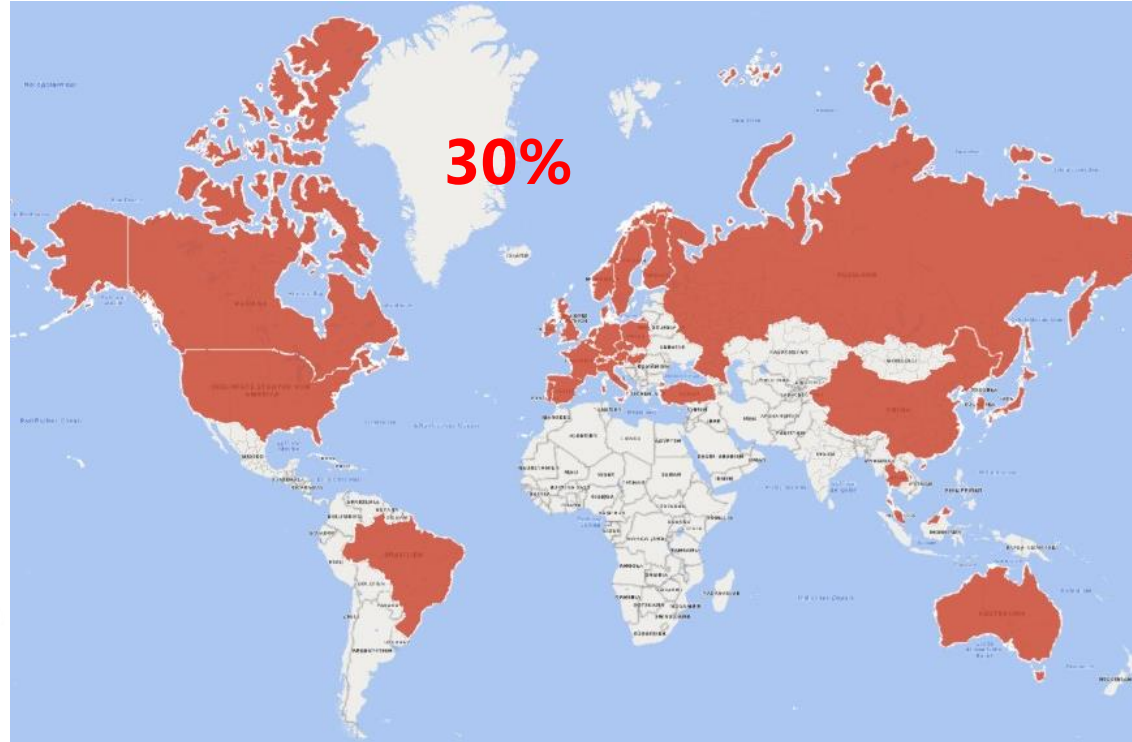
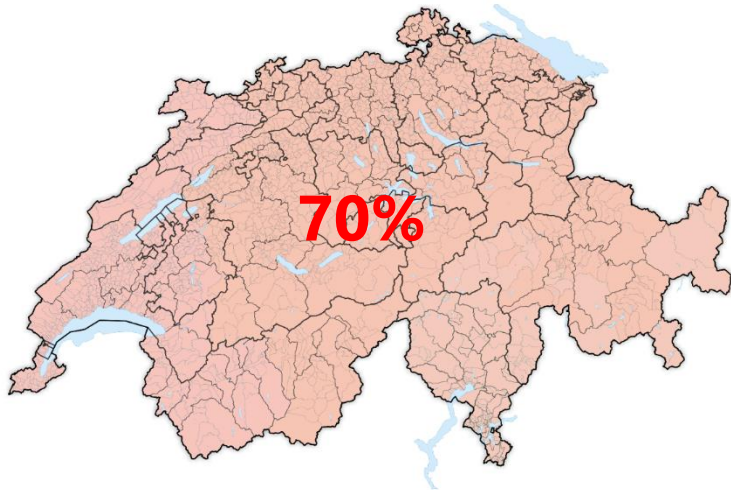


2018:
700 publications with impact
factor 5.53

Source: InCites (January 2019)

Empa Contracts with Industry

Total: 1212 contracts
852 Switzerland
(70%)
360 international (30%)



... Research and Technology Transfer Platforms

$\frac{3}{4}$ of CH-Energy consumption in housing and mobility

NEST: housing platform
Dynamic and flexible with energy hub



Move: Future Mobility platform
Excess renewable energy (power to gas),
i.e. "clean" fuels (H₂, ...) for power to mobility



Decentralized & Integrated Energy Management (SCCER)

ETH Domain Strategic Focus Areas 2017–2020

**Advanced
Manufacturing**

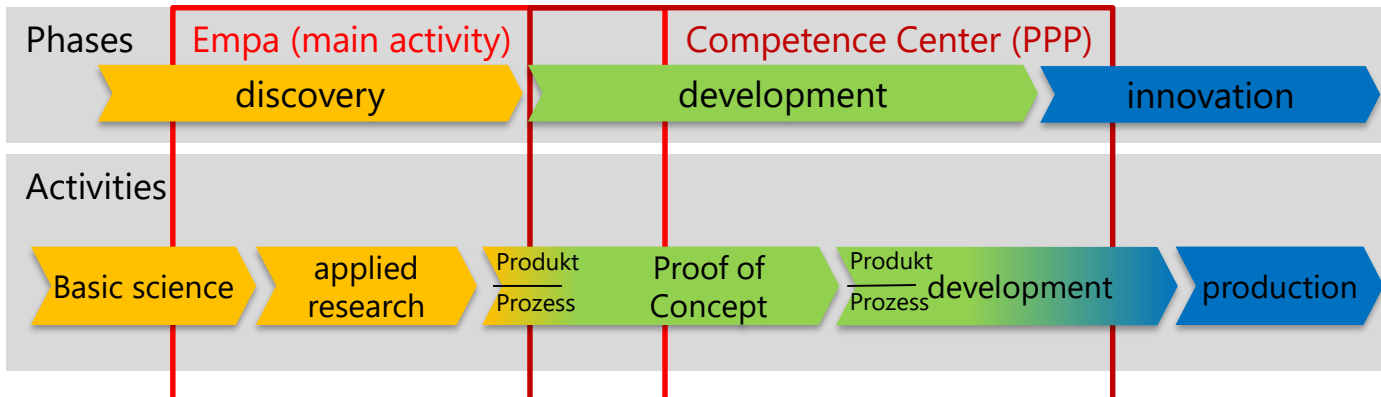
Data Science

**Personalized Health
and Related
Technologies**

Energy Research



From Discovery to Innovation

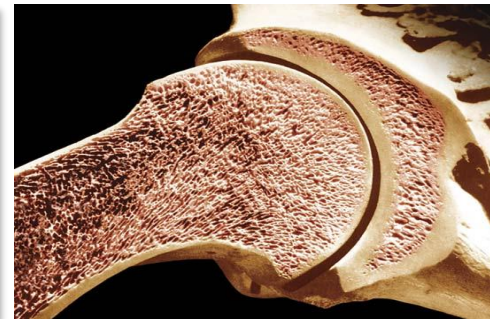
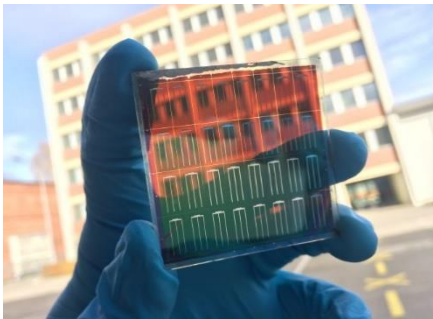
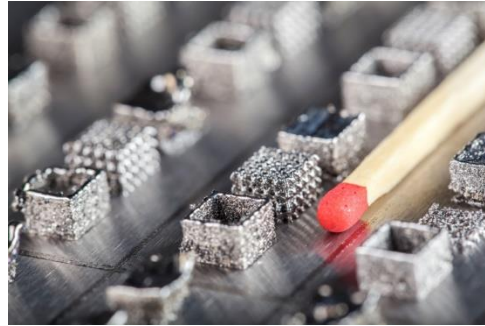
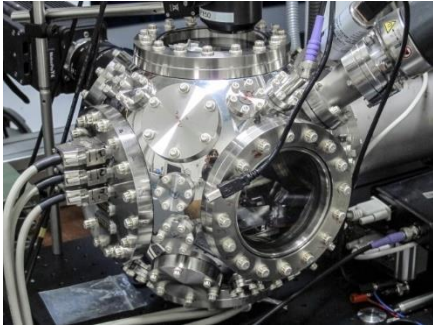


Swiss Innovation Park Zürich



Science – Technology – Innovation

Empa - The Place where Innovation Starts



Excellence in science leads to economic impact