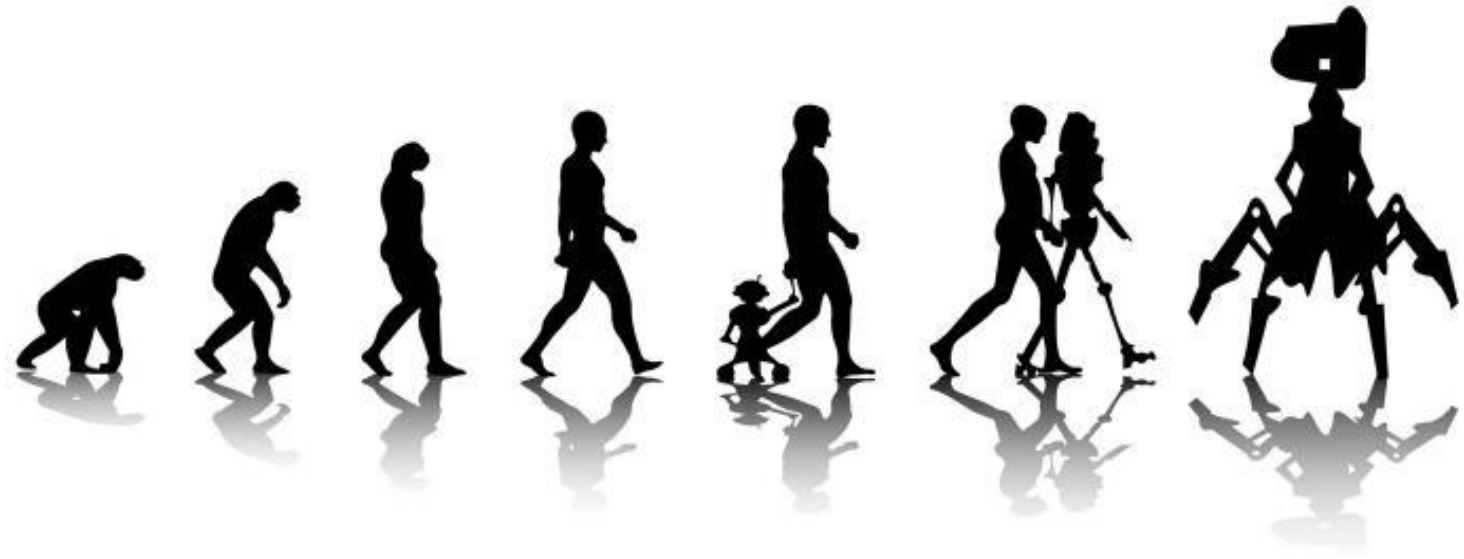
THE 2ND ILSAS CONFERENCE ON LEARNING AND DEVELOPMENT

Working World 4.0 – Revolutionizing Professional Education?

Armin Ritter, Fraunhofer-Gesellschaft



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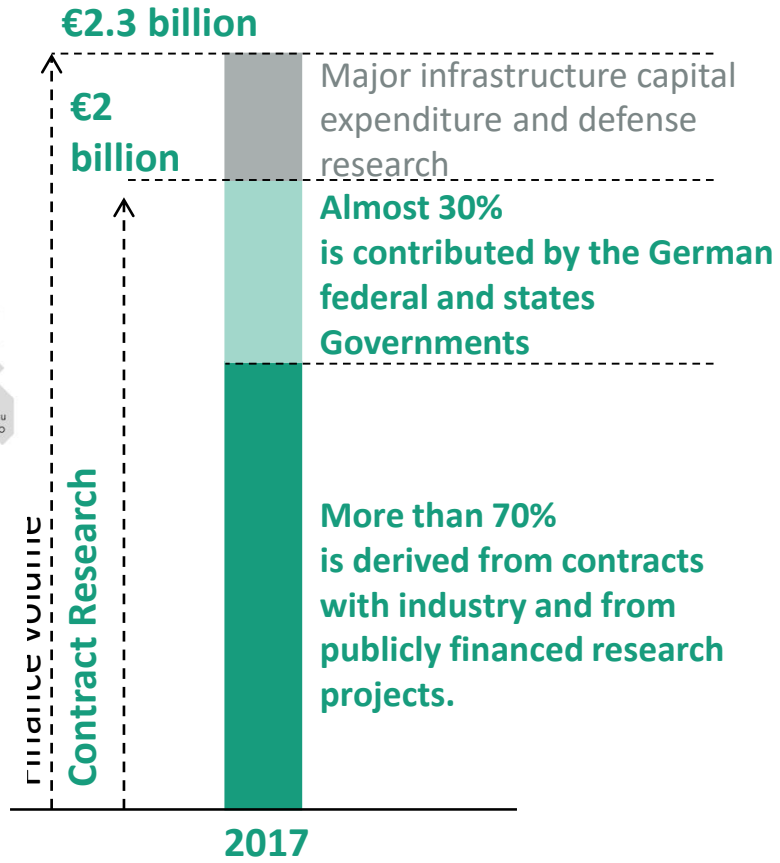
Fraunhofer Gesellschaft at a glance

The Fraunhofer-Gesellschaft undertakes applied research of direct utility to private and public enterprise and of wide benefit to society.

25,327 staff

72 institutes and research units



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Promotion of Innovation by Fraunhofer

Professional Training
Fraunhofer Academy

Transfer of people »Brain transfer«

Promotion of Innovation by Fraunhofer

Contract Research

Formation of Companies

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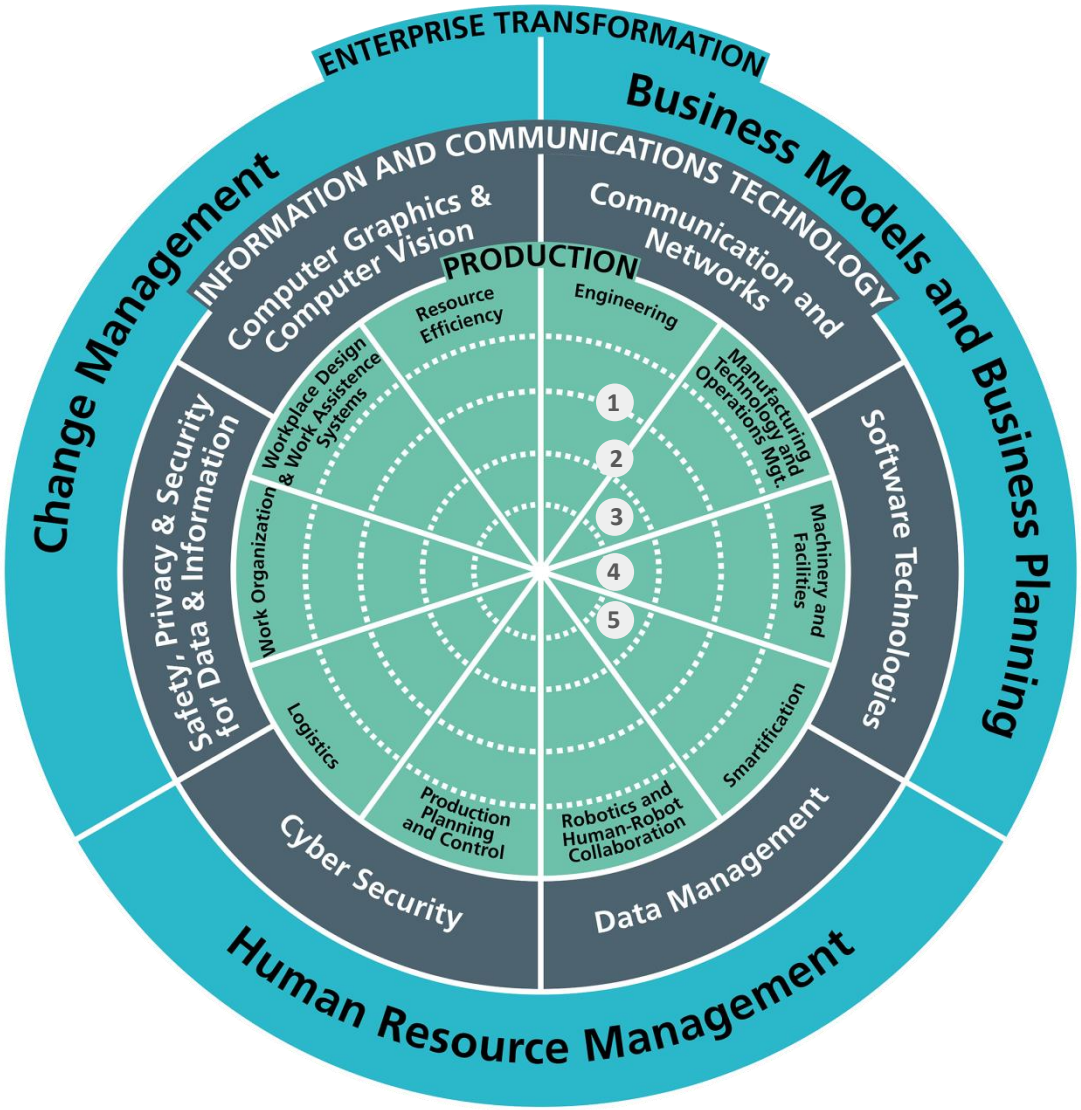
Fraunhofer‘s contribution for developing Industrie 4.0 innovations

LAYERS:

- ENTERPRISE TRANSFORMATION
- INFORMATION AND COMMUNICATIONS TECHNOLOGY
- PRODUCTION



Functional Areas:

1. **Data recording and processing**
2. **Assistance Systems**
3. **Interconnectedness and integration**
4. **Decentralization, service orientation and transformation ability**
5. **Selforganizing and autonomy**

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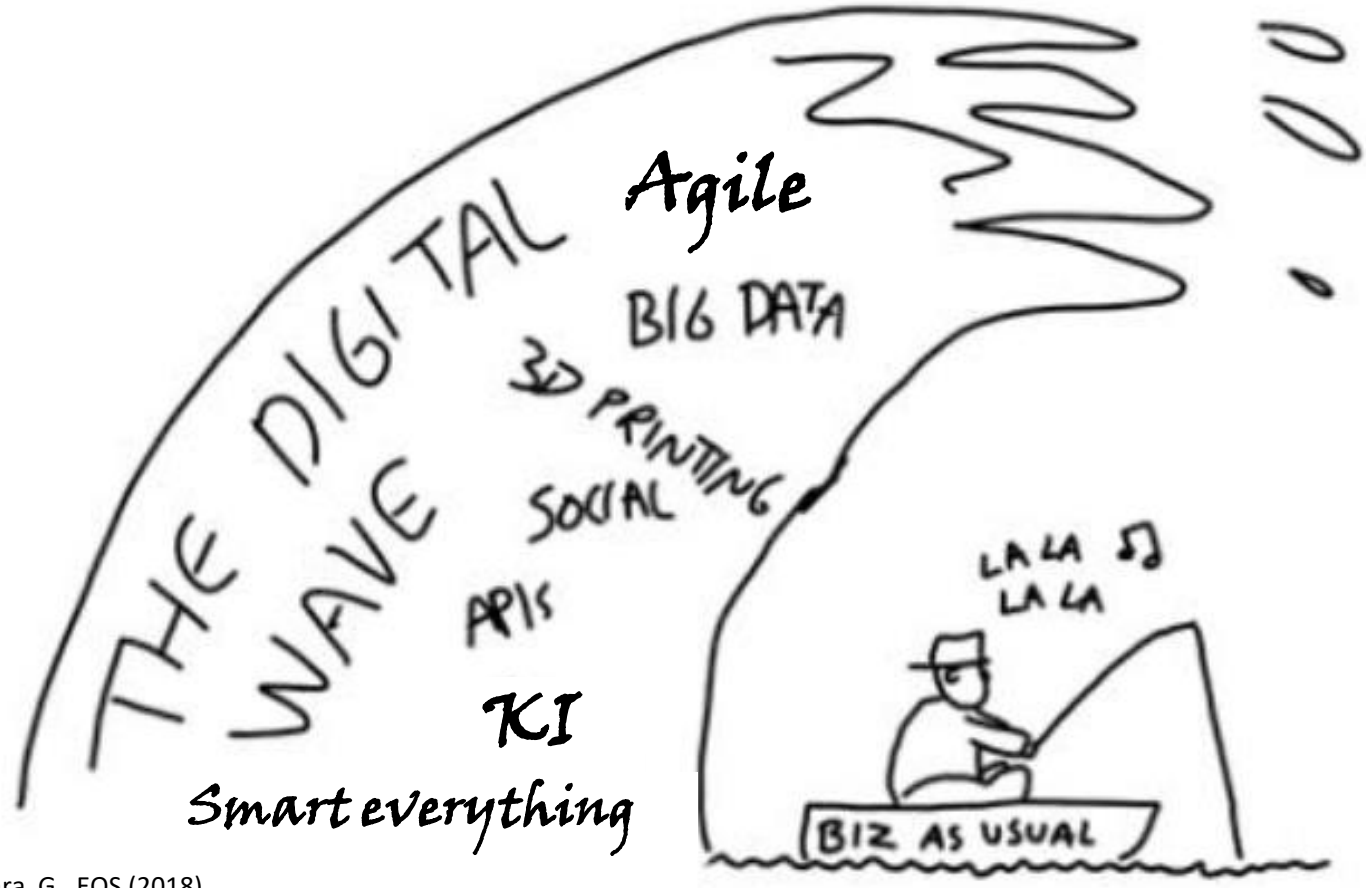
Business as usual …



Source: Kara, G., EOS (2018)

Digitalization – a new phenomenon?

How old is actually…?

The Internet	1969
Neural Networks	1943
Autonomous Driving	1986
Nano Technology	1991
Internet of Things	1991
Hypersonic Drive	1960

Revolutionary ideas are **rare** and it takes a long time to develop itself to a disruptive innovation

Convergence & innovation based on mature technologies are drivers of the near future

Source: Bantes, R., Fraunhofer INT

The meaning of Digitization (and Industry 4.0)?

- In the physical reality Digitization implies a great number of sensors, networks, actors and IT-Systems
- **Evolution in usage** based on predefined rules

The great things about Digitization are not these system but the intelligent usage of data with AI

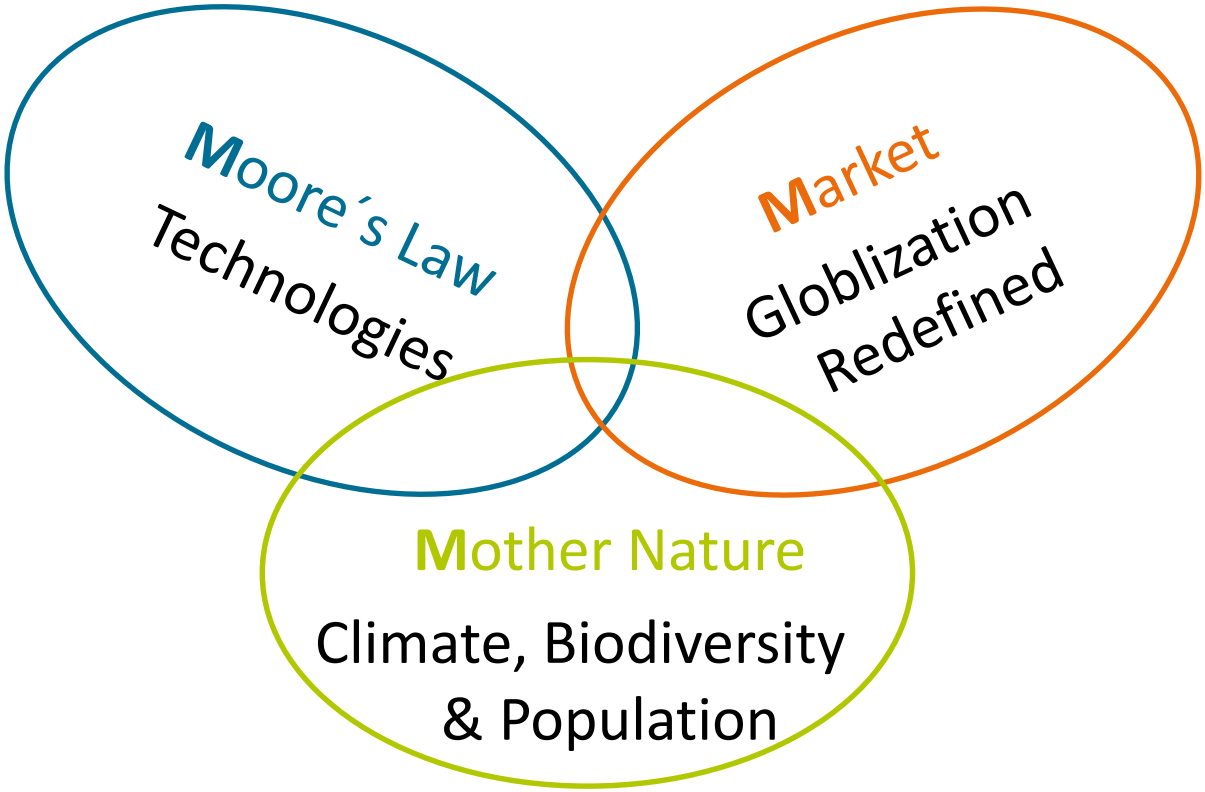
- **Revolution in usage**: from rules to target states
  - Humans define operational targets
  - AI organizes/decides dynamically operational procedures

Form subject matter expertise to
expertise in handling of intelligent systems

Source: Bantes, R., Fraunhofer INT

The „Great Acceleration“

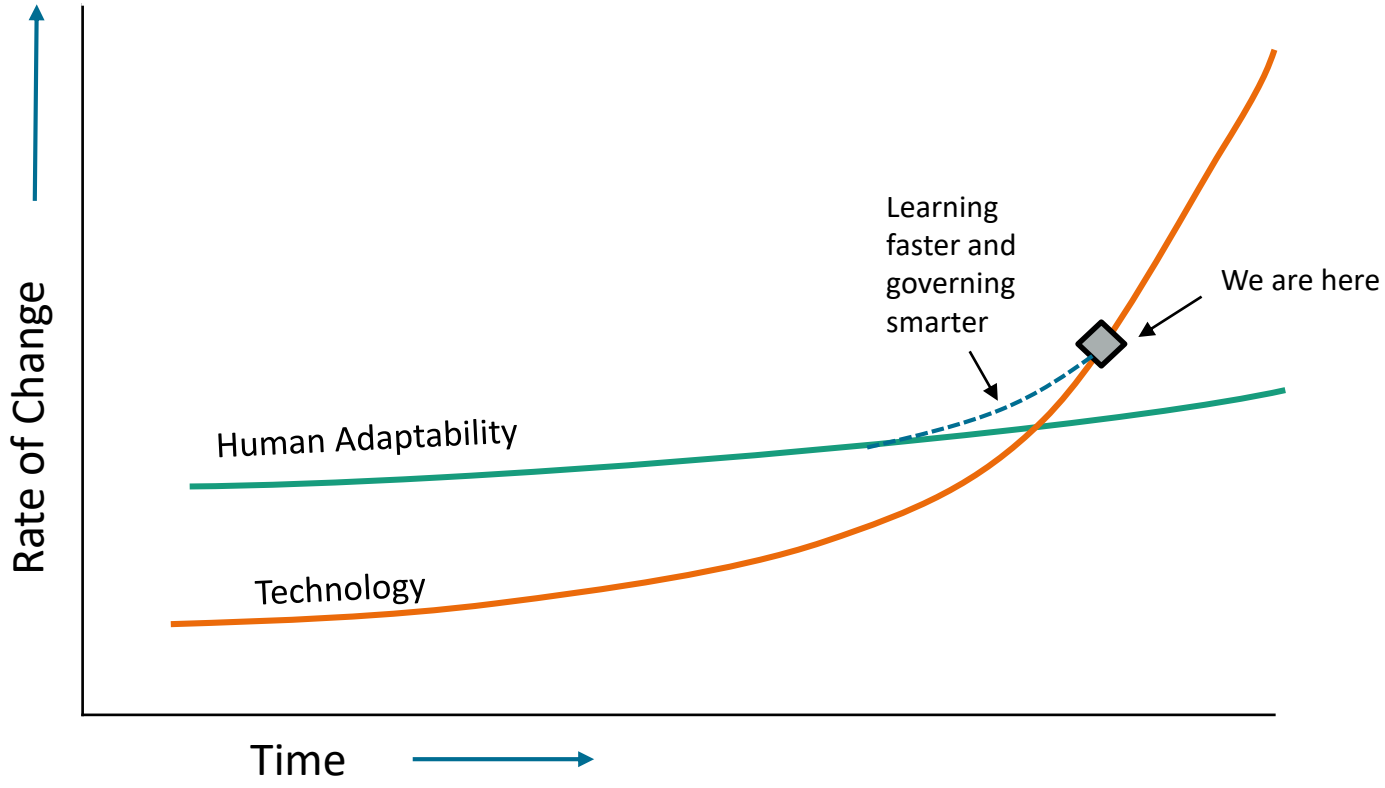
Fundamental driving forces for reshaping the world



State of permanent acceleration und reshaping

The Age of Acceleration

Moore´s Law



Source: Teller, E. in Friedman, T. (2016): Thank you for being late – An Optimist´s Guide to Thriving in the Age of Accelerations

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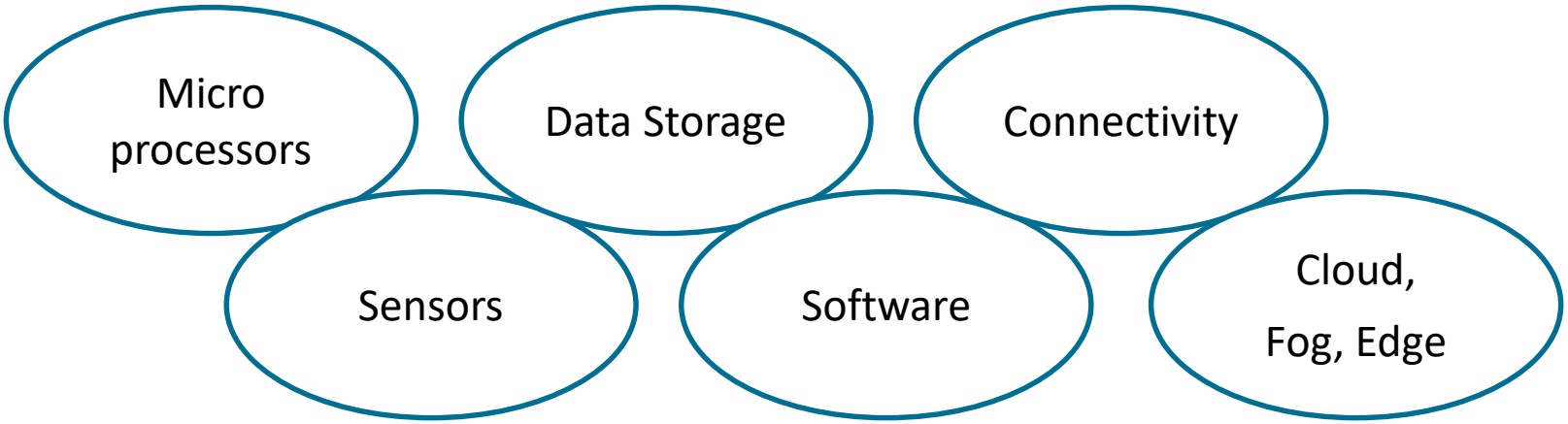
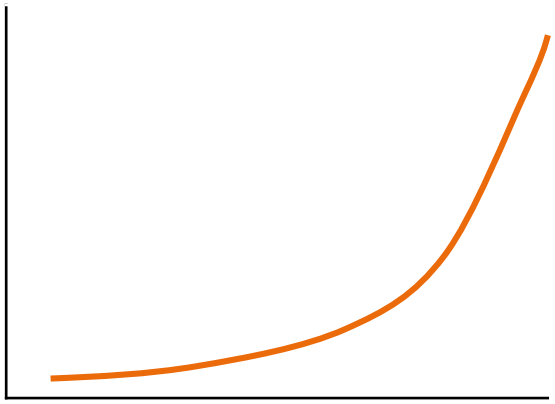
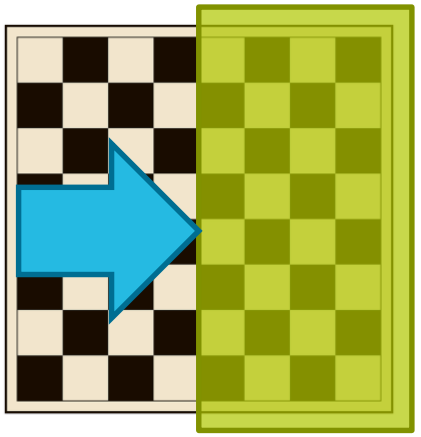
Moore´s Law – the technological turbo booster







Effects of exponential functions

Example: Chessboard

$a_1 = 1$
$a_2 = 2$
$a_3 = 4$
$a_4 = 8$
$a_5 = 16$
$a_6 = 32$
$a_7 = 64$
$a_8 = 128$
$a_9 = 256$
$a_{10} = 512$

All 10 fields:
1023 rice grains

Geometrical Order
$(a_n) = 1 \times 2^{n-1}$

Number of rice grains for the 64th field: $a_{64} = 1 \times 2^{64-1}$

$a_{64} = 9.223.372.036.864.775.808$
9 sextillion 223 quadrillion 372 trillion, 36 billion, …

For all 64 fields: **18.446.744.039.484.029.952**

100 rice grains = 3 gram

Weight of all 64 fields: 540 trillion tons

Weight global crop/y in 2006: 618 billion tons

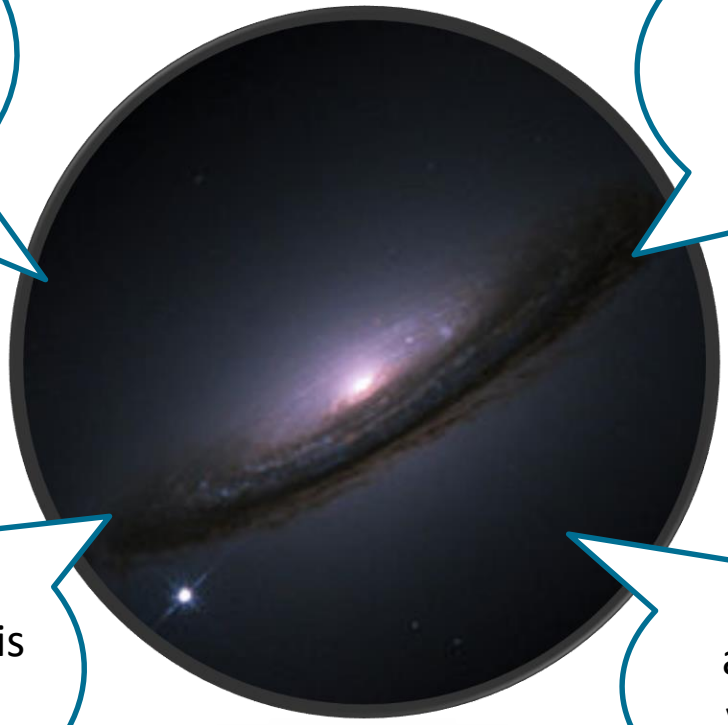
540 trillion : 618 billion = **873 years**

Source: http://www-hm.ma.tum.de/ws1213/lba1/erg/erg07.pdf

The Supernova

All critical components are exponentially powerful and cheaper

Enabling the reshaping of virtually every man-made system that modern society is build on



https://de.wikipedia.org/wiki/Supernova

Everything is getting changed, and everyone is being impacted by it, positive or negative

These capabilities are being extended to virtually every person on the planet

The Supernova

- **Analyse** data and **find** unseen patterns
- Any system can be **optimized** to peak performance
- We can **prophesise** – guessing is over
- Any peace can be customized
- Many machines can now be **automated** and **roboticed**

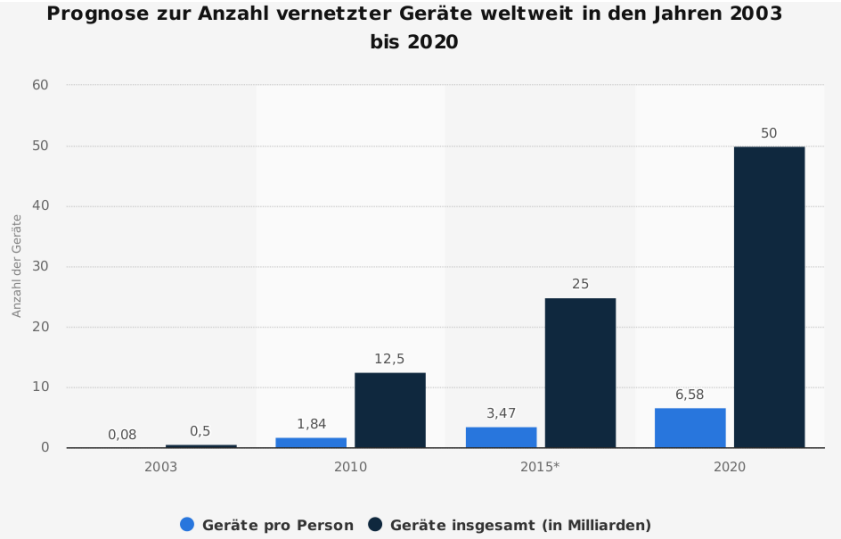
https://de.wikipedia.org/wiki/Supernova

Make old things work better, make new things possible, do old things in fundamentally new ways

Markets in the Age of Acceleration

Globalization redefined

No. of connected devices till 2020



Quelle: Cisco Systems, in: Statista (2018)

„The Big Shift“

- Knowledge stocks depreciate at an accelerating rate
- Shift from stocks to flows
- Refreshing knowledge stocks at an accelerating rate
- Participate more effectively in diverse knowledge flows
- Key of creating economic value

Driving forces: Countries → Institutions → anyone and everyone

Google Motors, Apple Bank, Amazon Cloud

MGI Connectedness Index: Participation in global flows

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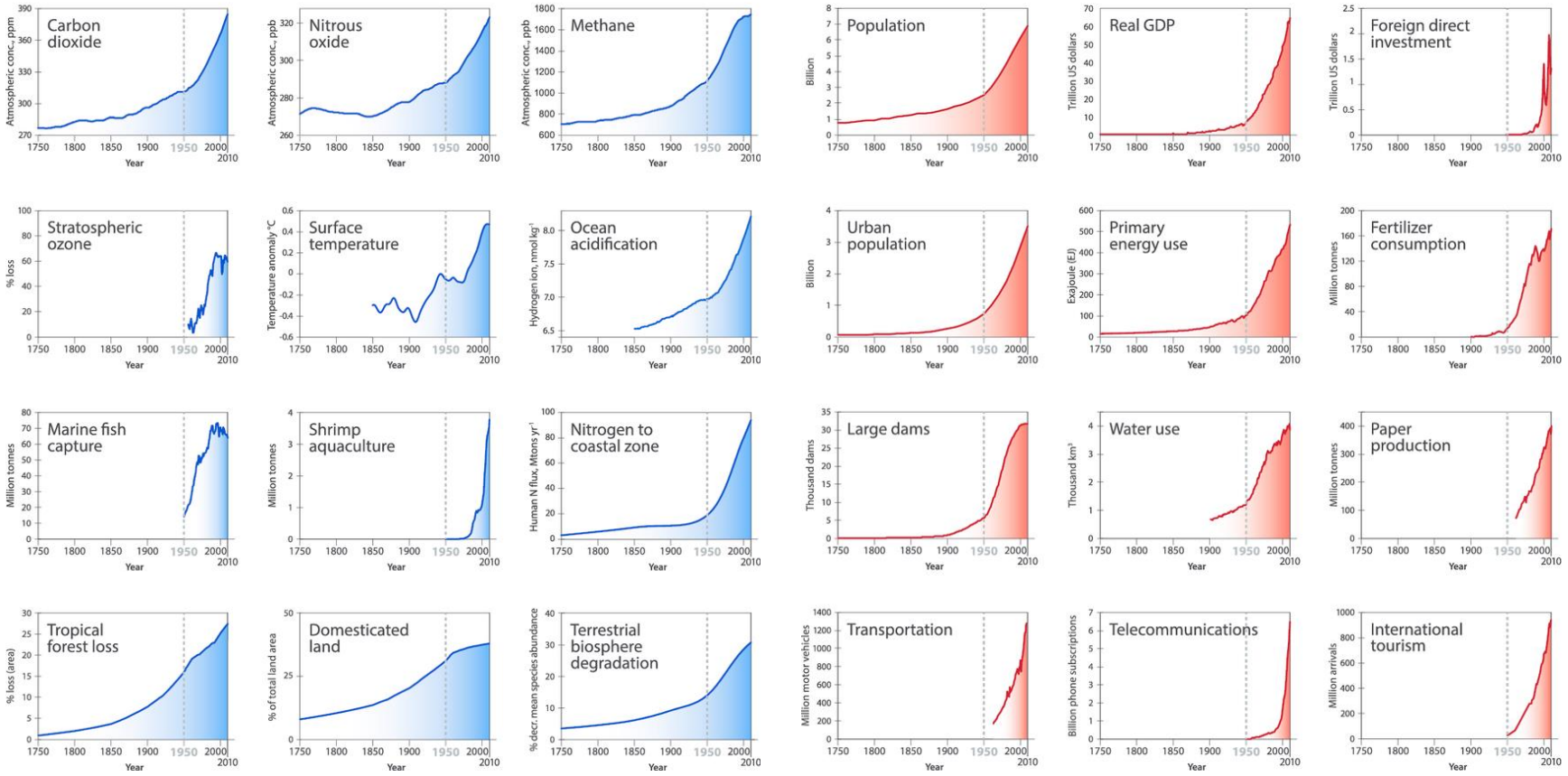
Mother Nature – Climate, Population, Biodiversity

The Great Acceleration



Source: Steffen, W. et al. (2015): The Trajectory of the Anthropocene: The Great Acceleration

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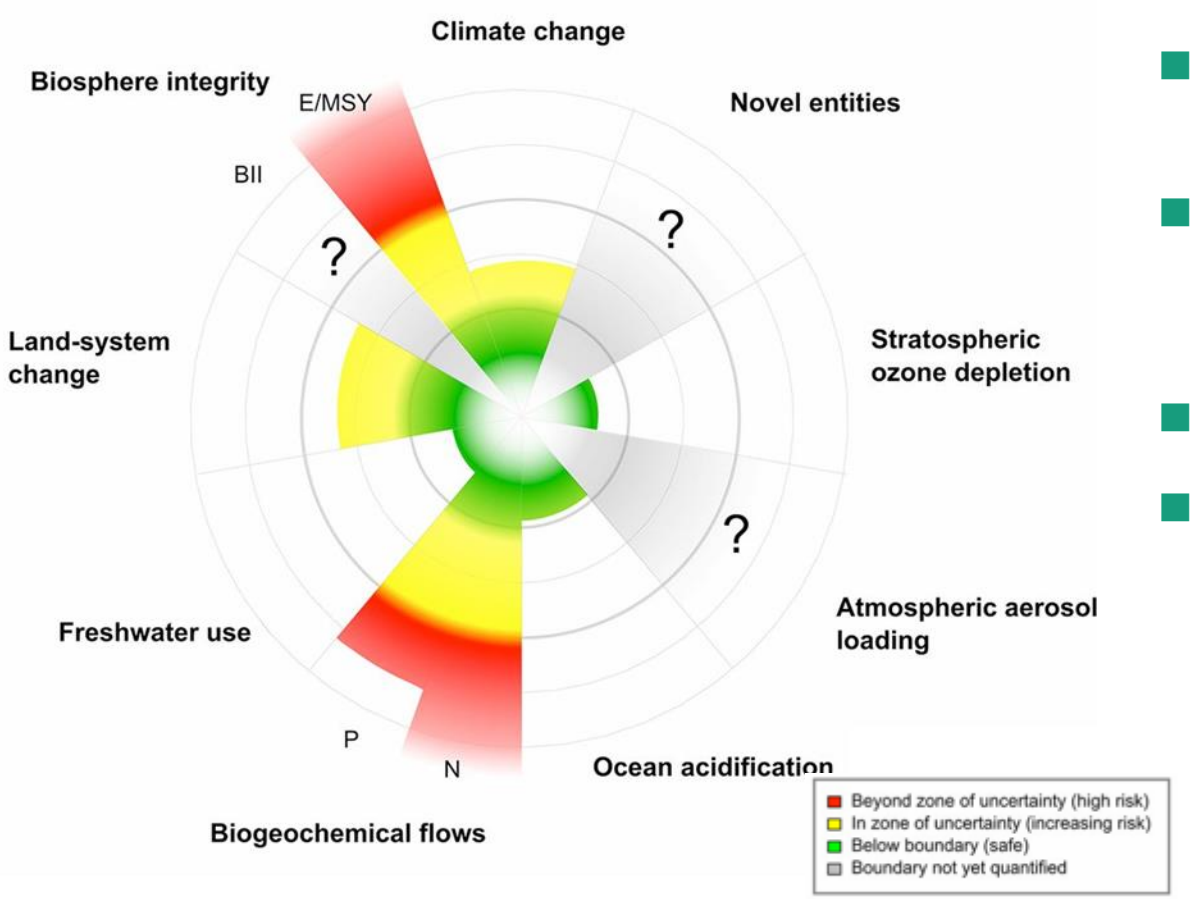
Mother Nature – Climate, Population, Biodiversity

From Holocene to Anthropocene?



- Planetary boundaries define stability & resilience
- … and are prerequisites for thriving societies around the world
- 4 out of 9 already exceeded
- Risk of shifting the Earth out of safe operating space

Source: Steffen, W. et al. (2015): Planetary boundaries: Guiding human development on a changing planet (http://science.sciencemag.org/content/early/2015/01/14/science.1259855)

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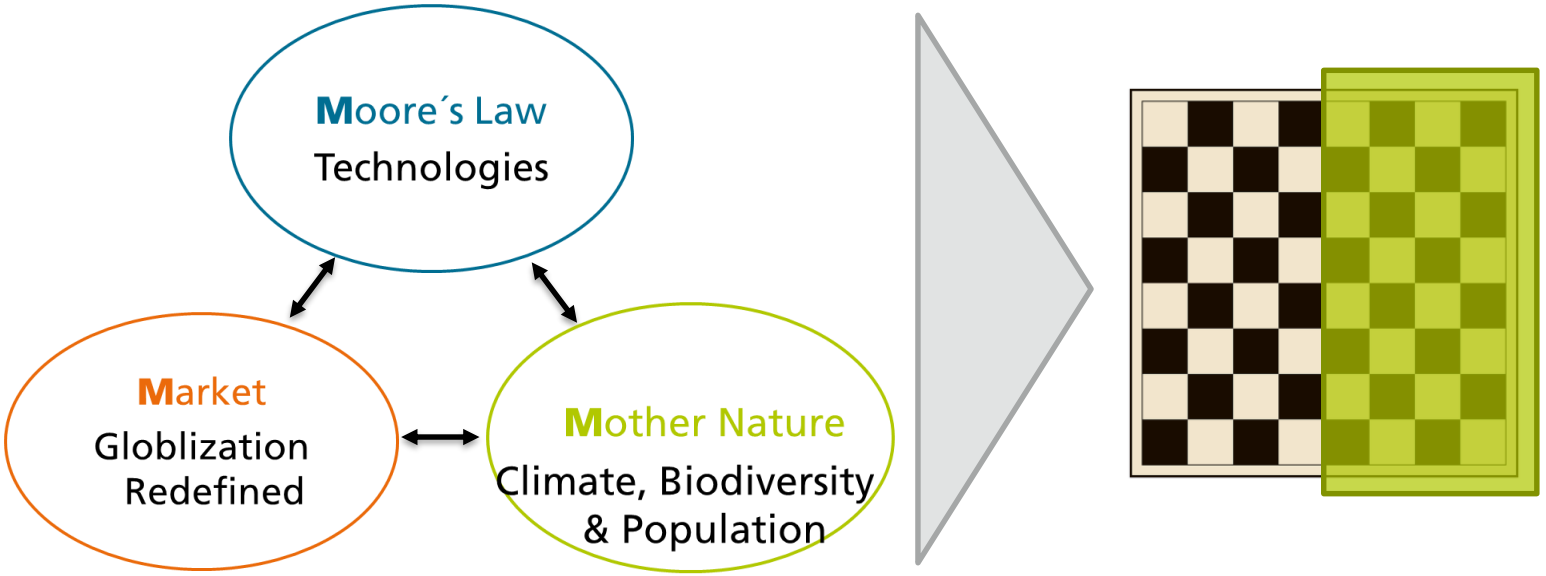
The Second Half of the Chessboard



The Great Acceleration … without limits?

- Boundaries of the exponential growth?
- Endless acceleration – Imaginable? Desirable?
- Ecological, social and personal limitations?
- There is currently no evidence, that the acceleration will slow down in the mid and long term

It might be a valid hypothesis for the next two decades

Impact on Labour Markets 4.0

Substitution of workplaces due to digital transformation

Bakshi, Downing, Osborne, Schneider (2017):

The Future Skills of Employment in 2030

Meta study with 110 competence profiles

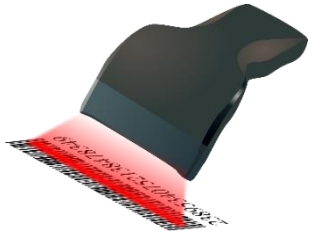
- 1/10 of workplaces 
- 1/5 of workplaces 
- 7/10 of workplaces ?

Impact on Labour Markets 4.0

No consistent patterns of the technology impacts

- Employment grows significantly faster in jobs that use computers and technologies more
- Automating of activity ≠ Automating of workplace
- Jobs are not going away, but the needed skills for good jobs are going up
- And with this new technology platforms we´re now on, it´s all happening faster

Source: Bessen, J. (2015): Learning by Doing. The Real Connection between Innovation, Wages and Wealth



Bilder: pixabay.com

It´s not about the labour market but **qualification**!

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Impact on Labour Markets and Working World 4.0

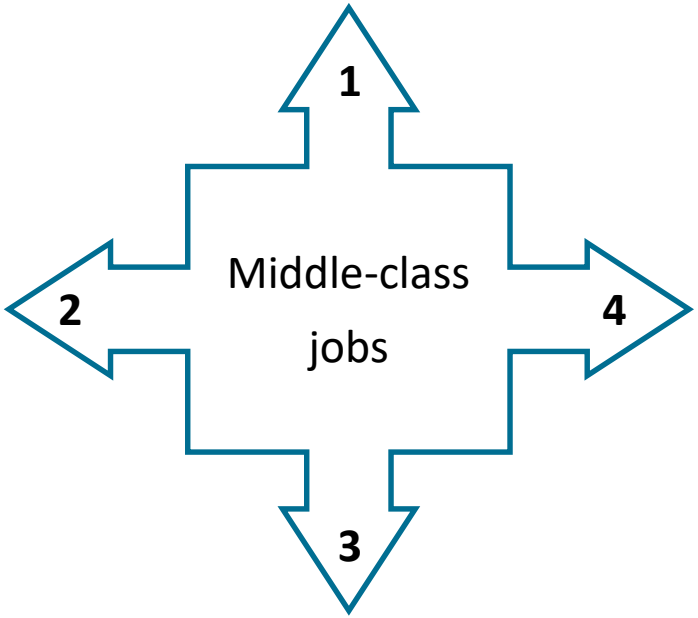
The End of the “Holocene” era for jobs?

UP

More knowledge and education

OUT

More machines, robots, and workers from India/China can now compete for all of it or a bigger part of it



APART

High-skilled parts may move up, the less skilled parts may get pulled down

DOWN

Outsourced to history in its present form, and made obsolete faster then ever

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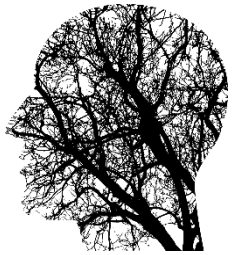
Future Skills

Upgrading workforce to target new opportunities

Higher Cognitive Skills

- Fluency of ideas
- Active learning
- Learning strategies



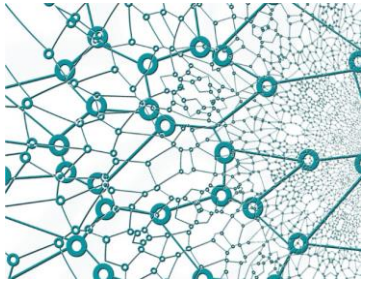
Interpersonal Skills

- Collaboration
- Coordination
- Social Perceptiveness

Personnel Skills

- Self motivation
- Habit of lifelong learning
- Entrepreneurship

System Skills



- Interconnections & feedback loops
- System analysis
- Problem Solving

Reference: Bakhshi, H., Downing, J., Osborne, M. and Schneider, P. (2017).The Future of Skills: Employment in 2030. London: Pearson and Nesta.

Pictures: pixabay.com

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Future Skills

What we actually experience in the working world

- Qualification of teaching and assessment staff
- Disintegration of still segregated domains
- Reshaping of teaching and learning scenarios
- Transition to an adaptive curriculum

Future Skills

What we actually experience in the working world

Professional Education

KI,
CPS, HMI,
Big Data,
Cybersecurity

Technology based skillset

Agile, Learning,
Collaboration
Ethics

Digital Key skills

Creativity, Adaption,
Endurance,
Entrepreneurship

Non-digital Key skills

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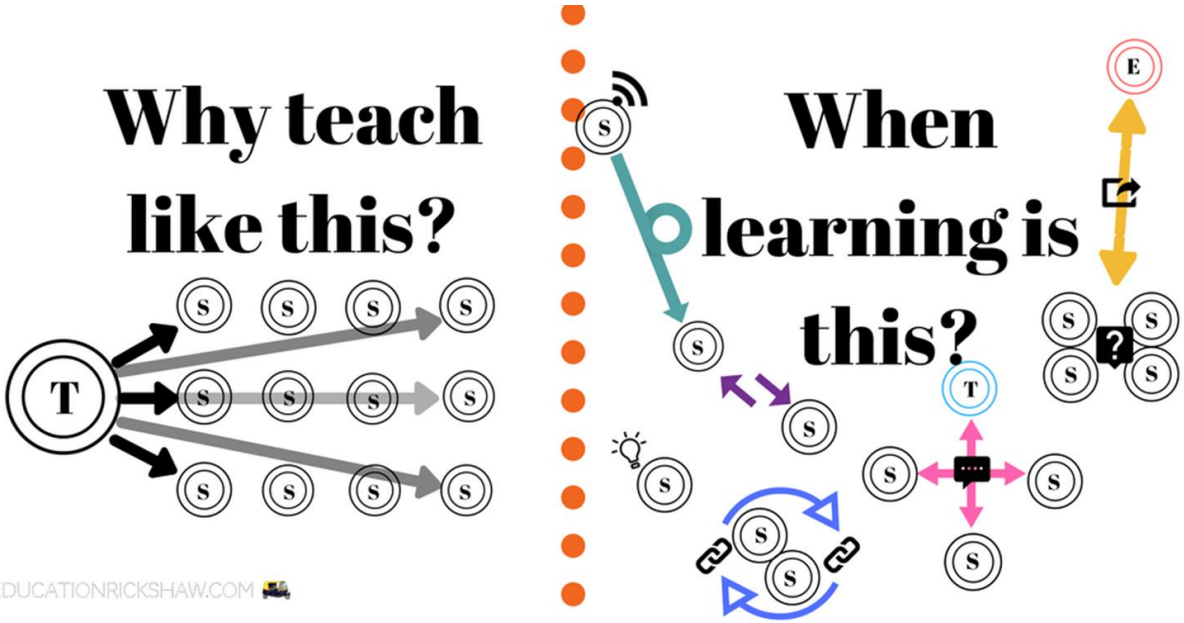
Challenges for Professional Education

- Fundamental change on the way in the working world – rapidly and anywhere
- „Knowledge flows“ instead „knowledge stocks“ – importance of skills that facilitate knowledge will increase substantially
- A great deal of building up relevant competencies must be accomplished “on the fly”
- Instead of knowing all the answers – rather the ability to ask all the right questions
- Are educational and training systems able to act on these challenges fast enough?

Ecosystems for Learning & Development

Education and pedagogics first, technology second?

- Subordination of learning & development might not to be a good idea
- Rebound of key pedagogic and educational findings



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Backup

Impulse 1: Expeditionary Learning

- Goes beyond problem-based learning and project-based learning
- Students engage in
  - interdisciplinary, in-depth study of compelling topics,
  - in groups and in their community,
  - with assessment coming through cumulative products, public presentations, and portfolios
- Design Principles:

The Primacy of Self-Discovery	The Having of Wonderful ideas	The Responsibility of Learning	Empathy and Caring	Success and Failure
Collaboration and Competition	Diversity and Inclusion	The Natural World	Solitude and Reflection	Service and Compassion

More information's available at: https://eleducation.org/who-we-are/our-approach

Impulse 2 OLIN College of Engineering

- Radically change engineering education to enable engineers solving the worlds complex future challenges
- Highly flexible structure, that can move at internet speed
- Revolutionary features:
  - The end of tenure
  - Close partnership with change agents in the making world
  - Constantly adapting curriculum
  - No departments
  - Project-based teaching

https://en.wikipedia.org/wiki/Olin_College

http://www.olin.edu/

Impulse 3: EdTec Start-ups

- Technology capable of predicting outcomes based on naturalistic data
- Turning commonplace learning experiences directly into assessments
- Improving meta-learning

Quelle: http://about.socoslearning.com/

noredink

- Builds stronger writers through
  - interest-based curriculums
  - adaptive exercises
  - actionable data
- Grammar tuition out of class

Quelle: https://www.noredink.com/

- Creating online lessons simple enough for anyone to deploy
- Blend classroom lectures with interactive assignments
- Professional Development
- Student Portfolios