# The Future of Labour and Social Systems

Dr. Christian Kellermann, German Research Center for Artificial Intelligence (DFKI)

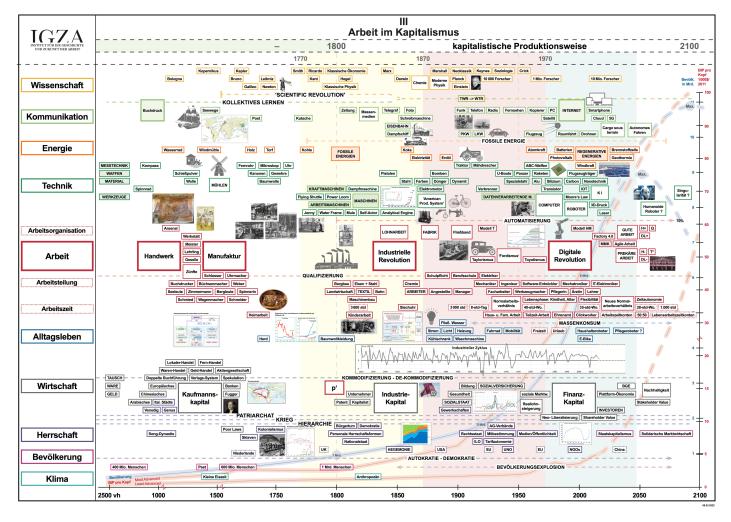24th International Summer School 2022 (June 29)

*Digitization, Artificial Intelligence and Responsibility of Sciences*

Alice Salomon University Berlin (ASH) in coop. with the Federation of German Scientists (VDW)
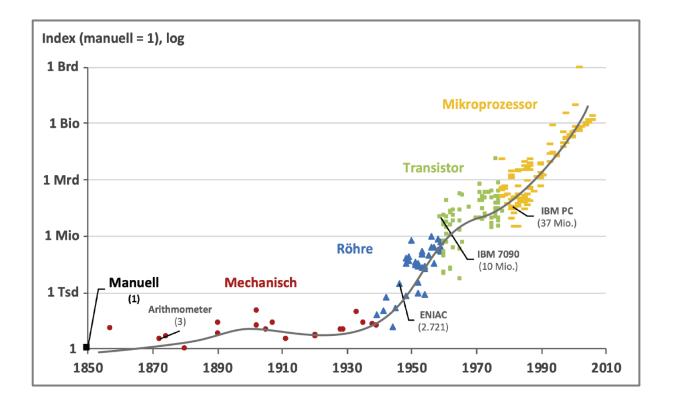
# Digitization and new social questions - Agenda

1. Digitization: an approximation
2. Impact on labour and jobs – premises and scenarios
3. Impact on social systems – resilience and reform
4. New concept of 'the social'?
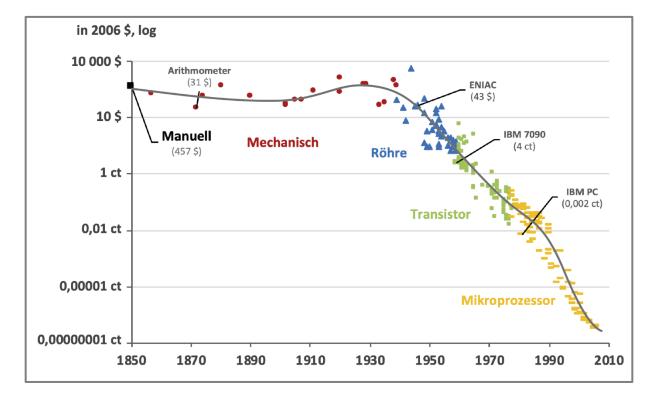
# 'Digital revolution'



Source: IGZA

# Computing speed, 1850 - 2010



Index = 1: addition of two five-digit numbers in 7 seconds.
source: own illustration based on Nordhaus (2010 appendix).

Source: IGZA

# Costs for 1m calculations (in 2006 $), 1850 - 2010
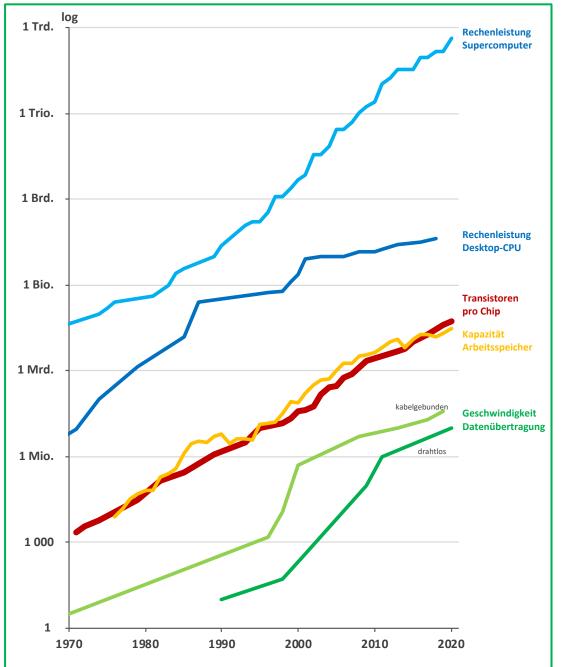


source: own illustration based on Nordhaus Nordhaus (2010).

Source: IGZA

# »Moore's Law«

Computing power
supercomputer: GFLPOS,
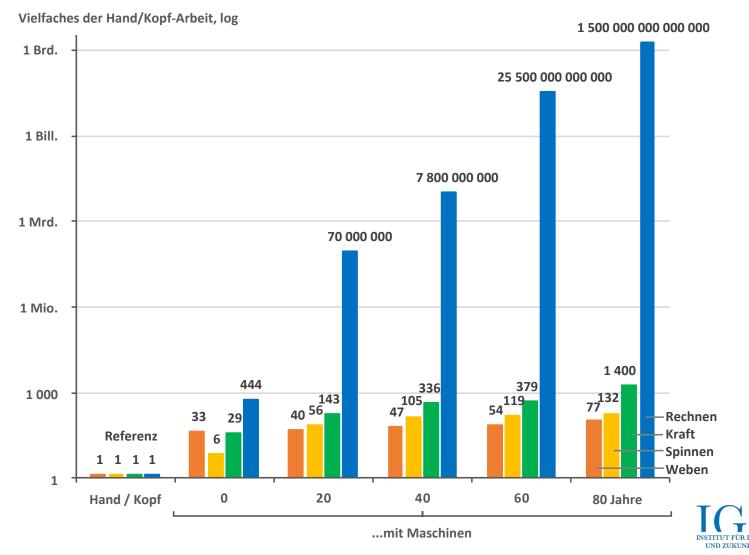Computing power desktop CPU:
KFLOPS, Memory capacity:
bytes,

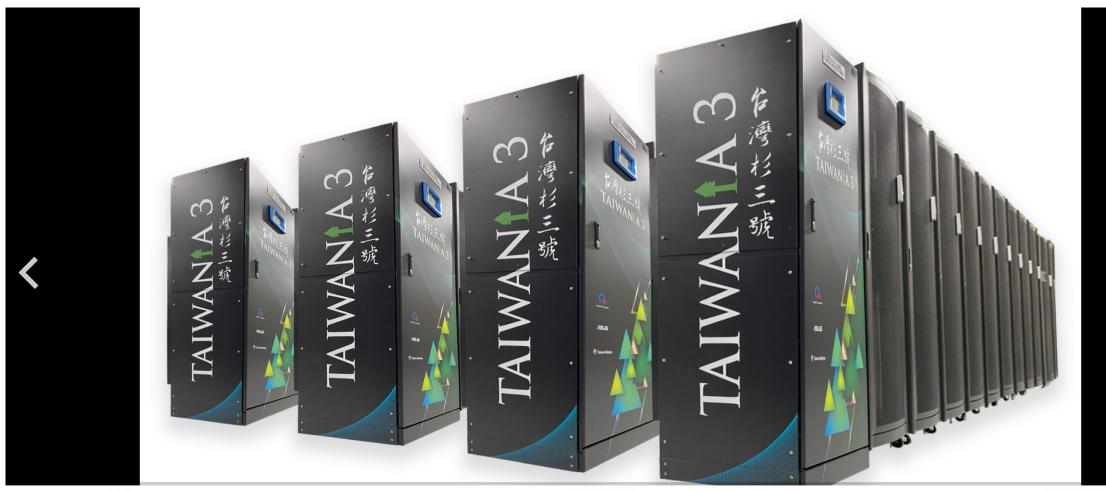Data transmission speed: Kbit/s.

Source: IGZA

# Productivity explosion - work and power machines vs. computers

Power = most powerful steam engine/turbine (1 hp = approx. 7 "human strengths"), spinning/weaving = labor productivity; computer = computing power, excluding supercomputer. Representation of the respective machine types. Data appendix. Source: Own illustration based on: Bohnsack (2002, 152); Landes (1983 [1968], 211); Roser / Ritchie (2013

Source: IGZA



Vielfaches der Hand/Kopf-Arbeit, log

| Jahre | Rechnen | Kraft | Spinnen | Weben |
|-------|---------|-------|---------|-------|
| Hand / Kopf (Referenz) | 1 | 1 | 1 | 1 |
| 0 | 33 | 6 | 29 | 444 |
| 20 | 40 | 56 | 143 | 70 000 000 |
| 40 | 47 | 105 | 336 | 7 800 000 000 |
| 60 | 54 | 119 | 379 | 25 500 000 000 000 |
| 80 | 77 | 132 | 1 400 | 1 500 000 000 000 000 |

...mit Maschinen

Taiwania 3 is a Taiwanese supercomputer which assisted the scientific community in fighting COVID-19. It was launched in 2020 and has a capacity of about two to three PetaFLOPS.

**More de**

National Center for High-performance Computing of Taiwan - NARLabs of Taiwan

Taiwania 3, a supercomputer made by Taiwan (a democratic country in the Pacific South from Japan East from China in Asia).

OGDL v1.0
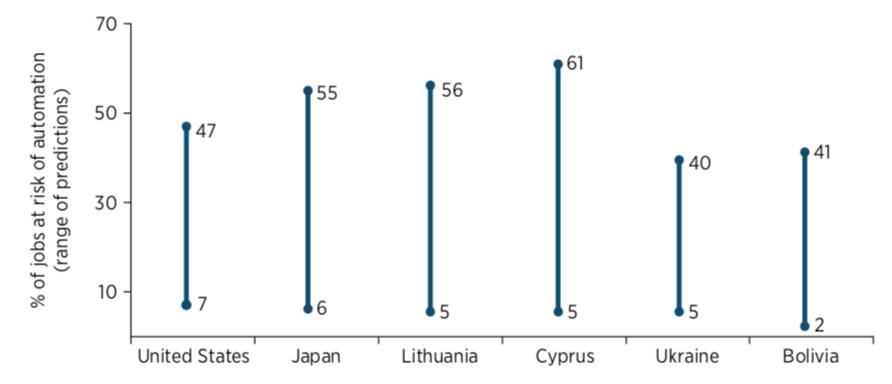File: Taiwania 3.jpg
Created: &lt;&lt;not_applicable&gt;&gt;

https://en.wikipedia.org/wiki/Supercomputer#/media/File:Taiwania_3.jpg

https://commons.wikimedia.org/wiki/File:Artificial_Intelligence_%26_AI_%26_Machine_Learning_-_30212411048.jpg

# 2. Impact on labour and jobs – premises and scenarios

**FIGURE 1.1** Estimates of the percentage of jobs at risk from automation vary widely

*Sources:* WDR 2019 team, based on World Bank (2016); Arntz, Gregory, and Zierahn (2016); David (2017); Hallward-Driemeier and Nayyar (2018).

*Note:* The figures represent the highest and lowest estimates of the percentage of jobs at risk of automation in economies for which more than one estimate has been produced by different studies. A job is at risk if its probability of being automated is greater than 0.7.

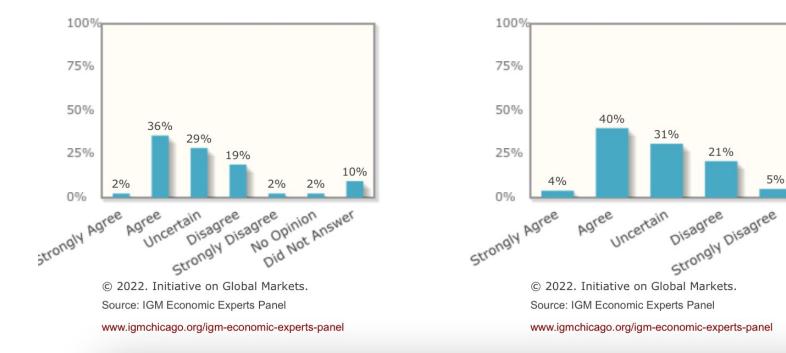Source: World Bank (2019): World Development Report, p. 22

## Question A:

Holding labor market institutions and job training fixed, rising use of robots and artificial intelligence is likely to increase substantially the number of workers in advanced countries who are unemployed for long periods.

### Responses

### Responses weighted by each expert's confidence



Responses bar chart:
- Strongly Agree: 2%
- Agree: 36%
- Uncertain: 29%
- Disagree: 19%
- Strongly Disagree: 2%
- No Opinion: 2%
- Did Not Answer: 10%

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Source: IGM Economic Experts Panel
www.igmchicago.org/igm-economic-experts-panel

Responses weighted bar chart:
- Strongly Agree: 4%
- Agree: 40%
- Uncertain: 31%
- Disagree: 21%
- Strongly Disagree: 5%

© 2022. Initiative on Global Markets.
Source: IGM Economic Experts Panel
www.igmchicago.org/igm-economic-experts-panel

Source: https://www.igmchicago.org/surveys/robots-and-artificial-intelligence-2/

# Is 'Artificial Intelligence' different?

- Data + Algorithms **shake up tech frontier**
- Limits of computability = limits to applicability
- Outperform humans in certain tasks → potential applications still opaque
- **Machine learning** has most use cases today → controlling cross-sectional tasks in enterprises
  - **Higher-level recognition** of actions (from string to picture, from picture to complex situation) → lifting pattern recognition up the ladder
  - Handling of **extremely large data volumes** → approach "real world" (vs. toy or controlled environment)
- Examples, observations, conclusions, generalizations → transfer solutions to comparable situations (lightweight robot or turbine; target specific advertising, people analytics, enterprise resource planning)
- **Rising precision of predictability** → production, administration, services or agriculture / medical sector & pharmaceutical sector
- Complete automation of economically important jobs? (Nils Nilsson)

# Scenarios for labour

- Large **spread of scenarios** depending on various factors: how far can or could AI reach out to tasks (manual / cognitive)?

- **Many variables** – complex models – abstract world/s

- **Dystopians:** ML is intelligent – cognitive routine tasks and beyond → **technological unemployment** in unprecedented scale

- **Utopians:** ML is productivity booster in lead sectors → higher sectoral competitiveness will lead to stronger growth in overall economy → even in non- or under-digitized sectors or branches → new jobs and new income (**pareto optimum 4.0**)

# Polarization 4.0

- **Some displacement effects** & also outnumbering effects possible – i.e. job growth in digitized sectors.

- Prices might fall (due to higher productivity), **but no automatic spillover** of these effects on to other sectors.

- **Speed and timing / concurrency crucial**: If labor is replaced by technology faster than new labor is created, then technology replaces work:

  - → no increase in labor demand in other sectors is necessarily created.

  - → digitization might result in **sinking average wages**, as the substitution effect leads to a decreased labor demand.

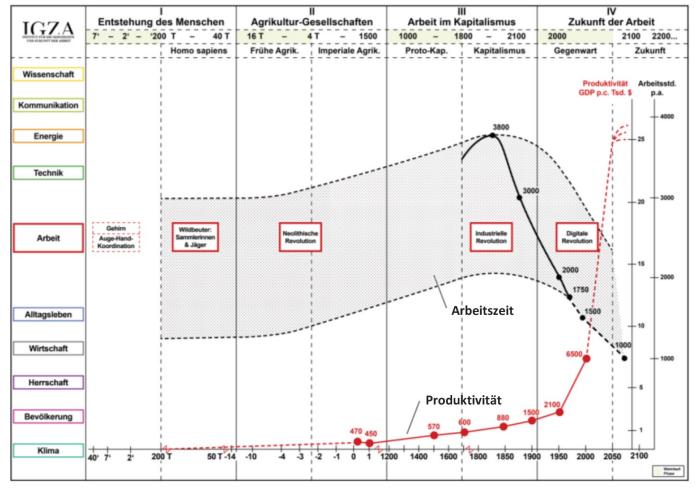# Polarization 4.0, cont'd

- **Even if higher wages materialize**
  - → does not mean a transfer to new purchasing activities: the nature of demand is important
  - → e.g. depending on which income groups would profit from higher wages.
- **Empirics today:** higher qualified do profit from digitization
  - → there is flexible demand for their products, and quite inflexible labor supply in these areas.
  - → picture changes on the lower end of qualifications: the demand for manual tasks is relatively inflexible. Lower prices for manual activities do not lead to a substantial higher demand.
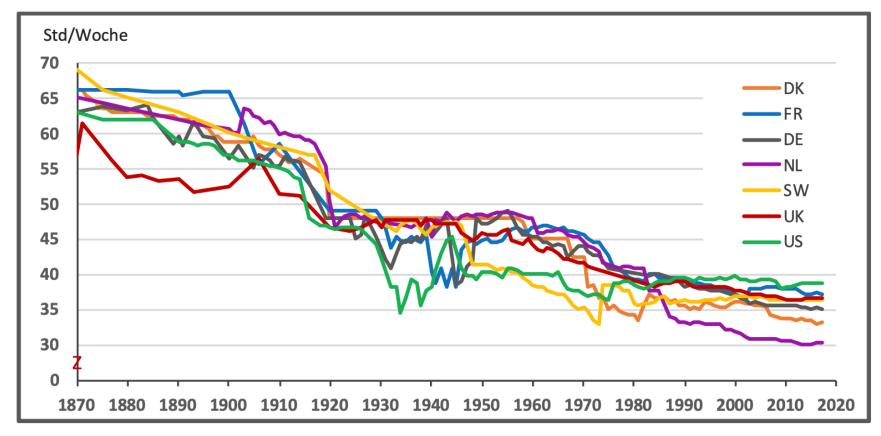
# 3. Impact on social systems – resilience and reform
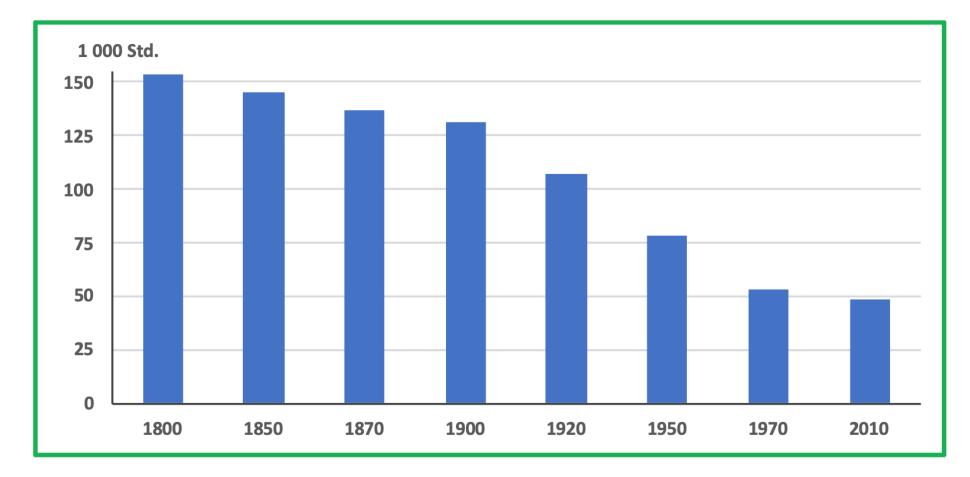
# Digitization: part of solution or problem?



Zeittafel des IGZA. Daten: Maddison (2007)
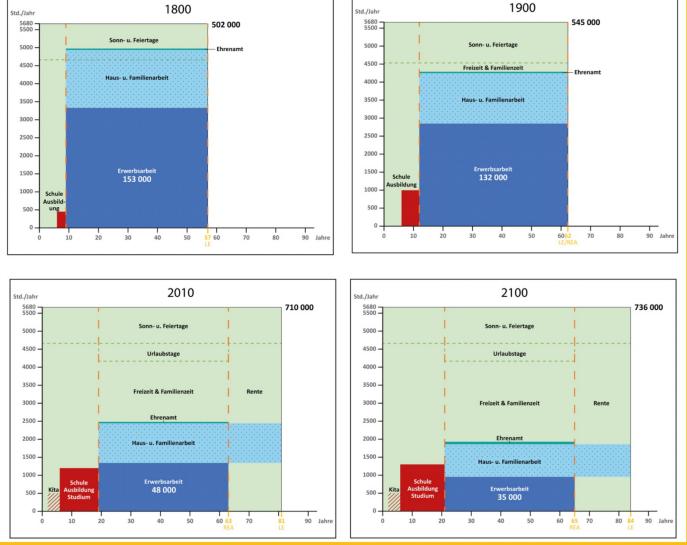
# Working hours, per week



Q: Gilmore, O. (noch nicht veröffentlicht); OECD LFS Datenbank; Bureau of Labor Studies Datenbank.

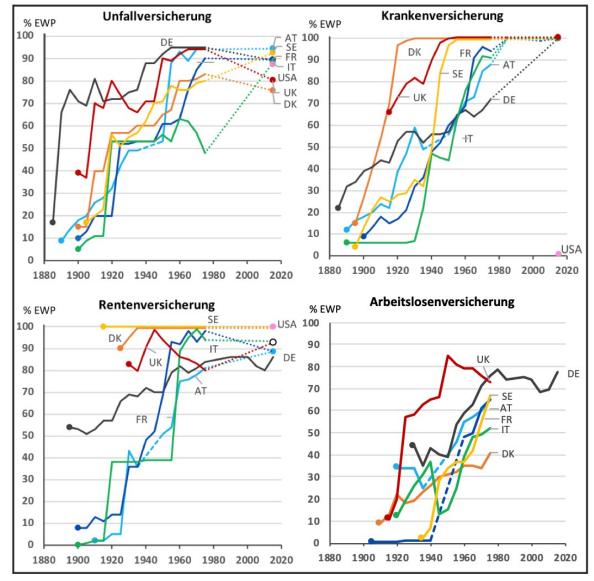# Working hours aggregated, life span, Germany



https://igza.org/wp-content/uploads/2018/11/IGZA_Arbeitspapier_4.pdf

# Lifetime and working lifetime in Germany 1800-2100



https://igza.org/wp-content/uploads/2018/11/IGZA_Arbeitspapier_4.pdf

# Coverage social insurance, by type and country, in % of working population



Q: 1880-1975: Alber (1987), 2017: ILO (2017), OECD (2018).

https://igza.org/wp-content/uploads/2018/11/IGZA_Arbeitspapier_4.pdf

# Characteristics of social insurance systems

1. the insurance principle
2. solidarity reinforced, e.g. no premiums for better risks
3. no charity, some 'means test'
4. the benefit principle: equivalence of payments in and payments out
5. work- and value-based
6. pay-as-you-go system: generational contract instead of capital market risks
7. self-governance
8. wide coverage ('citizen insurance')
9. structure of a lifetime work account

# 4. New concept of 'the social'?

- 'Freeing' of productivity potential in digitization
- Long-term employability
- Reactive to pro-active insurance schemes
- Redistribution 4.0
- Phases and insurance schemes (e.g. lifetime work account)
- Decent work 4.0 (define)
- Basic insurance schemes

# Thanks for your attention!

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