Digitalization and the World of Work

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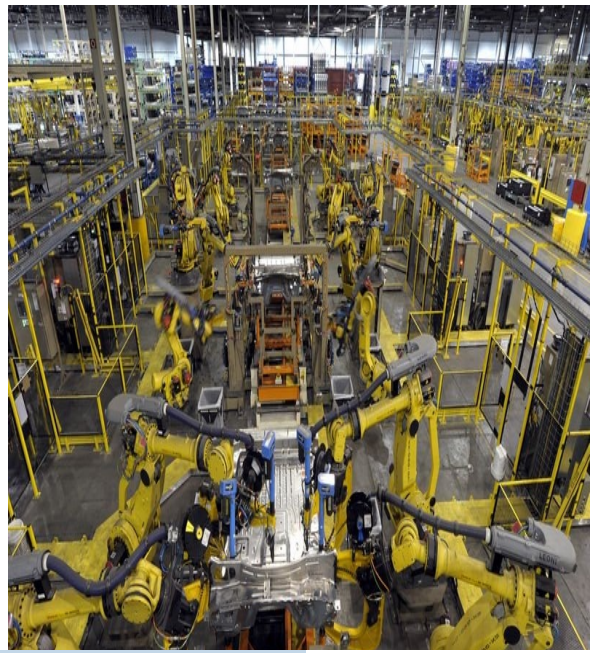


International Labour Organization

How will we work? Two thought frameworks:

1. "Simple" technological change:
   - The economic system remains in place but it adapts

2. Revolutionary change ("The Fourth Industrial Revolution"):
   - The system changes (i.e. the institutions change)

How do we want to work?

3. Policy Considerations
   - Policy challenges and new policy ideas

In the economics literature and policy debates:

- Digitalization often discussed in the context of AI (or AGI)
- AI as "general purpose technology" (example electricity)
- Automation: changes in capital-labor ratios
- Data as labor
- Heteromation
- Digital (labor) platforms
- Algorithmic management or "people analytics"
- Governance, regulation of AI

Work in the Digital Economy - ILO Research Agenda (prelim.):

- Pillar I: Economic dimensions: impact on jobs, incomes and equality
- Pillar II: Digitalization and automation in the workplace
- Pillar III: Digital labor platforms
- Pillar IV: Digital technologies for labor governance
- Pillar V: Workers rights and protections in the digital economy: policy development and coherence (including the creation of an "AI Observatory")

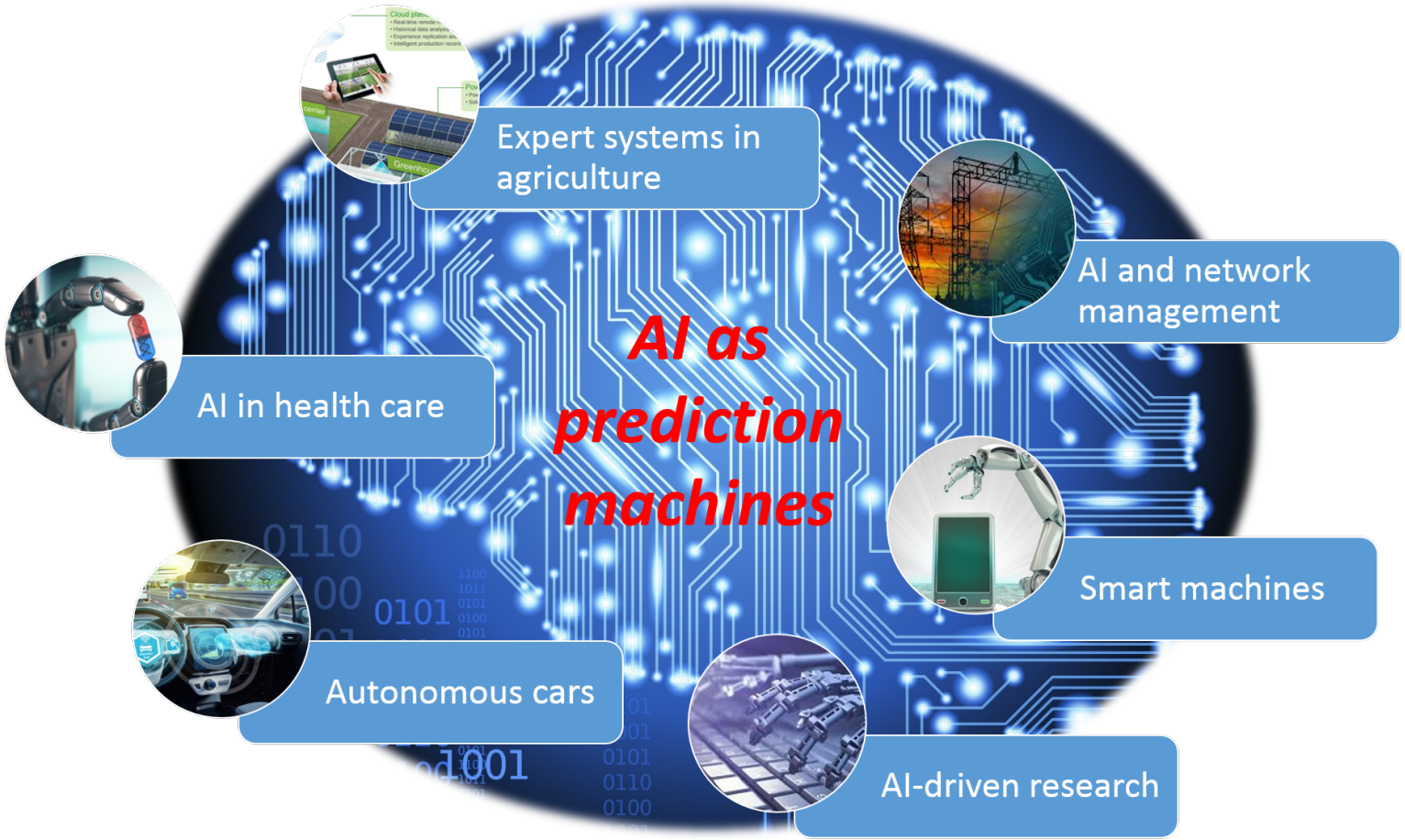
What exactly is changing?

- Data creation, storage and availability
- Networks and connectivity
- Automation
- Availability of information - decision making under uncertainty (reduction of complexity?)

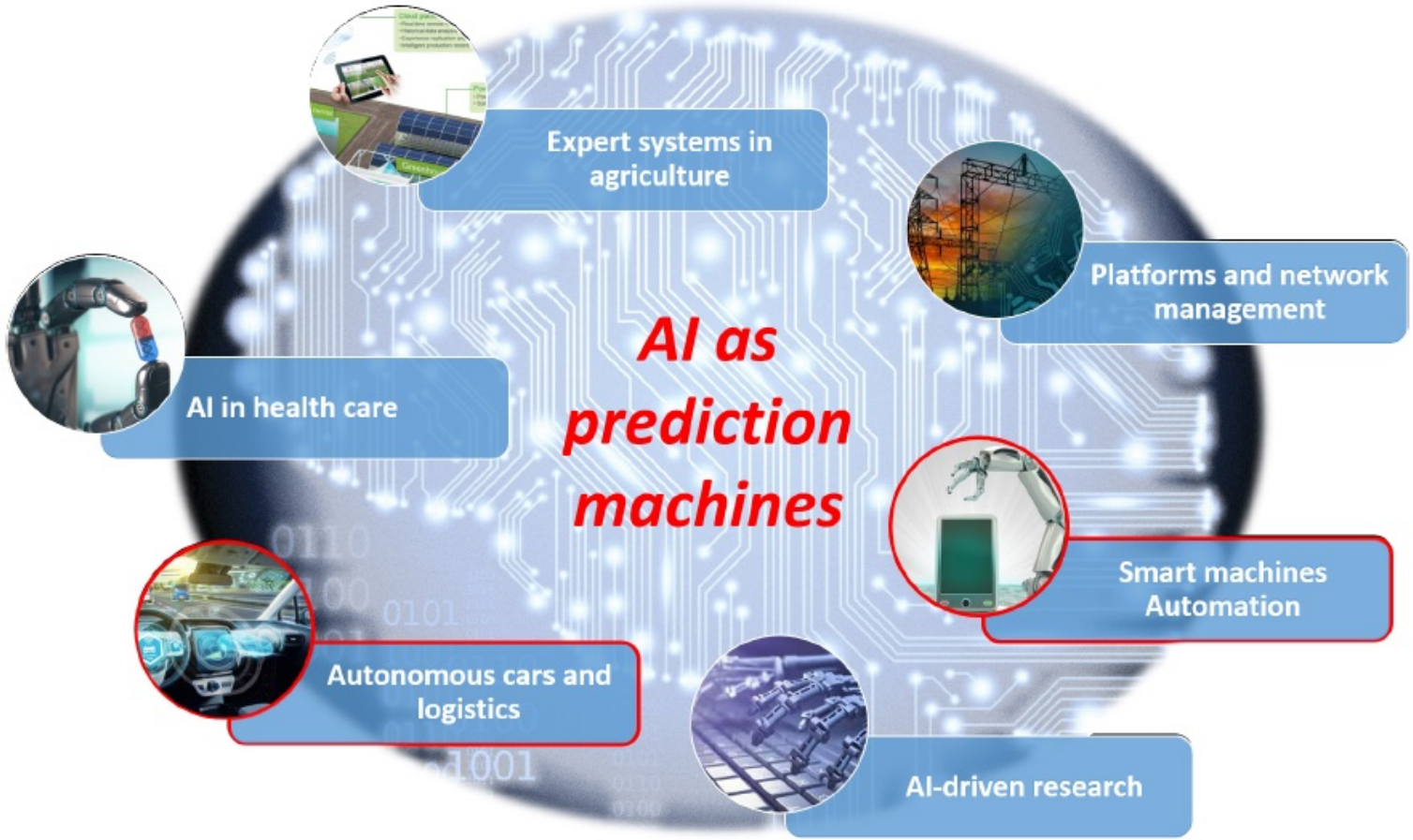
Labor Market Dimensions:

Job quality - what is behind "quality"?

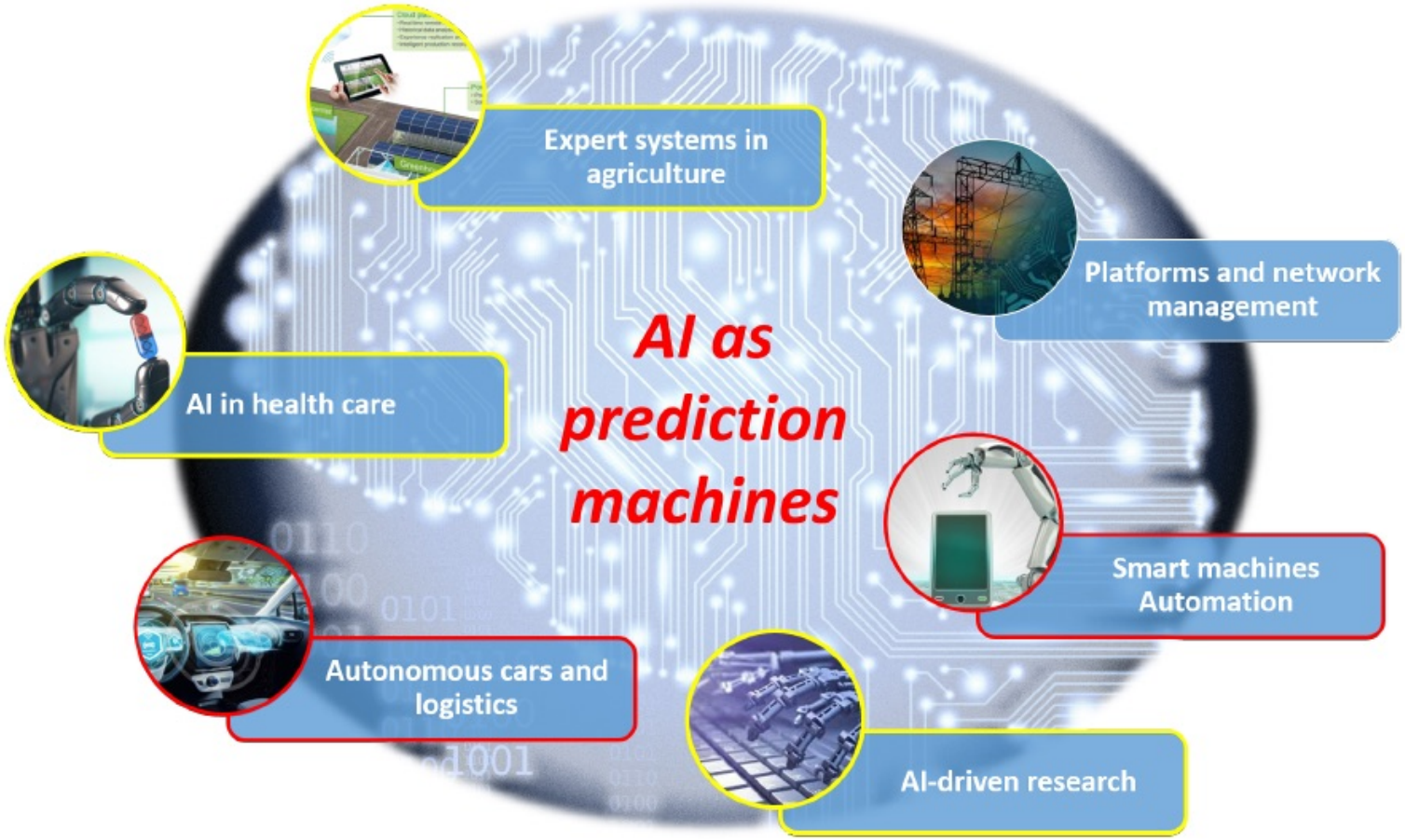
Where can we see current uses?



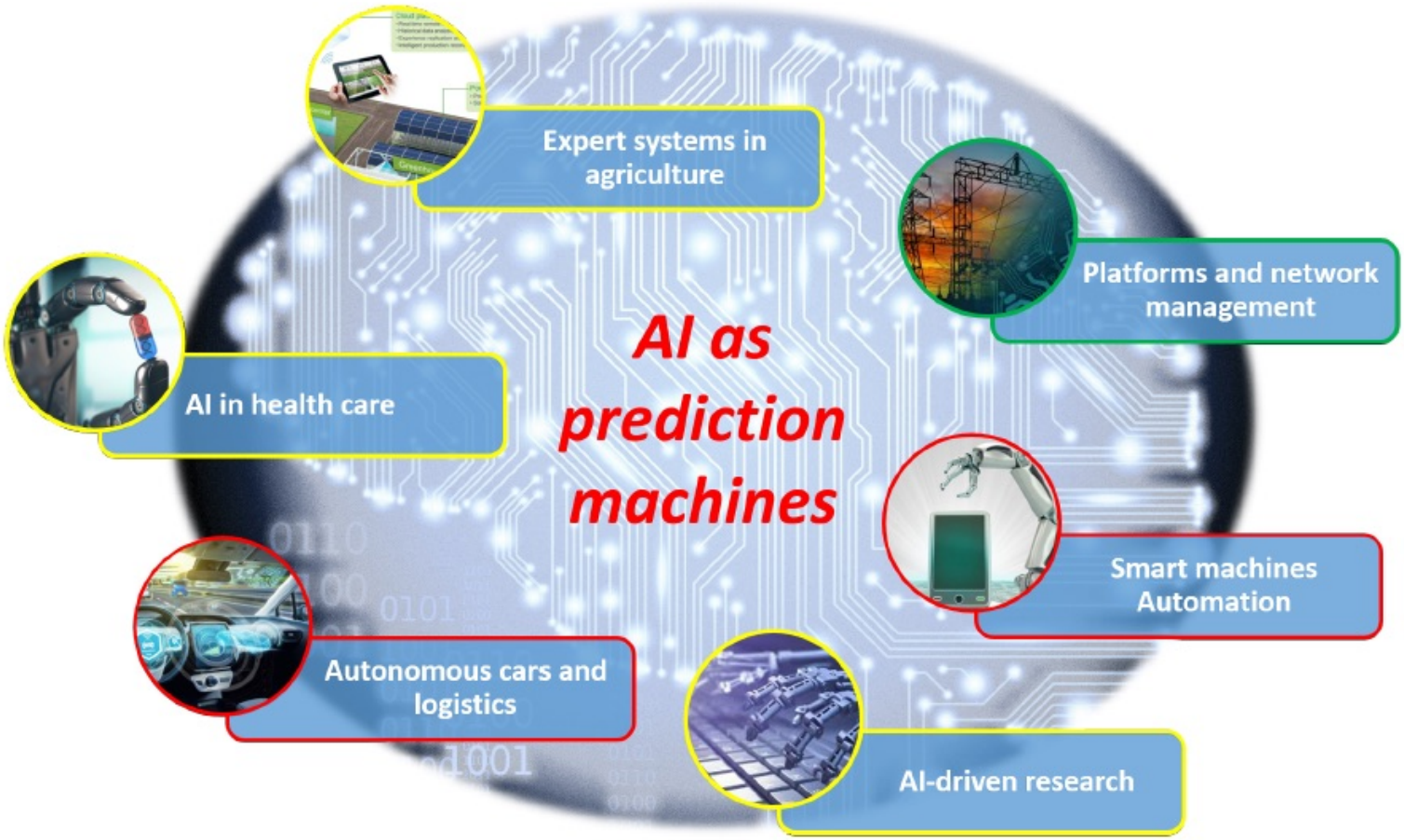
Examples of AI applications: Labour saving



Examples of AI applications: Capital saving



Examples of AI applications: Factor augmenting



Expected (or possible) socio-economic consequences:

- Replacement of jobs - unemployment (?)
- Productivity increases
- Changes in skills and education
- Income shifts
  - From labor to capital (profit incomes vs. labor incomes)
  - Wage polarization
- Better or worse job quality (working conditions, job security, ...)
- Reduced competition and higher concentration (monopolies or monopsonies)

Three hypotheses:

1. We might currently overestimate the impact of AI on our societies in the short run (next 5 - 10 years).
2. The long-run impact (next 30 years) tends to be bigger or can be huge (next 100 years) but is very difficult to predict or to quantify.
3. Technology is not as far as we sometimes want to believe it is (There is no AGI and specific applications have limitations)

"Einstein predicted gravitational waves in 1916. It took ninety nine years of people looking before we first saw them in 2015 (...) Some things just take a long time, and require lots of new technology, lots of time for ideas to ferment, and lots of Einstein and Weiss level contributors along the way. I suspect that human level AI falls into this class. But that it is much more complex than detecting gravity waves, controlled fusion, or even chemistry, and that it will take hundreds of years.

Rodney Brooks, Professor of Robotics (emeritus) at MIT

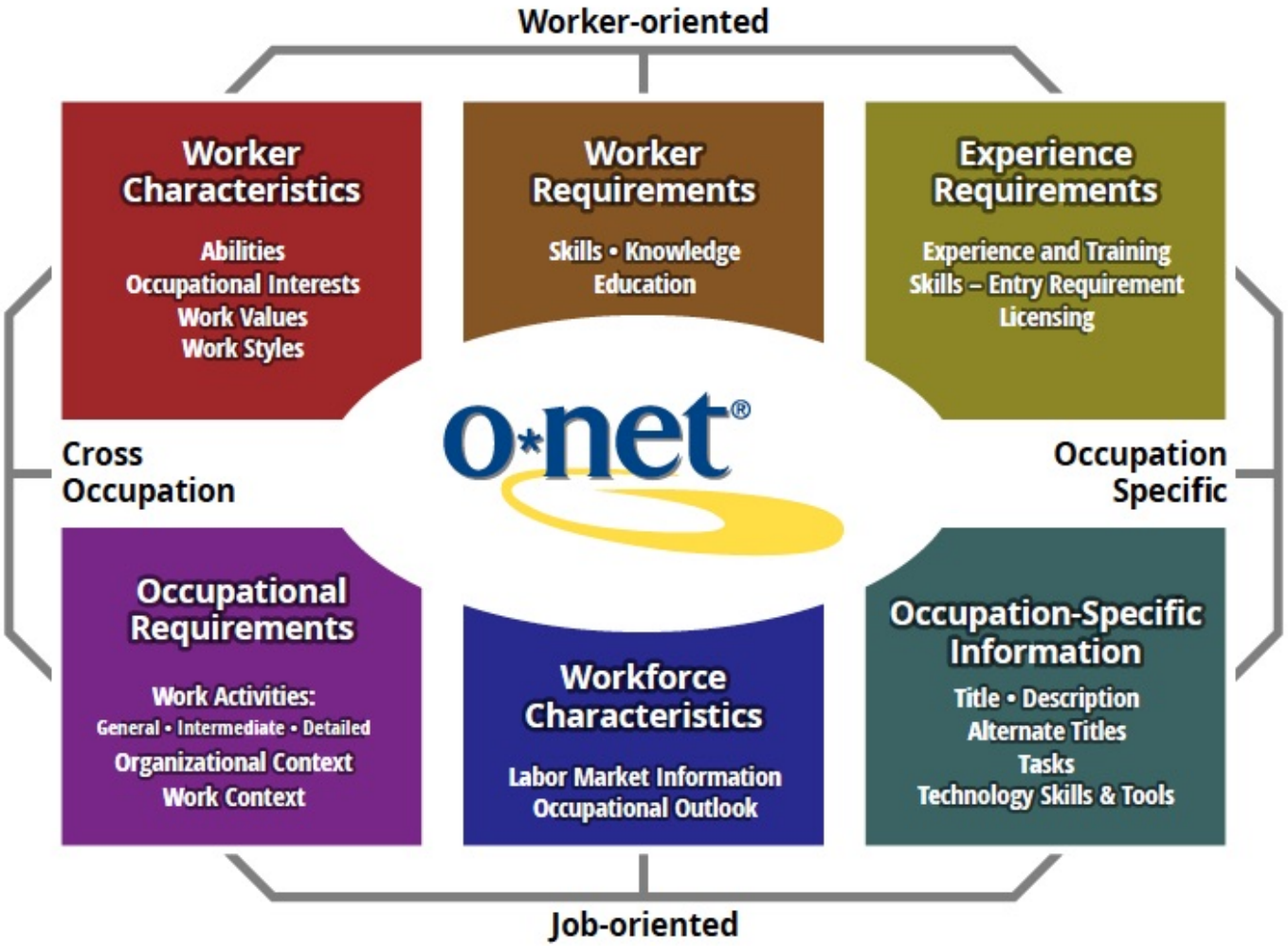
Replacement or displacement (?): many studies over the last 10 yrs predict destruction of jobs:

1. Brynjolffson & McAfee (2017), ("What can machine learning do? Workforce implications")
2. Frey&Osbourne (2013), and Frey&Osbourne (2017), ("...47 % of U.S. occupations at risk of risk of being automated by 2030")
3. OECD (2016), The Risk of Automation for Jobs in OECD Countries ("...on average across the 21 OECD countries, about 9 % of jobs are automatable").
4. ILO (2016), ASEAN in Transformation - the future pf jobs at risk of automation, ("... Nearly three in five jobs face a high risk of automation in ASEAN-5").
5. IAB(2015) study for Germany by Dengler % Matthes ("...15 per cent...")
6. ...

What do these studies (not) do?:

1. Evaluate the capacity of AI to carry-out certain tasks that are today performed by humans
2. No consideration of job creation (e.g. new tasks, more jobs)
3. No general equilibrium effects - for example through changing wages

The O*Net Content Model: Anatomy of an occupation (https://www.onetcenter.org)



The Task Model by David Autor(2013) and Autor et.al (2003)

- Distinguish a job from an occupation
- Distinguish tasks/activities from skills
- (Distinguish skills from abilities)
- Manual tasks vs. analytical and interactive tasks
- Routine versus non-routine tasks

TABLE I

PREDICTIONS OF TASK MODEL FOR THE IMPACT OF COMPUTERIZATION ON FOUR CATEGORIES OF WORKPLACE TASKS

	Routine tasks	Nonroutine tasks
	Analytic and interactive tasks	
Examples	• Record-keeping • Calculation • Repetitive customer service (e.g., bank teller)	• Forming/testing hypotheses • Medical diagnosis • Legal writing • Persuading/selling • Managing others
Computer impact	• Substantial substitution	• Strong complementarities
	Manual tasks	
Examples	• Picking or sorting • Repetitive assembly	• Janitorial services • Truck driving
Computer impact	• Substantial substitution	• Limited opportunities for substitution or complementarity

Autor et.al (2003), "The skill content of recent technological change", QJE

- Empirical implementation: U.S. data (Dictionary of Occupational Titles "DOT") on occupations and task (1960 - 1998), 4 waves
- Variation of employment in occupation
- Variation of tasks within occupations
- Selecting empirical measures of the four task categories

Autor et.al (2003)

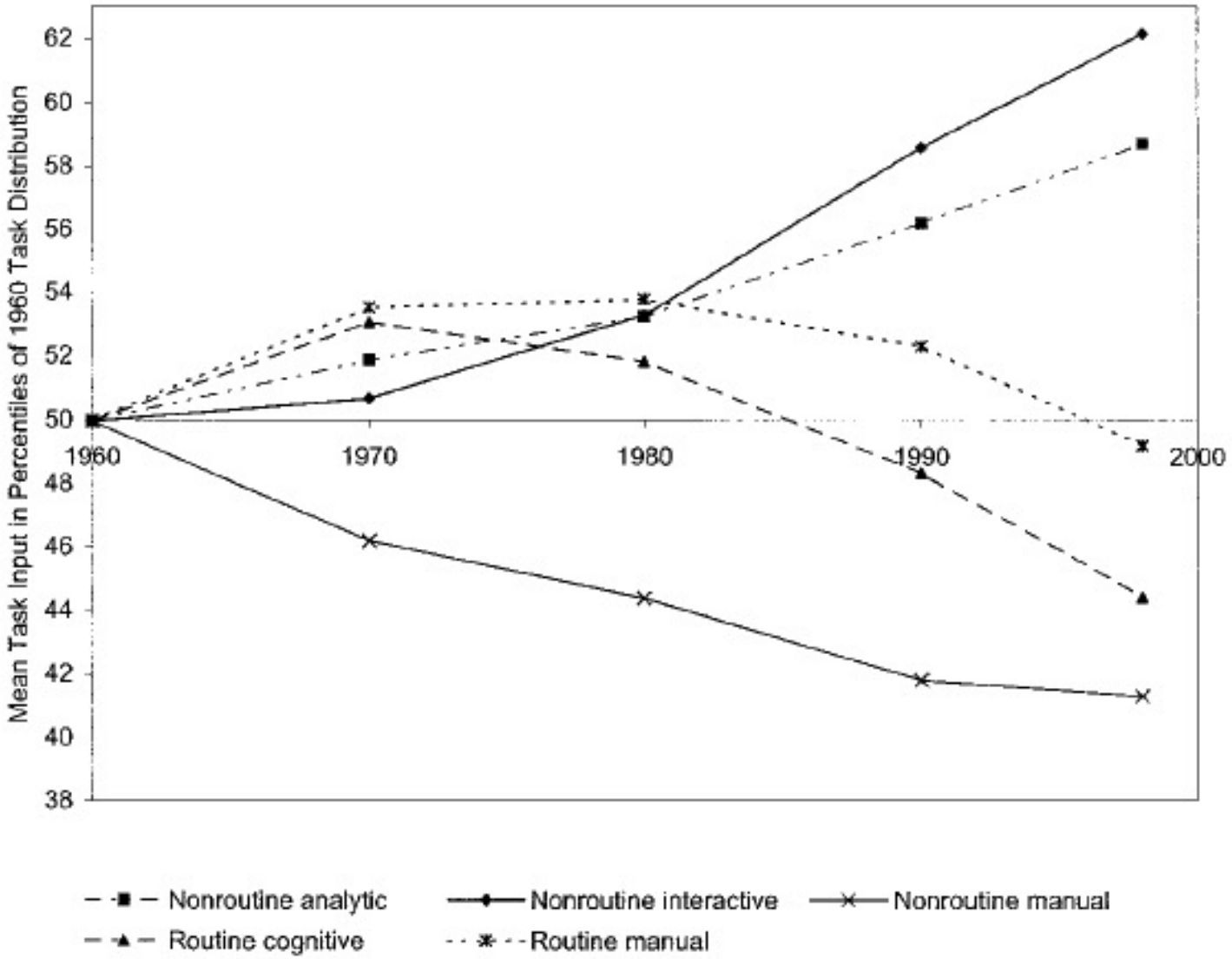


FIGURE I

Trends in Routine and Nonroutine Task Input, 1960 to 1998

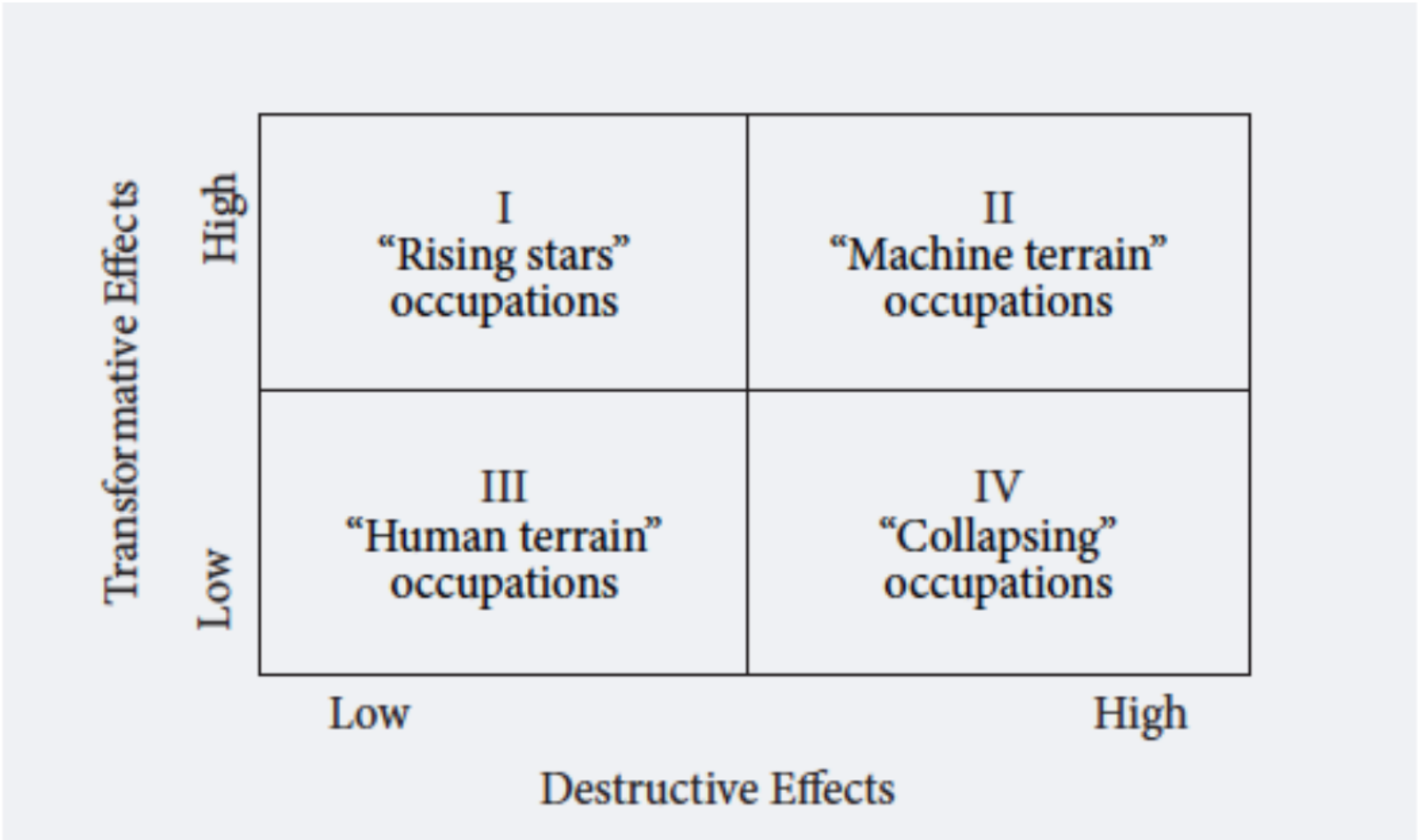
Which metrics exist to measure the impact of AI on the economy?

1. Frey and Osborne (2013, 2017): bottleneck skills
2. Brynjolfson et al. (2018) - scores for 2000 DWAs ("Detailed Work Activities") in O*Net
3. Felten et. al. (2018): "AI Occupational Impact (AIOI)" based on AI progress measured by the Electronic Frontier Foundation, indicates the "transformation" of jobs and exists for all O*Net occupations
4. Michael Webb (2019): text of job task descriptions and the text of patents of AI
5. University of Lausanne (2020) based on links between AI and human skills
6. WIPO Technology Trends 2019 - Artificial Intelligence (no index but links to sectors)
7. Stanford AI index - aggregated index for economies as a whole

Some observations:

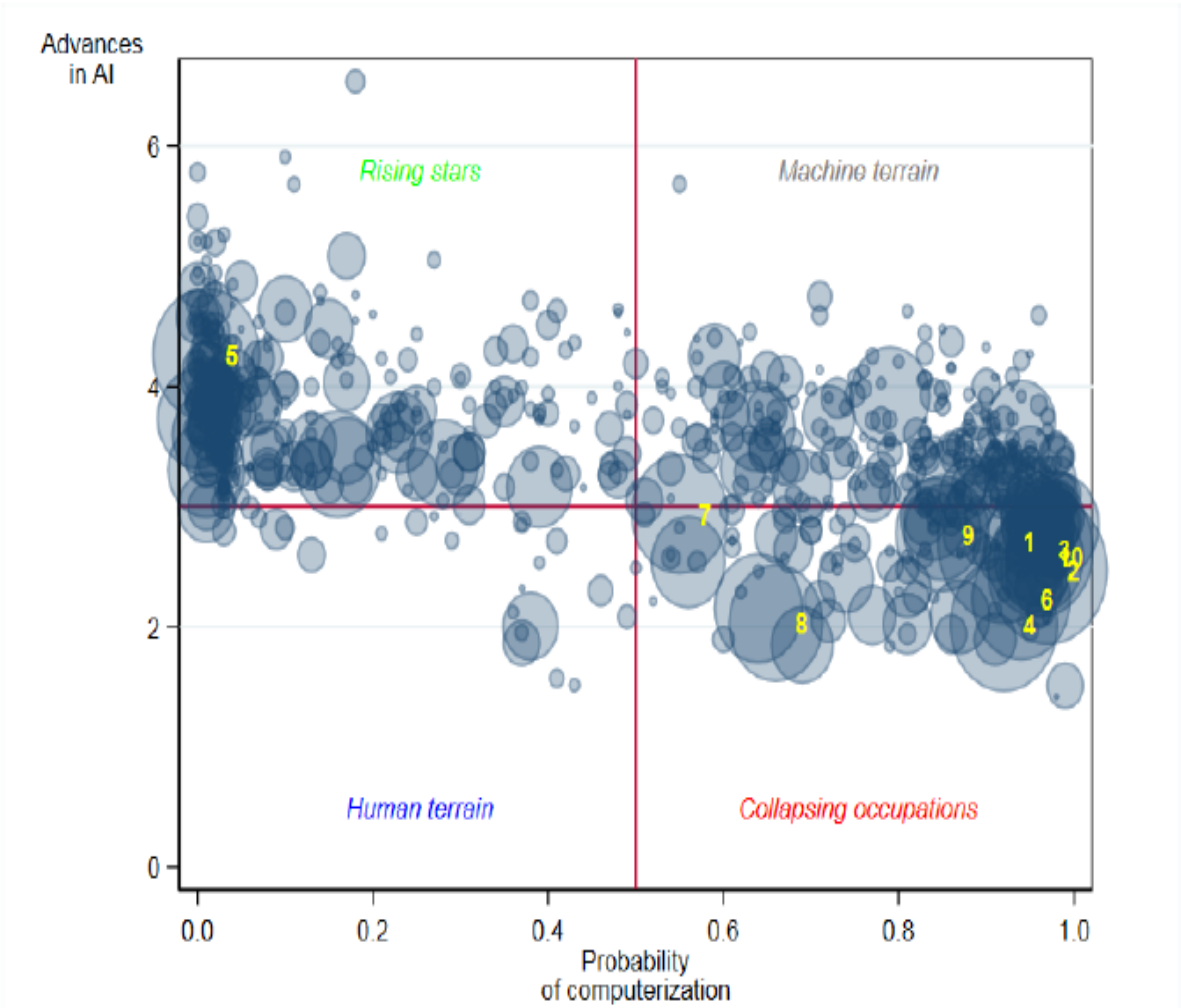
- Penetration of AI often measured through labor market variables
- U.S. focussed, hence results cannot be easily transferred The Impact of Artificial Intelligence on Labor Markets in Developing Countries: A New Method with an Illustration for Lao PDR and Viet Nam.
- Area of research for ILO: Carbonero, Ernst, Fossen, Samaan and Sorgner "The Impact of Artificial Intelligence on Labor Markets in Developing Countries: A New Method with an Illustration for Lao PDR and Viet Nam" (forthcoming) in Journal of Evolutionary Economics (using the World Bank STEP survey).

Displacement or Transformation?



Source: Fossen and Sorgner (2019)

Displacement or Transformation?



1	Retail Salespersons
2	Cashiers
3	Office Clerks
4	Food Preparation and Serving Workers
5	Nurses
6	Waiters and Waitresses
7	Customer Service Representatives
8	Janitors and cleaners
9	Laborers and Freight, Stock, and Material Movers
10	Secretaries and Administrative Assistants

Humans have comparative advantages in many areas

"Large neuronal networks today have a maximum of 1 million nodes but consume the energy of a nuclear power plant. The human brain has 84 billion neurons and runs on a slice of bread."

Chris Boos, AI expert and founder of Arago

Future tasks and skills: Humans vs. Machines

Machines:

- computing
- handling large amounts of data
- same context problems
- non-personal communication
- standardized transactions
- categorizing and matching
- correlations

Humans:

- personal communication
- changing contexts
- causality
- no data or small data sets
- unstructured problems
- switching tasks

Up-skilling, de-skilling or re-skilling?

- Industrial revolution: De-skilling
- ICT implementation (1980's and 1990's): "skill-biased technical change" (up-skilling)
- AI implementation: ?

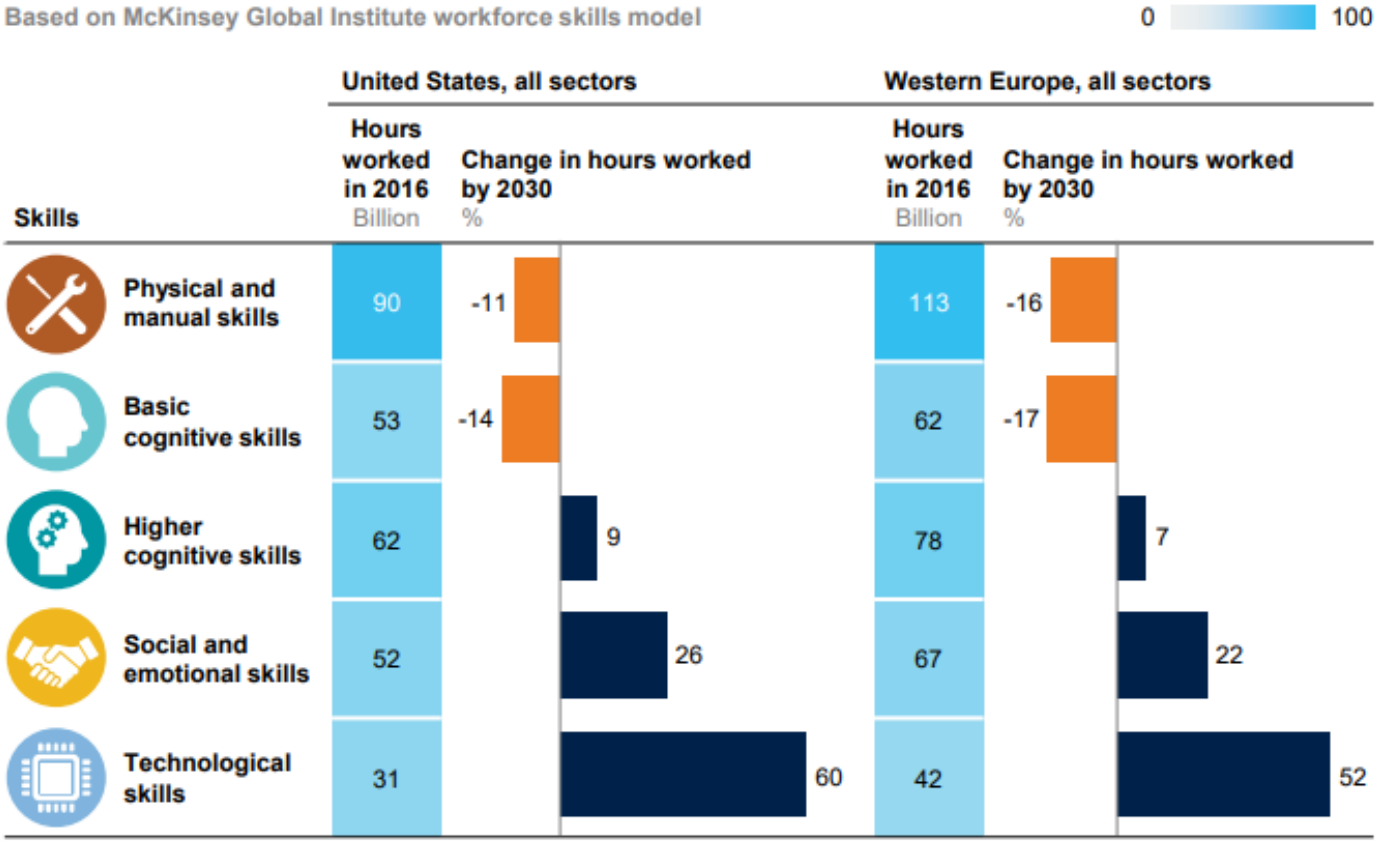
Skill: Capacity of a person to use her abilities, her knowledge, experience and training to carry out particular tasks in a certain context:

- Which are the most relevant economic sectors in (e.g.) 2030?
- Which products and services do our societies need?
- What technologies are we using (or not using anymore)?
- What kind of organizational structures are we using?

Emotional intelligence trumps STEM

Automation and AI will accelerate the shift in skills that the workforce needs.

Based on McKinsey Global Institute workforce skills model



NOTE: Western Europe: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom. Numbers may not sum due to rounding.

SOURCE: McKinsey Global Institute workforce skills model; McKinsey Global Institute analysis

What are "digital skills"?

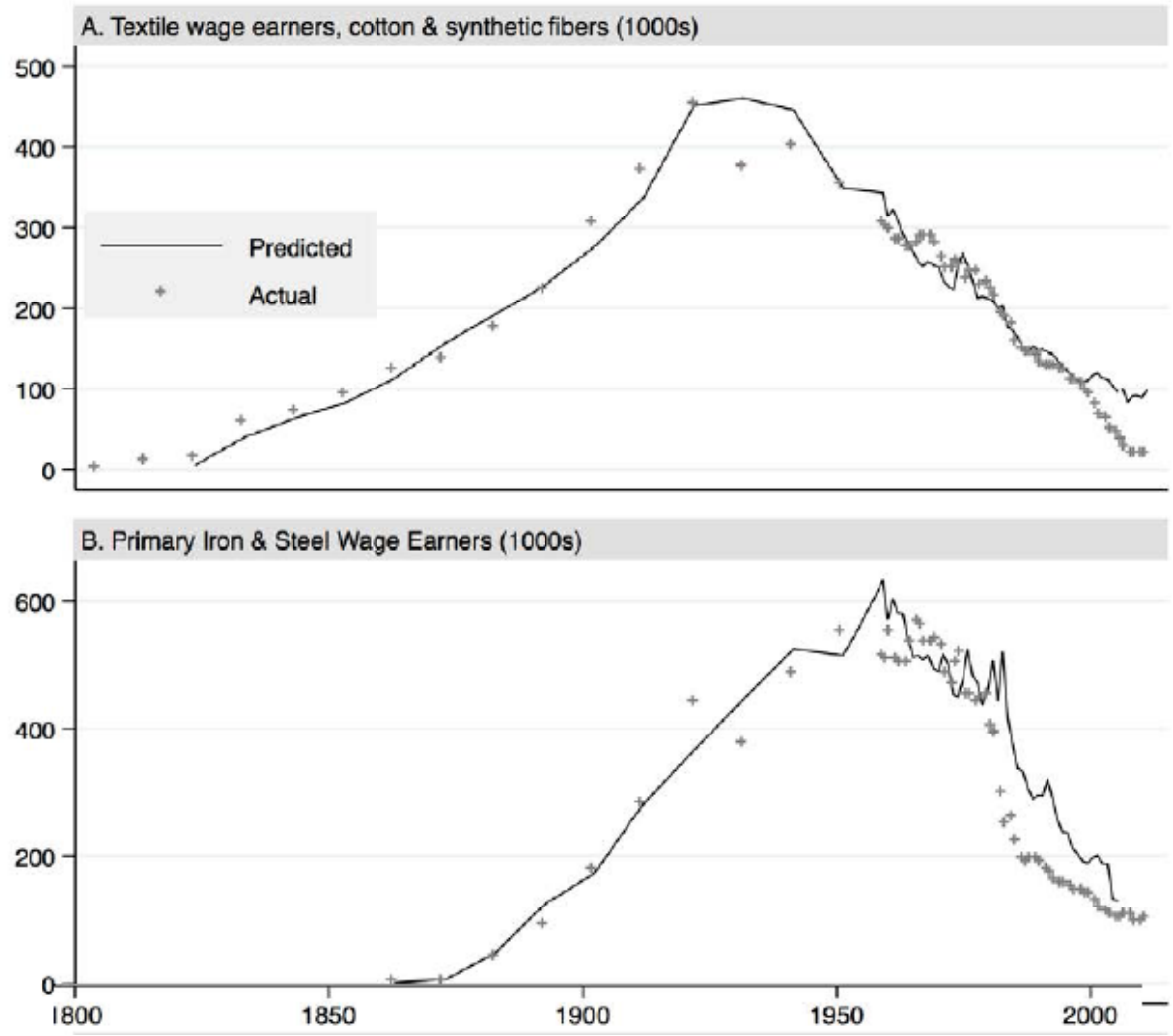
1. Use of (specific) digital technologies (DT)
2. Creation, maintenance and development of DT
3. Capacity to perform tasks that are NOT carried out by DT
4. Evaluation and interpretation of output produced by DT
5. Ethical considerations of DT

Extraction of some skills from ONET for the above:

1. Active Listening (basic skill): Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
2. Critical Thinking (basic skill): Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems
3. Social Perceptiveness (cross-functional skill): Being aware of reactions of others and understanding why they react as they do.
4. Technical Skills (cross-functional skill) - Developed capacities used to design, set-up, operate, and correct malfunctions involving application of machines or technological systems
5. Mathematics (knowledge) - Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

Employment in two U.S. manufacturing Industries, 1800 -2010 (taken from Bessen (2018))

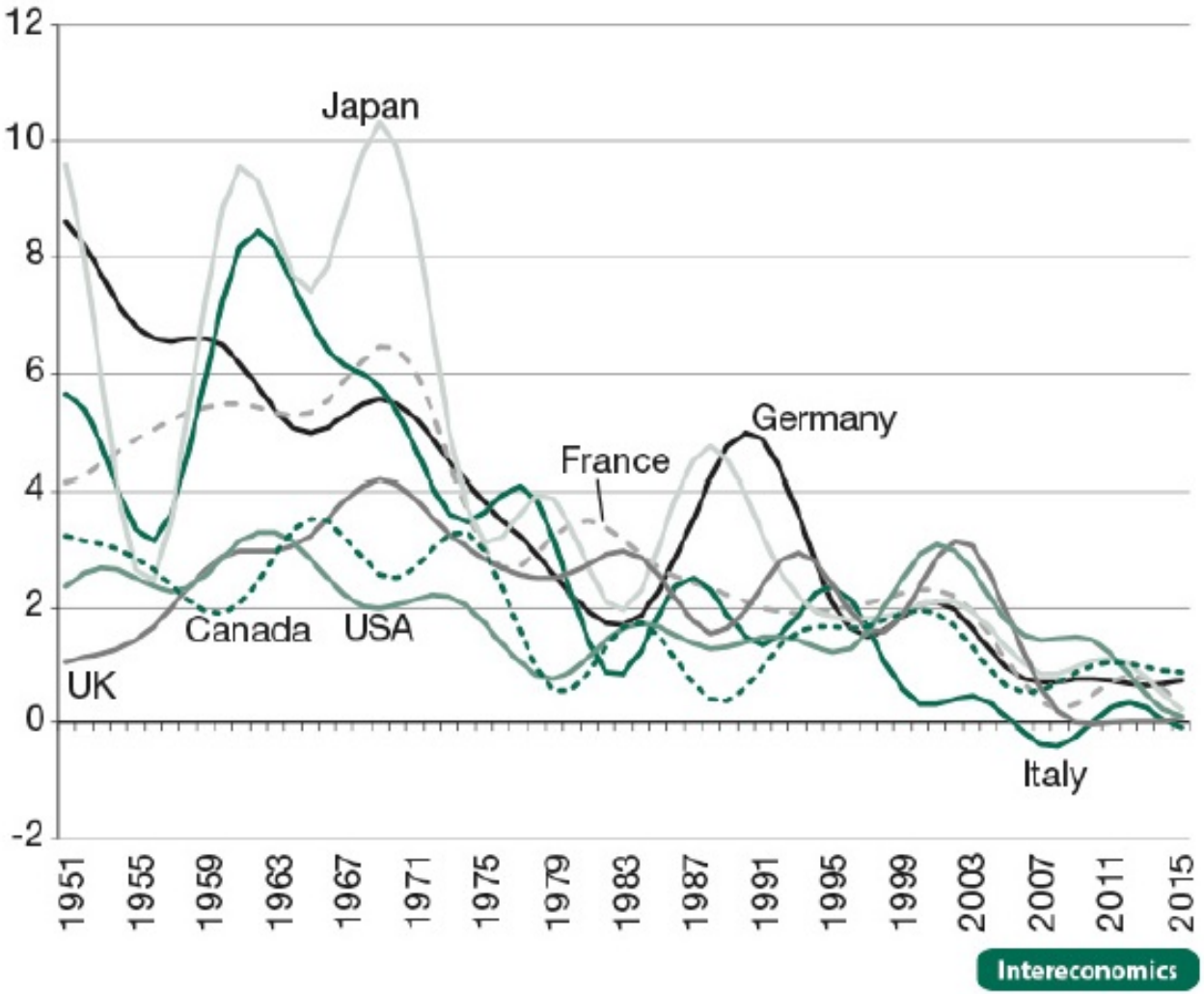
Figure 1. Production Employment in Three Industries



Employment in U.S. manufacturing, 1800 -2010

Figure 2. Manufacturing Share of the Labor Force

The modern productivity paradox: Labor productivity growth G-7, 1951 - 2015



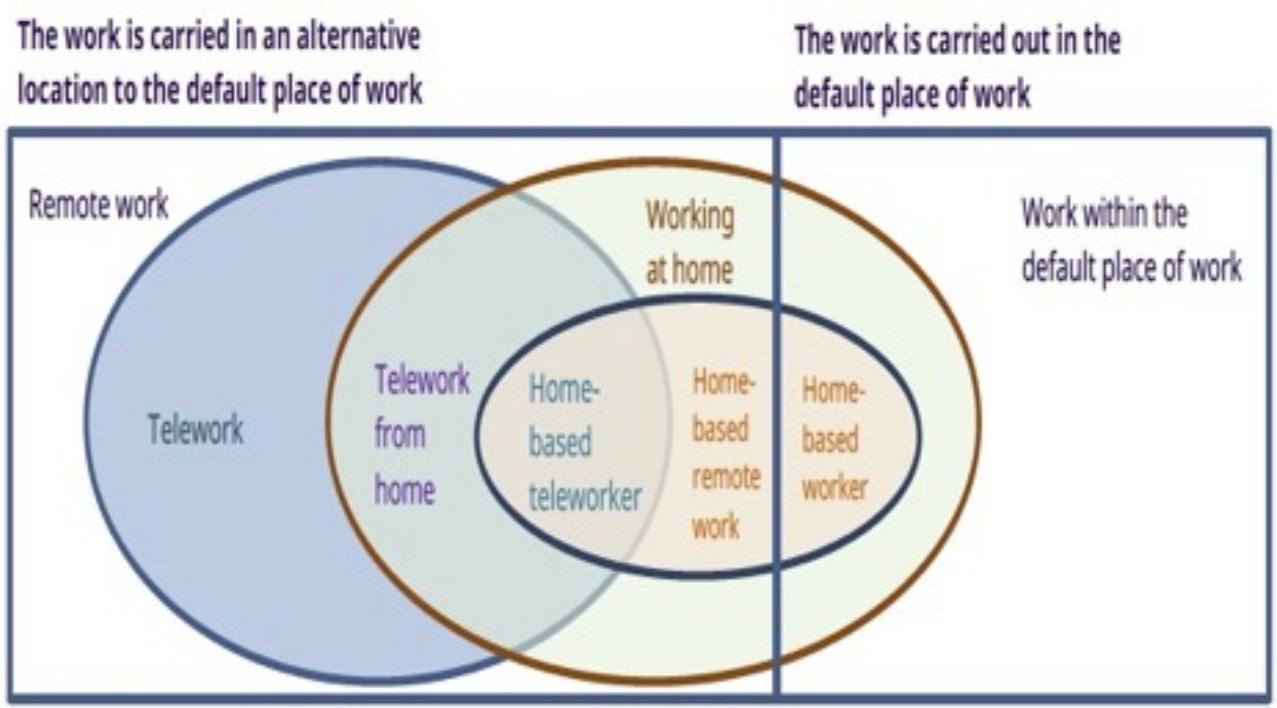
What are possible explanations?

1. It's just a time lag.
2. We are mismeasuring it - (individual) service output is difficult to measure.
3. We have indeed a productivity slow-down (the lower hanging fruits have been already harvested).

How could the world of work look like in a post-industrial society?

- Robot tax, taxing algorithms, (slow down digitalization)
- Apply existing labor law and competition law more rigorously
- Universal Basic Income (UBI)
  - reduce working hours
  - replace the existing social security system with UBI
  - UBI on top of existing social security system
  - how much?
  - financing?
  - immigration?
- Something completely different? Public or private property? (public or private decision making mechanisms)

No clear default place of work:



Very diverse workforce with very different aspirations:

- age
- culture (immigration)
- gender
- educational status (life long learning)
- part-time, full-time, project-related work

Infrastructure and capacity are available:

- Internet
- Networks, data, knowledge available
- Highly educated workforce
- Cheap access to hardware, mobile phones
- Algorithms and software can be interchanged easily at low cost

What are the alternatives?

- Frithjof Bergmann: "New Work New Culture"
- David Graeber: "Bullshit Jobs"
- Adam Smith and Karl Marx on "Productive Labor"
- Economics literature on transaction costs (John Commons, Ronal Coase, Oliver Williamson, and others)

Work without jobs (and without companies)? A New Work culture from bottom-up

- Our institutional framework for the labor market is about "jobs" (= a bundle of activities....)
- ...while digitalization is currently offering to de-construct "jobs"
- The "job design" is in inheritance from the industrial revolution
- Our policy incentives are targeted at corporations to make them create many "jobs"
- Our education and training systems focus on "jobs"
- Our production systems are still designed on mass production and waste of resources

Can we organize our work bottom-up?

- "High-tech self-providing" HTSP (Bergmann)
- Provision of technological and digital infrastructure (platforms)
- Education for HTSP
- De-centralized, self-organizing groups
- New education system (no degrees)
- Disincentivize of large corporate structures (taxes and regulations)
- Some form of universal basic income (UBI) - parallel to existing system

Some final thoughts:

- We can run out of jobs, never out of work
- We are inventing "jobs" because we need "jobs"
- Most of our time we are not productive ("bullshit")
- We need to redefine what "productive labor" means on a societal level
- We are not focusing on the right things (mass production instead of resource productivity)
- More and more "jobs" are transaction activities with little "value"
- We need a bottom-up approach in which people can work on what they want