Digitalization of Manufacturing and SMEs
Consequences for Jobs, Work Organization and Skills

Prof. Dr. Hartmut Hirsch-Kreinsen
TU Dortmund University
Faculty of Economic and Social Sciences
The German Vision: From Industry 1.0 to Industry 4.0

1. Industrial revolution
   - Follows introduction of water- and steam-powered mechanical manufacturing
   - End of 18th century

2. Industrial revolution
   - Follows introduction of electrically-powered mass production based on the division of labour
   - Start of 20th century

3. Industrial revolution
   - Uses electronics and IT to achieve further automation of manufacturing
   - Start of 1970s

4. Industrial revolution
   - Based on Cyber-Physical Systems
   - Today

Source: DFKI 2011

Hirsch-Kreinsen, October 2015
1. Job Losses: Controversial and Unclear

- **On the one hand:**
  Pessimistic theses about far-reaching job losses
  Nearly 50 percent of all occupations susceptible to computerization
  Especially routinized low-skilled and medium-skilled jobs

- **On the other hand:**
  Optimistic theses significant about job gains
  Nearly 400,000 new jobs in German manufacturing in ten years
  Demand for better qualifications and higher skill levels

**However, compensation mechanisms?**
*short-term job losses and long-term job gains*

**Germany 2025: loss of 610,000 jobs and one million new jobs?**

(cf. Brynjolfsson/McAfee 2014; Frey/Osborne 2013; BCG 2015; FAZ 2015)
2. Jobs and Qualifications: Upgrading vs. Polarization

**Upgrading:**
Substitution and automation of most low-skilled jobs
Growing need for decision making and management of complexity
Increasing demand for medium- and high-skilled jobs

„skill-biased technical change“

**Polarization:**
Substitution of middle-skill jobs based on routine tasks
Stabilization of low-skilled manual jobs with nonroutine tasks, e.g. security, maintenance, assembly
Stabilization and growing relevance of high-skilled jobs including e.g. problem-solving, intuition, creativity, social interaction

„Lousy and Lovely Jobs“

(cf. Goos/Manning 2007; Autor/Dorn 2013; Brynjolfsson/McAfee 2014; Autor 2015)
Divergent patterns of work organization

Polarized organization

„Swarm“ organization

„White-collar“ jobs, highly skilled experts, high autonomy of work
Planning and supervising level
Remaining „blue-collar“ operational jobs
Semi-skilled workers
Operational level

Highly skilled Employees, high autonomy of work
Integration of planning and operational levels
3. Increasing Delimitation of Work

- **Companyinternal:**
  - Decentralization and flexibilization of the company organization
  - Perspective „swarm-organization“
  - Temporary project work, internal „Crowdworking“

- **Intercompany and company networks:**
  - Increasing modularization, differentiation of jobs
  - „Open innovation and production“, „Crowdsourcing“, „Crowdwork“, e.g. R&D, engineering

*Ambivalent effects on the work situation*

4. Digitalization: a Political and Strategic Design Project

Digitalization as a „Socio-Technical System“

- Input
- Work / action
- Autonomous technological components
- Work organization
- Output
5. Risks and Opportunities of Digitalization

**Risks**

- Deskilling and increased division of work
- Automation, esp. loss of low-skilled jobs
- Increased surveillance and privacy risks
- Delimitation, flexibilization and intensification of work
- Aversions against digitalization of many SMEs

**Opportunities**

- Opportunity for human-centric and skill-based work design
- Opportunity to implement workplace innovations
- Chances for age-related work design
- Increasing the attractiveness of industrial work
- Maintaining and expanding stable industrial employment
Thank you for your attention!

hartmut.hirsch-kreinsen@tu-dortmund.de