

# **Digitization and the Transformation of Work**

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### Mainstream Prediction: "Disruptive" Change of Work



#### Digitization of just about everything

- Professions of all kinds from lawyers to truck drivers will be affected
- Routinized manual and intellectual work will be automated





#### Industry 4.0: Connectivity - Big Data - Artificial Intelligence – Cyber-Physical Systems



(Sources: Fraunhofer IML, Jettainer, Daimler, ten Hompel 2015)



### Three theses:

- 1. In the long term only moderate job losses, but structural change of work
- 2. Industry 4.0 and Work 4.0 as design projects
- 3. The indispensible role of public policies the reskilling imperative



Changes in employment shares, past and projected by economic sector, EU 28

(Source: Cedefop skills forecast 2016, quoted by Nedelkoska/Quintini, 2018)



Changes in employment shares, past and projected by occupation, EU 28

(Source: Cedefop skills forecast 2016, quoted by Nedelkoska/Quintini, 2018)

Two challenges for the transformation of work

- First, a numerical divergence between short-term job losses and long-term creation of new jobs
- Second, divergence between the skill profiles of replaced jobs and the skill profiles of the newly created jobs

A considerable **gap concerning number of jobs and skills** between those loosing their jobs and those needed in future



A **strong justification** for intensive measures of training and competence development on all skill levels

In the Long Term: Divergent and Coexisting Scenarios of Work

### **Automation** Technology-driven organization Mostly highly qualified personnel remain

...substitute for labour in a wide range" (Frey/Osborne)

**Polarization** Segmented organization



"lousy and lovely jobs" (Goos/Manning)



"better jobs at every level" (Zuboff)

(Own source)



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### 2. Industry 4.0 and Work 4.0 as a Design Project

- Although "technology push" no automatic and deterministic social consequences of new technologies no "one best way" of digital work
- Technological potential of new systems not identical with their actual patterns of implementation on the company level *no* "*technological determinism*"



**Determining factors of implementation patterns**: e.g. company strategies, existing organizational structures, negotiation processes with unions

### **Multifunctionality of Digital Technologies**





Different design options for work

(Source: FhG IML Innovationslabor 2018, own source)

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Alternative Design of Man-Machine-Interaction, Assistance Systems

# Automation: "performance guidance"

- Optimization of information and work process
- Low skill level
- Restricted autonomy, intensive surveillance
- Very limited training required



Foto: dolgachov/Panthermedia.net

# Augmentation: "knowledge system"

- Support for work and decision making
- Enablers of intensive and targeted learning processes
- Existing working autonomy
- Higher skill level required, practical knowledge necessary



### Design Options of Work Organization



Automation hierarchy

# Dezentralized networked processes

(Source: Bettenhausen/Kowalewski, 2013: 6)

#### 2. Design project

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Change of traditional assembly lines to networked assembly islands and New Forms of Skilled Team Work

# Connectivity: differentiation and integration of processes



Bildquellen: <u>https://www.sixsigmablackbelt.de/audi-revolutioniert-die-montage-durch-abschaffung-des-fliessbandes/</u>: <u>https://www.audi.com/content/dam/com/EN/investor-relations/for-investors/investor-presentations/20170227\_arculus.pdf</u> Anxieties of 'Modern Times' still with us. By Julian E. Zelizer, Special to CNN November 29, 2010 -- Updated 1407 GMT (2207 HKT))

### Industry 4.0 as a Socio-Technical System

Political regulation, functional context preconditions, networks, value chains Framework specifications: strategic, normative HUMAN TECHNOLOGY ORGANIZATION

Not only focusing on technological or human elements but **"joint optimization"** of the whole system

Socio-technical design as a pre-condition for economic efficiency based on skilled work



# 3. The Indispensible Role of Public Policies – the Reskilling Imperative

- Addressing the issue of skills from the supply side focusing on the need to improve the number of people with vocational qualifications, post-secondary and tertiary academic skills
- Also promoting the demand for skills working with employers to move them into higher skilled and more productive economic activities
- Transfer of "best practice" examples of successful skill-based patterns of job design
- Compensation of regional-sectoral differences of knowledge and experiences – learning from "smart" regions
- Stimulating the development of networks among firms to encourage investment in training and further education, in particular SMEs

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## Supply Side – Education System:

- Upgrading education policies aiming at rapidly raising education and skills levels of individuals of all ages
- Focus on both STEM (Science, Technology, Engineering and Mathematics) and non-cognitive soft skills, enabling people to leverage their unique human capabilities
- Accelerating the diffusion of digital learning methods
- Digital assistance systems as support for qualification measures and further training



(Source: www.ibb.com/blog/digitales-lernen-und-e-learning-wegweisender-ansatz-oder-technik-spielerei)

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### Support by Assistance Systems



#### Working Assistance:

expanding the capability of workers

**Interaction:** multimodal human-machine and human-human interaction

### Learning Asistance:

personalized, skillspecific....

(Source: DFKI/Ulrich)

## **Demand Side – Need for New Company** Strategies

- Professionalization of HR management, development of HR strategies - especially for SMEs
- Strong focus of executive leadership and HR management on the digital transformation
- Promoting skill-oriented work design *learning-by-doing* and new forms of practice-oriented learning in the workplace necessary
- Using of digital assistance systems to support low-skilled employees
- Establishment of a "corporate learning culture"



(Source: FhG IML)

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### The Important Role of Public Policies to Meet the Economic and Societal Challenges of Industry 4.0

- Pushing interdisciplinary cooperation to promote Industry 4.0: companies, science, politics, associations, trade unions, civil society
- Supporting the transfer of the vision of industry 4.0 to companies
- Transfer of knowledge from "high-tech" to "low-tech" companies especially to SMEs
- Initiating a societal debate on the social challenges of Industry 4.0
- Unlocking the technological potential in a way that benefits society as a whole



**Social Challenges** 



# Thank you for your attention!

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#### Digitalisierung industrieller Arbeit

Die Vision Industrie 4.0 und ihre sozialen Herausforderungen



