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Washington



# Robotics and Artificial Intelligence: Policy Implications for the Next Decade

- International Panel -

Dr. Robin Mishra





# Structure

1. TV Thriller 4.0
2. Research 4.0
3. Industry 4.0
4. Work 4.0



# 1. TV Thriller 4.0

## „Tatort“ – German Crime Series

→ TV Market Share (2015): 25,8 %

Tatort Stuttgart „HAL“ on August 28, 2016







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## Tatort Bremen „Echolot“ on October 30, 2016





## 2. Research 4.0

### Center for Robotics & Mechatronics (RMC) at DLR (Oberpfaffenhofen)

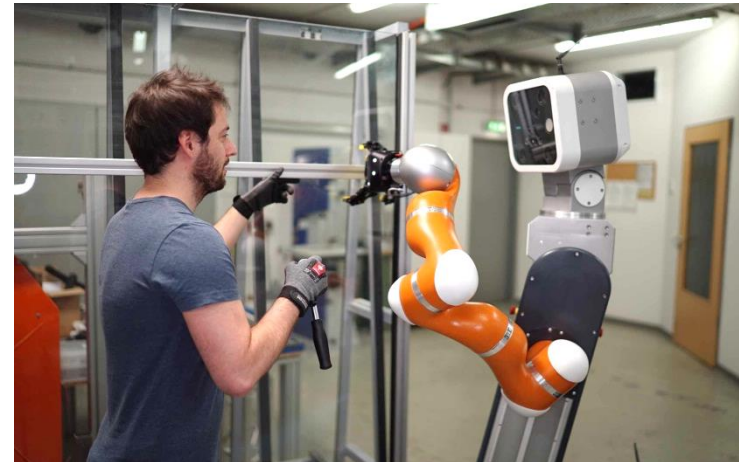
- Core Competence RMC:
  - ✓ interdisciplinary (virtual) design
  - ✓ computer-aided optimization & simulation
  - ✓ implementation of complex mechatronic systems & human-machine interfaces
- Robotics community → one of the world leading institutions
- Research areas:
  - Flying Robots,
  - Medical Robotics,
  - Personal robot assistance





## Fraunhofer Institute for Factory Operation and Automation IFF (Magdeburg)

- Research areas:
  - Digital Engineering & Industry 4.0
  - Convergent Supply Infrastructures
  - Smart Work Systems
  - Resource efficient production
    - make factories more energy efficient
    - reducing transportation
    - implementing smart energy cascades
    - closed energy & material cycles







## Max Planck Institute for Intelligent Systems (Stuttgart, Tübingen)

- future-oriented research on intelligent systems
- 3 scientific departments:
  - Perceiving Systems
  - Autonomous Motion
  - Empirical Inference



*Perceiving Systems*



*Autonomous Motion*



*Empirical Inference*

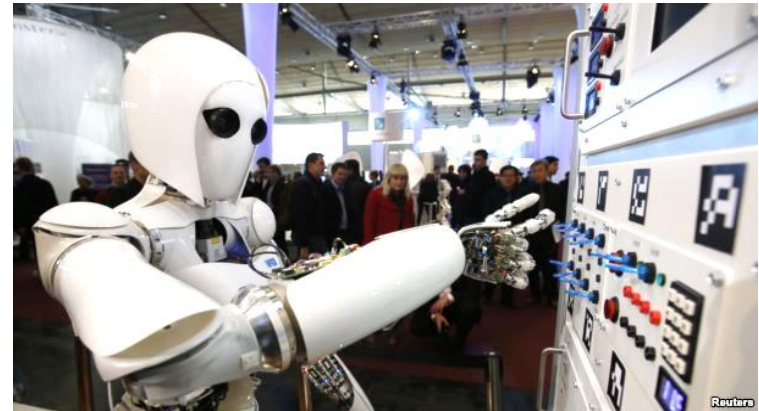


## German Research Center for Artificial Intelligence (Kaiserslautern, Saarbrücken, Bremen)

- Leading German research institute in field of innovative software technology
- Public-private partnership: among shareholders are BMW, Volkswagen, Deutsche Telekom, Bosch; but also Google, Intel, John Deere
- Variety of projects & applications:
  - Multilingual Technologies, Plan-based Robot Control, Educational Technology Lab, Robotics Innovation Center, Intelligent Analytics for Massive Data, etc.



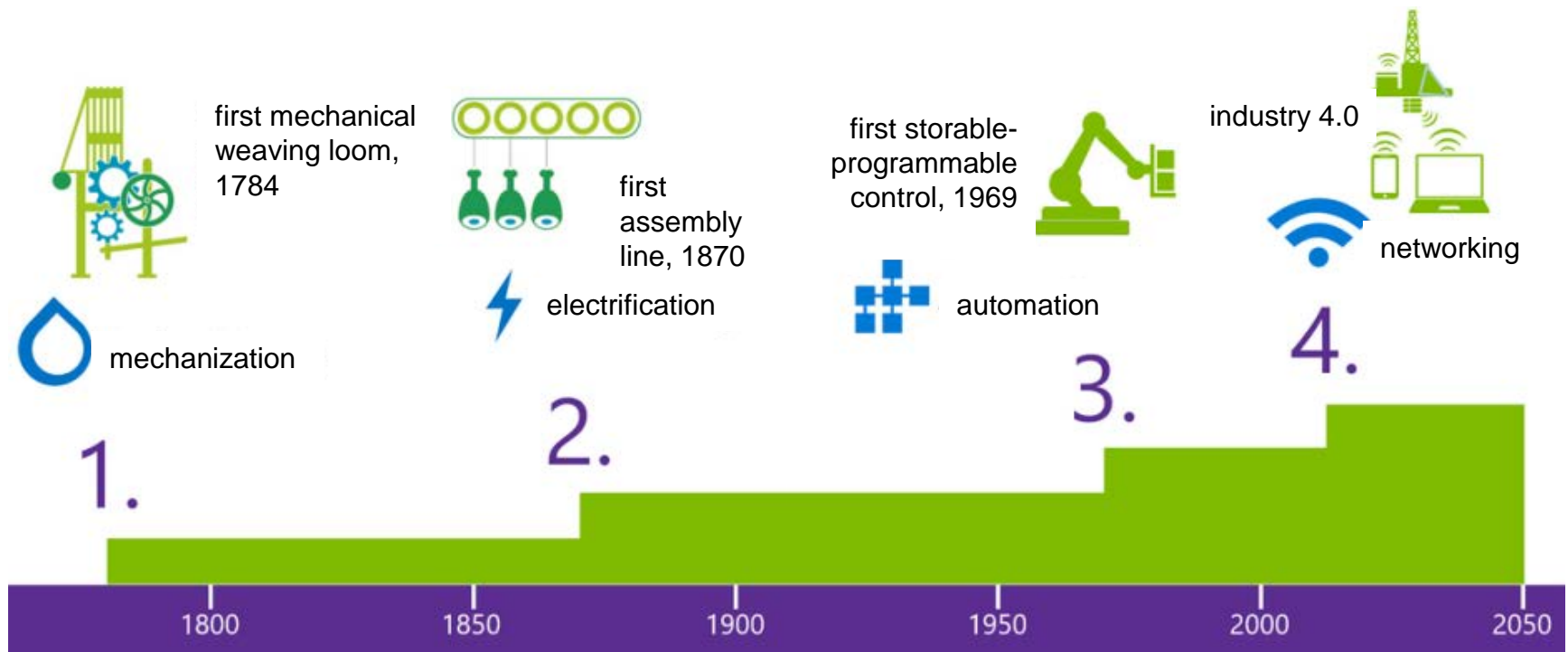
Saarbrücken







## 3. Industry 4.0





## Economic potential of Industry 4.0 for Germany

Forecast until 2025:

- up to 430,000 new jobs  
→ simultaneous elimination of 490,000 low-skilled jobs \*
- GDP growth of about 30 billion EURO \*\*
- Total investment of about 250 billion EURO \*\*



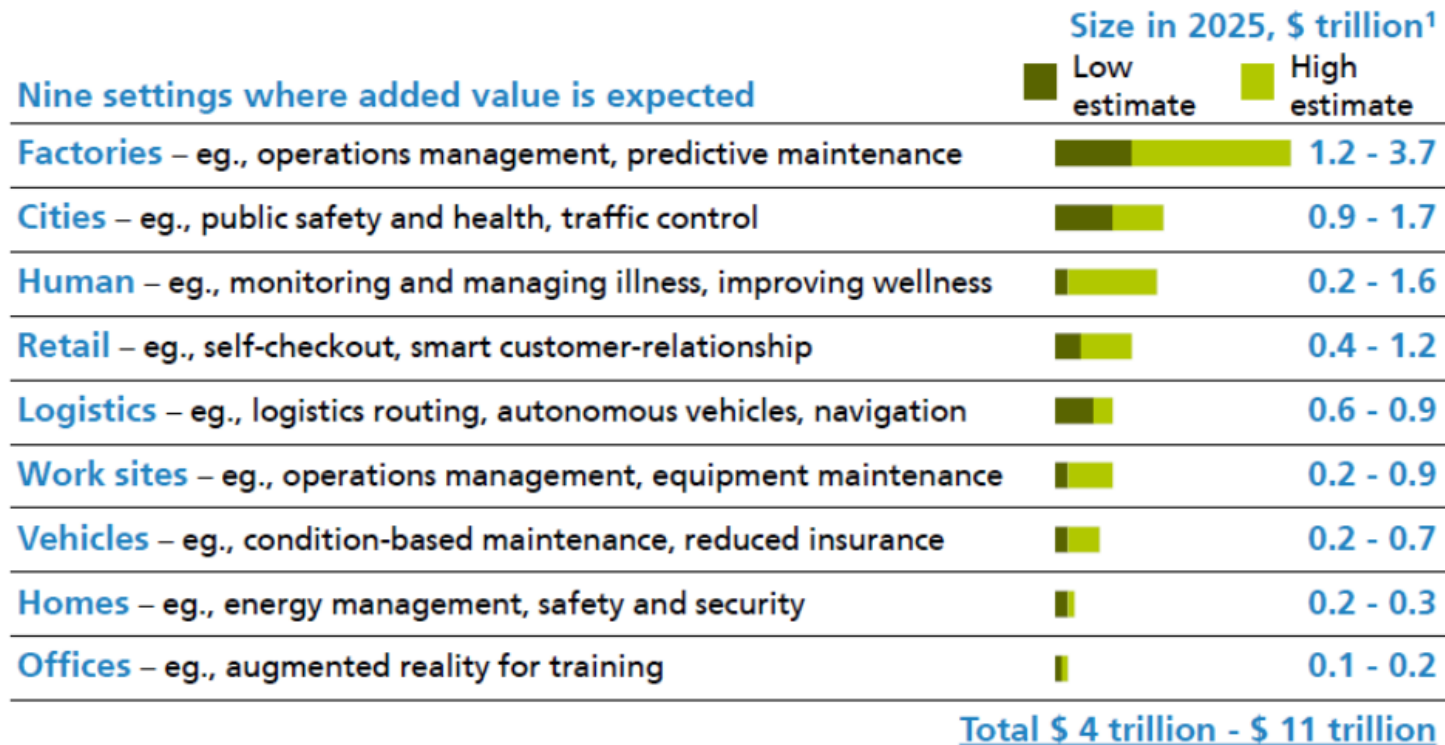
Source:

\* Study: IAB, BIBB, GWS (November 2015)

\*\* BCG-Study: Industry 4.0 (April 2015) from Prof. Neugebauer SFU 2015



# Global economic potential of the Internet of Things



<sup>1</sup>Adjusted to 2015 dollars, for sized applications only; includes consumer surplus.  
Numbers do not sum to total, because of rounding

Source: McKinsey Global Institute analysis,  
June 2015





## Consequences for German economy

### **Challenges:**

- Export-oriented economy
- Reliance on industries that are challenged by machine learning/AI (e.g. automotive, manufacturing, engineering)
- Data protection laws may slow down machine learning

### **Opportunities:**

- Strong industrial base (GER Industry accounts for 30% of GDP compared to 20% in USA, GB, F)
- Strength in incremental (vs. disruptive) changes
- Structure of SME and family-owned „hidden champions“
- High quality universities and research organizations
- Vocational and educational training system



## Consequences for individual companies

### **Challenges:**

- Platforms and consulting companies may challenge existing B2B business models
- Risk aversion that may lead to slower adaptation of machine learning
- Data sharing beyond corporate boundaries
- Limited size and scalability

### **Opportunities:**

- Minimize time for development and reduce downtimes
- Predictive maintenance
- Competitive advantage through real data about production processes
- Smart sensors / mixed reality interfaces



## 4. Work 4.0

### Weißbuch (White Paper) Work 4.0

- published on November 29, 2016
- summarized conclusions of dialogue about „work 4.0“
- documents broader social debate
- stimulus for social design of the future of work



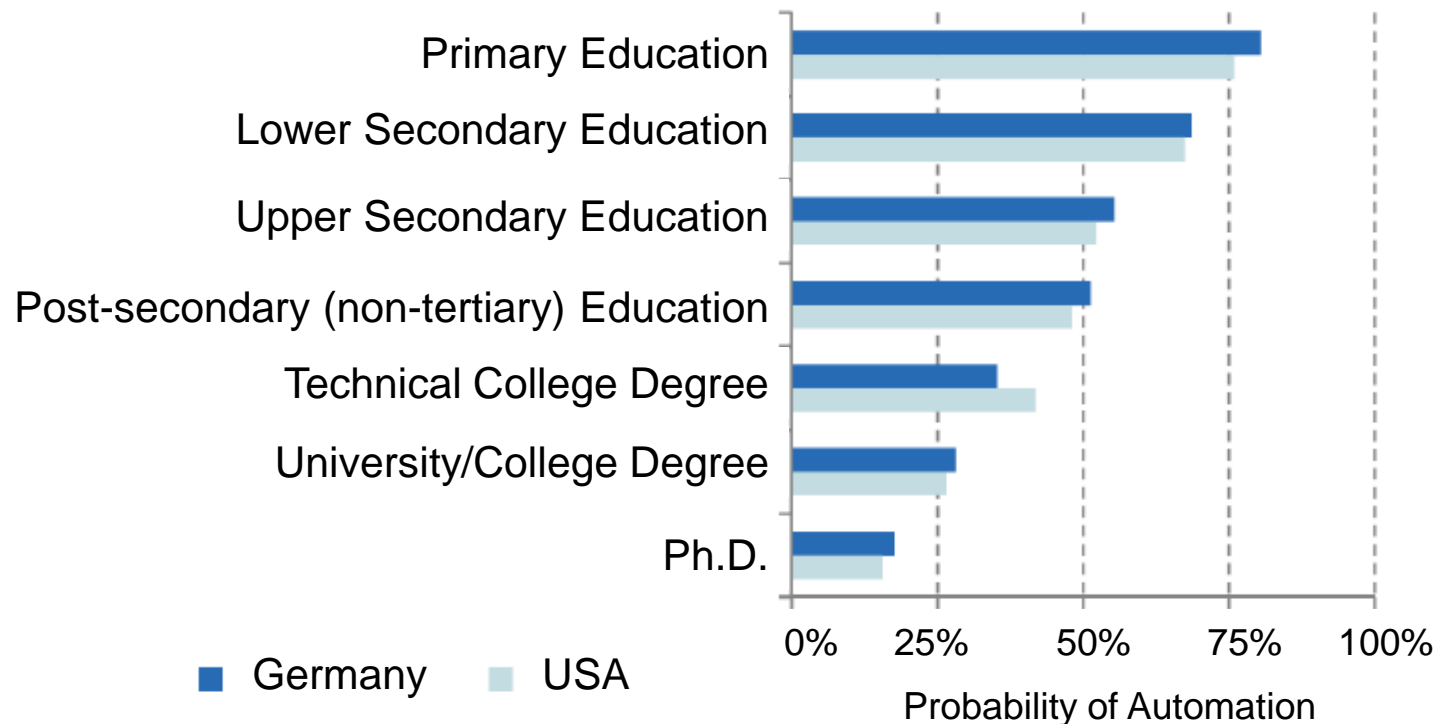




## Labor Market is transforming

### Challenges:

- Digital transformation → lead to unemployment (esp. for **low skilled workers**)





## Labor Market is transforming

### **Challenges:**

- Digital transformation → lead to unemployment (esp. for low skilled workers)
- Quick devaluation of qualifications
- Demographic Change

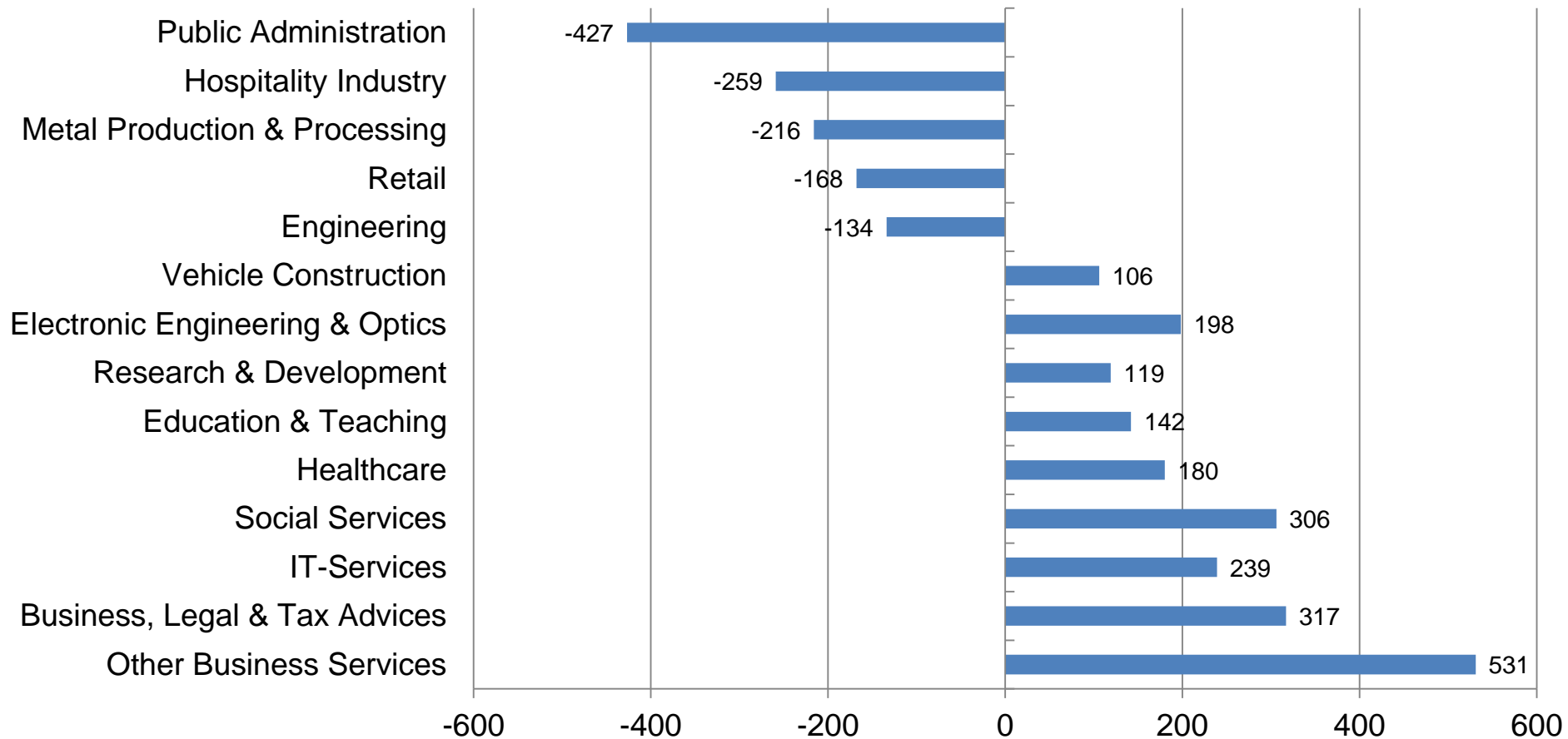
### **Opportunities:**

- New jobs in services, healthcare, education etc.



## Labor Market is transforming

Predicted number of employees in selected industries, 2014 – 2030 (in 1000)







## Labor Market is transforming

### **Challenges:**

- Digital transformation → lead to unemployment (esp. for low skilled workers)
- Quick devaluation of qualifications
- Demographic Change

### **Opportunities:**

- New jobs in services, healthcare, education etc.
- New quality of learning on the job
- Demographic dividend



## Labor Market is transforming

### **Tools:**

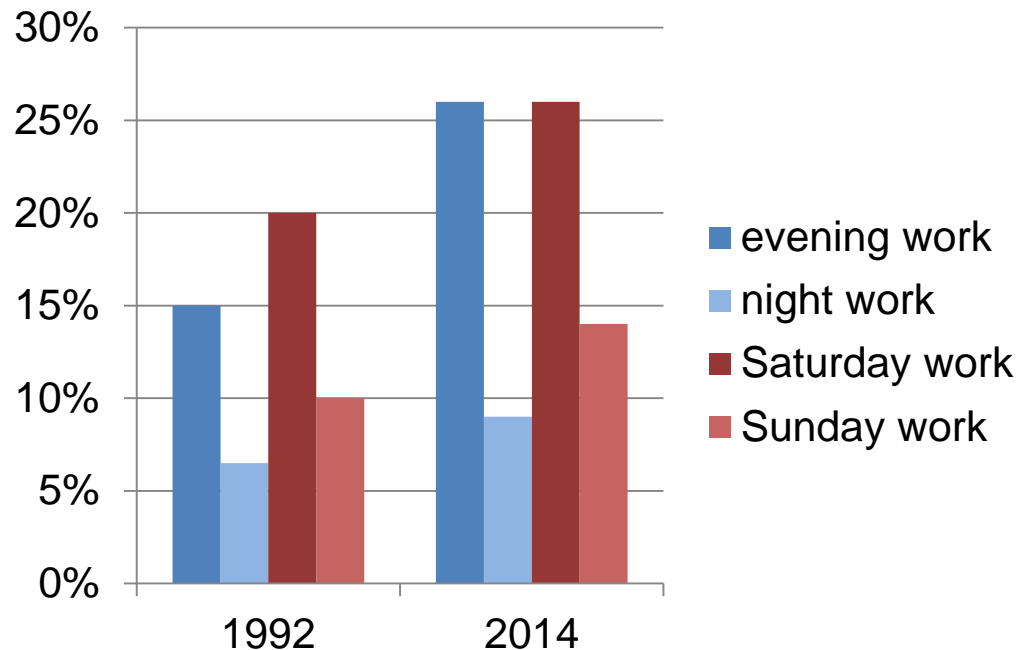
- Strengthen digital literacy
- Strategy for lifelong qualification & upskilling (turning unemployment insurance into a labor insurance?)
- Incentives & benefits for founders and start-ups



## Working Conditions are changing

### Challenges:

- Removal of boundaries between work and leisure
- excessive demand on employees





## Working Conditions are changing

### **Challenges:**

- Removal of boundaries between work and leisure
- excessive demand on employees

### **Opportunities:**

- getting rid of physically and psychologically demanding work
- sovereignty of working time and working place
- self-determined life planning

### **Tools:**

- collective or company agreements with room for experimental spaces
- working time accounts





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your  
attention!**



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