Digital transformation of production and employment

Fact-finding seminar on skills, innovation and access to and provision of training

Ricardo Rodriguez Contreras, Eurofound

Brussels, 26 June 2019
Content

1. Eurofound approach to digitalisation

2. Digital transformation in production processes and the provision of services

3. Some findings on the impact on skills
Six Strategic Areas of Intervention

Key Topics

- Industrial relations
- Labour market change
- Quality of life and public services
- Working conditions and sustainable work
- Monitoring convergence in the European Union

The digital age: opportunities and challenges for work and
Eurofound approach to technological change

Understanding the technological change

Work processes

Employment, jobs and skills

Impact on working conditions
Five game-changers in manufacturing

- Additive manufacturing
- Electric vehicles
- Industrial Internet of Things
- Advanced Industrial robotics
- Industrial biotechnology

Across sectors

Future of Manufacturing

Product specific
Five game changers in the services sector

- Wearable devices
- Advanced robotics
- Virtual/augmented reality
- Autonomous transport devices
- Blockchain
La economía de los servicios

Wholesale and retail trade
Transportation and Logistics
Professional and Businesses services
Education and Health
Leisure and HORECA
Financial activities
Other services
Media&Information and Arts
Government
## Traditional conceptions of manufacturing and services sector

<table>
<thead>
<tr>
<th>Manufacturing</th>
<th>Services sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production of physical goods</td>
<td>Intangible output</td>
</tr>
<tr>
<td>Physical location</td>
<td>Less dependent of physical sites</td>
</tr>
<tr>
<td>Management of stock</td>
<td>Inventory aligned to forecasts</td>
</tr>
<tr>
<td>Market-oriented</td>
<td>Service delivery based on customer-oriented</td>
</tr>
<tr>
<td>Capital intensive</td>
<td>Labour intensive</td>
</tr>
<tr>
<td>More able to automate production processes</td>
<td>Social relations</td>
</tr>
</tbody>
</table>
How is the digital age affecting work and employment? 
Three vectors of change

**AUTOMATION**
- Artificial Intelligence
- Autonomous transport devices
- Advanced Robotics

- Replacement of labour

**DIGITISATION OF PROCESSES**
- Internet of things
- 3d printing
- Wearables
- Virtual/augmented reality

- Work process reorganisation

**COORDINATION BY PLATFORMS**
- Blockchain
- Crowd employment/platform work

- Management and work organisation
Overview of main technology clusters

**Automation**
- **What is it?** Human tasks REPLACED by machines
- **Examples** Robotics, drones, Artificial Intelligence
- **Challenges for work and employment** Job polarisation, work organisation, skill demands

**Digitisation**
- **What is it?** Digital Production PROCESSES
- **Examples** Internet of Things, VR, 3D printing
- **Challenges for work and employment** Fragmentation of jobs, contractual arrangements, privacy

**Platforms**
- **What is it?** COORDINATION Matching of supply and demand
- **Examples** Transport, delivery, online services
- **Challenges for work and employment** Work organisation, fragmentation, employment status
Game-changing technologies and the production process

(Remove all details about the graph)

Advanced Industrial Robots (AIR)
Industrial Internet of Things (IIOT)
Additive Manufacturing (AM)
Advanced robotics
Robots with a physical presence that combine improvements in machine dexterity and the ability to interact with the environment with intelligent functions

- The market interest and activity in advanced robotics has seen a general upward trend since 2007.
- The service robotics sector is set to experience significant growth in the coming years, particularly in the fields of logistics, public relations, defence, and healthcare.

Drivers
- Increased efficiency in work processes
- Safety benefits offered
- Continued technological advances
- Novelty and PR value

Barriers
- Intensive development and investment costs
- Public acceptance
- Sector-specific challenges depending on the limits of the technology and ethical and practical concerns

Sectors impacted
- Health and healthcare
- Civil service
- Technical safety
- Science and research
- Customer service
- Logistics

Robot adoption may drive employment demand in specific areas (e.g., jobs that involve engaging with, supervising or developing automating technologies); however, the ultimate impact on job creation/loss is difficult to predict, and may vary significantly across sectors.

- The use of robots is likely to change the nature of tasks performed by humans, automating some repetitive tasks but relying on human collaboration for other tasks.
- Work environments may need to be redesigned to accommodate robots.
- Robots may enhance productivity by augmenting or replacing human labour.
- Robotics, along with wider digital technologies, may change work organisation within the service sector by enabling greater remote and platform working.
- New service sector business models may be created, including system integrators and a new ‘robotics as a service’ sector may develop.

European Foundation for the Improvement of Living and Working Conditions

www.eurofound.europa.eu
Key trends

• Workplaces and work environments change

• Increasing servitisation of the industry ....

• Some techs still in the infancy, but interoperability is key, particularly AI and IoT combined with Big data and cloud

• Uneven pace of deployment challenged by a) financial constrains; b) regulatory issues; c) privacy invasion concerns; d) insufficient connectivity and data management; e) cybersecurity issues; f) sectoral features
Figure 5: Change in the task indices in the EU, 2015 to 2030

- Physical
  - Strength
  - Dexterity
- Intellectual
  - Literacy – Business
  - Literacy – Technical
  - Literacy – Humanities
  - Numeracy – Accounting
  - Numeracy – Analytic
  - Information-gathering and evaluation
  - Creativity
- Social
  - Serving/attending
  - Selling/persuading
  - Teaching
  - Managing
  - Autonomy
  - Teamwork
  - Repetitiveness
  - Standardisation
- Methods
  - Machines
  - ICT – Basic IT
  - ICT – Programming

Source: Authors’ calculations
A task-centred analytical approach: understanding what people do at work

Two main patterns of employment growth:

• Upgrading
• Polarisation

Assumptions:

• Tech progress involves greater demand for high-skilled workers
• Less demand for lower-skilled
• Middle of job-wage distribution: the more the tasks are easy to codify, the more to be replaced by machines
• The less routine jobs, the less easy to automate
In terms of the content

1. **Physical tasks**: physical manipulation and transformation of material things:
   - a. **Strength**
   - b. **Dexterity**

2. **Intellectual tasks**: manipulation and transformation of information and the active resolution of complex problems:
   - a. **Information processing** (literacy and numeracy)
   - b. **Problem solving** (gathering and evaluation of information, creativity and resolution)

3. **Social tasks**: interaction with other people:
   - a. **Serving/attending**
   - b. **Teaching/training/coaching**
   - c. **Selling/influencing**
   - d. **Managing/coordinating**

In terms of the methods and tools

1. **Methods**: forms of work organisation used in performing the tasks:
   - a. **Autonomy**
   - b. **Teamwork**
   - c. **Routine** (repetitiveness and standardization)

2. **Tools**: type of technology used at work:
   - a. **Machines** (excluding ICT)
   - b. **Information and communication technologies** (basic and programming)
Automatable tasks

Routine tasks
- Repetitive and standardised → easy to automate
- Both physical and intellectual routine tasks on decline

Non-routine tasks
- Physical tasks: social norms and economic considerations limit automation
- Intellectual tasks: most advanced expression of human activity (e.g. creativity, problem solving)
- Deep learning techniques and artificial neural networks make it possible to automate

Social tasks
- Human interaction, e.g. in education, health, social services
- Machines would need to become indistinguishable from humans
Changing nature of jobs in the manufacturing sector: are blue collar jobs turning white?

- Use of digitally controlled equipment:
  - more developed ICT skills
  - reading technical documentation
  - dealing with numerical information
  - troubleshooting production lines and handling errors

- Use of quality control and standards:
  - use of benchmarking documentation
  - monitoring performance indicators
  - assessing numerical targets
  - documenting problems and filling in forms
Eurofound research on digitalisation 2017-2020

Employment and working conditions

Automation
Game-changing techs. in manufacturing

Digitisation
ICT-based mobile workers
Nature of work

Platforms
Platform work
Platform economy

Digitalisation in health and social services

European Company Survey 2019

Web repository
Eurofound publications

https://www.eurofound.europa.eu/topic/digital-age
THANK YOU FOR YOUR ATTENTION

Ricardo Rodriguez Contreras
rrc@eurofound.europa.eu