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Industry 4.0 and the consequences on labour

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Field research: the case of Italy

- Field research on **Industry 4.0 and the consequences on labour** with FIOM CGIL
- Interviews with workers:
 - ① Occupational impacts
 - ② Skills, competences
 - ③ Production cadences, working times, saturation
 - ④ Short description of lean production – other production models
 - ⑤ Scope and modalities of control on employees' performance
 - ⑥ Scope and modalities of technology-driven work activities
 - ⑦ Networks: main suppliers, other Group companies, customers (possibly themselves producing intermediate goods/services)
 - ⑧ Industrial Relations
 - ⑨ Company agreements and bargaining activities

“The development of technology takes entirely place within capitalistic process”

“Lo sviluppo della tecnologia avviene interamente all'interno [del] processo capitalistico”

“The capitalistic use of machines is not [...] the simple distortion or deviation from an objective development, inherently rational, but does determine technological development”

“L'uso capitalistico delle macchine non è [...] la semplice distorsione o deviazione da uno sviluppo oggettivo, in se stesso razionale, ma esso determina lo sviluppo tecnologico”

Capitalistic development of technology implies, through the various stages of rationalisation and more and more refined forms of integration, an increasing capitalistic control”

“Lo sviluppo capitalistico della tecnologia comporta, attraverso le diverse fasi della razionalizzazione e di forme sempre più raffinate di integrazione, un aumento crescente del controllo capitalistico”

“technology is not an autonomous force affecting human events from outside, but rather the result of a social process [. . .] [Its] social effects are actually originated by the same social causes which determined its existence”

“la tecnologia non è una forza autonoma che interviene nelle vicende umane dall'esterno, ma è piuttosto il prodotto di un processo sociale
[. . .] [I] suoi effetti sociali sorgono in realtà dalle stesse cause sociali che ne hanno determinato l'esistenza”

“The technology of production is thus twice determined by the social relations of production: first, it is designed and deployed according to the ideology and social power of those who make such decisions; and second, its actual use in production is determined by the realities of the shop-floor struggles between classes.”

Noble, D. F. (1979). *Social choice in machine design*. In Zimbalist (ed.), *Case Studies on the Labor Process*, pp. 100-134. Monthly Review Press, New York

Industry 4.0 within industrial production

- ① machineries, plants, products and components, human beings can interact via connected devices
 - ① RFID
 - ② sensors
 - ③ actuators
 - ④ mobile phones and tablets
- ② Hence IoT is a network in which all devices and workers communicate with each other
- ③ This is called CPS, i.e. the fusion between real and virtual world
- ④ This is made possible by systems like SAP and MES

Characteristics of productive structures

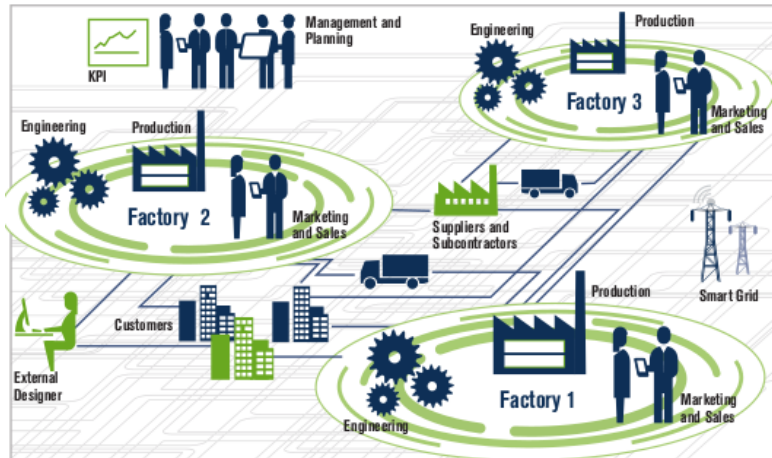
- ① Geographically fragmented and distributed:
 - ① freedom of movement of capital
 - ② freedom of establishment in the EU
 - ③ delocalisations
- ② Just-in-time production: strict coordination and synchronisation
- ③ Automotive industry:
 - ① car made up by 15.000 parts and components
 - ② production chain dispersed through Europe
 - ③ demand from market: necessity of synchronising the whole chain



Objectives of Industrie 4.0 in Germany

- ① networking different parts of the same production chain, even if located in different plants, companies, or countries
- ② digital integration of the different production stages
- ③ horizontal digital engineering as key strategies

Horizontal integration through value networks



Horizontal Integration: connection with other plants

- ① Great importance of **connections**:
 - **between plants** belonging to the same Group but located in different places/countries
 - **with suppliers**, which can themselves be located abroad.
- ② **Centralised software systems** to coordinate the various stages:
 - **APS (Advanced Planning and Scheduling)**: software tool to enable management of resources: short-medium run planning of plants productive capacity
 - **MRP (Material Resources Planning)**: software tool for **warehouse management**, detecting and notifying inputs required to meet a specific order (to be produced or purchased)
 - **ERP (normally SAP)**: software tool for managing the whole production process, including **supply orders**
 - imposing kanban logic to external suppliers: high degree of integration of production chains
 - suppliers share the same computer-based management system: orders delivered by simply pressing a button in the logistics office

Vertical Integration: In-plant information systems

- 1 Software for **machine-to-machine (M2M) connection**: the whole system is connected to a server;
- 2 **ERP (SAP)**: to record and manage
 - Parts and components supply orders
 - Production orders
 - Problems, downtimes, etc.
 - Final production
- 3 **MES**: to deliver work-orders to production lines on a daily basis
 - identification of current production stage and specific operation in progress with immediate detection of problems;
 - tracking what each worker does in any moment (optical scanners, touchscreen PCs, bar codes);
 - tracing the production process as a whole.
- 4 **Workstream**: infrastructure based on MES:
 - workers move batches from one machine to the other, keeping track of manufacturing process;
 - automatically processes operations, follows them in real time and interact with the different machines.

Integration Industry 4.0 – Lean Production

- The pillars of the 5S system: all these principles, which characterize lean production, are also at the base of Industry 4.0;
- SMED (Single Minute Exchange of Die) aims to organise the production process in a fluid way;
- Takt Time provides the maximum time allowed for the completion of each phase, and then fixes the working time in all the lines and in each workstation;
- The elimination of waste (Muda, Mura, Muri) imposes rhythms and systems of work to achieve the standards set by the company;
- Just-in-time implies the production of only the products already ordered, which in turn requires a different way of managing the warehouse and the flows of goods;
- MES guide workers in the performance of the different operations, indicating the components to be used and the sequence of operations to be carried out;
- Logistics: the lines are automatically supplied by electronic kanbans (warehouse and external suppliers, which in turn make use of the same software tools and computer systems for tracking their supplies.

New technologies: reorganising working times

- **Software tools** allowing:
 - ① production planning (generally on weekly basis);
 - ② operations scheduling (on daily or shorter basis);
 - ③ production orders delivery to departments, lines and workstations;
 - ④ real-time rescheduling of work orders;
 - ⑤ recording of concluded stages with times and possible problems
- **Operation times reduction:**
 - **not bargained** but unilaterally imposed
 - precondition for lean production, just-in-time/sequence, WCM:
 - ① compliance of supplies deliveries to planning
 - ② synchronisation of production stages
 - ③ high degree of variability of workloads and production mix
- **Work orders:** barcodes embed cycle times based on machine times:
 - ① workers' tasks complementary to machines': loading and unloading
 - ② workers in charge of operating more than one machine at the same time
 - ③ additional tasks (self-checks, quality control, filling in production sheets, etc.)
 - ④ data immediately uploaded through ERP or MES.

Control

- Introduction of **devices for remote control** of plants and equipment/work performance
- ERP/MES and optical readers: **matching barcodes** associated with:
 - ① workers
 - ② machine they operate
 - ③ batch which is being produced
 - ④ specific component under process
- **Machines also generate data** about production volumes, downtimes (breakdowns, set-up, controls, lack of materials, tooling, etc.)
- This **monitoring system** often involves:
 - ① **suppliers:** can connect to machines for remote maintenance
 - ② **customers:** can monitor in real time the testing process
- Companies can achieve **additional goals**:
 - ① computing production costs
 - ② compute the cost of each worker
 - ③ decide whether to externalise or not some specific production stages, possibly to low-cost countries.

Man/Machines relation

- **Production plans and machine scripts:**
 - ① elaborated by planning and engineering departments
 - ② supplied by companies supplying equipments
- Scripts **uploaded by programmers**, even remotely (intranet);
- Once uploaded scripts are **not always launched by workers**, but by:
 - ① head of the department or production responsible;
 - ② optical readers: barcodes associated to batches associated to scripts;
- **Workers unaware of data and scripts** by which the system works:
 - ① More advanced tools do not imply higher level skills;
 - ② Neither machines equipment is part of workers' tasks;
 - ③ Workers only in charge of supporting tasks;
 - ④ Machines' increased autonomy: higher degree of skill saturation;
 - ⑤ No human control on workers anymore: machines are indisputable;
- **Strategical decisions** not dictated by technological necessities:
specific social decision
- Programming requires computer science skills, but workers could be involved in discussing **software and scripts goals**

Agenda for company-level bargaining

- 1 Employment effects;
- 2 Pace of work and working times;
- 3 Working hours;
- 4 Systems for the control of working performance;
- 5 Consequences, regarding workers' health/safety, of new technologies, also from the psychological point of view (stress);
- 6 New organisation of labour and production;
- 7 Skills and training;
- 8 Externalisations, procurements, etc.;
- 9 Tools for workers' participation;
- 10 Productivity and distribution of wealth generated.