

Observatoire des futurs
EM Strasbourg

Modes of Production

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Modes of Production

1. Definition and Relationships with Other Factors

General Definition

- **Modes of production** refer to the organization and use of production factors (human, material, digital, etc.) to create a product or service. This includes design, performance, maintenance, and distribution.
- **Augmented reality** involves the overlay of real and virtual elements calculated by a computer system in real time.
- **Additive manufacturing** refers to processes for manufacturing and shaping an object by adding material or stacking successive layers of material, most often with computer assistance.
- **Automation** refers to the complete or partial execution of technical tasks by machines operating without human intervention. **Robotization** further enhances the human-machine interface.

Connection to Uberization and Industry 2030/Key Questions for the Future

- These technologies form the foundation of Industry 4.0. They are at the heart of the digital transformation of manufacturing in companies (such as BASF). They can improve the productivity of production lines (through predictive maintenance and labor efficiency) and are reshaping the data value chain to enable better decision-making. These new production methods also offer the potential for better skills management (such as improved training and knowledge transfer).

Relationship with Other Factors/Stakeholders:

- Digital technologies
- Manufacturers
- Upstream / downstream
- Economic models (sustainable development)
- Occupations and training
- Key players in digital transformation

2. Summary of the Retrospective Analysis

Retrospective

In General and for Uberization and Industry 2030

- **General retrospective:**
- **Augmented reality:** Pioneered by Sutherland (MIT) in 1965, initially applied to the military (1980s); interactions with virtual objects then began to develop (1970s)
- **Additive manufacturing:** First patent in 1984 by the French, closely followed by the Americans; a real leap forward since 2005, when the 3D printer was developed
- **Automation/Robotization:** Its precursors were the automatons created in the 17th century; the first patent was granted in the U.S. in 1954; as early as 1961, manufacturers (such as General Motors) began using robots for tasks that were dangerous for humans, notably with Unimate

Cross-cutting retrospective on “Uberization and Industry 2030”: Advances in ICT; a sharp increase in computer processing power; lean management; capitalism, which has been established for several decades

Current Trends

In General and for Uberization and Industry 2030

- General trend: increased productivity of factors of production (not an increase in their number); 75 percent of companies using augmented reality derive more than 10 percent of their operating profits from it (improvements in wiring at Boeing); approximately 13 percent annual growth for additive manufacturing ($2.6 billion in 2020); a 30 percent increase in sales of industrial robots in 2017, with 73 percent of sales occurring in five countries

- Uberization and Industry 2030 trends: creation of new jobs (+58 million by 2023), such as e-maintenance technicians; a rise in skill levels; maintenance taking a central role within companies; smart manufacturing; the challenge of data management; sustainable development; a decline in French industry (-18 percent in the number of facilities between 2006 and 2015)

3. Summary of Prospective Exploration

Major Trends / Constants

- Continued creation of new positions, particularly in maintenance, with a focus on skills development
- Acceleration of product development and time-to-market cycles (through additive manufacturing)
- Questioning the power of capitalism

Uncertainties

- The changing relationship with machines
- The future of metrology

Seeds of Change

- Toward a sixth mode of production, coexisting with capitalism: the internet + volunteer contributors
- Mass-production additive manufacturing

Controversies

- Cyberattacks, cybersecurity
- Fear of machines, fear of humans being replaced: the relationship with machines as a source of social tension

Disruptions

- A paradigm shift driven by makers and three-dimensional printing, where industry and the supply chain must be reimagined because they have become obsolete
- De-automation in favor of humans, for greater profitability and flexibility



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