

Industry 4.0

Subjects: Sociology

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The concept of Industry 4.0 is often associated with the fourth industrial revolution industrial, given the profound implications for the productive paradigm. But what exactly is Industry 4.0? Industry 4.0 emerged in Germany in 2011, with the aim of increasing the competitiveness of German industry. In short, it applied digital technologies to production, in a close association between economy and digital technology, resulting in innovation through the integration between the real and the virtual world (Cyber-Physical Systems) in industrial activity and production.

Keywords: Industry 4.0 ; smart factory ; digital factory ; digital technologies ; digital economy

1. Introduction

According to Stentoft and Rajkumar (2020)^[1], citing Kagermann, Wahlster, and Helbig (2013, p. 14), Industry 4.0

"involves the technical integration of Cyber-Physical Systems into manufacturing and logistics and the use of the Internet of Things and Services in industrial processes. This will have implications for value creation, business models, downstream services and work organization"^[1].

Industry 4.0 (both in the production and in the management processes) is deeply interrelated with technology^[2]. Stentoft and Rajkumar (2020) ^[1]put forth several technologies related to Industry 4.0 ^[1](Table 1).

Table 1. Technologies relating to Industry 4.0

Materials and smart manufacturing technologies

- 3D printing
- 3D scanning
- Robotics
- iBin (intelligent Kanban bin)
- Advanced materials
- Augmented reality and simulation^[3]

Smart connecting technologies

- Mobile internet
- Advanced sensors
- Remote control
- Advanced Enterprise Resource

Planning (ERP) Technology

- Simulation
- Big data
- Digital documentation
- Automatic analysis and visualization of data
- Cloud computing
- Internet of things

2. Implementation of the Industry 4.0 Production

The implementation of the Industry 4.0 production paradigm materialises in the “smart factory” (Ferreira & Serpa, 2018)^[4], as the “core concept of Industry 4.0, which employs cyber-physical systems to monitor the physical production processes of the factory and make decentralized decision-making possible. Then the physical systems become the Internet of Things, communicating and cooperating both with each other and with humans in real-time via the wireless web”^[5].

From the implementation of Industry 4.0, and according to Grabowska’s (2020) proposal, four general categories of emerging new generation factories with different features of their own may be found within the same general framework ^[2] (Table 2).

Table 2. Four types of future smart factories

Archetypes of factories of Industry 4.0	
1. Intelligent automated and robotic factories	Responding to the demand for mass products with the implementation of very high production volumes at low costs
2. Digital mass-individualisation factories, otherwise known as customer-centric plants, i.e., customer-focused factories	Possibility of using predictive maintenance to reduce unplanned downtime
3. E-plants in a box, mobile modular factories, i.e., mobile modular factories	Real-time tracking and location of the unfinished product has a high level of integration and automation at production sites; factory management is centralised in one main building
4. Handmade production with a digital touch	Focus on production in the scope of large or medium volumes; however, they enable full personalisation of their products, which makes the products highly individualised through short or very short series, articulating flexibility with productivity

In general, the implementation of digital technology in production processes, besides having potentialities, also raises deep challenges to be considered. As Hanna (2020) ^[6] points about several challenges for the development of the digital economy,

- “1. Clarifying and prioritizing objectives
2. Securing coherence among assessment tools
3. Addressing poverty, and inequality
4. Attending to process, participation, and partnerships
5. Strengthening country implementation
6. Integrating innovation, and managing risks

7. Integrating digital economy into a country development strategy

8. Promoting local demand and effective use

9. Collaborating across sectors and practices

10. Engaging business".

Focusing on digital technology in production, Industry 4.0 is one of the critical economic and social foundations of the emergence of Society 5.0 – a *super-smart society*.

References

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