



Original Article

# Digital economy to improve the culture of industry 4.0

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## Abstract

The digital economy refers to economic activities facilitated by digital technologies, encompassing online connections, transactions, and the transformation of traditional industries through digital means. It involves the internet, mobile technology, big data, and information and communications technology, leading to new business models, products, and services. Industry 4.0, also known as the Fourth Industrial Revolution, refers to the ongoing trend of automation and data exchange in manufacturing technologies. It involves the integration of technologies like the Internet of Things (IoT), cloud computing, big data, and artificial intelligence to create smart factories and optimize industrial processes. This revolution aims to enhance productivity, efficiency, flexibility, and enable more intelligent decision-making in manufacturing and supply chain operations.

The digital economy has emerged as the backbone of Industry 4.0, reshaping industrial culture by integrating advanced technologies into economic and social processes. It leverages the Internet of Things (IoT), cloud computing, big data, artificial intelligence (AI), and automation to create smart, interconnected ecosystems that drive efficiency, innovation, and competitiveness. By transforming traditional economic activities into digital formats, the digital economy enables faster decision-making, optimized supply chains, and personalized services while fostering sustainable practices. However, its adoption also brings challenges such as cybersecurity risks, high implementation costs, workforce reskilling, and ethical considerations. This study highlights the symbiotic relationship between the digital economy and Industry 4.0, emphasizing how digital platforms and intelligent systems not only enhance productivity and flexibility but also open new opportunities for cultural transformation and global collaboration. The paper argues that with robust infrastructure, skilled human resources, and responsible policies, the digital economy can ensure an inclusive and sustainable transition toward Industry 4.0.

**Keywords** Digital economy, Industry 4.0, Technologies

## Introduction

The world economy is now going to depend more on data than it does on currency. Although data is often seen as a way to offer insights into consumer behavior or to aid in creating individualized marketing strategies, it is also crucial for making production floors and companies work efficiently. The digital economy is defined as the economy that comes from the Digital Transformation of economy, where traditional economic activities are converted into digital form, driven by the internet, electronic means, and data. When traditional economic activities and products/forms of services are converted to digital, they are called the digital economy. In the traditional economy, businesses depend on print advertisements and word-of-mouth to reach their targeted audience, whereas the digital economy uses digital platforms, social media strategies, search engine optimization (SEO), and other digital marketing techniques to promote their businesses and reach their targeted audience.

Billions of connections between people, devices, data, and businesses help constitute the digital economy; there being a global and interconnected economy means it wastes no geographical confines. The digital economy, fueled by Industry 4.0 technologies, is transforming the culture industry by enhancing its reach, efficiency, and sustainability. This transformation involves leveraging digital platforms, data analytics, and new technologies to improve content creation, distribution, and consumption, while also creating new opportunities for cultural exchange and economic growth.

## Key Components of Industry 4.0

- Internet of Things (IoT): Connecting devices and machines through the internet for data collection, analysis, and remote control.

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- **Cloud Computing:** Utilizing cloud platforms for data storage, processing, and application deployment, allowing for scalability and accessibility.
- **Artificial Intelligence (AI) and Machine Learning (ML):** Employing AI and ML algorithms for tasks like predictive maintenance, process optimization, and quality control.
- **Big Data and Analytics:** Analyzing large datasets to gain insights into performance, identify trends, and improve decision-making.
- **Robotics and Automation:** Utilizing robots and automated systems to perform repetitive or hazardous tasks, increasing efficiency and precision.
- **Digital Twins:** Creating virtual models of physical assets or systems to simulate and optimize performance.
- **3D Printing (Additive Manufacturing):** Using 3D printing for rapid prototyping, customized production, and on-demand manufacturing.
- **Augmented Reality (AR):** Overlaying digital information onto the real world to assist workers in tasks like maintenance and assembly.

#### **Goals of Industry 4.0:**

- **Increased Productivity:** Automating tasks and optimizing processes to improve output and efficiency.
- **Reduced Costs:** Minimizing waste, optimizing resource utilization, and reducing downtime.
- **Improved Product Quality:** Utilizing data analytics and automation to enhance quality control and reduce defects.
- **Faster Time to Market:** Streamlining production processes and enabling faster product development.
- **Greater Flexibility and Customization:** Adapting to changing customer demands and offering personalized products.
- **Enhanced Safety and Security:** Improving worker safety through automation and implementing robust cyber security measures.

#### **Impact of Industry 4.0:**

Industry 4.0 has the potential to revolutionize various industries, particularly manufacturing, by transforming traditional processes into more efficient, flexible, and intelligent systems. It also presents opportunities for developing countries to leapfrog traditional industrialization stages by adopting advanced technologies. However, it also raises concerns about job displacement due to automation and the need for workforce reskilling and up skilling. Additionally, the increased reliance on technology necessitates robust cyber security measures to protect sensitive data and prevent disruptions.

#### **Need for digital economy for implementing industry 4.0**

Industry 4.0, or the Fourth Industrial Revolution, fundamentally transforms manufacturing and industrial practices by integrating advanced technologies like the Internet of Things (IoT), artificial intelligence (AI), big data analytics, robotics, and cloud computing. This shift towards smart factories and connected ecosystems is intrinsically linked to the digital economy, which refers to economic activities driven by internet connectivity, data, and advanced technologies.

Here's why the digital economy is vital for the successful implementation of Industry 4.0:

##### **1. Enabling connected and intelligent systems**

- **IoT & connectivity:** The digital economy fosters a hyper connected environment through the Internet, mobile technologies, and the IoT. This connectivity enables the real-time exchange of data among machines, sensors, devices, and systems, forming the bedrock of Industry 4.0's smart factories and supply chains.
- **Big data & analytics:** The vast amounts of data generated by Industry 4.0 technologies necessitate a robust digital economy capable of collecting, storing, analyzing, and distributing this information effectively. AI and machine learning algorithms, fueled by this data, allow businesses to derive actionable insights, leading to optimized operations, predictive maintenance, and data-driven decision-making.

##### **2. Driving innovation and new business models**

- **Platform-based models:** The digital economy thrives on platform-based business models and network effects, enabling the creation of integrated ecosystems that generate value, foster innovation, and build resilience through networked goods, assets, people, and processes.
- **Servitization & personalization:** Industry 4.0 facilitates the transition from selling products to offering services (servitization), where companies leverage IoT data to provide value-added services like predictive maintenance, remote monitoring, and personalized experiences, according to SciSpace. This fosters customer satisfaction and strengthens competitive advantages.

##### **3. Enhancing operational efficiency and productivity**

- **Automation and optimized processes:** Industry 4.0, supported by the digital economy, allows for the automation of repetitive tasks and optimization of production processes, leading to increased productivity and efficiency.
- **Improved supply chain management:** Real-time monitoring and data exchange, enabled by digital technologies, enhance supply chain visibility, enabling businesses to proactively address disruptions, optimize logistics, and improve efficiency.
- **Reduced costs:** Predictive maintenance, optimized resource utilization, and streamlined operations through Industry 4.0 technologies can lead to significant cost savings.

#### **4. Fostering a skilled workforce and collaboration**

- **Workforce transformation:** While automation may impact certain job roles, the digital economy creates new opportunities and demands for a skilled workforce proficient in areas like data science, AI development, and digital marketing. Reskilling and upskilling initiatives become crucial to adapting to the evolving demands of Industry 4.0.
- **Enhanced collaboration:** Digital platforms and cloud computing facilitate seamless communication and collaboration across teams, departments, and even with external stakeholders like suppliers and partners, regardless of location or time zone. In essence, the digital economy provides the necessary infrastructure, technologies, skills, and environment for Industry 4.0 to thrive. It's a symbiotic relationship where the digital economy fuels the innovation and efficiency gains of Industry 4.0, which in turn drives further growth and transformation within the digital economy itself.

#### **Major requirements of industry 4.0 to be fulfilled through the digital economy**

Industry 4.0, characterized by the digital transformation of manufacturing, requires several key elements that are fulfilled through the digital economy. These include enhanced digitalization, interconnectedness, data-driven decision making, flexibility, and increased efficiency. The digital economy provides the infrastructure and technologies to support these requirements, such as cloud computing, IoT, AI, and advanced analytics. Industry 4.0 necessitates the widespread adoption of digital technologies across all aspects of production. The digital economy provides the tools and platforms for this, including cloud computing for data storage and processing, and software solutions for automation and control. Seamless communication and data exchange between machines, systems, and humans are crucial for Industry 4.0.

The digital economy enables this through technologies like the Internet of Things (IoT), which allows devices to connect and share data, and robust network infrastructure. Industry 4.0 requires the ability to adapt quickly to changing market demands and production requirements. The digital economy supports this through flexible manufacturing systems, digital twins for simulation and optimization, and the ability to quickly adjust production schedules and processes. With the increased reliance on digital systems and data, robust cybersecurity measures are essential to protect against cyber threats. The digital economy provides the framework for implementing security protocols and addressing vulnerabilities. The digital economy fosters innovation by providing platforms for research, development, and testing of new technologies. This includes support for application-related research and investments in future technologies. Industry 4.0 promotes a more decentralized decision-making process, where information and control are distributed across the organization. The digital economy enables this by providing tools for real-time monitoring and control from various locations. Essence, the digital economy acts as the foundation upon which Industry 4.0 is built, providing the technologies, infrastructure, and ecosystem necessary for its successful implementation.

#### **Major limitations of digital economy for industry 4.0**

##### **1. Cybersecurity Risks:**

- Industry 4.0 relies heavily on interconnected systems and data exchange, making it vulnerable to cyberattacks.
- The increased attack surface, with numerous devices and networks connected, creates opportunities for hackers to exploit vulnerabilities.
- Companies need robust security measures to protect their systems and data from breaches and unauthorized access.

##### **2. High Implementation Costs:**

- Adopting Industry 4.0 technologies like IoT, AI, and automation can be expensive, especially for small and medium-sized enterprises (SMEs).
- The costs extend beyond hardware and software to include training, infrastructure upgrades, and specialized personnel.
- Smaller businesses may struggle to secure the necessary funding for these investments.

##### **3. Workforce Skills Gap:**

- Industry 4.0 requires a workforce with specialized skills in areas like data analysis, cyber security, AI, and automation.
- Many companies face a shortage of qualified professionals with the necessary expertise.
- Up skilling and reskilling existing employees, as well as attracting new talent with relevant skills, are crucial challenges.

##### **4. Job Displacement:**

- Automation and AI-driven technologies can lead to job displacement in certain sectors, particularly those involving repetitive tasks.
- While Industry 4.0 also creates new job opportunities, the transition may not be seamless, and some workers may need to adapt to new roles or face unemployment.

##### **5. Data Management and Integration:**

- Industry 4.0 generates vast amounts of data from various sources, requiring robust data management and analysis capabilities.
- Integrating data from different systems and formats can be complex and challenging.
- Ensuring data quality and accuracy is crucial for effective decision-making.

##### **6. Interoperability and Standardization:**

- The diverse range of technologies and systems involved in Industry 4.0 can create interoperability issues.

- Lack of common standards and protocols can hinder seamless communication and data exchange between different devices and systems.

#### **7. Ethical Concerns:**

- The use of AI and automation raises ethical questions about transparency, bias, and accountability.
- Data privacy and security are also significant ethical considerations, especially when dealing with sensitive personal information.

#### **8. Environmental Impact:**

- The increased energy consumption associated with data centers and digital infrastructure can have a negative impact on the environment.
- E-waste generated by discarded digital devices is another environmental concern.

#### **9. Change Management:**

- Implementing Industry 4.0 technologies requires significant organizational changes.
- Resistance to change from employees and a lack of understanding about the benefits can hinder adoption.
- Effective change management strategies are essential for successful implementation.

#### **10. Digital Divide:**

- The benefits of Industry 4.0 may not be evenly distributed, potentially exacerbating the digital divide between developed and developing nations, and within societies.
- Access to technology, infrastructure, and skills may be limited in certain regions or communities

### **Conclusion**

The digital economy significantly improves the culture of Industry 4.0 by fostering innovation, enhancing efficiency, and driving sustainable practices. It enables businesses to leverage technologies like big data, AI, and IoT for intelligent manufacturing, leading to increased productivity, personalized products, and competitive advantages. This shift also necessitates a focus on workforce development and addressing potential social and environmental impacts. The digital economy provides the infrastructure and tools for Industry 4.0 technologies to flourish. Cloud computing. Technologies like AI, machine learning, and big data analytics enable intelligent manufacturing systems that optimize processes, predict potential issues, and improve product quality.

Digital twins, for instance, allow for virtual simulations of real-world systems, enabling better analysis and optimization of industrial processes. The digital economy supports sustainability initiatives within Industry 4.0 by enabling efficient resource management, waste reduction, and the development of eco-friendly products. Data-driven insights help optimize energy consumption, reduce emissions, and promote circular economy principles. As Industry 4.0 technologies become more prevalent, there is a growing need for skilled workers who can operate and maintain these systems. Careful consideration of its social and environmental impacts. Addressing issues like job displacement, digital divide, and responsible data management is crucial for ensuring a just and sustainable transition to Industry 4.0.

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The authors declare that there are no conflicts of interest regarding the publication of this paper.

### **References**

1. Williams L.D. Concepts of digital economy and industry 4.0 in intelligent and information systems Int. J. Intell. Newt., 2 (2021), pp. 122-129
2. Bryndin E. Directions of development of industry 4.0, digital technology and social economy Am. J. Inf. Sci. Technol., 2 (1) (2018), pp. 9-17
3. P. Doucek, J. Hološka, Digital economy and industry 4.0, in: Proceedings of the IDIMT-2019 Innovation and Transformation in a Digital World, 2019, pp. 33-40.
4. Khachaturyan A., Ponomareva S. Scientific and technical development of Russia's high-tech companies in the context of introducing the conception industry 4.0 and the digital economy development SHS Web of Conferences, vol. 55, EDP Sciences (2018), p. 01020

5. Bryndin E. Technological, economic and social aspects of management by development of the digital industry 4.0 Int. J. Manag. Stud. Res., 6 (3) (2018), pp. 19-30
6. Rainnie A., Dean M. Industry 4.0 and the future of quality work in the global digital economy
7. Labour Ind.: J. Soc. Econ. Relat. Work, 30 (1) (2020), pp. 16-33
8. Gadre M., Deoskar A. Industry 4.0–digital transformation, challenges and benefits Int. J. Future Gener. Commun. Netw., 13 (2) (2020), pp. 139-149
9. Ivanov I., Luk'yanova T.Y., Belova O. Digital economy: Knowledge in the logic of the industry 4.0 concept Artificial Intelligence: Anthropogenic Nature vs. Social Origin, Springer International Publishing (2020), pp. 50-59