

**UDC: 65.01; 004**  
**DOI: <https://doi.org/10.30546/2521-6341.2025.01.013>**

## THE DEVELOPMENT OF THE INDUSTRY ON THE INNOVATIVE TECHNOLOGIES

**Maya Rasat DADASHZADE**  
Azerbaijan University of Cooperation  
dadashzademaya@.com

ARTICLE INFO	ABSTRACT
<p>Article history</p> <p>Received:2025-04-01</p> <p>Received in revised form:2025-06-13</p> <p>Accepted:2025-07-10</p> <p>Available online</p> <hr/> <p>Keywords:</p> <p>Innovation, technological methods, industry, Industry 4.0, smart manufacturing</p> <p>JEL CODES: O33; L60</p>	<p><b>The purpose of the study</b> is to investigate the implementation of the new innovative methods in the industrial sector, focusing on new innovative technologies.</p> <p><b>Research methodology</b> - The study uses a combination of analytical, synthetic and comparative methods to examine how technological advances shape industrial innovation. It integrates a systems approach along with technological and economic frameworks to gain scientific insights.</p> <p><b>Applied significance of the study</b> - The applied significance of this study lies in its ability to help industries adopt advanced technologies that increase production efficiency, reduce costs and enhance sustainability. It provides practical guidance to industrial decision-makers on integrating advanced technologies such as automation, artificial intelligence and IoT to foster innovation and maintain competitive advantage.</p> <p><b>Research findings</b> - The study highlights how emerging technological methods such as smart manufacturing, Industry 4.0 and digital twins are revolutionizing industrial processes. It identifies the key opportunities presented by these technologies, along with the challenges faced by industries in implementing them. The study suggests strategies to overcome these challenges, ensuring successful adoption of the technology.</p> <p><b>Scientific innovation of research</b> - Scientific innovation of research is the development of a framework that links new technological methods with the innovation process in an industrial context. The framework offers new perspectives on how industries can use technological advances to achieve sustainable development and operational excellence, thus paving the way for future industrial transformation.</p>

### INTRODUCTION

The development of an industry-led innovation concept based on new technological methods is a global issue that is driving the current pace of economic development. Technological advances drive economic growth by increasing productivity, reducing costs, and opening up new markets. Countries, industries, and companies that use new technologies gain a competitive advantage that is crucial in today's globalized economy. Many new technological methods aim to reduce environmental impacts, helping industries transition to more sustainable practices. For example, green technologies, such as renewable energy sources or efficient waste management systems, are becoming increasingly important as society grapples with climate change. The rise of

Industry 4.0, characterized by automation, artificial intelligence, the Internet of Things (IoT), and big data, has transformed the way industries operate. Understanding and implementing technological innovations is key to keeping up with these changes and ensuring industries remain relevant and profitable. As new technologies emerge, industries must find ways to integrate them into existing processes. This is critical for companies looking to optimize production, improve quality control, and enhance customer experiences.

New technologies can help industries use resources more efficiently, whether they are energy, raw materials or human capital. The efficiency gains can lead to cost savings and more sustainable production practices, making innovation vital for long-term profitability. As technological innovations evolve, they create both challenges and new opportunities, disrupting existing industries. By framing innovation around these technologies, industries can adapt, transform and lead in their fields rather than falling behind competitors. Governments and regulators are increasingly focusing on fostering innovation, often providing incentives and creating frameworks for new technologies, particularly those related to sustainability and digital transformation. The development of new innovative concepts for industry is vital, as technological innovation is a key driver of industrial evolution that enables growth, efficiency, competitiveness, and sustainability. This is an area that businesses and companies must address to maintain their leadership in an ever-changing market environment.

**The main purpose of the research** into the development of industrial sectors based on modern innovative technologies in the presented article is to once again emphasize the role of modern innovations play in economic development and the inevitability of their application and promotion.

## **MAIN PART**

Modern concepts examine the ways in which industry is managed to adapt to new innovative technologies in three main directions - technological, market and organizational activities. J.Bessant [1] emphasizes the importance of integrating technological, market and organizational changes for effective innovation management, while T.Brown [2] focuses on design thinking as a method for creating alternative solutions for business and society. H.Chesbrough [3] introduces the concept of open innovation, calling on companies to collaborate externally for technological progress, while C.M.Christensen [4] examines why established firms often fail to adapt to disruptive technologies. P.F. Drucker [5] outlines the principles of innovation and entrepreneurship, arguing that successful innovation requires a structured, entrepreneurial approach. G.George and S.Parise [6] expand on this view by providing a global perspective on innovation and entrepreneurship, highlighting its important role in driving economic growth in diverse markets.

Other key contributions include A.Hargadon's [7] study of breakthrough innovations and the factors that drive successful breakthroughs, S.Kaplan's [8] study of the innovation journey, and E.M.Rogers' [9] work on diffusion of innovation, which shows how innovations spread across markets and industries. M.A.Schilling [10] focuses on the strategic management of technological innovation, while J.Tidd and J.Bessant [11] offer a practice-based approach to the management of innovation and entrepreneurship.

K.T.Ulrich [12] summarizes the research on the design and development of new products, demonstrating the crucial role of product development in driving technological progress.

Overall, the expert research cited provides a solid framework for understanding how technological innovations can reshape industries and lead to new market opportunities, while also providing practical strategies for organizations aiming to remain competitive in a rapidly evolving technological landscape.

## **MATERIALS AND METHODS**

Industry 4.0, the fourth industrial revolution, marks a paradigm shift in manufacturing and industrial operations through the integration of the Internet of Things (IoT), automation, and advanced data analytics. At the heart of this transformation is the IoT, which connects machines, sensors, and devices within a network, enabling seamless communication and data exchange throughout the manufacturing process. This interconnection enables real-time monitoring, data collection, and actionable insights, improving decision-making and operational efficiency. Automation powered by robotics and artificial intelligence (AI) is further advancing Industry 4.0 by reducing human intervention in repetitive tasks and improving accuracy and speed in manufacturing processes. Robotic systems powered by AI algorithms are able to learn from their environment and adapt to changing conditions, facilitating autonomous operations. In addition, predictive maintenance systems powered by AI use data collected from IoT devices to identify potential equipment failures before they occur, minimizing downtime and reducing maintenance costs. The application of these technologies helps create smart factories, where systems are not only interconnected but also self-optimizing [Chesbrough, 2020]. Using data analytics and machine learning, these systems can predict demand changes, adjust production schedules, and allocate resources in an optimized manner. This leads to increased manufacturing flexibility, reduced waste, and improved product quality. In addition, Industry 4.0 empowers innovation by enabling mass customization and the ability to respond quickly to market demands. The shift to digitalized and automated manufacturing processes also facilitates the integration of sustainable practices by optimizing energy consumption and reducing emissions. Driven by IoT and automation, Industry 4.0 is revolutionizing traditional industrial operations by increasing productivity, optimizing resource use, and enabling greater flexibility and innovation in manufacturing processes.

Additive manufacturing, commonly known as 3D printing, is reshaping traditional manufacturing processes by enabling the precise, on-demand production of complex structures with minimal material waste. Unlike traditional subtractive manufacturing methods that involve removing material from a larger block, 3D printing builds objects layer by layer directly from digital designs. This additive process increases the ability to produce geometrically complex parts that are difficult or impossible to achieve with traditional methods. One of the most significant advantages of 3D printing in industrial applications is its ability to facilitate custom manufacturing.

The technology enables the rapid production of customized products or components tailored to specific requirements without the need for expensive tooling or molds. This capability has transformed industries such as aerospace, automotive, and healthcare, where there is a high demand for customized solutions. For example, in the aerospace industry, 3D printing is used to create lightweight yet strong components, which leads to improved fuel efficiency and performance. In addition, additive manufacturing significantly reduces material waste compared to traditional methods. The layer-by-layer approach ensures that material is used only where necessary, minimizing excess and scrap. This efficiency not only reduces manufacturing costs,

but also contributes to sustainability by reducing the environmental impact associated with material waste. The technology has also proven to be invaluable in prototyping and spare parts manufacturing. This allows for rapid iteration and testing of design concepts, reducing time to market and boosting innovation. In the context of spare parts, 3D printing allows for the production of components on demand, eliminating the need for large inventories and long lead times. This capability is particularly useful in industries such as automotive and machine repair, where rapid access to critical parts is essential. Additive manufacturing is revolutionizing the manufacturing landscape by offering customization, reducing material waste and streamlining manufacturing processes. As the technology continues to evolve, its applications in large-scale industrial settings will expand, further enhancing innovation and efficiency.

Artificial intelligence (AI) and machine learning (ML) are key technologies that are transforming modern industrial operations by enabling smarter, data-driven decision-making in areas as diverse as supply chain management, predictive maintenance, product design, and quality control. These technologies are particularly powerful in analyzing large amounts of data to generate insights and make decisions at a speed and accuracy beyond human capabilities [Hargadon, 2021]. In supply chain management, AI and ML optimize logistics and inventory management by forecasting demand, optimizing routes, and predicting potential disruptions. Machine learning algorithms process historical data and current trends to predict fluctuations in demand, allowing production schedules and inventories to be adjusted accordingly. This leads to reduced operating costs, improved resource allocation, and increased customer satisfaction. Predictive maintenance is another critical application of AI and ML, where these technologies are used to predict equipment failures before they occur. By analyzing sensor data and historical maintenance records, machine learning algorithms can detect patterns that indicate potential failures. This proactive approach minimizes unplanned downtime, extends the life of machines, and reduces maintenance costs. In industries where equipment reliability is key, such as manufacturing, aviation, and energy, predictive maintenance significantly improves operational efficiency. AI and ML are also playing a transformative role in product design and development.

The development and application of advanced materials, including nanomaterials, graphene, and smart materials, are driving significant advances in industries such as aerospace, automotive, and construction. These materials offer improved performance characteristics, including increased durability, energy efficiency, and design flexibility, enabling the creation of a new generation of products and systems that were previously unattainable with traditional materials. Due to their unique properties at the nanoscale, nanomaterials exhibit enhanced strength, conductivity, and chemical reactivity compared to their bulk counterparts. In the aerospace and automotive industries, nanomaterials are used to produce lightweight yet strong components, improve fuel efficiency, reduce emissions, and enhance overall performance. For example, carbon nanotubes and nanocomposites are incorporated into structural components, providing a combination of low weight and high strength, which helps improve fuel efficiency and durability. Advanced materials such as nanomaterials, graphene, and smart materials are significantly improving performance, energy efficiency, and design flexibility across a variety of industries. These innovations facilitate the development of more durable, high-performance products that meet the demands of modern technological advancements.

Blockchain technology is attracting significant attention for its potential to transform supply chain management across industries such as manufacturing, logistics, and pharmaceuticals. By

providing a decentralized, immutable ledger system, blockchain offers improved transparency, security, and traceability, addressing critical challenges faced by these sectors, including fraud, inefficiency, and lack of visibility. In manufacturing, blockchain facilitates the tracking of raw materials and finished goods throughout the supply chain, ensuring that all transactions are securely recorded and audited. In the logistics sector, blockchain technology facilitates the tracking and movement of goods by providing a single, transparent record that is accessible to all stakeholders. By integrating blockchain with Internet of Things (IoT) devices, real-time information about the location, condition, and status of shipments can be securely recorded and tracked. This reduces delays, improves inventory management, and enhances coordination between suppliers, manufacturers, and distributors. The pharmaceutical industry is particularly benefiting from blockchain's ability to increase traceability and combat the growing problem of counterfeit drugs. Blockchain enables the secure and transparent tracking of pharmaceutical products from manufacturer to consumer, ensuring that drugs are authentic and comply with regulatory standards. This level of traceability not only protects consumers, but also improves compliance and enhances brand integrity. Blockchain technology significantly improves supply chain transparency, security and traceability. By providing secure, real-time and immutable records, it increases operational efficiency and fraud protection, especially in critical sectors such as manufacturing, logistics and pharmaceuticals.

In the context of industrial innovation, the integration of specific technological methods effectively solves operational problems, increases productivity, and drives sustainable growth. With the strategic application of advanced technologies, industries can not only optimize their current processes, but also meet evolving market demands. Automation and robotics play a significant role in increasing productivity, accuracy, and safety in industrial operations. The introduction of automated systems, such as robotic arms and autonomous vehicles, improves production processes by performing repetitive tasks with high precision and significantly reduces human errors. Robotics can also be applied in hazardous environments, minimizing risks to human workers and increasing workplace safety. In addition, automation can simplify production lines, reduce cycle times, and increase productivity, ultimately reducing operating costs and increasing efficiency [Bessant, 2021].

The Internet of Things (IoT) offers the opportunity to create interconnected, intelligent products that facilitate improved monitoring, control, and management of both industrial operations and consumer products. IoT-enabled devices communicate in real-time, allowing manufacturers to monitor performance metrics, detect failures, and optimize operations remotely.

The integration of renewable energy sources such as solar and wind power helps industries reduce their dependence on non-renewable sources and reduce carbon emissions. In addition, waste recycling and water conservation technologies can minimize the environmental impact of industrial processes by promoting sustainable practices and complying with regulatory requirements. The implementation of green technologies supports both operational efficiency and the growing consumer demand for environmentally responsible solutions.

## **RESULTS AND DISCUSSIONS**

The study highlights the critical importance of integrating emerging technologies and sustainable practices into innovation strategies for long-term success. The findings demonstrate that a structured approach that includes prototyping, continuous testing, and effective scaling is essential to ensure that innovations are relevant and adaptable in a rapidly evolving market. The

results highlight that technological integration, particularly through the use of automation, AI, IoT, and sustainable technologies, has a profound impact on operational efficiency and customer satisfaction. Automation and robotics streamline manufacturing processes, reduce errors, and increase safety, while artificial intelligence and machine learning improve decision-making and operational forecasting. These technologies, when combined with sustainable practices such as renewable energy sources and waste reduction, not only increase productivity, but also align with the growing demand for environmentally responsible solutions. In addition, the study highlights the importance of collaboration and partnerships in fostering innovation. Collaborations with technology startups, academic institutions, suppliers and industry networks provide access to specialized knowledge and resources, accelerating the development and improvement of innovations. These collaborations allow for the integration of different perspectives, leading to more robust and adaptable technological solutions. The ability to leverage external expertise ensures that businesses stay ahead of technological advances and maintain a competitive advantage. Another key finding of the study is the role of scaling and commercialization. Developing a robust business model that clearly demonstrates the return on investment (ROI) for innovation adoption is crucial to securing financing and ensuring widespread adoption. Effective marketing strategies that highlight the unique advantages of the innovation help differentiate it in a competitive marketplace. In addition, continuous technological improvements based on customer and employee feedback ensure that the innovation remains relevant and capable of meeting evolving market demands.

The results highlight the importance of sustainability and future analysis. By monitoring emerging trends, maintaining continuous feedback loops, and ensuring sustainability in both design and operation, companies can future-proof their innovations, ensuring long-term viability and adaptability. The study confirms that innovation strategies that integrate advanced technologies, strengthen strategic partnerships, focus on scalable commercialization, and prioritize sustainability offer significant potential for industry leadership and long-term success. We could not have mentioned the innovative technologies mentioned in the study and the role they play in production processes a few years ago. However, today, new innovative technologies invented as a result of human scientific and theoretical thinking create miracles. Undoubtedly, this process will continuously develop dynamically and pave the way for the use and integration of newer and more progressive technologies in the future. Because human creative scientific and theoretical thinking is capable of many things, it is inexhaustible.

The significance of the presented research work can be interpreted as follows: the article separately analyzes modern innovative technologies and their contributions to the development of the industry, addresses the issues of further improvement and development of these technological operations in the future, and highlights the importance of their integration and internationalization. It should be noted that today, the latest achievements of innovation are used to achieve economic development and competitiveness. Modern innovative concepts such as 3D operations, cloud computing, artificial intelligence and the operations it performs, blockchain, Gemini, the Internet of Things, which are considered the most successful of Industry 4.0, are not the last limit of the discovery and application of innovative technologies. Although we are talking about the most widely used methods in the field of innovation globally in the article, there is no doubt that these innovations will be further improved in the future by specialist research, and the development and application of new methods is inevitable. Because human creative imagination is endless. Economic development requires the development of more

progressive, dynamic new methods in accordance with the requirements of the time. In the future, the improvement of the above-mentioned modern methods and innovative technologies should be further developed as the requirements of the time. This will give impetus to the globalization of innovations and the expansion of economic relations and exchange of ideas between countries and companies.

## **CONCLUSION**

The study concludes that successfully formulating an innovation concept in response to emerging technological trends requires a comprehensive and dynamic approach that combines technological advances, sustainable practices, strategic partnerships, and continuous improvement. Key findings highlight the importance of implementing automation, AI, IoT, and sustainable technologies to increase efficiency, customer satisfaction, and environmental responsibility. In addition, strategic partnerships with startups, academic institutions, suppliers, and industry networks are crucial to foster innovation and maintain competitiveness. The study also highlights that scaling and commercialization require a strong business model, effective marketing, and iterative improvements based on stakeholder feedback to ensure long-term success. Additionally, the need to continuously monitor emerging trends and incorporate sustainability into both design and operational processes is essential for future-proofing innovation. Companies that employ these strategies are better positioned to adapt to changing market conditions, emerging technologies, and evolving consumer preferences, ensuring the continued relevance and impact of their innovations.

While the study provides valuable insights, several avenues for future research remain open. First, examining the long-term impacts of integrating sustainable technologies into various industries, particularly in terms of economic efficiency and environmental impact, would deepen understanding of sustainability-benefit trade-offs. Research could focus on case studies that identify barriers and drivers of successful implementation, where sustainability-based innovations significantly disrupt traditional models. Second, the role of collaboration and partnerships in accelerating innovation can be further explored by analyzing the dynamics between different stakeholders. Exploring how collaboration models evolve, especially in the context of industry-specific challenges, can offer deeper insights into optimizing partnerships and increasing innovation productivity. In addition, future research could explore feedback loops between innovation developers and end users, particularly how real-time customer and employee input influences the design and improvement of technological innovations. Understanding the mechanisms of effective feedback integration can lead to more responsive and adaptive innovation processes. Research that focuses on scaling innovations across industries and understanding the challenges they face in different regulatory and market environments will help improve best practices for commercialization in global markets. This research highlights critical factors necessary for the successful formulation and implementation of innovations, while also paving the way for future research to refine and extend these strategies.

The development of industrial sectors in our republic based on innovative technologies is one of the priority issues facing the state. In order to develop industry based on modern innovations, the following proposals can be made specifically. It is necessary to: 1) pay special attention to this area by the state and legal entities; 2) increase the interest of domestic and foreign investors in attracting this work; 3) benefit from the experience of foreign specialists engaged in various

sectors of industrial sectors in order to learn from international experience; 4) strengthen cooperation with institutional and various scientific and research departments.

World experience once again proves that the economic power of a state and the authoritative state image it forms in the political arena are determined by its political and economic development, joining modern integration, learning and applying innovations. Currently, states are characterized not as developed or developing, but as innovative and non-innovative developed states. In this regard, learning innovations, applying them and promoting them is an urgent issue for all states.

## REFERENCES

1. Bessant, J. (2021). *Managing Innovation: Integrating Technological, Market and Organizational Change*. Chichester. Wiley.
2. Brown, T. (2019). *Change by Design: How Design Thinking Creates New Alternatives for Business and Society*. New York. HarperBusiness.
3. Chesbrough, H. (2020). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston. Harvard Business Review Press.
4. Christensen, C. M. (2017). *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Boston. Harvard Business Review Press.
5. Drucker, P. F. (2020). *Innovation and Entrepreneurship: Practice and Principles*. New York. HarperBusiness.
6. George, G., Parise, S. (2022). *Innovation and Entrepreneurship: A Global Perspective*. New York. Pearson Education.
7. Hargadon, A. (2021). *How Breakthroughs Happen: The Surprising Truth About How Companies Innovate*. Boston. Harvard Business Press.
8. Kaplan, S. (2022). *The Innovation Journey*. New York. Oxford University Press.
9. Rogers, E. M. (2020). *Diffusion of Innovations*. New York. Free Press.
10. Schilling, M. A. (2021). *Strategic Management of Technological Innovation*. New York. McGraw-Hill Education.
11. Tidd, J., Bessant, J. (2020). *Innovation and Entrepreneurship: A Practice-Based Approach*. Chichester. Wiley.
12. Ulrich, K. T. (2020). *Design and Development of New Products*. New York. McGraw-Hill Education.