

Role of Modern Technology in Industry 4.0: An Empirical Study in the Context of Artificial Intelligence

Vinayendra Mani Tripathi

CommerceGraphic Era Hill University, Dehradun Uttarakhand

Abstract

Artificial intelligence (AI) is a key component of current technology that is revolutionizing the Indian industrial landscape in the context of Industry 4.0. India is embracing AI's potential as a major engine of economic development and industrial change. Automation of diverse industrial processes is one of the key functions of contemporary technology, especially AI, in Industry 4.0. In sectors including manufacturing, shipping, and warehousing, AI-powered robots and machines are being utilized to improve productivity, streamline production lines, and decrease human error. The use of AI in predictive maintenance helps to reduce downtime and boost productivity by analyzing data from sensors and other sources to anticipate equipment problems. In order to prepare the Indian workforce for the demands of Industry 4.0, AI is playing a crucial role. In order to prepare workers for the changing industrial landscape and the digital economy, training programmes and initiatives are being designed to teach them about AI and other cutting-edge technology. Overall, modern technology, in particular AI, is propelling the transformation of Indian companies in the era of Industry 4.0, resulting in increasing automation, data-driven decision-making, and workforce upskilling, placing India as a global leader in the Fourth Industrial Revolution.

Keywords: Artificial intelligence (AI), Industry 4.0, Automation, Modern Technology, Workforce upskilling.

Introduction

Artificial intelligence (AI), in particular, has a significant impact on inclusive economic growth and the development of an economy in India's Industry 4.0 context. Aggarwal et al. (2019) assesses the main obstacles preventing the implementation of Industry 4.0 technologies in India using a "DEMATEL (Decision-Making Trial and Evaluation Laboratory)" method. They found that the absence of a competent labour, a deficient digital infrastructure, and data security issues were the main obstacles. The availability of competent individuals with AI proficiency in the Indian setting is essential for the successful implementation of Industry 4.0. To close the skill gap and give the Indian workforce the tools it needs to use AI and other cutting-edge technologies in the context of industry, upskilling and reskilling the workforce is crucial. In order to foster trust in the use of AI and other technologies in the Indian industrial landscape, it is also essential to address concerns about data security and privacy.

In the context of India's Industry 4.0, Singh et al. (2019) emphasised the relevance of contemporary technology, particularly AI, in increasing supply chain coordination. The necessity for effective coordination and collaboration among many stakeholders has grown crucial as a result of the growing complexity and globalisation of supply chains. Artificial intelligence (AI)-based technology can facilitate real-time data analysis, predictive analytics, and intelligent decision-making, enhancing the visibility, agility, and efficiency of the supply chain. For example, AI may aid in the optimisation of logistics planning, demand forecasting, and inventory management, resulting in shortened lead times, decreased costs, and enhanced customer service. Data integration, data quality, and system interoperability issues must be resolved for AI to be successfully used to supply chain coordination.

In addition, Kumar and Nath Banerjee (2014) emphasized the significance of current technology, particularly AI, in determining the degree of collaboration in the supply chain, which is crucial in the context of Industry 4.0. For Industry 4.0 projects to be successful, cooperation is essential across a variety of stakeholders, including manufacturers, distributors, and suppliers. By automating communication, enhancing data exchange, and facilitating analytics, AI may promote efficient collaboration. It also provides real-time visibility into the supply chain. AI-driven solutions can also facilitate group decision-making, which can increase supply chain responsiveness, efficiency, and innovation. For the successful implementation of AI-enabled collaboration in the Indian context of Industry 4.0, however, significant obstacles must be overcome. These obstacles include fostering a collaborative culture, establishing stakeholder trust, and addressing issues related to data sharing and intellectual property rights.

Literature Review

In India, Industry 4.0 is having a substantial and multifaceted impact on current technology, especially AI. In order to increase productivity, efficiency, and competitiveness, it entails utilizing AI in a variety of production, supply chain, and performance assessment aspects. But for the appropriate and long-term adoption of AI in the Indian industrial landscape during the industry 4.0 era, issues including skilled talent, digital infrastructure, data security, ethical considerations, and regulatory frameworks need to be addressed. In the framework of Industry 4.0, Zhong et al. (2017) discuss intelligent manufacturing, emphasizing how AI is revolutionizing the manufacturing industry. Production planning, process optimisation, quality control, and other areas of manufacturing could be revolutionized by AI-powered technologies like machine learning, robots, and predictive analytics. Adopting AI in manufacturing in India might result in higher productivity, efficiency, and competitiveness, which would spur economic growth and open up job prospects. In order to successfully implement AI in India's manufacturing sector, however, issues including the lack of trained talent, the requirement for digital infrastructure, and regulatory frameworks must be solved.

Industry 4.0 bibliometric analysis and summary by Muhuri et al. (2019) emphasized the contribution of contemporary technology, particularly AI, to the development of various industries. By allowing machines and systems to interact and work together autonomously, AI-powered solutions can enable smart factories and supply chains, enhancing their responsiveness, agility, and adaptability. Industry 4.0's adoption of AI in India can benefit a number of sectors, including the automobile, electronics, textile, and pharmaceutical industries. For instance, AI can enable real-time

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tracking of commodities in the supply chain, intelligent inventory management, and predictive maintenance of machines. However, for the responsible and sustainable deployment of AI in the Indian context of Industry 4.0, issues like data security, ethical considerations, and legal frameworks need to be addressed.

Piotrowicz and Cuthbertson (2015) emphasized the significance of metrics and performance measurement in supply chains, which can be improved by using contemporary technologies, including AI, in the context of Industry 4.0. Real-time data collection, analysis, and visualization can be made possible by AI-powered solutions, which will improve supply chain visibility and transparency. This may lead to better decision-making, increased effectiveness, and lower costs. Adopting AI in supply chain performance measurement in the Indian context can assist in addressing issues like demand forecasting, inventory management, and logistics planning, which are essential for the success of Industry 4.0 efforts. However, for the seamless integration of AI in supply chain performance evaluation in India, concerns including data quality, interoperability, and integration among various systems must be solved.

For the purpose of measuring performance in supply chain entities, Chia et al. (2009) suggested a balanced scorecard perspective. Organizations may collect, analyze, and visualize performance data in real-time with the help of AI-powered technology, resulting in a more precise and timely knowledge of key performance indicators (KPIs). According to Arzu Akyuz et al. (2010), supply chain performance measurement practices can be improved with the help of current technologies, including AI. Data gathering, processing, and reporting can be automated using AI-powered technology, decreasing the need for labor-intensive manual processes. Data used for performance measurement may become more accurate, consistent, and timely as a result of this. Additionally, AI can offer sophisticated analytics capabilities, such as predictive and prescriptive analytics, allowing businesses to foresee and proactively fix performance gaps. The Internet of Things (IoT) and artificial intelligence (AI) have been integrated into the industrial and other industries, according to Skobelev and Borovik (2017). It highlighted the shift from Industry 4.0 to Industry 5.0 while putting an emphasis on how digital manufacturing is developing into a digital society. It draws attention to the role that AI and other contemporary technologies have played in bringing about this shift and stresses the need for a comprehensive strategy that takes into account the social, economic, and ethical implications of technological adoption.

Elgazzar et al. (2019), with an emphasis on utilizing contemporary technologies, such as AI, highlighted critical elements for creating a supply chain performance monitoring system. AI-powered technology can make it easier to develop flexible performance monitoring systems that can change with the needs of the corporate environment. According to Sergi et al. (2019), using AI in Industry 4.0 necessitates a tremendous amount of data for decision-making and training. This calls into question issues with data privacy and security, as well as moral questions concerning bias, fairness, and openness in AI systems. Strong data governance frameworks, cybersecurity safeguards, and ethical guidelines are necessary for Industry 4.0 adoption of AI in India in order to ensure the responsible and ethical usage of AI technologies. To further guide the responsible use of AI in the context of Industry 4.0 in India, standards, laws, and guidelines for AI adoption must be developed through collaborations between academics, industry, and policymakers. Industry 4.0 has

effects on labor markets, Kurt (2019), as well as labor relations. The adoption of AI-powered technology may result in changes to the workforce's skill requirements, with a trend towards higher-skilled employment requiring knowledge of AI and data analytics. As a result, there may be possibilities for the workforce to retrain and upgrade their skills, making them more knowledgeable and effective. However, it also brings up issues with job displacement and the necessity for strong labor laws to handle possible issues.

Objectives of the study:

To measure the role of modern technology in industry 4.0.

Research Methodology:

It is an empirical type of study. 220 respondents were contacted in this study to give their viewpoints on the role of modern technology in industry 4.0. Frequency distribution and pie charts are used for the data analysis and therefore the data was presented.

Data Analysis and Interpretation:

Table 1 AI helps to reduce downtime and boost productivity

Particulars	Agree	Disagree	Can't Say	Total
Respondents	181	29	10	220
% age	82.0	13.0	5.0	100

Table 1 presents that with the statement **AI helps to reduce downtime and boost productivity**, it is found that 82.0% of the respondents agree with this statement.

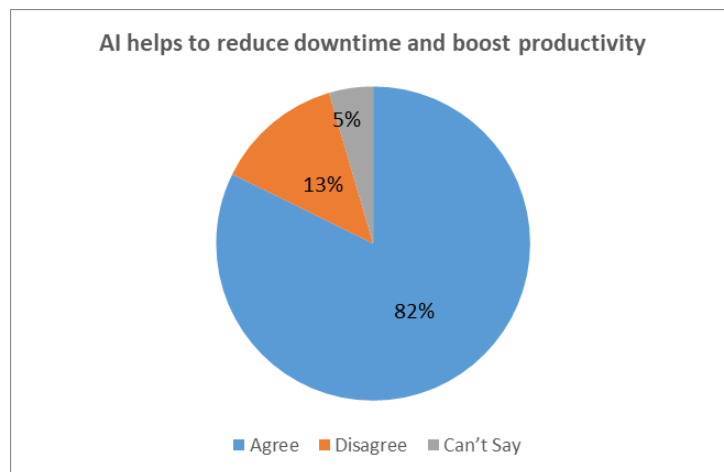


Figure 1 AI helps to reduce downtime and boost productivity

Table 2 AI analyze data from sensors and other sources to anticipate equipment problems

Particulars	Agree	Disagree	Can't Say	Total
Respondents	190	23	7	220
% age	86.0	11.0	3.0	100

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Table 2 presents that with the statement **AI analyze data from sensors and other sources to anticipate equipment problems**, it is found that 86.0% of the respondents agree with this statement.

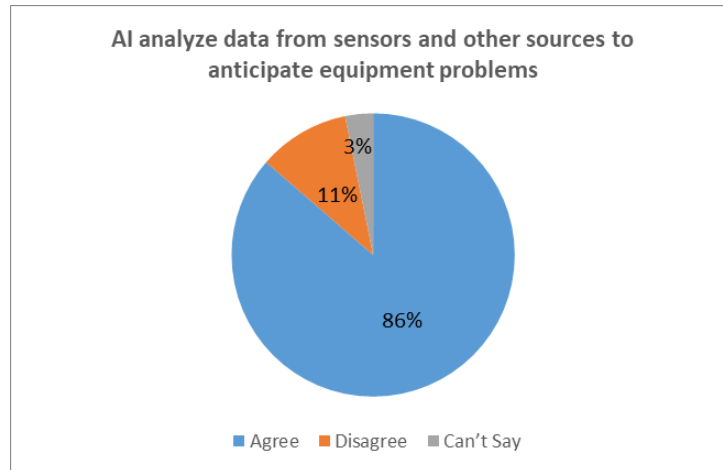


Figure 2 AI analyze data from sensors and other sources to anticipate equipment problems

Table 3 AI helps in optimization of logistics planning, demand forecasting and inventory management

Particulars	Agree	Disagree	Can't Say	Total
Respondents	185	27	8	220
% age	84.0	12.0	4.0	100

Table 3 presents that with the statement **AI helps in optimization of logistics planning, demand forecasting and inventory management**, it is found that 84.0% of the respondents agree with this statement.

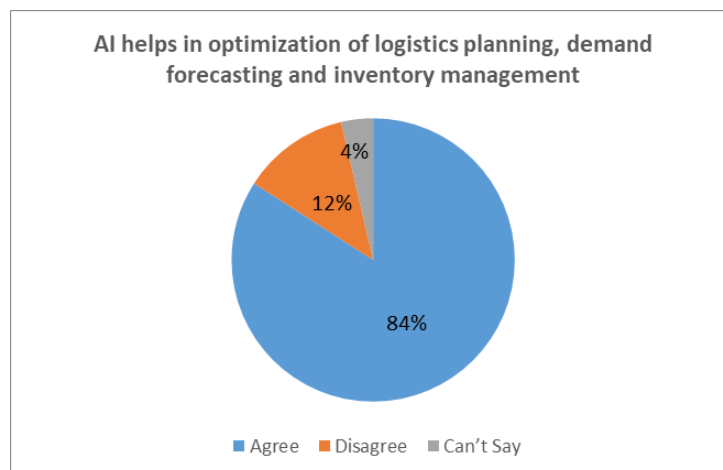


Figure 3 AI helps in optimization of logistics planning, demand forecasting and inventory management

Table 4 AI can facilitate real-time data analysis, predictive analytics and intelligent decision-making

Particulars	Agree	Disagree	Can't Say	Total
Respondents	176	31	13	220
% age	80.0	14.0	6.0	100

Table 4 presents that with the statement **AI can facilitate real-time data analysis, predictive analytics and intelligent decision-making**, it is found that 80.0% of the respondents agree with this statement.

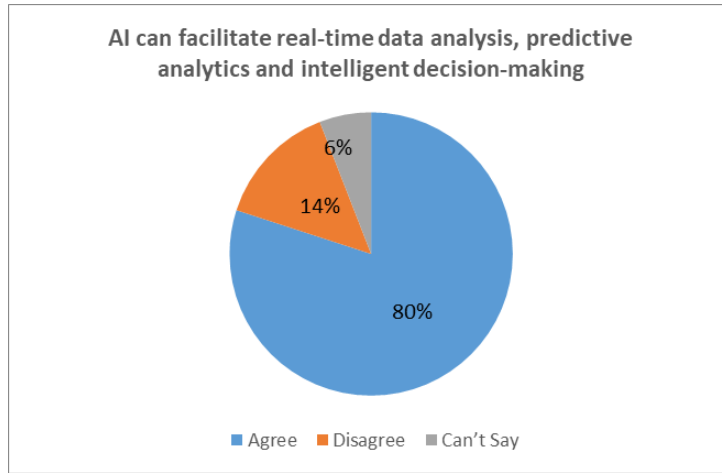


Figure 4 AI can facilitate real-time data analysis, predictive analytics and intelligent decision-making

Table 5 AI-powered solutions can enable smart factories and supply chains

Particulars	Agree	Disagree	Can't Say	Total
Respondents	193	19	8	220
% age	88.0	8.0	4.0	100

Table 5 presents that with the statement **AI-powered solutions can enable smart factories and supply chains**, it is found that 88.0% of the respondents agree with this statement. Considering all the responses of the statements, it was found that to a good percentage, the respondents have agreed that modern technology play an important role in industry 4.0.

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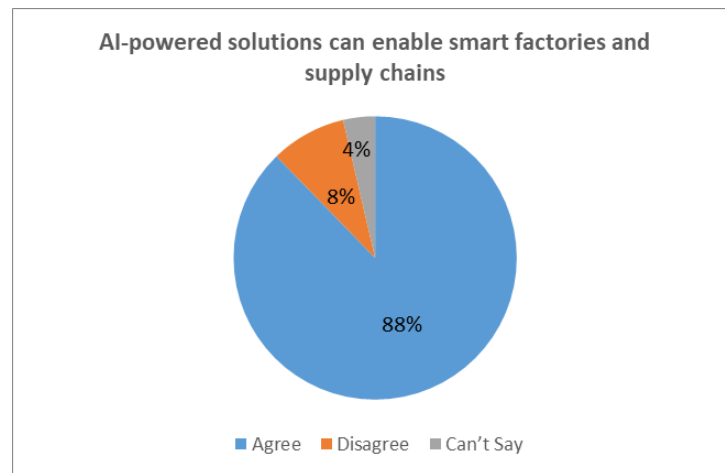


Figure 5 AI-powered solutions can enable smart factories and supply chains

Conclusion

In conclusion, the growing automation and digitization of sectors, known as "Industry 4.0," is made possible by current technology, particularly artificial intelligence (AI). In India, artificial intelligence (AI) is quickly changing a number of industries, including manufacturing, healthcare, agriculture, and transportation. Businesses have seen a rise in efficiency, production, and cost savings as a result of the deployment of AI in Industry 4.0. Manufacturing procedures have been streamlined, supply networks have been optimized, and product quality has increased thanks to AI-powered automation and data analytics. AI is assisting in healthcare with precise diagnosis, individualized treatment programmes, and remote patient monitoring. AI is being utilized in agriculture for pest management, precision farming, and crop monitoring, which has increased yields and encouraged sustainable practises. Artificial intelligence (AI) is enabling autonomous vehicles, intelligent traffic management, and predictive maintenance in the transportation industry, improving safety and easing congestion. AI is also encouraging innovation and developing new business models in India. Innovative solutions for social problems including healthcare access in rural regions, financial inclusion, and personalized education are being developed using AI by both start-ups and established businesses. In conclusion, Industry 4.0 in India is changing industries, spurring innovation, and opening up new opportunities due to the involvement of contemporary technology, particularly AI. India can utilize the potential of AI in Industry 4.0 to achieve sustainable economic growth, societal advantages, and inclusive development if the proper frameworks and policies are put in place.

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