# Impact and Usability of Artificial Intelligence in Manufacturing workflow to empower Industry 4.0

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**Abstract**

AI has created a massive revolution in the information and technology sector around the world. Analyzing the capabilities of AI, it is clear that the manufacturing sector is soon going to experience a drastic game-changing effect at various levels of production. To take advantage of Industry 4.0's tremendous potential and capabilities, businesses must begin focusing on where AI can offer more value and increase efficiency and productivity. This study analyzes the manufacturing capabilities of Industries powered by Artificial Intelligence. The authors have broadly discussed the role of GDP in AI for manufacturing industries globally by 2030. The paper also sheds light on the impact of AI in Manufacturing on the economy and scaling of the same.

**Keywords**

Artificial Intelligence, Industries, GDP, Analytics, Manufacturing

## 1. Introduction

Artificial intelligence (AI) is gently but steadily entering practically every area of our life. Its applications in medicine, geology, consumer data analysis, self-driving cars, and even art are diverse and ever-changing. However, AI has raised as many questions as it has answered, such as how the technology is defined and used (for example, assisted vs. augmented vs. autonomous intelligence), whether computers can think like humans (the so-called Turing test), the broader impact of automation on society, and the unexpected ethical and moral quandaries it may cause [9][13].

As the digital world grows, assembling will change – and Artificial Intelligence (AI) will undoubtedly be at the center of this transformation. Artificial intelligence has the potential to provide a competitive advantage to businesses at every stage of the value chain [15]. Direct automation, predictive support, reduced vacation, every minute of everyday creation, improved security, lower functional expenses, higher productivity, quality control, and faster navigation are just a few of the advantages available to businesses that embrace change and expertly implement AI across their entire business [9][14].

## 2. Literary Work

According to a Gartner survey, 79 percent of respondents stated their companies were looking into or piloting AI projects, but only 21 percent said their AI initiatives were operational in manufacturing. It also stated that 66 percent of organizations increased or did not change their investments in AI projects since the onset of Covid-19 [11][16].

The influence of AI on manufacturing GDP is predicted to grow in every area of the globe. AI is predicted to contribute 24 percent of China's GDP by 2030 to the manufacturing sector [6]. With a 10% contribution from AI in the manufacturing sector, North America comes in second [6].

In terms of AI implementation in manufacturing, the Automotive Industry currently leads [4][17].

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Despite being a slow-growing sector in many parts of the world, the Automotive Industry has still emerged as the biggest hub for smart manufacturing using AI models in quality control, product development, and manufacturing [8]. Motivated by the success of their first AI system now through its "Dreamcatcher system," GM has used machine learning to build goods that are more cost-effective and faster.
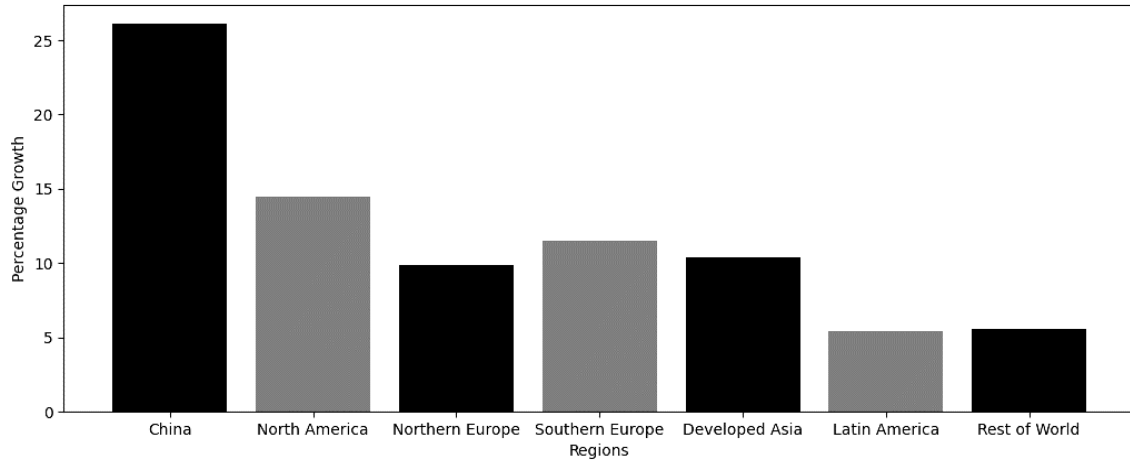


**Figure 1**: GDP impact of AI by 2030 around various regions of the world in the manufacturing industry

*Source- Statista*

Demand Planning is an important aspect in manufacturing to ensure a sufficient amount of manufacturing is taking place at any given point of time. By reducing stockouts and waste, AI helps businesses improve product availability. AI can be used to assist in bettering our understanding of sales patterns [11].

## 3. Benefits Of Deploying AI Models

Deploying AI models for smart manufacturing has led to such a huge difference in not only the revenues for the companies but also the GDP of the nation's contributing towards the development of AI technologies for smart manufacturing [7][18].

Businesses have been seen expanding their manufacturing capacity to fulfill the increased demand of clients all around the world. Although bringing AI to the industrial business would need a considerable financial expenditure, the return on investment will be tremendous [3]. Businesses can experience much cheaper operational costs as intelligent devices take care of day-to-day tasks.

This has resulted in better utilization of the human resource which earlier did all the labor work will now be able to focus on sophisticated and inventive jobs as AI takes over the manufacturing facility and automates mundane and dull human labor. Humans may focus on pushing innovation and bringing their firm to advanced levels while AI takes care of unskilled tasks [4][19].

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## 4. Scaling AI in manufacturing operations

The latest industrial revolution (Industry 4.0) is destined to integrate more automation using machine learning and AI models. However, currently, manufacturers are facing the issue of integrating and deploying digital platforms and technologies. In the automotive industry, only 14% of manufacturers have deployed AI at scale [3][10].

Successful prototype deployment in live industrial situations is a good starting point for AI system deployment. Prototypes have already been tested and implemented in a sandbox or controlled environment. As a result, the system is limited in its exposure to real-time data sets and difficulties.

Before deploying a model into a production-ready environment, it must be trained to a level of accuracy suitable for real-time manufacturing processes. Testing on real-time data will not only

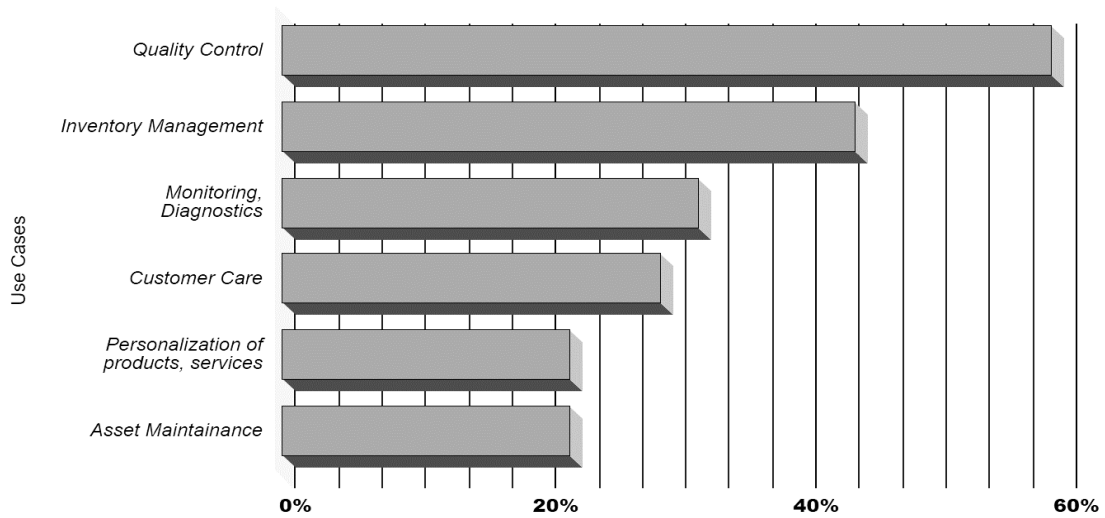improve development accuracy but will also confirm that the solution meets industrial requirements [5][20].



**Figure 2**: AI use cases various sectors of the manufacturing industry

*Source- Statista*

## 5. Challenges and Future Opportunities

While AI may appear to be a profitable alternative for manufacturing, it has its own set of hurdles and restrictions that might cause issues. In the next sections, we will talk about the problems of AI.

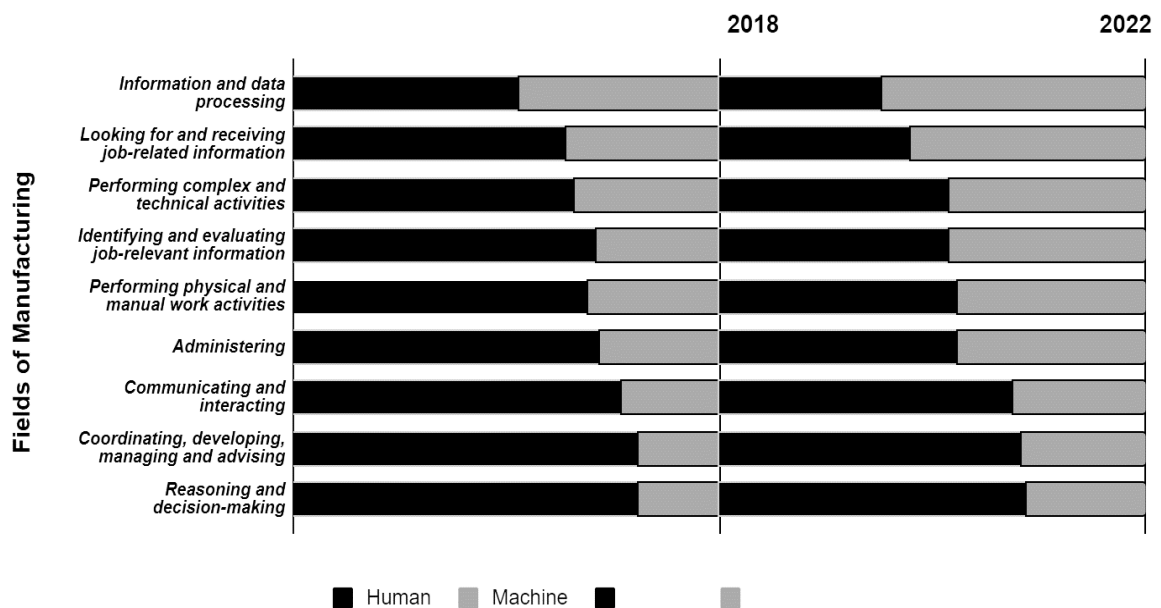### 5.1. Increase in job displacements and transformation of work



**Figure 3**: Machine vs Human contribution in various fields of manufacturing

*Source- Future of Jobs Survey 2018, World Economic Forum*

When it comes to existing job duties, there will be a substantial change in the human-machine divide, and in organizations that are more advanced in their use of AI, staff resources will be supplemented rather than displaced.

One of the main fears about AI is that human capital would lose value as technology advances since some feel that AI's automation will diminish the need for expensive human labor. However, this assumption is faulty because most organizations will boost work possibilities as their efficiency and

services improve. Employee resources will be supplemented rather than replaced in organizations that are more advanced in their use of AI [4]. According to the World Economic Forum, a new division of labor between people and robots would create more than 130 million new jobs by 2022. In reality, between 2018 and 2022, there will be a dramatic change in the human-machine frontier when it comes to existing labor duties [2][21].

Before very long, a significant variable affecting the GDP is the number of cases, recuperation rates, and the speed at which immunization will be finished. Given the current circumstances, India's GDP is predicted to rebound quickly, and as per the forecasts as displayed in Figure **4**.

### 5.2.Lack Of Specialized Workforce for AI Systems

Artificial Intelligence is a growing body of knowledge that will need more educated and qualified personnel to design, manage, and debug systems. Today's manufacturing business is characterized by ever-shorter cycles of technological advancement, which results in a fast shift like the industrial jobs that must be performed, and therefore in the workers' skill sets [12][24]. It's widespread criticism and concern among manufacturers today that finding personnel with the necessary skills to implement and maintain these technologies is proving difficult since current workforce training and expertise will become obsolete as technological sectors will likely evolve at a quicker rate than ever before [10][22]. To fill the consequent skills gap, new jobs requiring higher degrees and technological abilities will arise.

### 5.3.Lack Of Trust and Explainability

Explainable AI is critical for providing clear recommendations with transparent information, evidence, uncertainty, confidence, and risk that people can understand and machines can comprehend [1]. To that end, people want computer systems to perform as expected and to provide clear explanations and justifications for their actions [13][23].

However, there are concerns about the human ability to regulate and comprehend the judgments made by powerful artificial intelligence algorithms. This problem complicates the application of AI systems in a variety of businesses.

### 5.4.Unreal Expectations From AI-Enabled the utilized Systems

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### 5.5.The Need for Accuracy in Data for AI Systems

AI systems cover the vast domains of data capture, data storage, data preparation, and sophisticated data analytics technologies, and are not restricted to a particular component of Data Management. Data Quality is a major issue in today's Enterprise Data Management since company data must be thoroughly cleaned and prepared before it can be utilized as input to any Analytics or Business Intelligence system [10].

Data preparation and exploration require a significant amount of labor, owing to data quality issues. In this regard, according to a recent Price Waterhouse Coopers poll, most big firms now recognize that, after years of accumulating company and consumer data, they are significantly hampered in their ability to exploit sophisticated data technologies owing to low Data Quality [12][25]. Data silos, poor data, data compliance difficulties, a lack of data professionals, and inadequate systems were the top reasons given by corporate leaders in the PwC study for failing to fulfill their data analytics ambitions [8][26].
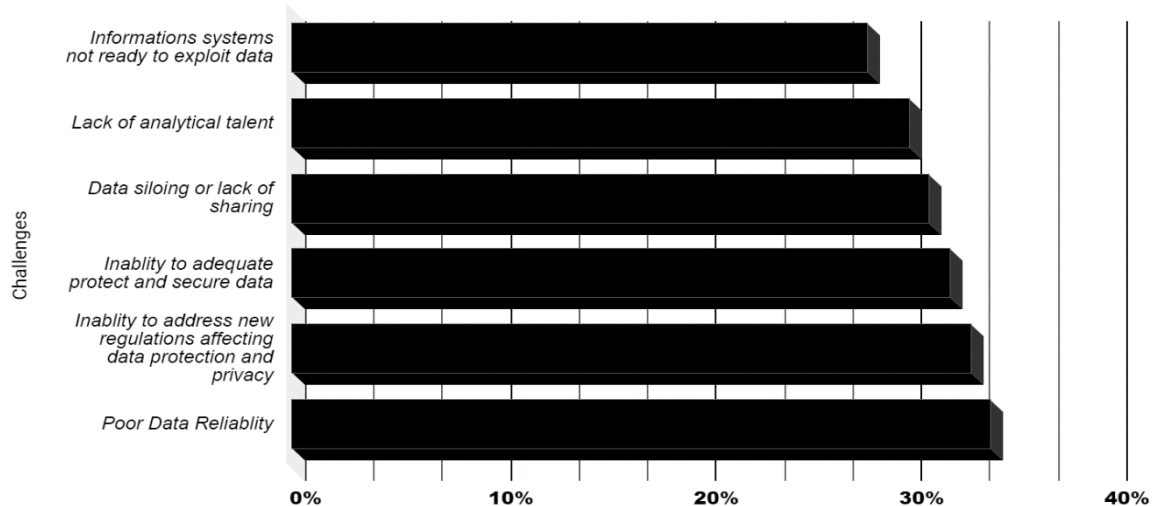
**Figure 4**: AI's challenges with data

*Source- PwC*

## 6. Conclusion

AI systems in manufacturing can play a big role in Industrial Revolution 4.0 by completely changing the ways of manufacturing and designing the products for consumers. While big multinational firms have begun experimenting with AI use cases, large-scale adoption remains uncommon. It will be difficult for manufacturing to enter into the 4.0 age until more companies move beyond pilots and proofs-of-concept to scale. The next industrial revolution can be shaped by manufacturers focusing on AI's most profitable use cases, while also ensuring proper governance, platform, and talent development.

With proper research and vision, AI models can be integrated into a stepwise process involving the integration of AI models with the old manufacturing methods and then slowly eliminating the loopholes of the current model and moving on to a newer and better version until the whole manufacturing unit becomes AI friendly with better efficiency and greater profits.

## 7. References

[1] Lee, Jay & Davari, Hossein & Singh, Jaskaran & Pandhare, Vibhor. Industrial Artificial Intelligence for Industry 4.0-based Manufacturing Systems. Manufacturing Letters. 2018. DOI: 10.1016/j.mfglet.2018.09.002.

[2] World Economic Forum. The Future of Jobs Report: Centre for the New Economy and Society. 2018. URL: https://www.weforum.org/reports/the-future-of-jobs-report-2018.

[3] Meziane, F., Vadera, S., Kobbacy, K. and Proudlove, N. "Intelligent systems in manufacturing: current developments and future prospects", Integrated Manufacturing Systems, Vol. 11 No. 4, pp. 218-238. 2000. DOI: 10.1108/09576060010326221.

[4] Pascal Brosset, Anne-Laure Thieullent, Sergey Patsko, Jerome Buvat, Yashwardhan Khemka, Amol Khadikar, Abhishek Jain. Capgemini India. Scaling AI in Manufacturing Operations: A Practitioners' Perspective. 2019. URL: https://www.capgemini.com/in-en/research/scaling-ai-in-manufacturing-operations/.

[5] Bo-hu Li, Bao-cun Hou, Wen-tao Yu, Xiao-bing Lu & Chun-wei Yang. Applications of artificial intelligence in intelligent manufacturing: a review. Frontiers of Information Technology & Electronic Engineering volume 18, pages 86–96. 2017. DOI: 10.1631/FITEE.1601885.

[6] Deloitte China. AI Enablement on the way to smart manufacturing: Deloitte Survey on AI Adoption In Manufacturing. 2020. URL: https://www2.deloitte.com/cn/en/pages/consumer-industrial-products/articles/ai-manufacturing-application-survey.html.

[7] Wang, Lihui. From Intelligence Science to Intelligent Manufacturing. Engineering 5(4): 615-618. 2019. DOI: 10.1016/j.eng.2019.04.011.

[8] Jiafu Wan, Xiaomin Li, Hong-Ning Dai, Andrew Kusiak, Miguel Martinez-Garcia, Di Li. Artificial-Intelligence-Driven Customized Manufacturing Factory: Key Technologies, Applications, and Challenges. Proceedings of the IEEE (IF10.961), vol. 109, no. 4, pp. 377-398. January 1, 2020. DOI: 10.1109/JPROC.2020.3034808.

[9] Spyros Makridakis, "Forecasting the Impact of Artificial Intelligence, Part 3 of 4: The Potential Effects of AI on Businesses, Manufacturing, and Commerce," Foresight: The International Journal of Applied Forecasting, International Institute of Forecasters, issue 49, pages 18-27, Spring. 2018. URL: https://ideas.repec.org/a/for/ijafaa/y2018i49p18-27.html.

[10] Gartner, Inc. Gartner survey reveals 66% of organizations increased or did not change AI investments since the onset of COVID-19. STAMFORD, Conn., October 1, 2020. URL: https://www.gartner.com/en/newsroom/press-releases/2020-10-01-gartner-survey-revels-66-percent-of-orgnizations-increased-or-did-not-change-ai-investments-since-the-onset-of-covid-19.

[11] World Manufacturing Forum. The 2019 World Manufacturing Forum Report, Skills for the Future of Manufacturing. 2019. URL: https://www. worldmanufacturingforum.org/.

[12] Steffen Kinkel, Marco Baumgartner, Enrica Cherubini. Prerequisites for the adoption of AI technologies in manufacturing – Evidence from a worldwide sample of manufacturing companies, Technovation, 2021, 102375, ISSN 0166-4972. 2021. DOI: 10.1016/j.technovation.2021.102375.

[13] U. Yadav (2021), AI techniques in Information Management, Insights2Techinfo, pp. 1.

[14] Jain, A. K., & Gupta, B. B. (2019). Feature based approach for detection of smishing messages in the mobile environment. Journal of Information Technology Research (JITR), 12(2), 17-35.

[15] Ab Malek, M. S. B., Ahmadon, M. A. B., Yamaguchi, S., & Gupta, B. B. (2016, October). On privacy verification in the IoT service based on PN 2. In 2016 IEEE 5th Global Conference on Consumer Electronics (pp. 1-4). IEEE.

[16] Gou, Z., Yamaguchi, S., & Gupta, B. B. (2017). Analysis of various security issues and challenges in cloud computing environment: a survey. In Identity Theft: Breakthroughs in Research and Practice (pp. 221-247). IGI global.

[17] Manepalli Ratna Sri, Surya Prakash and T Karuna (2021) Classification of Fungi Microscopic Images – Leveraging the use of AI, Insights2Techinfo, pp.1.

[18] Gupta, B. B., Tewari, A., Cvitić, I., Peraković, D., & Chang, X. (2021). Artificial intelligence empowered emails classifier for Internet of Things based systems in industry 4.0. Wireless Networks, 1-11.

[19] Manasrah, A. M., & Gupta, B. B. (2019). An optimized service broker routing policy based on differential evolution algorithm in fog/cloud environment. Cluster Computing, 22(1), 1639-1653.

[20] Sudhakar Kumar, Sunil Kr Singh, Naveen Aggarwal, Kriti Aggarwal, "Evaluation of automatic parallelization algorithms to minimize speculative parallelism overheads: An experiment", pp 1517-1528, 2021 Journal of Discrete Mathematical Sciences and Cryptography, Volume 24, Issue 5 , Taylor & Francis, (2021).

[21] Aggarwal, K., Singh, S. K., Chopra, M., & Kumar, S. (2022). Role of Social Media in the COVID-19 Pandemic: A Literature Review. In B. Gupta, D. Peraković, A. Abd El-Latif, & D. Gupta (Ed.), Data Mining Approaches for Big Data and Sentiment Analysis in Social Media (pp. 91-115). IGI Global. http://doi:10.4018/978-1-7998-8413-2.ch004.

[22] Singh, K. S. (2021). Linux Yourself (1st ed.). Routledge.

[23] Chopra, M., Singh, S. K., Aggarwal, K., & Gupta, A. (2022). Predicting Catastrophic Events Using Machine Learning Models for Natural Language Processing. In B. Gupta, D. Peraković, A. Abd El-Latif, & D. Gupta (Ed.), Data Mining Approaches for Big Data and Sentiment Analysis in Social Media (pp. 223-243). IGI Global. https://www.igi-global.com/gateway/chapter/293158.

[24] Aggarwal, K., Singh, S. K., Chopra, M., & Kumar, S. (2022). Role of Social Media in the COVID-19 Pandemic: A Literature Review. In B. Gupta, D. Peraković, A. Abd El-Latif, & D.

Gupta (Ed.), Data Mining Approaches for Big Data and Sentiment Analysis in Social Media (pp. 91-115). IGI Global. URL: https://www.igi-global.com/gateway/chapter/293151.

[25] Gupta A., Bansal A., Mamgain K., Gupta A. (2022) An Exploratory Analysis on the Unfold of Fake News During COVID-19 Pandemic. In: Somani A.K., Mundra A., Doss R., Bhattacharya S. (eds) Smart Systems: Innovations in Computing. Smart Innovation, Systems and Technologies, vol 235. Springer, Singapore. https://doi.org/10.1007/978-981-16-2877-1_24.

[26] Adil, K., Jiang, F., Liu, S., Grigoriev, A., Gupta, B. B., & Rho, S. (2017). Training an agent for fps doom game using visual reinforcement learning and vizdoom. International Journal of Advanced Computer Science and Applications, 8(12).