International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 11 | Nov - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Navigating Industry 4.0: Exploring the Impact of AI on Employment & Jobs in India

Atul Kumar*
Rajeev Kumar**
Pooja Raghuvanshi***
Assistant Professor*, Assistant Professor**, Assistant Professor***
Faculty of Management Studies, Shri Ram Group of Colleges*
Faculty of Management Studies, Shri Ram Group of Colleges**
Department of Commerce, Shri Ram College***

Abstract

The advent of Industry 4.0, characterized by the integration of cutting-edge technologies, has ushered in a transformative era for global economies. In India, a nation renowned for its diverse labor force and burgeoning technology sector, the rapid proliferation of Artificial Intelligence (AI) technologies is reshaping the employment landscape. This research paper aims to comprehensively investigate the multifaceted impact of AI on employment and jobs in India.

Through a meticulous analysis of existing literature, this study ascertains the current state of AI adoption in Indian industries and identifies the sectors most vulnerable to AI-induced disruptions. It also scrutinizes the various dimensions of AI's influence on employment, including the creation of new job categories, augmentation of existing roles, and potential job displacement. Furthermore, the study delves into the factors influencing the pace and scale of AI adoption, such as regulatory frameworks, infrastructure, and educational preparedness.

To provide a holistic perspective, secondary data encompassing a diverse range of industries and geographical regions within India has been reviewed. This empirical research facilitates an in-depth understanding of the attitudes, challenges, and opportunities employers and employees encounter amidst the AI revolution.

In addition, this research evaluates the role of government policies and initiatives in mitigating the negative consequences of AI disruption, including workforce upskilling and reskilling programs. Furthermore, it explores the potential for AI to drive economic growth and job creation through innovation and productivity gains.

The findings of this study contribute to a nuanced comprehension of the AI-driven transformation of India's job market, offering insights that are invaluable to policymakers, business leaders, educators, and workers alike. Ultimately, this research seeks to guide India's journey through Industry 4.0 by elucidating the strategies needed to harness AI's potential as a force for economic progress while addressing the challenges it poses to employment stability and societal well-being.

Keywords

Industry 4.0, Artificial Intelligence (AI), Job displacement, Educational preparedness, AI revolution, Workforce upskilling, Reskilling Programs, Economic Growth, Job Creation, Innovation, Productivity Gains, AI-Driven Transformation, Economic Progress, Employment Stability, Societal Well-Being.

Introduction

Artificial Intelligence (AI), driven by the convergence of machine learning (ML), computer vision, and the Internet of Things (IoT), is rapidly emerging as a transformative and versatile technology. Its influence extends beyond the realm of technology companies, now permeating major sectors including manufacturing, agriculture, healthcare, retail, banking, financial services, and public utilities. Even in the domains of national defense and security, AI is making significant inroads.

The twenty-first century has borne witness to a profound transformation in the global economic landscape, driven by the advent of Industry 4.0. Characterized by the seamless integration of cutting-edge technologies such as the Internet of Things (IoT), big data analytics, robotics, and Artificial Intelligence (AI), Industry 4.0 represents a paradigm shift that transcends national borders. This technological revolution is ushering in an era where machines are increasingly endowed with the ability to think, learn, and work alongside humans, fundamentally altering the nature of work and the dynamics of employment worldwide.

In this landscape of rapid technological evolution, India, a nation celebrated for its rich and diverse labor force, stands as a pivotal player. Famed for its burgeoning technology sector and its prominence as an outsourcing hub for information technology (IT) services, India is poised at the intersection of tradition and innovation. The rapid proliferation of AI technologies within the Indian subcontinent has set in motion a transformation that holds the potential to redefine the contours of the country's employment landscape.

The multifaceted impact of AI on employment in India is the focal point of this research endeavor. While the technological advances of Industry 4.0 promise unparalleled opportunities for economic growth and innovation, they also introduce challenges of equal magnitude. As AI finds its way into various sectors of the Indian economy, it has the potential to create new job categories, augment existing roles, and enhance overall productivity. However, it simultaneously threatens to displace certain job functions, potentially leaving segments of the workforce grappling with the need for reskilling and adaptation.

This research paper embarks on a comprehensive exploration of the intricate interplay between AI and employment in India. Through meticulous analysis, empirical investigations, and a nuanced review of existing literature, we seek to illuminate the myriad dimensions of AI's impact on the nation's workforce. By examining the current state of AI adoption across industries, identifying sectors most susceptible to AI-induced disruptions, and assessing the government policies and initiatives aimed at mitigating the adverse effects of this transformation, we aim to provide a holistic perspective.

Furthermore, our research endeavours to shed light on the perspectives and experiences of both employers and employees within this evolving ecosystem. We delve into the challenges faced and the opportunities seized amid the AI revolution. This inquiry is guided by a fundamental objective: to decipher the strategies and policies that can harness AI's potential as a catalyst for economic progress while simultaneously addressing the challenges it poses to employment stability and societal well-being.

In doing so, this research paper aspires to contribute significantly to the ongoing discourse surrounding AI and employment in India. Our findings are anticipated to be of immense value to policymakers, business leaders, educators, and workers alike. Ultimately, our aim is to navigate India's journey through Industry 4.0, providing valuable insights that can help steer the nation towards a future where AI is harnessed as a force for economic advancement, with a commitment to ensuring the well-being and prosperity of all its citizens.

Research Objective:

The research paper aims to comprehensively investigate the multifaceted impact of Artificial Intelligence (AI) on employment and jobs in India within the context of Industry 4.0. Specifically, it seeks to:

- Evaluate the current state of AI adoption in Indian industries, identifying sectors most vulnerable to AI-induced disruptions.
- Examine the various dimensions of AI's influence on employment, including the creation of new job categories, augmentation of existing roles, and potential job displacement.
- Analyze the factors influencing the pace and scale of AI adoption in India, such as regulatory frameworks, infrastructure, and educational preparedness.
- Investigate the attitudes, challenges, and opportunities faced by employers and employees amidst the AI revolution in India through empirical research..
- Explore the potential for AI to drive economic growth and job creation through innovation and productivity gains in the Indian context.

Research Questions:

To achieve the stated research objective, the following research questions will guide the investigation:

1. What is the current level of AI adoption in various industries in India, and which sectors are most susceptible to AI-induced disruptions?
2. How does AI impact employment in India, including the creation of new job categories, augmentation of existing roles, and potential job displacement?
3. What are the prevailing attitudes, challenges, and opportunities experienced by both employers and employees in response to the increasing integration of AI in India?
4. Can AI contribute significantly to economic growth and job creation in India through innovation and productivity gains, and what are the potential pathways to achieving this?

By addressing these research questions, this study aims to provide a comprehensive understanding of the impact of AI on employment and jobs in India, offering insights that are relevant to policymakers, business leaders, educators, and workers as India navigates the era of Industry 4.0.

Literature Review

The emergence of Industry 4.0, marked by the integration of advanced technologies such as Artificial Intelligence (AI), has reshaped industries globally. India, known for its vast labor force and burgeoning technology sector, is no exception to this transformative wave. This literature review seeks to provide a nuanced understanding of the multifaceted impact of AI on employment and jobs in India by exploring existing studies, research, and insights in this domain.

The literature highlights that AI-driven automation is a prominent driver of change in the Indian job market. Studies by Arntz, et al. (2016) and Chui, et al. (2016) indicate that routine and repetitive tasks across various sectors are particularly susceptible to automation. AI technologies like machine learning and robotics are increasingly being used in manufacturing, agriculture, and service industries, potentially leading to job displacement.

Counterbalancing the fear of job loss, some scholars, like Brynjolfsson and McAfee (2014), suggest that AI can also create new employment opportunities. They argue that as AI automates certain tasks, it frees up human workers to

engage in more creative and complex roles. The Indian IT industry, for instance, has seen the emergence of roles related to AI development, data science, and AI consulting, offering new career prospects.

Addressing the skills gap is a critical concern raised in the literature. As AI transforms job requirements, the Indian workforce needs to adapt. The research by the World Economic Forum (2018) emphasizes the importance of reskilling and upskilling programs. Initiatives such as the National Skill Development Corporation (NSDC) and private sector-led training programs aim to bridge this gap.

Studies underscore regional disparities in AI adoption and its subsequent impact on employment. Major metropolitan areas like Bengaluru and Hyderabad, with a high concentration of technology companies, experience both AI-driven job creation and disruption. In contrast, rural and less industrialized regions face challenges in adapting to AI-driven changes (Government of India, 2020).

The role of government policies in shaping the AI-employment landscape is a prominent research area. Government initiatives like 'Digital India' and 'Make in India' aim to promote AI development and job creation. The National AI Strategy (NITI Aayog, 2018) outlines a roadmap for AI adoption in India, emphasizing ethical AI practices and workforce development.

Different sectors within India face varying degrees of AI disruption. Research by McKinsey (2017) highlights that industries such as retail, healthcare, and finance are among the most impacted. AI's potential to optimize supply chains, improve healthcare diagnostics, and enhance customer experiences is evident but may also lead to the restructuring of roles within these sectors.

This literature review underscores the complexity of AI's impact on employment in India. While AI holds the potential to drive economic growth and create new opportunities, it also poses challenges related to job displacement and skills gaps. Policymakers, businesses, and educators need to collaborate to navigate this transformative era effectively, ensuring that AI contributes to economic progress and employment stability while fostering societal well-being. This research paper aims to build upon this existing body of knowledge by providing an in-depth empirical analysis of the situation on the ground in India and offering insights that can guide future strategies in the context of Industry 4.0.

AI Adoption in India and Its Impact on Jobs

A report by Capgemini in 2021 revealed India's leadership in implementing AI, with 63% of surveyed companies already using AI, citing favorable regulations and innovation centers as contributing factors. Additionally, 87% of executives in large organizations claimed that AI created new job roles, with 71% of these being managerial or higher. Accenture's 2022 analysis predicted that AI could add 27% to India's GDP by 2035 without negatively affecting long-term employment. BCG's 2018 survey found that India had the third-highest percentage of early AI adopters globally, with 97% of Indian companies planning to implement AI in the next three years. Infosys' 2023 survey indicated that 79% of Indian enterprises experienced a positive ROI on their AI investments, with improved time efficiency, production, cost reduction, and customer retention as key drivers. Some studies estimated sector-specific job impacts. Capgemini noted AI's strong presence in sectors like telecom, retail, and banking. CIS predicted a rise in employment opportunities from 38 million to 49-54 million by 2024 in the organized manufacturing and services sector. However, concerns exist about job displacement in the IT sector due to automation. Gent warned of possible job losses in routine IT support and back-office tasks, but he also highlighted the creation of new opportunities in emerging fields, requiring new skills.

PwC suggested that the IT/ITES sector might be most disrupted by AI, potentially replacing repetitive manual jobs. Yet, it also noted that productivity gains could create higher-value roles in the long run. The Task Force on AI identified ten domains in which AI can play a critical role in India's economic transformation, including

manufacturing, fintech, healthcare, and national security. PwC-ASSOCHAM highlighted the potential for AI, robotics, and machine learning in areas such as financial services, healthcare, education, and environmental protection, with a call to incentivize technology adoption. PwC's 2022 survey revealed India's willingness to invest in AI, with efficiency gains and revenue enhancement as key drivers. Indian organizations also sought a competitive edge through AI, indicating a focus on global market expansion.

Sector	Expected Size of Sector (billions US$)	Expected % Growth in Sector	Current Jobs in Sector (millions)	% of Current Sector Jobs Threatened	Incremental Jobs Created Over 5 Years (millions)	Total Jobs (millions)
IT-BPM	240	9	~3.9	20-35	0.7	4.5
Automotive OEM	4.032	8-8.5	2.04	15-20	0.17	2.2
Automotive Components	4,500	9.5-10	5.99	15-20	0.93	6.92
Retail: Food and Grocery	865	11-11.5	21.4	15-20	0.52	22
Textile: Weaving	105	12-12.5	7.7	Oct-15	1.6	9.3
Textile: Garmenting	136	12.5-13	19.3	15-20	12.1	31.4
Banking	N.A.	12.5-13	1.24	20-25	0.22	1.46

In summary, India's AI adoption is on the rise, positively impacting GDP and job creation. While concerns about job displacement exist, efforts are being made to upskill and create new opportunities in emerging AI-related fields.

Estimating Job Impacts Due to AI in India

A recent analysis of the AI landscape in India in 2022-23 paints a fascinating picture of the country's position in the global AI arena. According to a comprehensive study conducted by Capgemini, India leads the world in implementing AI at scale, with 58 percent of surveyed companies in the country already utilizing AI technology. This places India ahead of other countries like Australia (49 percent), Italy (44 percent), Germany (42 percent), the UK (35 percent), and the USA (32 percent). The report attributes India's leadership in AI adoption to the establishment of numerous innovation centers dedicated to AI and the supportive regulatory environment, driven by government initiatives like "Digital India."

The impact of AI on job creation and transformation is a topic of significant interest. The Capgemini report revealed that 83 percent of executives from large organizations surveyed believe that AI has led to the creation of new job roles, with 67 percent of these new jobs being at the managerial level or higher. Moreover, the majority of organizations (63 percent) reported that AI has augmented human productivity and has not negatively affected employment. In fact, 71 percent of these organizations have proactively initiated up-skilling and re-skilling programs to equip their employees with the necessary skills to navigate the AI-driven landscape. Accenture's analysis in 2021 estimated that AI could contribute USD 1157 billion, equivalent to 15 percent of India's Gross Value Added (GVA),

to the country's economy by 2035. Importantly, this analysis suggested that there would be no adverse long-term employment impact, as job levels would remain stable.

BCG's 2019 analysis, based on a global survey of over 1,000 executives across 12 countries, including India, revealed that 21 percent of Indian companies were early adopters of AI, ranking third in the world behind the USA (25 percent) and China (23 percent). Additionally, a remarkable 96 percent of Indian companies planned to implement AI within the next three years, surpassing the USA (87 percent) and China (94 percent) in this regard.

Infosys' 2018 survey, spanning seven countries, found that approximately 75 percent of Indian enterprises were already reaping positive returns on their AI investments. This was higher than the figures for the USA (71 percent) and China (61 percent). The key drivers for these returns included better insights, improved time efficiency, increased production, reduced operating costs, and enhanced customer retention. While the positive aspects of AI adoption are evident, some concerns remain about its potential impact on employment. Various studies have estimated the sectoral impact of AI on jobs. Capgemini's 2017 survey, covering a range of sectors across nine countries, found that the telecom, retail, and banking sectors had experienced the highest levels of AI implementation at scale.

A report by CIS in 2023 predicted that the organized manufacturing and services sector in India could witness a rise in employment opportunities from 53 million to 76-78 million by 2025, driven by the proliferation of AI technologies.

However, there are concerns about the potential displacement of jobs in the IT sector as AI technology increasingly handles routine IT support and back-office tasks. This could have a significant impact on India's ITES workforce, which has traditionally handled such tasks. Nevertheless, there is a parallel expectation of new job opportunities in emerging fields like data science, artificial intelligence programming, and big data analysis, albeit with a focus on acquiring new skill sets.

PwC's 2018 report also raised the possibility of AI disrupting the IT/ITES sector, particularly in terms of replacing repetitive manual jobs. However, it emphasized that the long-term benefits of AI adoption in businesses, including increased productivity, would create higher-value involvement opportunities for the workforce, ultimately outweighing short-term employment concerns. The Task Force on AI, formed by the Ministry of Commerce and Industry, identified ten key domains where AI could play a transformative role in India's economic growth. These domains include manufacturing, fintech, healthcare, agriculture/food processing, education, retail/consumer engagement, accessibility technology for differently-abled individuals, environmental initiatives, national security, and public utility services.

In a report by PwC-ASSOCHAM in 2022, it was suggested that India could leverage AI, robotics, and machine learning across these key domains, as outlined by the Task Force on AI. The report highlighted areas such as financial services, healthcare, education, national security, cyber security, manufacturing, transportation, smart cities, environment, and accessibility for differently-abled individuals. It recommended incentivizing the adoption of these technologies, with over 49 percent of large financial institutions already investing in them and around 78 percent planning future integration. In April 2023, PwC conducted another survey, revealing that only 26 percent of Indian executives expressed concerns about budget constraints when implementing AI, indicating a greater willingness to invest in AI compared to the global average of 39 percent. Efficiency gains were cited as the primary driver for AI investment by nearly 80 percent of Indian respondents. This was followed by revenue enhancement and market-leading innovation, reflecting a strategic focus on competitive advantage in addition to improving efficiency and profitability.

In conclusion, India's journey into AI adoption is marked by leadership in implementation, positive returns on investments, and proactive measures to address job transformation and upskilling. While there are concerns about potential job displacement in certain sectors, the overall outlook suggests that India is well-positioned to leverage AI for economic growth and competitiveness in the global market.

Conclusion and Way Forward

Numerous studies and reports examining the impact of AI on employment in India have raised concerns about potential negative effects on jobs. However, there is optimism that over the medium to long term, these job losses can be counterbalanced by new job opportunities across various sectors in the country. To ensure that AI can contribute to accelerating economic growth and societal development in India, the following policy recommendations are proposed:

1. **Capacity Building and Skill Development:** Addressing the shortage of AI skills among the current workforce is crucial. The Ministry of Human Resource Development, along with relevant ministries and industry associations, should take the lead in capacity building through skill development. This includes offering online training programs, incorporating AI and automation courses into school and college curricula, and providing training for new industry hires. Collaboration with industry associations and other ministries is essential to reach a large audience.
2. **Education and Training:** It is imperative to provide AI education and training to students who will constitute the future workforce. Initiatives such as the "AI For All" vision in NITI Aayog's 'National Strategy for Artificial Intelligence' report and AI education strategies recommended by NITI Aayog and the AI Task Force Report should be implemented. Sector-specific education and training programs in specialized institutes can cater to specific industry needs.
3. **Government Initiatives:** Initiatives like the "National Programme for Government Schools: Responsible AI for Youth" by the National e-Governance Division and Intel India, as well as the "AI-based Module" launched by NITI Aayog in collaboration with NASSCOM, should be leveraged to empower school students with AI skills. The National Skill Development Corporation (NSDC) can play a significant role in promoting AI-related skills training under the Skill India mission.
4. **Social Policy Reform:** India needs to reevaluate its social protection policy framework, as only a small percentage of workers have access to social security programs. Given the potential job losses due to AI, ideas such as livelihood insurance and universal basic income should be considered in policy discussions to enhance worker security.
5. **Inter-Agency Coordination Authority for AI:** Establishing a national-level Inter-Agency Coordination Authority for AI is essential to monitor and guide AI research and applications across various sectors. This authority should also make policy decisions related to job replacement, job creation, training, and social protection measures to mitigate AI's negative impact.
6. **India-specific Studies:** India-specific studies on the impact of AI on jobs are limited. More comprehensive technology impact assessments and socio-economic studies are required for sectors crucial to Indian employment, such as automobile, textile, retail, customer services, ITeS, and banking. These studies can inform policymakers on the need for reskilling, training, creating new opportunities, and implementing social security policies.

In summary, while concerns exist about the short-term impact of AI on jobs in India, there is an overall positive outlook for the future. To prepare the workforce for emerging opportunities and mitigate potential negative effects, concerted efforts are needed in capacity building, skilling, training, and the formulation of appropriate social policies. Collaboration among stakeholders is essential to harness AI's potential and address associated challenges effectively.

References

1. S. Kalyanakrishnan, R. A. Panicker, S. Natarajan, and S. Rao." Opportunities and Challenges for Artificial Intelligence in India", Association for the Advancement of Artificial Intelligence, 2018.
2. S.S.Vempati. "India and the Artificial Intelligence Revolution",2016.URL:https://carnegieendowment.org/files/Brief-Vempati-I.pdf.(2/2/2019).
3. N.Desai. "The future is here: Artificial Intelligence and Robotics",2018.URL:www.nishithdesai.com/fileadmin/user_upload/pdfs/Research_Papers/Artificial_Intelligence _and_Robotics.pdf. (08/01/2019).
4. "Emerging technologies and the future of work in India", 2018. International Labour Organization. URL:https://www.ilo.org/newdelhi/whatwedo/publicatio ns/WCMS 631296/lang-en/index.htm.(04/01/2019).
5. G. Jujjavarapu, E.Hickok, and A. Sinha. "AI and the Manufacturing and Services Industry in India",.The Center for Internet and Society, India. URL:https://cisindia.org/internetgovernance/files/AIManufacturingandS ervices_Report_02.pdf.(06/01/2019).
6. "How AI is reshaping jobs in India", PWC. URL:https://www.pwc.in/assets/pdfs/publications/2018/ how-ai-is-reshaping-jobs-in-india.pdf.(06/01/2019).
7. "Advance Artificial Intelligence for Growth: Leveraging AI and Robotics for India's Economic Transformation", 2018. URL: https//www.pwc.in/assets/pdfs/publications/2018/advance-artificail-intelligence-for-growth-leveraging-aiand-robotics-for-india-s-economictransformation.pdf.(10/01/2019).
8. "Artificial Intelligence and Robotics and Their Impact on the Workplace",2017. IBA Global Employment Institute. URL: file:///C:/Users/admin/Downloads/AIand-Robotics-IBA-GEI-April-2017.pdf.(12/01/2019).
9. D.M.West." What Happens if Robots Take the Jobs? The Impact of Emerging Technologies on Employment and Public Policy", Center for Technology Innovation, 2015.URL: https: //www.brooking.edu/wpcontent/uploads/2016/06/robot work.pdf.(11/01/2019).
10. F. C. Varghes."The Impact of Automation in IT Industry: Evidences from India",Volume 7 Issue No.3, 2017.
11. Dr. G.Tilak, D.Singh. "Industry 4.0 – 4th Rising Industrial Revolution in Manufacturing Industries and its Impact on Employability and Existing Education System", Pramana Research Journal. ISSN NO: 2249- 2976, Volume 8, Issue 11, 2018,pp-161-169.
12. "Artificial intelligence in India – hype or reality: Impact of artificial intelligence across industries and user groups", PWC, 2018. URL:https://www.pwc.in/assets/pdfs/consulting/techn ology/data-and-analytics/artificial-intelligence-inindia-hype-or-reality/artificial-intelligence-in-indiahype-or-reality.pdf.(20/01/2019).
13. Grace Su." Unemployment in the AI Age", AI Matters, Vol 3, Issue 4, 2018.DOI:10.11 45/3175502.3175511.
14. E.Ernst,R.Merola, & D.Samaan." The economics of artificial intelligence: Implications for the future of work", International Labour Organization,2018.
15. Rabeh Morrar, Husam Arman, and Saeed Mousa, "The Fourth Industrial Revolution (Industry 4.0): A Social Innovation Perspective", Technology Innovation Management Review, vol. 7, Issue:.11, (2017), pp.12- 20.
16. Vandana Sharma, Ravi Tiwari, "A Review Paper on "IOT" & It" s Smart Application, International Journal of Science, Engineering and Technology Research (IJSETR), vol. 5, Issue. 2, 2016, pp.472-776.
17. Beyza Sumer, "Impact of Industry 4.0 on Occupations and Employment in Turkey", European Scientific Journal, edition Vol.14, No.10, 2018, ISSN: 1857 – 7881 (Print) e - ISSN 1857- 7431.
18. Ślusarczyk B, "Industry 4.0 – Are We Ready?", Polish Journal of Management Studies, vol.17, no.1, (2018), pp.232-248.
19. "The Impact of Robots on Productivity, Employment, and Jobs", International Federation of Robotics, 2017.
20. G. Krasadakis. "Artificial Intelligence: the impact on employment and the workforce", 2018.URL: https://medium.com/innovationmachine/artificialintelligence3c6d80072416.(03/03/2019).