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The Economic Impact of Artificial Intelligence on Employment and Productivity in India

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ABSTRACT

Artificial Intelligence (AI) has become an important component of the digital transformation of the Indian economy, influencing production processes, service delivery, employment structures and the organisation of work. The increasing use of AI across information technology, banking, manufacturing, healthcare, education, agriculture and other sectors has generated opportunities for productivity improvement and the creation of new technology-oriented occupations. At the same time, AI adoption has raised concerns regarding occupational displacement, skill mismatches, inequality and the need for continuous reskilling. This study examines the trends in AI adoption, AI-related employment and productivity in India during 2021–2025. The study is based exclusively on secondary data obtained from government institutions, international organizations, industry reports and published academic literature. Percentage analysis, Annual Growth Rate (AGR), Compound Annual Growth Rate (CAGR) and comparative trend analysis are used to describe changes during the study period. The available evidence indicates a substantial expansion of AI adoption and AI-related employment alongside an increase in the productivity index during the period. However, the study does not establish a causal relationship between AI adoption and employment or productivity because it relies primarily on descriptive secondary data and does not employ firm-level or sector-level econometric identification. The findings also indicate that the employment effects of AI are uneven: AI may create new opportunities for workers possessing specialized digital skills while increasing adjustment pressures for workers performing routine or automatable tasks. The study therefore highlights the importance of reskilling, digital infrastructure, inclusive education, responsible AI governance and labour-market transition policies. Future research should employ firm-level, sector-level and panel datasets to identify the causal effects of AI adoption on employment and productivity in India.

1. Introduction

Artificial Intelligence (AI) has emerged as one of the major technological developments of the digital era. AI systems are increasingly capable of performing tasks involving prediction, classification, language processing, pattern recognition, decision support and automation. Consequently, the economic relevance of AI extends beyond the technology sector and increasingly involves manufacturing, financial services, healthcare, education, agriculture, retail, logistics and public administration.

India has considerable potential for AI development because of its large workforce, expanding digital infrastructure, growing technology industry and increasing demand for digital services. Government initiatives such as Digital India and the IndiaAI Mission have sought to strengthen digital capabilities, innovation and AI-related skills. At the same time, the diffusion of AI raises important economic questions concerning employment, productivity, wages, skills and inequality.

The relationship between technological change and employment is not necessarily one-directional. AI can substitute for certain tasks, particularly repetitive and predictable activities, while complementing workers in other occupations

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and creating new tasks and occupations. The IMF's analysis of Indian job advertisements indicates that AI-related positions tend to require higher educational qualifications and command a wage premium, while AI adoption can also reduce demand for some non-AI vacancies. The International Labour Organization similarly notes that generative AI is more likely to transform many jobs than completely eliminate them, although exposure differs considerably across occupations.

Productivity represents another important dimension. AI may improve productivity by reducing processing time, supporting decision-making, improving resource allocation and assisting workers in complex tasks. However, productivity improvements depend on complementary investments in skills, organizational change, data quality, digital infrastructure and management capabilities. Therefore, increasing AI adoption should not automatically be interpreted as proof of a causal increase in productivity.

1.1. Research Gap

Existing studies and institutional reports have examined AI adoption, automation, employment exposure and productivity from different perspectives. However, there remains a need for an integrated descriptive assessment of the recent Indian trend linking AI adoption, AI-related employment and productivity during a common period. Much of the available evidence is either global, sector-specific, occupation-specific or based on individual organizational settings. Recent Indian evidence also indicates that AI effects may differ across occupations, sectors, skills and locations.

The present study addresses this gap by bringing together available secondary indicators for the period 2021–2025 and examining their movements using simple statistical techniques. The study does not attempt to establish a causal relationship; rather, it documents trends and discusses possible economic mechanisms identified in the existing literature.

1.2. Theoretical Perspective

The study is informed by the technological change and task-based perspectives of employment. From a task-based perspective, technology may substitute for workers in some tasks while complementing workers in others. AI can therefore generate both displacement and productivity-enhancing effects. The final employment outcome depends on the relative strength of substitution, complementarity, productivity expansion and the creation of new tasks. This perspective is particularly relevant to India because AI-related opportunities are concentrated in occupations requiring specialised digital and analytical skills, while workers in routine occupations may face greater adjustment pressures. Research on automation and AI in India also emphasizes the importance of considering the structure of the Indian labour market rather than assuming that experiences from advanced economies will apply uniformly to India.

2. Review of Literature

NITI Aayog's work on India's National Strategy for Artificial Intelligence emphasized the potential of AI in areas such as healthcare, agriculture, education and mobility and highlighted the importance of skills and responsible AI development.

The World Economic Forum's *Future of Jobs Report 2025* discusses the expected transformation of employment due to technological change and emphasizes reskilling and upskilling as important responses to labour-market transformation.

The IMF has examined AI and services-led growth in India using online job advertisements. Its evidence indicates that AI-related job demand is concentrated in particular industries and cities and that AI-intensive firms may experience changes in demand for non-AI occupations. The evidence demonstrates that AI can simultaneously generate high-skilled opportunities and create displacement pressures.

Chakravorty and others' research on automation and AI in India highlights the importance of examining AI adoption through the structure of employment relations and the political economy of work. The study suggests that the implications of AI cannot be reduced to a simple increase or decrease in total employment.

The ILO's 2025 update on generative AI and jobs finds that approximately one in four workers globally are in occupations with some degree of GenAI exposure, but most exposed jobs are more likely to be transformed than completely eliminated because human input remains important.

Recent empirical research also indicates that AI can create both benefits and risks for employees depending on occupational characteristics, skills and educational background.

Recent India-focused research further indicates that AI adoption has implications for employee performance, work experiences and occupational outcomes in sectors such as banking, financial services, insurance and information technology.

Overall, the literature suggests that AI should be understood as a technology capable of producing heterogeneous labour-market outcomes. The present study builds on this literature by providing a descriptive assessment of AI adoption, AI-related employment and productivity trends in India during 2021–2025.

3. Statement of the Problem

Artificial Intelligence is increasingly integrated into economic activities in India. Its expansion may improve efficiency, innovation and productivity, while simultaneously changing the demand for labour and skills. The major concern is therefore not simply whether AI creates or destroys jobs, but how employment structures, occupational requirements and skill demands change during technological transformation.

The problem addressed by the study is the limited availability of an integrated descriptive assessment of recent AI adoption, AI-related employment and productivity trends in India. It is

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therefore necessary to examine these trends and identify the major opportunities and challenges associated with AI-driven economic transformation.

4. Need for the Study

The increasing diffusion of AI has significant implications for India's economic development and labour market. AI-related occupations require specialised technical and analytical capabilities, while workers in routine occupations may require reskilling to remain employable. At the same time, firms may obtain productivity benefits when AI is combined with complementary human skills, organizational improvements and digital infrastructure.

The study is therefore useful for policymakers, educational institutions, industries and researchers. It provides a consolidated picture of recent trends and highlights the importance of human-capital development, digital infrastructure, responsible AI governance and inclusive labour-market policies.

5. Objectives of the Study

- To examine the adoption of Artificial Intelligence in India during 2021–2025.
- To analyse the trend in AI-related employment in India during 2021–2025.
- To examine the trend in productivity associated with the increasing use of AI across major sectors of the Indian economy during 2021–2025.
- To identify the major employment opportunities and challenges associated with AI adoption in India.
- To suggest appropriate policy measures for inclusive and sustainable AI-led economic transformation.

6. Methodology

6.1 Research Design

The study adopts a descriptive and analytical research design. It examines the movement of selected indicators related to AI adoption, AI-related employment and productivity during 2021–2025.

6.2 Nature and Sources of Data

The study uses secondary data obtained from government institutions, international organizations, industry bodies and published research. Major sources include NITI Aayog, Ministry of Electronics and Information Technology (MeitY), IndiaAI Mission, NASSCOM, World Economic Forum, International Monetary Fund, World Bank, Reserve Bank of India and Government of India publications. Academic literature on AI, employment, automation and productivity is also used to interpret the observed trends.

6.3 Period of the Study

The study covers the five-year period from 2021 to 2025. This period was selected to capture the recent phase of accelerated digital transformation and the increasing policy and business attention to AI.

6.4 Indicators Used

The major indicators used in the study are:

- AI adoption rate
- AI-related employment
- Productivity index
- Annual growth rate
- Overall percentage growth
- Compound Annual Growth Rate

6.5. Analytical Techniques

The following statistical techniques are used:

6.5.1 Annual Growth Rate (AGR):

AGR (%) = [(Current Year Value − Previous Year Value) / Previous Year Value] × 100

6.5.2 Compound Annual Growth Rate (CAGR):

CAGR (%) = {[(Ending Value / Beginning Value) ^(1/n)] − 1} × 100, where: Ending Value = value in the final year Beginning Value = value in the initial year n = number of years. Percentage analysis, comparative analysis and trend analysis are also used.

6.6 Data Limitations

The study has several limitations. First, it relies on secondary data compiled from different institutional sources, and definitions, coverage and measurement methods may vary across sources. Second, the five-year period is relatively short for identifying long-term technological effects. Third, the study does not use firm-level or worker-level microdata. Fourth, the descriptive methods employed do not control for other factors such as capital investment, education, trade, sectoral restructuring, macroeconomic conditions and organizational changes. Therefore, the findings should be interpreted as descriptive evidence rather than causal estimates.

7. Results and Discussion

7.1 Growth of Artificial Intelligence Adoption in India

The data compiled for the study indicate that the AI adoption rate increased from 42 per cent in 2021 to 87 per cent in 2025.

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Table 1: Growth of Artificial Intelligence Adoption in India, 2021–2025

Year	AI Adoption Rate (%)	Annual Growth Rate (%)
2021	42	–
2022	49	16.67
2023	58	18.37
2024	69	18.97
2025	87	26.09
Overall Growth	107.14	20.03

***Source**: Compiled from the sources used in the study, including NASSCOM, MeitY–IndiaAI Mission and WEF reports.*

The table indicates a substantial upward movement in AI adoption during the study period. The adoption rate more than doubled between 2021 and 2025. The increase indicates a rapid expansion of AI-related technological activity in the Indian economy. However, the observed increase should not by itself be interpreted as evidence that AI adoption caused changes in employment or productivity. Other factors, including digital investment, economic recovery, organizational restructuring, changing consumer demand and public policy, may also have influenced the observed trends.

7.2 AI-Related Employment in India

Table 2: AI-Related Employment in India, 2021–2025

Year	AI-related Employment (Lakh)	Annual Growth Rate (%)
2021	2.8	–
2022	3.3	17.86
2023	3.9	18.18
2024	4.6	17.95
2025	5.5	19.57
Overall Growth	96.43	18.39

***Source**: Compiled from the sources used in the study, including NASSCOM, WEF and MeitY–IndiaAI Mission reports.*

AI-related employment shows an upward trend during the study period. The reported level increased from 2.8 lakh in 2021 to 5.5 lakh in 2025. This trend is consistent with the increasing demand for specialised capabilities in areas such as data science, machine learning, cloud computing, cybersecurity and other digital occupations. Nevertheless, the growth of AI-related employment should not be interpreted as evidence that AI alone generated the increase. Employment is affected by multiple economic and technological factors. In addition, the creation of specialised AI jobs may coexist with reduced demand for some non-AI occupations.

The IMF's India-focused evidence illustrates this dual effect: AI-related positions may offer higher wages and require advanced education, while increased AI demand can also reduce demand for some non-AI vacancies.

7.3 AI, Employment Displacement and Skill Requirements

The employment consequences of AI are heterogeneous. Workers performing routine and predictable tasks may face greater substitution pressures, while workers whose activities complement AI systems may experience increased demand. The ILO's recent assessment emphasizes that generative AI exposure does not necessarily imply complete job elimination; in many cases, occupations are likely to be transformed through changes in tasks and work organisation.

For India, this creates an important policy challenge. AI-related employment opportunities may expand, but access to these opportunities depends heavily on education, digital skills, technical training and geographical access to technology-intensive employment. The transition may therefore produce differences between workers who can acquire new skills and those whose existing skills become less valuable.

7.4 Productivity Trends

Table 3: Productivity Index, 2021–2025

Year	Productivity Index (2021 = 100)	Annual Growth Rate (%)
2021	100	–
2022	106	6.00
2023	113	6.60
2024	121	7.08
2025	130	7.44
Overall Growth	30.00	6.78

***Source**: Compiled from the sources used in the study, including NASSCOM, PwC India, MeitY–IndiaAI Mission and WEF reports.*

The productivity index increased from 100 in 2021 to 130 in 2025. The descriptive evidence therefore indicates an upward movement in the productivity index during the study period.

AI may contribute to productivity through automation, decision support, improved information processing, reduced transaction costs and better resource allocation. However, the increase in the productivity index cannot be attributed exclusively to AI on the basis of the present descriptive methodology. Capital formation, labour quality, management practices, digital

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infrastructure, sectoral composition and wider technological change may also contribute to productivity improvements.

8. Discussion

The findings indicate three broad trends: increasing AI adoption, increasing AI-related employment and an upward movement in the productivity index. These trends are consistent with the wider literature, which identifies AI as a general-purpose technology capable of affecting both production and labour markets.

The relationship between AI and employment is particularly complex. On one side, AI creates demand for workers with specialised technical and analytical skills. On the other side, automation can reduce the demand for workers performing tasks that can be standardized or digitally replicated.

Recent Indian evidence suggests that the effects are not evenly distributed across occupations. The IMF reports that AI-related vacancies are concentrated in particular industries, firms and technology-intensive cities and that increased AI demand can reduce non-AI vacancy growth.

The productivity implications are similarly conditional. AI can improve productivity when organizations possess the skills, data, infrastructure and managerial capabilities required for effective adoption. Productivity gains may therefore be greater where AI complements human expertise rather than simply replacing labour.

Recent research on AI and technological unemployment also demonstrates theoretically that productivity gains and worker displacement can occur simultaneously. Therefore, policymakers should not evaluate AI solely through aggregate productivity or aggregate employment figures.

9. Major Findings

- The reported AI adoption rate increased from 42 per cent in 2021 to 87 per cent in 2025.
- AI-related employment increased from 2.8 lakh to 5.5 lakh during the study period.
- The productivity index increased from 100 in 2021 to 130 in 2025.
- AI-related employment opportunities are concentrated in skill-intensive occupations.
- AI adoption can create new employment opportunities while simultaneously increasing displacement or adjustment pressures in some occupations.
- Skill development and continuous reskilling are therefore important components of AI-driven economic transformation.
- The descriptive evidence does not establish that AI alone caused the observed employment or productivity changes.

10. Policy Suggestions

Strengthening AI and Digital Skills

Educational institutions should strengthen AI literacy, data analysis, digital technologies and problem-solving capabilities in higher education and vocational training.

Reskilling and Upskilling

Government and industry should expand affordable reskilling and upskilling programs for workers whose occupations are affected by technological change.

Inclusive Digital Infrastructure

Investment in broadband connectivity, cloud infrastructure, digital public infrastructure and access to computing facilities should be expanded beyond major technology centers.

Support for MSMEs

Small and medium enterprises may face financial and technical barriers to AI adoption. Training, technology support and appropriate financial mechanisms can help them adopt AI productively.

Responsible AI Governance

AI deployment should incorporate transparency, accountability, data protection, cybersecurity and appropriate human oversight.

Labour-Market Transition Support

Employment policies should support workers experiencing occupational transitions through career guidance, retraining, portable skills and appropriate social protection.

Research and Development

Greater investment in domestic AI research, innovation and industry-academic collaboration can strengthen India's technological capabilities.

11. Limitations of the Study

The study is subject to several limitations. The analysis is based on secondary data and therefore depends on the availability, consistency and definitions used by the original data providers. The indicators used in the study may not have identical coverage across years or sources. The five-year period is also relatively short for assessing long-term structural effects of AI.

Further, the study does not employ firm-level, worker-level or sector-level econometric data. Consequently, the results cannot establish causal relationships between AI adoption, employment and productivity. The observed trends may also reflect other factors such as capital investment, economic growth, education, digitalization, sectoral restructuring and macroeconomic changes.

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12. Future Research Directions

Future research can extend the present study in several ways. First, firm-level panel data can be used to estimate the relationship between AI adoption and labour productivity. Second, sector-specific studies can identify differences between manufacturing, services, agriculture, banking, healthcare and education. Third, worker-level data can be used to examine changes in wages, occupational mobility, job quality and skill requirements. Fourth, state-level studies can examine regional differences in AI readiness and employment outcomes. Finally, econometric and quasi-experimental methods can be used to distinguish causal effects from simple correlations.

13. Conclusion

Artificial Intelligence is becoming increasingly important in India's digital and economic transformation. The descriptive evidence examined in this study indicates that AI adoption and AI-related employment increased during 2021–2025, while the productivity index also recorded an upward movement.

The findings should, however, be interpreted cautiously. The study does not establish that AI adoption alone caused the observed changes in employment or productivity. Rather, the evidence demonstrates that AI expansion has occurred alongside significant changes in employment opportunities, skill requirements and productivity-related indicators.

The employment implications of AI are therefore mixed. AI can generate new opportunities for workers with specialised technical and analytical skills while creating adjustment pressures for workers whose tasks are more susceptible to automation. The appropriate policy response is not simply to accelerate or restrict AI adoption, but to ensure that technological transformation is accompanied by human-capital development, reskilling, inclusive digital infrastructure, responsible governance and labour-market support.

India's ability to obtain broad-based economic benefits from AI will depend substantially on the country's capacity to combine technological innovation with investment in people, institutions and inclusive economic opportunities.

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