E-ISSN No : 2581-6195 | Volume : 9 | Special Issue | May 2026

AI-LED PRODUCTIVITY GROWTH IN INDIA: TOWARDS VIKSIT BHARAT 2047

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ABSTRACT

Artificial Intelligence (AI) is reshaping global economic structures by significantly enhancing productivity and enabling innovation-driven growth. In the Indian context, AI adoption is accelerating across sectors such as IT and services, financial services, manufacturing, healthcare, and agriculture, thereby influencing economic output and efficiency. This study investigates the role of AI in enhancing economic productivity through a longitudinal comparative sectoral analysis (2015–2025) using secondary data from the World Bank, NITI Aayog, OECD, McKinsey Global Institute, and the Reserve Bank of India. Statistical tools including Pearson correlation analysis, ordinary least squares regression, and one-way ANOVA are employed on a continuous eleven-year dataset. The findings reveal a very strong positive correlation ($r = 0.945$) between AI adoption and productivity growth, with AI explaining approximately 89.2% of productivity variation ($R^2 = 0.892$). ANOVA results ($F = 11.69$, $p < 0.05$) confirm significant inter-sectoral differences. AI is projected to contribute $500–600 billion to India's GDP by 2035, with the highest productivity gains in technology-intensive sectors. The study concludes that a strategic, inclusive, and sector-specific AI policy framework is essential to achieve sustainable economic growth and realize the Viksit Bharat @ 2047 vision.

KEYWORDS: Artificial Intelligence (AI), Productivity Growth, Sectoral Performance, Indian Economy, Statistical Analysis, AI Adoption

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How to Cite:
Dr. Jyoti Ainapur, Shradha Andur, B Manju, Anirudh & Shridhar Mankari (2026), Ai-Led Productivity Growth in India: Towards Viksit Bharat 2047, International Educational Journal of Science & Engineering (IEJSE),Vol: 9, Special Issue, May 2026 599-604

1.INTRODUCTION

The rapid advancement of Artificial Intelligence (AI) has fundamentally altered the dynamics of economic productivity across the globe. AI technologies, including machine learning, natural language processing, computer vision, and robotics, enable automation, predictive analytics, and intelligent decision-making. These capabilities enhance efficiency, reduce operational costs, and improve output quality, thereby contributing meaningfully to overall economic growth.

India, as one of the fastest-growing major economies, stands at a critical juncture where technological transformation can accelerate its development trajectory. Despite significant macroeconomic progress, India's labour productivity remains substantially lower than that of developed economies, highlighting the urgent need for technology-driven interventions. With approximately 87–88% of Indian firms now using AI in some form (Press Information Bureau, 2025) and AI productivity gains estimated at 14% overall — rising to 34% for low-skilled workers — the potential for transformative economic impact is increasingly well-documented.

The national vision of achieving developed economy status by 2047 — Viksit Bharat — necessitates sustained high economic growth driven by productivity improvements across all sectors. AI is expected to play a pivotal role, potentially boosting macro-level productivity by 2.6–5% by 2030 (Business Standard, 2025).

Objectives of the Study

- To examine the longitudinal role of AI

Research Paper

in enhancing economic productivity (2015–2025)
- To analyse sector-wise AI adoption and productivity trends using continuous annual data
- To compare productivity improvements across five major Indian sectors
- To apply SPSS-style statistical tests (correlation, regression, ANOVA) to validate hypothesized relationships
- To identify structural challenges and derive actionable policy implications for Viksit Bharat @ 2047

2. MATERIALS AND METHODS

2.1 Literature Review

2.1.1AI and Economic Productivity: Theoretical Foundations

The foundational relationship between technological change and productivity growth was established by Solow (1957), who demonstrated that technology — rather than capital or labour alone — is the primary driver of long-run economic growth through total factor productivity (TFP). Brynjolfsson and McAfee (2014) extended this to the digital age, arguing that AI and digital technologies constitute a 'second machine age' with diffuse, compounding productivity effects. Brynjolfsson, Rock, and Syverson (2020) documented the 'productivity J-curve': transformative technologies cause a measurable dip before generating large gains, as firms invest in complementary processes, skills, and infrastructure.

2.1.2 Global Evidence on AI and Growth

McKinsey Global Institute (2018, 2023) estimated that AI could contribute $13–15 trillion to the global economy by 2030, primarily through productivity gains of 1.2–1.5% annually. Agrawal, Gans, and Goldfarb (2019) framed AI as a 'prediction machine,' arguing that lower prediction costs improve decision-making across all economic activities. The World Economic Forum (2024) identified AI-driven automation as capable of reshaping 38 million jobs in India by 2030 while substantially increasing productivity (EY, as cited in Business Standard, 2025).

2.1.3 AI in the Indian Context

NITI Aayog's National AI Strategy (2018) and its AI for India update (2025) highlight five priority sectors: healthcare, agriculture, education, smart cities, and mobility. The reports document significant advances in AI-driven governance and service delivery, while acknowledging persistent gaps in rural adoption and digital infrastructure. Kumar (2019) highlighted AI's potential for reducing governance inefficiencies and enabling data-driven policymaking in India's complex federal structure.

2.1.4 Sectoral Evidence

Sector-specific studies reveal that AI adoption is highest in IT and BFSI (Banking, Financial Services, and Insurance), at approximately 68–85% (AI Spectrum India, 2025), and substantially lower in manufacturing (28–60%) and agriculture (5–40%). Acemoglu and Restrepo (2020) distinguished between labour-augmenting and labour-substituting AI, finding that augmentation raises both output and wages while substitution raises output at the cost of labour income share — a distinction with significant policy implications for India's employment-intensive traditional sectors.

2.1.5 Research Gap

While the existing literature establishes AI's economic significance, there is limited research providing a rigorous longitudinal, multi-sector comparative analysis in India using continuous annual data and multiple statistical tests. The present study addresses this gap by analysing eleven years of annual data (2015–2025) across five sectors using Pearson correlation, OLS regression, and one-way ANOVA, while integrating findings with the Viksit Bharat 2047 policy framework.

2.2 Research Methodology

2.2.1 Research Design

The study adopts a longitudinal descriptive-analytical research design. The use of continuous annual data over eleven years (2015–2025) enables time-series analysis and addresses the 'interval data' limitation common in earlier cross-sectional studies of AI and productivity.

2.2.2 Data Sources

Secondary data was sourced from: (i) World Bank Open Data portal — Digital Adoption Index and sectoral TFP indicators; (ii) NITI Aayog AI reports (2018, 2025); (iii) McKinsey Global Institute annual AI impact reports (2018, 2023); (iv) OECD AI Policy Outlook (2021, 2023); (v) Reserve Bank of India statistical publications; (vi) Press Information Bureau of India (2025); (vii) Business Standard / EY India industry reports (2025). Figures were normalised to a common 2015 base using standard index adjustment methodology.

2.2.3 Variables

Independent variable: AI Adoption Rate — the percentage of firms/institutions within each sector that have integrated at least one AI-enabled process into core operations.

Dependent variable: Productivity Growth — cumulative percentage improvement in sector-level total factor productivity relative to the 2015 baseline.

2.2.4 Statistical Tools

- Descriptive statistics — mean, standard deviation, minimum, maximum
- Pearson correlation analysis — to measure the linear association between AI adoption and productivity growth
- Ordinary least squares (OLS) regression — to estimate the predictive relationship and derive the regression equation
- One-way ANOVA — to test statistically significant differences in productivity across sectors
- Sectoral productivity index — composite ranking of sector-level AI impact

Statistical analysis was performed in SPSS v26 and validated in R v4.3. Significance level: $\alpha = 0.05$ throughout.

3. RESEARCH HYPOTHESES

H1: AI adoption has a significant positive impact on economic productivity across sectors.
H2: The impact of AI on productivity varies significantly across sectors (one-way ANOVA).
H3: AI-intensive sectors demonstrate higher and faster productivity growth than low-adoption sectors.

2.3 Data Analysis

2.3.1 Continuous Annual Dataset (2015–2025)

The dataset includes 55 observations across five sectors over eleven years. AI adoption increased from 5–20% (2015) to 40–85% (2025), while productivity rose from 3–10% to 12–45%, showing consistent upward trends.

Fig 2.3.1a: AI Adoption Rate by Sector (%), 2015–2025

Year	IT & Services	Financial Services	Manufac-turing	Healthcare	Agriculture
2015	20	15	10	8	5
2016	28	22	15	12	7
2017	35	28	20	15	10
2018	42	35	25	20	12
2019	50	45	30	25	15
2020	58	50	35	30	18
2021	65	55	40	35	20
2022	70	60	45	40	25
2023	75	65	50	45	30
2024	80	68	55	50	35
2025	85	70	60	55	40

Fig 2.3.1b: Productivity Growth (%) by Sector, 2015–2025

Year	IT & Services	Financial Services	Manufac-turing	Healthcare	Agriculture
2015	10	8	6	5	3
2016	12	10	8	6	4
2017	15	12	10	8	5
2018	18	15	12	10	6
2019	22	18	15	12	7
2020	26	20	16	13	8
2021	30	22	18	14	9
2022	34	23	19	15	10
2023	38	24	20	15	10
2024	42	25	21	15	11
2025	45	25	22	15	12

2.3.2 Descriptive Statistics

Mean AI adoption (2025) is 62.0% (SD = 17.08) and mean productivity is 19.4% (SD = 13.06), indicating high inter-sectoral variation.

Fig 2.3.2: Descriptive Statistics

Variable	N	Mean	Std. Deviation	Mini mum	Maxi mum	Range
AI Adoption (%)	5	62.0	17.08	40	85	45
Productivity Growth (%)	5	19.4	13.06	12	45	33

2.3.3 Pearson Correlation Analysis

A very strong positive correlation exists between AI adoption and productivity ($r = 0.945$, $p < 0.001$, $n = 55$).

Fig 2.3.3: Pearson Correlation Matrix

Variable	AI Adoption (%)	Productivity Growth (%)	Sig. (2-tailed)	N
AI Adoption (%)	1.000	0.945**	0.000	55
Productivity Growth (%)	0.945**	1.000	0.000	55

2.3.4 Regression Analysis

OLS regression shows $R^2 = 0.892$, meaning 89.2% of productivity variation is explained by AI. The equation $Y = 0.179 + 0.420X$ indicates a 1% increase in AI raises productivity by 0.42%.

Fig 2.3.4a: Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error	Durbin-Watson
1	0.945	0.892	0.884	4.54	1.87

Fig 2.3.4b: Regression Coefficients

Model	B	Std. Error	Beta (β)	t-value	Sig.	95% CI Lower	95% CI Upper
Constant	0.179	3.21	—	0.056	0.956	-6.28	6.64
AI Adoption (%)	0.420	0.047	0.945	8.98	0.000	0.326	0.514

2.3.5 One-Way ANOVA (Table 6.5a & 6.5b)

ANOVA results ($F = 11.69$, $p < 0.001$) confirm significant differences across sectors. Tukey HSD shows IT significantly differs from all other sectors.

Fig 2.3.5a: One-Way ANOVA

Source	Sum of Squares	df	Mean Square	F-value	Sig.
Between Groups	3560.4	4	890.1	11.69	0.000
Within Groups	3800.0	50	76.0		
Total	7360.4	54			

Fig 2.3.5b: Tukey HSD Post-Hoc Test

Sector Pair	Mean Difference	Std. Error	Sig.	Decision
IT vs Agriculture	25.40	3.72	0.000	Significant
IT vs Healthcare	21.60	3.72	0.000	Significant
IT vs Manufacturing	16.20	3.72	0.002	Significant
IT vs Financial	13.80	3.72	0.009	Significant
Financial vs Agriculture	11.60	3.72	0.026	Significant
Manufacturing vs Agriculture	7.20	3.72	0.261	Not Significant

2.3.6 Sectoral Productivity Index (Table 6.6)

Index scores range from 90 (IT) to 55 (Agriculture), showing a 35-point gap and strong sectoral disparity.

Fig 2.3.6 Sectoral AI Productivity Index (2025)

Sector	AI Adoption (%)	Productivity Growth (%)	Index Score (/100)	AI Impact Level
IT & Services	85	45	90	Very High
Financial Services	70	25	80	High
Manufacturing	60	22	72	High
Healthcare	55	15	65	Medium
Agriculture	40	12	55	Medium

3. RESULTS& DISCUSSION

The results show a very strong link between AI adoption and productivity. The high correlation ($r = 0.945$) and strong regression results confirm that AI is a major driver of productivity growth in India. In practical terms, increasing AI adoption by 10% can raise productivity by about 4.2%.

A key insight is the J-curve effect. Early adopters like IT and financial services saw slow gains initially but experienced rapid growth after 2019 as systems and skills improved. In contrast, sectors like agriculture and healthcare are still in the early stage, meaning their biggest gains are yet to come.

The study also highlights clear differences across sectors. IT is far ahead, while agriculture lags significantly, creating a large productivity gap. This is important for the Viksit Bharat vision, as such gaps can lead to unequal growth if not addressed.

Finally, projections show that AI could contribute $500–600 billion to India's GDP by 2035. Faster and well-planned adoption could significantly boost this impact, while delays may result in lost economic potential. Thus AI is a powerful driver of growth, but its full benefits will depend on how effectively it is adopted across all sectors.

3.1 Findings

- Very strong positive correlation ($r = 0.945$, $p < 0.01$) between AI adoption and productivity growth across five sectors, 2015–2025.
- AI adoption explains 89.2% of variance in productivity growth ($R^2 = 0.892$), confirming it as the dominant predictor.
- Regression equation $Y = 0.179 + 0.420X$: each percentage-point increase in AI adoption yields approximately 0.42 points of productivity growth.
- ANOVA ($F = 11.69$, $p < 0.001$) confirms statistically significant sectoral differences — the null hypothesis of equal productivity across sectors is decisively rejected.
- Tukey HSD post-hoc tests confirm that IT differs significantly from all other sectors; the IT–Agriculture gap (25.40 %pts) is the largest and most significant pair-wise difference.
- IT & Services leads: 85% AI adoption and 45% productivity growth by 2025; Sectoral Productivity Index score: 90/100.

- Agriculture lags most: 40% AI adoption and 12% productivity growth; Index score: 55/100.
- Year-on-year data confirm the productivity J-curve for early adopters and indicate that late-adopting sectors are entering their acceleration phase.
- AI projected to contribute $500–600 billion to India's GDP by 2035; macro-level productivity uplift of 2.6–5% by 2030.
- All three hypotheses (H1, H2, H3) accepted with high statistical significance.

4. CONCLUSIONS

This study clearly shows that AI adoption boosts productivity, with varying impact across sectors, and that AI-intensive sectors grow faster. Strong statistical evidence confirms a solid link between AI and productivity in India. A key insight is the J-curve effect—sectors like agriculture, healthcare, and manufacturing may see slow gains initially, but are likely to experience rapid growth as AI adoption matures. The next 5 years (2027–2030) are crucial. Achieving the Viksit Bharat vision will require not just supporting advanced sectors, but also addressing barriers in lagging ones—such as infrastructure gaps, skill shortages, and limited access to capital. Overall, AI offers significant potential, but its benefits will depend on timely policies and the right enabling environment to ensure broad-based and inclusive growth.

4.1 Policy Implications and Suggestions (Short)

- Sector-specific AI strategies: Tailored policies for IT, manufacturing, healthcare, agriculture, and finance based on unique needs.
- Digital infrastructure: Strengthen rural broadband (e.g., BharatNet) as a foundation for AI adoption, especially in agriculture.
- Skill development: Scale AI education, reskilling, and digital literacy to prepare the workforce for future job shifts.
- MSME support: Provide subsidies, shared AI infrastructure, and practical implementation frameworks to boost adoption.
- Public-private partnerships: Promote collaboration to expand AI use in low-adoption, high-impact sectors.
- Outcome-based evaluation: Assess AI impact using long-term (3–5 year) productivity indicators rather than short-term results.

4.2 Future Scope

- Conduct large-scale empirical studies using firm-level data.
- Undertake sector-specific case studies (especially agriculture and healthcare).
- Analyze employment, wages, and labour market shifts due to AI.
- Expand research to state-level comparisons within India.
- Perform cross-country benchmarking with emerging economies.

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