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The Role of Artificial Intelligence in Shaping Innovation, Employment, and Growth in India

Ms. Renu Singh[1*] & Dr. Havisha Gupta[2]
[1]Assistant Professor, University of Delhi, Delhi, India.
[2]Assistant Professor, University of Delhi, Delhi, India.

***Corresponding Author:** renusingh.du.commerce@gmail.com
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Abstract

Rapid developments in automation, robots, and artificial intelligence (AI) are causing a significant shift in India's labour and economy. By helping workers, taking the place of monotonous tasks, and opening up new job prospects, these technologies are changing the nature of the labour market. Call centres, banking, healthcare, retail, manufacturing, and agriculture have all experienced substantial disruptions since AI became widely used in 2019. By 2026, automation is expected to eliminate around 5.1 million jobs in India, but AI is also increasing need for highly trained workers in fields like data science, machine learning, AI ethics, and human-machine cooperation. Positively, AI applications encourage innovation across industries, increase productivity, and lower prices. Healthcare diagnostics, financial fraud detection, agricultural quality testing, and logistics optimization are a few examples of applications for artificial intelligence. According to McKinsey, by 2030, AI may create 20–50 million employment worldwide. On the other hand, the drawback suggests hazards for low-skilled positions in blue-collar, data entry, IT, and customer service sectors. Workers from lower-income groups are disadvantaged by this, exacerbating India's socioeconomic inequities, which are already characterized by gender inequality, wealth gaps, income disparities, and inadequate healthcare. If these workers don't upskill, they run the danger of losing their jobs and having less social mobility. In response, the government has launched projects like talent development plans, AI skill penetration programs, and strategies for growing the digital economy. In order to expand the AI ecosystem, it places a strong emphasis on collaborations between government, business, and academia. A nodal AI authority

should be established, inclusive data strategies should be developed, startups should be encouraged, AI research and development should be increased, safety and ethics standards should be strengthened, and educational reforms should be implemented to close the skills gap in AI. AI has enormous promise to solve pressing issues in national development, healthcare, and education in the future. India may be able to use AI similarly to its previous IT revolution with the right infrastructure, policy, and human capital development. However, it is still essential to strike a balance between financial advantages and fair employment security. AI has the potential to propel sustainable growth, assist programs like Digital India and Skill India, and position India as a global leader in technological innovation if it is used intelligently.

Keywords: AI, Innovation, Indian Economy, Economic Growth, Job Opportunities.

Introduction

A new era of automation has been brought about by recent advancements in artificial intelligence (AI), robotics, and the Internet of Things. AI-led technologies, robotics, and computers are now capable of carrying out not only routine tasks but also those that were previously limited to human intelligence and other tasks.

Therefore, there are three ways that AI may affect employment. In some jobs, it can assist humans; in other positions, it can fully replace humans; and in yet other jobs, it can create new kinds of jobs for people. Given the circumstances, it is critical to comprehend the extent to which this technological innovation has affected employment and jobs in India and what has been its impact on growth.

Since the introduction of AI in 2019, the employment landscape in India has changed. The emergence of OpenAI signalled a sea change by automating repetitive tasks and upending industries like call centres and data input. According to a research by the World Economic Forum, the growing impact of automation and AI-related technologies is expected to displace almost 5.1 million employment in India by 2026.

However, this advancement in AI has created a new variety of highly skilled employment by opening up a myriad of chances in data science, engineering, and machine learning. AI has brought about both disruption and adaptation; the potential for AI to transform established industries like education, healthcare, and agriculture balances out issues like the digital divide and societal discontent.

The incorporation of artificial intelligence (AI) into a variety of industries signifies a change in technology and a revolutionary economic force that has the potential to completely alter how businesses function and compete. Beyond simple automation, this development of AI affects many facets of economic growth, including labour markets, educational systems, and dynamics of international trade. AI's capacity to increase productivity and stimulate innovation creates new opportunities

for economic growth and brings up significant issues related to inequality and competition. As AI technologies develop, they create ever-more intricate relationships inside global economic systems, drawing interest from scholars, decision-makers, and business executives who want to comprehend and take advantage of these shifts.

A dynamic and developing field of study, the relationship between AI innovation and economic growth is based on a number of theoretical underpinnings. Knowing how these theories interact sheds light on how artificial intelligence (AI) as a technical advancement might promote economic growth and change in various international economies.

Economic growth theories offer a comprehensive explanation of the relationship between innovation and economic development, especially those put forth by Schumpeter and contemporary endogenous theorists like Romer (1990) and Lucas Jr. (1988). In the context of AI, Schumpeter's theory of "creative destruction" has a lot of resonance, since AI frequently sparks significant shifts in a variety of industries, upending labour markets and business models while promoting new kinds of economic activity and productivity (Aghion & Howitt, 1990). In addition to being destructive, this disruption also generative, opening up previously unattainable possibilities for growth and development.

At the cutting edge of knowledge and technology, artificial intelligence (AI) is a prime example of how technical investment spurs innovation and increases economic outputs through enhanced capabilities and efficiencies. Together, these theories imply that the route to long-term economic expansion is largely dependent on how well an economy uses AI in its innovation ecosystem.

There is still a lack of knowledge regarding the precise processes by which AI innovation leads to economic growth in various institutional and economic contexts, despite the abundance of theoretical frameworks accessible. The majority of current research concentrates on the broad effects of technology on growth without exploring the particular characteristics of AI, including its capacity for self-learning and its effects on productivity and labour markets across a range of industries. Furthermore, more thorough research is needed to determine how AI differs in its effects in developing and developed countries, which are influenced by variables like innovation system efficiencies and technology diffusion rates.

By offering a variety of perspectives on this relationship, these theories together encourage investigating the ways in which AI innovation affects economic growth. The significance of continuous innovation and the revolutionary potential of AI on economic structures are emphasized by Schumpeterian and endogenous growth theories (Schumpeter, 2021). On the other hand, theories of innovation systems and technology diffusion emphasize the significance of widespread and successful adoption as well as beneficial ecosystem interactions and policies. By analysing AI

innovation using these theoretical frameworks, its economic effects may be thoroughly examined, assisting company executives and policymakers in utilizing AI's potential for long-term prosperity.

In this regard, advancements in artificial intelligence stimulate economic growth by bringing about new capacities and efficiencies that are essential for increasing economic outputs and productivity. This theory is supported by the positive connections found between AI-related factors and GDP growth, including national AI plans, patent applications, patents per million people, and scholarly publications on AI. These factors represent the creation of new technological knowledge as well as its application and economic integration, two crucial processes that are highlighted by both Schumpeterian and endogenous growth models.

In conclusion, the advancements in artificial intelligence are positively correlated with the acceleration of economic growth. By clearly demonstrating how artificial intelligence affects economic dynamics, the in-depth analysis of each artificial intelligence component adds to a more nuanced understanding that is consistent with both classical and contemporary theories of economic growth. This provides strong support for the original theory and emphasizes how crucial artificial intelligence is in determining the directions of modern economic growth.

Positive Impact of AI Application

Impact of AI on Employment Opportunities in Indian Context

Proponents of artificial intelligence contend that rather than being a destroyer, technology may create jobs. The potential for AI to boost productivity and efficiency in a variety of industries could result in the creation of new jobs involving human intellect, creativity, and emotional intelligence—areas where machines now lack these skills. Artificial intelligence, machine learning, and data science experts are needed for the creation and upkeep of AI systems, for instance. Experts in these domains are becoming more and more in demand as industries embrace AI.

The need for automation, improved decision-making, and the ability to collect and analyse large amounts of data are currently driving the need for artificial intelligence (AI) in industry. The following are some of the primary industries within the three Indian economic sectors that are currently using AI:

- **Healthcare**: AI is being utilized in healthcare to analyse medical pictures, aid in diagnosis, and create individualized treatment regimens.
- **Finance:** AI is being used for portfolio management, risk assessment, and fraud detection.
- **Retail**: AI is being used to improve the customer experience and personalize recommendations.

- **Human Resource**: AI is being used in human resources to help with hiring, onboarding, and staff retention.
- **Logistics and Transportation**: AI is being used for driverless cars, demand forecasting, and route optimization.
- **Cyber Security**: AI is being used in cyber security for incident response, threat intelligence, and intrusion detection.
- **Marketing**: AI is being used to analyse vast volumes of consumer data, forecast consumer behaviour, and improve advertising efforts.
- **Manufacturing**: AI is being applied to quality control, process optimization, and predictive maintenance.
- **Energy**: AI is being used for solar energy forecasts, smart grid management, and predictive maintenance of power facilities.
- **Agriculture**: AI is being applied to yield prediction, crop monitoring, and precision farming.

It is evident that the services industry is where AI is most likely to create job opportunities, and this sector may also see significant disruptions.

Furthermore, AI has the potential to enhance human talents, enabling workers to focus on more strategic and complicated activities while delegating ordinary duties to machines.

A McKinsey & Company analysis projects that by 2030, artificial intelligence would generate 20–50 million new employment globally. These new positions will be in a variety of sectors, such as manufacturing, banking, and healthcare. AI is creating a number of new career roles, some of which include:

- **AI Teachers and Trainers**: These are the people in charge of instructing and training AI systems. They create new AI systems and applications and ensure that AI algorithms are precise and efficient.
- **Scientists and data analysts**: As the amount of data produced by AI systems grows, there is a growing need for people with the skills to analyze and interpret this data. AI technologies are used by data scientists and analysts to examine data and identify trends and insights that could aid companies in making better decisions.
- **Human-Machine Teaming Managers:** As artificial intelligence (AI) becomes more prevalent in the workplace, there is a growing demand for people who can oversee human-machine interaction. Managers of human-machine teams ensure that AI systems collaborate well with human employees, boosting output and effectiveness.

- **Experts in AI Ethics and Policy**: As AI becomes more pervasive, there is a pressing need for people who can handle the ethical and policy ramifications of AI. Experts in AI ethics and policy ensure that AI technologies are developed and applied responsibly and morally.

Economic Implications for Businesses Adopting AI

AI-based applications are so versatile that their economic effects can be felt in both core and supporting roles in organizational and production operations The AI apps' capacity to predict across a variety of tasks is at the heart of all their advantages. More knowledge and understanding about any particular activity or process can be obtained through improved predictive skills, which in turn can have varying effects depending on the situation, as will be covered below.

A variety of businesses have improved their quality testing and control procedures by utilizing AI's capabilities. For example, Nebulaa's convolutional neural net-based grain analyser uses data from many Indian agricultural markets to provide rapid, precise, and affordable quality assessment. Their present efforts have resulted in a 75% reduction in expenditures and a reduction in grain testing time from 30 minutes to nearly immediate findings. They intend to broaden their offerings to include India's more recent agricultural markets.

Businesses who used AI software also claimed shorter turnaround times for various operations, which led to lower expenses. For example, vPhrase's application combines generational natural language processing to generate a presentation of data analytics and statistics with humanized tales for a number of banking and financial services companies. The time and expense involved in creating individualized and analytical reports for these companies' clients has been significantly decreased by this application.

Negative Impact

Approximately 16 million people were employed by the domestic IT sector, with 9 million of them working in BPO and low-skilled positions, according to NASSCOM. Automation will undoubtedly have an influence on jobs, even though these figures may change over time.

Jobs requiring pattern recognition and highly repetitious operations, as well as those involving the analysis or processing of large amounts of structured data, are most likely to experience a reduction. Jobs including data collection, paperwork processing, inventory tracking, and customer interaction are increasingly being handled by algorithms.

They may therefore have an effect on positions like data entry clerks, secretaries and administrative assistants, accountants and bookkeepers, financial analysts, manufacturing and warehousing workers, retail salespeople, customer service agents, and drivers. Advanced robotics and artificial intelligence (AI) have

made it possible for machines to perform physical tasks that they were previously incapable of, putting some blue-collar industries like transportation, sales, and warehouse management at risk.

Socio-Economic Impact of AI on Society at Large

By 2025, 50% of all work-related tasks are expected to be automated by machines, up from 29% in 2021, according to a World Economic Forum analysis. The blue-collar workers in the services industry will be the ones who will suffer the most. Given that the services industry is the second-largest employer in the Indian economy, it is thought that these blue-collar workers, who are from the middle and lower middle classes, will need to improve their skills in the upcoming years or risk losing their jobs.

Due to social and economic inequality in Indian society, not all impacted employees may experience the same upskilling process. Employees from the wealthier segments of society will adjust to this shift swiftly and effortlessly, but for those from the weaker segments, this development—the shifting nature of employment—will be the end of the road. In addition to being an economic problem, income inequality in blue-collar jobs is also a social one, which can impede social mobility, cause financial instability, and restrict access to healthcare and education.

According to the Oxfam and WEF report, India's inequality trends are as follows:

- **Wealth Inequality**: With 77% of the nation's wealth held by the top 10% of the population, India is among the most unequal nations in the world. While the lower half of Indians compete for just 4.1% of the nation's wealth, the richest 1% of the population possesses 53% of it.
- **Income inequality**: The wealthiest 10% and 1% of the population in India own 57% and 22% of the nation's total income, respectively, making it one of the most unequal nations in the world, according to the World Inequality Report 2022. The bottom 50% now make up 13% of the population.
- **Tax Burden on the Poor:** Only 4% of the nation's goods and services tax (GST) comes from the richest 10% of the population, whilst roughly 64% came from the bottom 50%.
- **Healthcare is Luxury:** A large number of common Indians lack access to the necessary medical care. The annual cost of healthcare pushes 63 million of them—nearly two people every second—into poverty.
- **Gender Inequality:** According to the 2023 Global Gender Gap Report, India was ranked 127th out of 146 nations. The country also struggles with the persistent problem of "missing women" in the workforce, which is a terrible problem.

Given this degree of disparity, the automation process brought about by AI will have an impact on the less fortunate segments of society.

Response of Government

With an outstanding score of 3.09 in a 2024 Wheebox research titled "Impact of AI on the Future of Work, Skilling & Mobility," India has emerged as a global leader in AI skill penetration and talent concentration. India is well-positioned to handle the current need of about 629,000 AI specialists, which is expected to increase to 1 million by 2026, thanks to an established talent pool of 416,000 as of August 2023.

Overall, India's young employability increased to 51.25% in the past year. Young people who are highly employable are concentrated in major talent-rich states like Telangana, Kerala, Andhra Pradesh, Uttar Pradesh, Maharashtra, and Haryana. In particular, Haryana is in first place with 76.47% of test takers achieving a score of 60% or above on the WNET. The state with the highest talent concentration among those aged 22 to 25 is Uttar Pradesh (74.77%), closely followed by Maharashtra (71.97%).

Furthermore, 63.58% is the overall employability rate for this age group in the top 10 cities. The automotive, legal, and healthcare sectors are among the modern industries implementing AI. According to the government, artificial intelligence (AI) is a key factor in the expansion of our digital economy, investments, and employment. The government has launched a number of programs to broaden the AI ecosystem and provide the nation's young with access to AI opportunities.

Policy Recommendations

The structure and operations of the Government for Development and Diffusion of AI would be crucial in promoting the widespread usage of AI in India.

- Need to choose a nodal organization to oversee all AI-related initiatives in India, also it is advised to encourage government agencies to build the capacity to adjust to governance systems based on artificial intelligence.
- Assign resources to areas that have already shown that AI has a good economic and social impact in order to create pockets of brilliance.
- Provide government support for apps that are relevant to society.

Establishing cooperative frameworks for interaction between academia, business, and governments in order to support growth and creative, locally focused solutions.

- State and federal governments can directly encourage the growth of startups by inviting and fostering creative, regional solutions and forming public-private collaborations.
- Frontier technology uptake and transfer are accelerated through cross-national partnerships. Expanding on current technologies can support the development

of AI-related capabilities in India, particularly in the hardware industry, where the country is trailing behind.

Developing an All-Inclusive Data Strategy to support objective, trustworthy, secure, and inclusive data sharing practices and increase state capacity to provide AI-compatible publicly available data.

- Examine different approaches to data exchange. For data integration and distribution, laws and regulations that promote objective, trustworthy, secure, transparent, and inclusive data sharing must be developed.
- Analyze how public data now exists in silos and make sure it is compatible with various usage.
- Boost current statistical agencies' ability to gather and analyze publically accessible data for AI applications.
- Create a national artificial intelligence resource. Create a generalized meta-data standard for data.gov.in that will allow resources such as books, tools, and data to be integrated.

Closing India's AI skills gap will assist develop directly industry-adaptable capabilities and make it easier to hire AI experts

- Engaging students with corporates through targeted sector-level collaborations can aid in the development of immediately industry-adaptable skills. Update the curriculum, particularly for technological schools, to inevitably incorporate AI program.
- Social sciences should be incorporated into AI training in addition to technological curriculum since they aid in algorithm construction and algorithmic impact analysis.
- Investigate a market for qualified AI specialists to fill the current skill shortage facing AI businesses.
- Encourage the hiring of foreign technology experts

Resolving AI Governance Issues to Advance Safety Standards and Prevent Biased Outcome Impacts

- It is suggested that ethics committees implement algorithmic impact assessments, which should be established at least at all government-funded research facilities developing AI for applications in the general public.
- Academic, commercial, and public researchers should collaborate to define fundamental procedures and documentation standards for particular application contexts that would be adequate to demonstrate due diligence in performing safety assessments.

- Examine how India might improve its involvement in the process of standardizing AI.

Involve scientists and other experts in the development and use of AI to prevent biases and the discriminatory effects they may have.

Future Aspects

The substantial benefits of AI advancements for economic expansion, allow for the formulation of particular suggestions for a range of stakeholders, including government organizations, corporate executives, and investors. By strategically implementing artificial intelligence technology, these ideas seek to improve economic outcomes and promote sustainable growth by utilizing the study's findings.

Investors ought to think about boosting their investments in industries leading the way in artificial intelligence development and applications, regions with a high level of artificial intelligence activity—such as tech startups that specialize in AI and well-established businesses that incorporate AI into their operations—are probably going to see an increase in growth and productivity. Investors may thus find it advantageous to focus their funds on businesses that are not just creating AI technologies but also putting them into practice to improve consumer experiences, streamline operations, and generate new goods and services.

To increase productivity and spur creativity, company managers in a variety of sectors should think about implementing artificial intelligence technologies. The study shows that through boosting productivity and encouraging innovation, artificial intelligence makes a substantial contribution to economic growth. With an emphasis on topics like automation, data analytics, and customer engagement, managers should evaluate their present operations to find procedures that may be optimized with artificial intelligence. In order to connect worker capabilities with emerging technology breakthroughs, training programs should also be put in place to upskill staff members and enable them to use artificial intelligence products efficiently.

Policymakers and government organizations should concentrate on establishing conducive conditions for AI research and development. This entails funding educational initiatives that foster artificial intelligence-related skills, providing grants and subsidies to encourage research and development, and making sure that laws and regulations favour innovation while safeguarding the public interest. National AI policies appear to have a major positive effect on economic growth, especially in developed nations. Therefore, governments hoping to capitalize on AI's advantages for national development should prioritize creating all-encompassing AI planning frameworks.

Governments should also help artificial intelligence technology spread throughout the economy so that small and medium-sized businesses (SMEs) may benefit from these advancements. In order to promote innovation and knowledge

sharing, this may entail setting up forums for cooperation between big businesses, SMEs, and educational institutions. All things considered, implementing these suggestions could assist interested parties in leveraging the financial advantages of AI, guaranteeing that technological innovation-driven growth is strong, equitable, and long-lasting. All stakeholders can contribute to and profit from artificial intelligence's economic potential by coordinating investment, management, and policy with the knowledge gained from this study.

Conclusion

India has a rare chance to use technology to address some of its most pressing issues, like a lack of healthcare facilities and poor educational standards. The goal of delivering high-quality healthcare and education cannot be achieved through traditional means. For example, it will take years to reach the number of doctors required to offer high-quality healthcare because it is so great. AI technology offers a substitute for doing the same thing. Although technology has the potential to significantly boost economic growth, it is likely to have a negative effect on employment opportunities. Any nation's problem is to take full advantage of opportunities while also addressing the issue of job loss.

Infrastructure development, public sector applications, policy and regulation, technological development, and human resource development are all areas in which the government has a significant role to play. However, with industry cooperation, this can be accomplished successfully. Although more research must be done to get accurate data for determining the next stages in infrastructure development, legislation and regulation, technology development, etc. In order to formulate appropriate policies, a survey regarding the anticipated loss of jobs in different sectors must also be conducted. The government's policy responses may be based on these studies. The current regulations must be examined and, if required, changed, even if it might be too soon to create new ones.

Right now, India has a special chance. It can replicate the IT industry's success story with the talent that is already there in the nation. However, the chance will be lost if the required actions are not completed in a timely manner. AI can support the government's main initiatives, including Make in India, Skill India, and Digital India. Actions must be taken in the areas of applications and infrastructure development, policy and regulations, research and development, and human resource development in order to hasten the advancement of AI technology and its applications.

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