

UNLEASHING THE POWER OF AI: TRANSFORMING INDIA'S ECONOMIC LANDSCAPE

Dr. Arathy S. Nair*
Dr. Ganga R Menon**

ABSTRACT

Advancements in the area of artificial intelligence(AI) have the potential to enhance and augment the functioning of economic entities. It has already begun transforming the way in which we live. With AI expanding its grip to a variety of domains ranging from simple mechanics to intellectual creativity, it becomes imperative to analyse the potential impact of artificial intelligence in economic enterprises. The potential gains and losses of AI expansion may go much beyond the automation and its impacts. The transformational ability of artificial intelligence is very well utilized by economic entities, particularly multinational corporations. Past few years have witnessed significant surge in transforming AI research and technology into viable products and services. Commercialising AI has opened a diverse array of opportunities as well as challenges. On the brighter side, AI is expected to increase total productivity leading to greater output and higher income. AI can intervene at various stages of the value chain such as strategizing business models, sourcing raw material, production, marketing and sales, supply chain management, customer services and even the supportive sectors like banking and finance. Concerns regarding the impact of AI interventions on labour markets are also on rise since AI related technological advancements could be labour displacing. India as a developing economy is posed with unique challenges which could well be addressed with the advancements in AI. Looking from the angle of global competitiveness also it becomes imperative for the Indian economy to adapt to the increased infusion of AI into various sectors at various levels. Despite the projected advantages, the unfair outcomes of AI could also be not overlooked. India being the world's most populous nation is expected to thicken its labour market contributions. The current unemployment crisis may further be accentuated temporarily or even permanently by the technological unemployment ingrained with the invasion of AI technologies. This paper attempts to examine the potential impact of application of AI and related technologies in various sectors of the Indian economy and business.

KEYWORDS: Artificial Intelligence, India, Economy, Impact, Technology.

Introduction

Advancements in the area of artificial intelligence has the potential to enhance and augment the functioning of economic entities. It has already begun transforming the way in which we live. With AI expanding its grip to a variety of domains ranging from simple mechanics to intellectual creativity, it becomes imperative to analyse the potential impact of artificial intelligence in economic enterprises. The potential gains and losses of AI expansion may go much beyond the automation and its impacts.

* Assistant Professor, Department of Economics, HHMSPBNSS College for Women Neeramankara, Thiruvananthapuram, Kerala, India.

** Assistant Professor, Department of Economics, NSS Hindu College, Changanacherry, Kerala, India.

The term Artificial Intelligence was coined by distinguished Stanford Professor John McCarthy in 1955. Prof. McCarthy defined AI as “the science and engineering of making intelligent machines”.¹ Artificial Intelligence could generally be described as a computing concept that enables machines to use human-like intelligence in complex problem solving. A large volume of research and development is evolving in the field of AI and its allied fields including machine learning and deep learning. Machine learning improves the performance of computer agents in identifying, processing and acting on issues on the basis of experience or data. It could be supervised learning, where machines learn with the feeding of labelled data or unsupervised learning where the machine uses unlabelled data to draw patterns and thus conclusions or reinforcement learning which is a feedback dependent machine learning model.²

The transformational ability of artificial intelligence is very well utilized by economic entities, particularly multinational corporations. Past few years have witnessed significant surge in transforming AI research and technology into viable products and services. Commercialising AI has opened a diverse array of opportunities as well as challenges. On the brighter side, AI is expected to increase total productivity leading to greater output and higher income. AI can intervene at various stages of the value chain such as strategizing business models, sourcing raw material, production, marketing and sales, supply chain management, customer services and even the supportive sectors like banking and finance. Concerns regarding the impact of AI interventions on labour markets are also on rise since AI related technological advancements could be labour displacing.

India as a developing economy is posed with unique challenges which could well be addressed with the advancements in AI. Looking from the angle of global competitiveness also it becomes imperative for the Indian economy to adapt to the increased infusion of AI into various sectors at various levels. Despite the projected advantages, the unfair outcomes of AI could also be not overlooked. India being the world's most populous nation is expected to thicken its labour market contributions. The current unemployment crisis may further be accentuated temporarily or even permanently by the technological unemployment ingrained with the invasion of AI technologies.

This paper attempts to examine the potential impact of application of AI and related technologies in various sectors of the Indian economy and business.

Review of Literature

Trabelsi, M.A. (2024) points out that the impact of AI on economic growth is uneven across different sectors and regions. The study also anticipates the possibility of widening the gap between developed and developing economies since adapting AI requires adequate infrastructure, data availability and conducive policies, which can vary across different economies.

Gonzales, J.T. (2023) attempts to identify the relationship between the level of AI innovation and long-run economic growth, using a panel dataset across countries between 1970 and 2019. The study exhibits a significant positive impact of AI patenting on long-run economic growth. It also points out that the effect of AI is more visible in the latter period, because of the increasing quantity and quality of AI innovation generated over time.

Wein K. Solos, Joel Leonard (2022) while analysing the economic impact of AI focus on employment and income inequality. The study proposes that with the existing unequal distribution of capital, AI and automation will raise capital intensity in the production process eventually leading to increased income inequality. Skill upgrades through rigorous need based training is suggested to retain and regain employment in the wake of AI induced automations.

Objectives of Study

- To explore the impact of AI on the Indian economy and its key sectors.

Data and Methods

This study made use of secondary data from government sources (NITI Aayog, RBI, Economic Survey), industry reports (NASSCOM, McKinsey, World Bank), and academic research papers. Data will be collected on AI adoption, sectoral trends, and economic policies related to AI in India.

Impact on Indian Economy

Development experience of economies suggest that the impact of General Purpose Technologies on the economy is not instant and the economies of scale are generated over time. AI aids expansion of the economy from the production and the supplyside. On the production side, innovations and application of superior technology not only increases efficiency but also helps to reduce resource

wastage. Upskilling labourforce and combining it with advanced AI tools could also assist better decision making and act as a catalyst for productivity surge. AI has the potential to bring considerable improvement on the supply side also by enhancing customer experience by providing highly customised and personalised product/service delivery. The study by PricewaterhouseCoopers (PwC) estimates that due to the proliferation of AI, global GDP is expected to rise by up to 14 %, equivalent to US\$15.7 trillion by 2030. Off this GDP expansion effect, 58% is expected from consumption effects and 55% is from increases in productivity which reflects faster transmission mechanisms on the production side of the economy. India's tremendous achievements in the domain of digital transformation signifies the fact that it has a huge potential to reap the benefits of AI induced inventions and innovations.

- **Economic Growth**

AI could become a key driver of India's GDP growth by fostering innovation, efficiency and increasing productivity. The study by accenture estimates that AI would raise the annual GDP growth rate of India 1.3% by 2030 which would imply an addition of US\$957 billion, or 15% of current gross value added to India's economy in 2035 compared with a scenario without AI. Realising this economic potential would require lumpy financial investments, upskilling labour force and conducive policy environment. Since the immediate implication of AI related technology is mainly spread around service and manufacturing sectors, care needs to be taken to customize such applications to be suitable for agriculture and allied sectors also where the vast majority of India finds its livelihood options so that any lopsided path of economic growth could be prevented towards a certain extent.

Projected Growth of A

- **Employment**

The technological advancements and rapid expansion of AI in various sectors have generated great deal of concerns on its impact on labour market. The estimates of International Labourorganisation suggest that close to 75 million jobs globally are facing threat from technology advances and automation. Though integration of advanced technology in labour market and the resultant increase in efficiency and productivity of labour is one channel through which AI is expected to drive up total factor productivity, its effect upon the labour markets of developing economies like India where labour supply is on the abundant side is a matter of concern. Many studies pointed out significant labour displacement due to AI induced automation. It is evident while going through the phases of industrial revolution that gains from increased productivity emerging out of the use of superior technology is not immediately available to the working class in the form of higher wages. The dynamic economic changes brought through AI driven technological advancements does not trickle down to the labour market and it will require policy interventions to assure livelihood options to displaced labourers and to upskill the labourforce to secure new employment opportunities. The Economic Survey of 2023-2024 points to the fact that the rising labourforce of India would require the generation of more than 75 lakh jobs annually in non-farm sector by 2030 to provide gainful livelihood options to its population. With its already high unemployment rates, AI expansion might pose some serious challenges in the labour market of India. Being a consumption based economy, labour displacement would also cause a fall in aggregate demand leading to adverse macroeconomic implications.

- **Manufacturing**

The expansion potential of AI is not just limited to the big players of the sector. AI induced automation while expanding the scale of operations enables small firms to step into new ventures. Increased competition and exploration of firms to new domains outside their core business is expected resulting in benefits for early adapters and economic decline for non adapters or late adapters. Some studies even consider AI as the detonator of the fourth wave of industrial revolution. Computer vision enabled quality control monitoring, predictive analytics and Machine Learning enabled supply chain management are a few examples of productivity and efficiency gains from AI infusion in the manufacturing sector. The retail sector also stands to benefit from personalized recommendations and inventory management, natural language processing powered 'conversational' commerce, computer vision powered smart shopping. The government initiatives such as 'Make in India' and Start Up India and the compelling drive towards 'Industry 4.0' have created a conducive public policy environment for indian manufacturing sector for technology-adaptive companies. The report by PwC points to the fact that indian companies are increasingly adopting analytics and AI with a current implementation rate of 54%. The results of the study of Rajat Kathuria, Mansi Kedia & Sashank Kapilavai (2020) find a positive and

significant relation between AI intensity and total factor productivity growth. The estimate suggests that a unit increase in AI intensity will increase the TFP growth by 0.05 %. Irrespective of its huge potential, The proliferation of AI varies significantly across sectors and companies owing to the differences in structural compositions and hefty financial requirements.

- **Service**

India has witnessed a surge in AI applications in major service sectors including health, banking tourism, transportation education etc. In the banking sector, its application sprawls in areas including credit underwriting, regulatory capital planning, liquidity management, fraud detection and prevention, risk assessment and management, portfolio optimisation, pricing models, and chatbots. The swift advancement of technology in fields such as artificial intelligence, blockchain, and data analytics, has opened up new avenues to rethink conventional financial services and processes. AI and large language models (LLMs) have improved customer support through engaging chatbots and tailored experiences, while blockchain provides secure, transparent, and efficient transaction methods. Additionally, changing consumer behavior and expectations driven by the emergence of digital natives and a rising demand for personalized, smooth, and convenient financial solutions compel the service providers to innovate in order to stay competitive. Examples of application of AI tools in the health care sector include predictive analysis to detect early stage diseases, Deep Neural Nets to interpret medical scans, pathology slides, skin lesion, retinal image, endoscopy etc. which not only reduces cost of medical diagnosis and treatment but also improves patient outcomes.

- **Agriculture**

Data insights and support from artificial intelligence (AI) enhance a farmer's understanding and eliminate uncertainty with solid information, potentially resulting in greater efficiency and higher profitability. Indian farmers with their marginal holdings face several challenges such as unpredictable weather, climate change issues, pest infestations, and declining yields. Even in the post harvest phase they face issues such as crop wastage, logistics, marketing issues etc. many of which could be addressed through the intervention of AI tools. The Artificial Intelligence for Agriculture Innovation (AI4AI) initiative by the World Economic Forum is working to enhance India's agricultural transformation by promoting the adoption of artificial intelligence (AI) and associated technologies for advancements in agriculture. This initiative, spearheaded by the Centre for the Fourth Industrial Revolution (C4IR) India, unites stakeholders from government, academia, and the business sector to create and apply innovative solutions within the agricultural field. One notable example of the successful implementation of the AI4AI initiative is the 'SaaguBaagu' pilot, which was created in collaboration with the Telangana state government in the Khammam district. This project has significantly enhanced the chilli value chain for over 7,000 farmers. A key component of the programme was a Telugu- language WhatsApp chatbot that assisted farmers with customised suggestions in time according to the growth phase of their crop. World Economic Forum estimates that farmers involved in the program experienced a 21% rise in chili production per acre, a 9% decrease in pesticide application, a 5% reduction in fertilizer consumption, and an 8% enhancement in unit prices attributed to improved quality. The Telangana state government has been instrumental in this change by establishing supportive infrastructure and policies, including India's first agriculture data exchange and agri data management framework.

Socio-Economic Impact

With its vast and diverse population and geography, bringing essential services to all has always been a challenge in India. For a substantial percentage of the population, AI could potentially be able to help with the problems of affordability, accessibility, and quality basic services. In the health sector artificial intelligence (AI), robotics, and the Internet of Medical Things (IoMT) could work together to create new models to solve healthcare issues and assist the government in achieving universal health coverage. Personalised learning platforms, virtual tutors, language translation tools etc. are dramatically reshaping the educational landscape of India by expanding quality education to a wider population at minimal cost. Even though the inadequacy of physical infrastructure can be covered by the expansion of AI enabled technologies to extend basic services to remote regions, increased demand for digital infrastructure poses a challenge. A tech-policy addressing the grassroot issues in this regard becomes the need of the hour to ensure that technological advancements are not creating a new wave of digital divide. AI is transforming vital services by increasing accessibility, reducing expenses, and boosting productivity. AI can contribute to bridging disparities in healthcare, education, and finances with the right investments and policies, guaranteeing a more inclusive and equitable future.

- **Augment digital India Initiatives**

Digital India Initiatives seeks to improve India in various important vision areas, which include establishing a digitally empowered society and knowledge economy through enhancing technological infrastructure, boosting tech literacy, services and resources, along with fostering an innovative digital ecosystem. AI has considerable potential to enhance India's effective Digital Public Infrastructure (DPI) model by promoting innovation, minimizing bureaucracy, and increasing citizen involvement through customized services. The development of its digital public infrastructure, including Aadhaar, DigiLocker, and the Unified Payment Interface (UPI), has served as the foundation for Digital India. More than a billion Indians now have a unique digital identity that makes it easier for them to access government services through Aadhaar, the largest biometric identification system in the world. DigiLocker enables citizens to safely save and retrieve important documents online, doing away with the need for paper records. Financial transactions have become faster, less expensive, and more secure through UPI, a ground-breaking digital payments system. In this digital era, AI could contribute to reshaping the conventional governance systems to be more efficient, citizen centered, transparent and inclusive. AI can significantly reduce governance costs and improve efficiency by increased automation to streamline government officials to strategic roles and reducing decision making errors. Automated and personalised service portals, grievance redressal platforms, chatbots etc. are providing more citizen centric services where people can access information as well as a number of services outside the constraints of office working hours. By analysing data and identifying trends and patterns, predictive analysis could be used to refine decision making processes at policy level. With the prevalence of the multiple languages, AI-powered language translation tools could ensure inclusivity in governance and public service delivery.

- **Crisis and Disaster Management**

India has historically faced a significant risk of natural disasters due to its distinct geo-climatic conditions. Floods, droughts, cyclones, earthquakes, and landslides have been recurring events. Approximately 60% of the country's land is at risk of earthquakes of various magnitudes; more than 40 million hectares are vulnerable to flooding; around 8% of the overall area is at risk of cyclones, and 68% of the land is susceptible to drought. Disaster management plays a crucial role in Indian policy framework, as it is the economically disadvantaged and marginalized population who suffer the most during calamities and disasters. With the growing climatic vagaries and increasing occurrence of natural disasters, AI application in disaster management has become a necessity. Using AI and machine learning algorithms, various aspects of disaster management such as prediction of calamities, hazard map development, real-time event detection, emergency responses etc could be made more efficient and accurate. A combination of drone imagery, satellite information, and climate data can be used to train AI and machine learning models as disaster preparedness technology. The Artificial Intelligence-based application Rapid Action for Humanitarian Assistance in Tragedies (RAHAT) launched by Cachar district administration in Assam is an example of successful integration of AI in disaster management. It was introduced to address flooding by enhancing communication between citizens, security personnel, and the government during flood crises. The app has a vital in sharing important information related to early warnings, evacuations, search and rescue operations, and distribution of essential supplies, particularly in remote regions. Atmospheric, Climate Science and Services (ACROSS), an initiative of the Ministry of Earth Sciences of Government of India also attempts to integrate Artificial Intelligence and Machine Learning framework to deliver Big Data Analytics solutions for disaster response.

Challenges and Suggestions

India stands at a pivotal moment in the development of artificial intelligence (AI). With its remarkable technological expertise and vibrant start-up culture, the country is well-placed to realize its promise of becoming a global leader in AI. However, there are several challenges that India needs to tackle in order to fully harness the transformative potential of a technology like artificial intelligence. While accelerating the pace of integrating advances in artificial intelligence in various sectors, some challenges are also to be addressed such as lack of supportive data ecosystems, low intensity AI research, inadequate upskilling opportunities for human resources, rigid Intellectual Property Rights framework and concerns regarding data privacy and security. Although AI has significant potential to boost productivity and drive economic expansion, it also raises serious issues related to job market polarization, increasing inequality, structural unemployment, and the creation of unwanted industrial frameworks.

Stepping up of core AI research is an immediate requirement because irrespective of the presence of premier academic institutes and leading IT firms in the country, the research output as well

as innovations in the field is relatively low when compared to global level. Conducive policy framework is also needed to bring out maximum R&D output. Existing regulatory policies that do not factor in the flexibility of transformative technologies like AI need to be reframed without compromising data privacy and security. Investments to improve the availability, accessibility and quality of digital infrastructure is a prerequisite to apply AI across different sectors. To harness the maximum benefits of AI, a trained and skilled workforce is a necessity for a heavily populous country like India. Immediate efforts are needed to bridge the skill gap to upskill the labourforce to adapt AI transformations as well as to secure gainful livelihood opportunities. While pushing for aggressive AI expansion care needs to be taken that it is disruptive upon economic and social structures and creating a new wave of inequality. Applying a multi stakeholder approach may accelerate AI adoption and enhance inclusivity.

Conclusion

Numerous forward-looking evaluations indicate that AI has the potential to significantly enhance productivity and drive economic growth. Nonetheless, the achievement of these advantages hinges on how rapidly AI systems are adopted and how their functionalities improve. India stands at a pivotal moment in the development of artificial intelligence (AI). With its remarkable technological expertise and vibrant start-up culture, the country is well-placed to realize its promise of becoming a global leader in AI. The potential gains from AI may be obstructed or rendered ineffective due to various risks linked to its development and implementation. Consequently, policymakers face the challenge of staying abreast of AI developments to optimize its advantages while reducing its associated risks. With the advancement and proliferation of AI, it is essential to revise regulatory frameworks. Particularly concerning issues like transparency, accountability, non-discrimination, unethical control practices, and the collection and use of data, regulatory gaps become significant.

References

1. Acemoglu D, Restrepo P. (2019). Automation and new tasks: How technology displaces and reinstates labor. NBER Working Paper No. 25684, JEL No. J23, J24. Available at: <http://www.nber.org/papers/w25684>
2. *Artificial intelligence definitions*. (n.d.). Retrieved January 20, 2025, from <https://hai.stanford.edu/sites/default/files/2020-09/AI-Definitions-HAI.pdf>
3. Chivu, Stefania. (2022). The Macroeconomic Impact of Artificial Intelligence. *International Journal of Sustainable Economies Management*. 11. 1-43. 10.4018/IJSEM.304874.
4. Dibbyo Saha. (2019). A Brief Introduction to Artificial Intelligence. Available at
5. https://www.torontomu.ca/sciencerezevous/SR2021/A_Brief_Introduction_To_AI.pdf
6. Gonzales, J.T. (2023). Implications of AI innovation on economic growth: a panel data study. *Economic Structures* 12, 13. <https://doi.org/10.1186/s40008-023-00307-w>
7. <https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf>
8. MGI. (2015). A Labour Market that Works: Connecting Talent with Opportunity in the Digital Era. McKinsey Global Institute
9. Rajat Kathuria, Mansi Kedia & Sashank Kapilavai (2020). Implications of AI on the Indian Economy.
10. Solos, Wein & Leonard, Joel. (2022). On the Impact of Artificial Intelligence on the Economy. *Science Insights*. 41. 501-560. 10.15354/si.22.re066.
11. Trabelsi, M.A. (2024). The impact of artificial intelligence on economic development. *Journal of Electronic Business & Digital Economics*, Vol. 3. 142-155. <https://doi.org/10.1108/JEBDE-10-2023-0022>
12. William D. Nordhaus, 2015. "Are We Approaching an Economic Singularity? Information Technology and the Future of Economic Growth," NBER Working Papers 21547, National Bureau of Economic Research,
13. <https://www.weforum.org/impact/ai-for-agriculture-in-india/>

