ICSSR-SRC

ICSSR-SRC Sponsored

HARNESSING ARTIFICIAL INTELLIGENCE, INNOVATION AND TECHNOLOGY: A PATHWAY TO ECONOMIC TRANSFORMATION AND SUSTAINABLE DEVELOPMENT IN INDIA

Chief Editor

Dr. R. Gayathri

VOLUME II

ICSSR-SRC Sponsored

HARNESSING ARTIFICIAL INTELLIGENCE, INNOVATION AND TECHNOLOGY: A PATHWAY TO ECONOMIC TRANSFORMATION AND SUSTAINABLE DEVELOPMENT IN INDIA

Volume II

Chief Editor

Dr. R. Gayathri

Seminar Convenor and Associate Professor,
UG Department of Commerce IB,
Nallamuthu Gounder Mahalingam College, Pollachi

Editor

Dr. N. Bhuvanesh Kumar

Assistant Professor and Head,
UG Department of Commerce (IB),

Editorial Board Members

Dr. R. Kalaiselvi

Assistant Professor, UG Department of Commerce (IB)

Dr. P. Karthika

Assistant Professor, UG Department of Commerce (IB)

Harnessing Artificial Intelligence, Innovation and Technology: A Pathway to Economic Transformation and Sustainable Development in India

Chief Editor : **Dr. R. Gayathri**

Editor : **Dr. N. Bhuvanesh Kumar**

Editorial Board Members : **Dr. R. Kalaiselvi & Dr. P. Karthika**

First Edition: 2025

ISBN: 978-93-94004-50-4

Price: ₹ 1400/-

Printed at
SHANLAX PUBLICATIONS
61, 66 T.P.K. Main Road
Vasantha Nagar
Madurai – 625003
Tamil Nadu, India

Ph: 0452-4208765,
Mobile: 7639303383
email:publisher@shanlaxpublications.com
web: www.shanlaxpublications.com

ARTIFICIAL INTELLIGENCE FOR CLIMATE ACTION, RESOURCE MANAGEMENT, AND SOCIAL EQUITY

Dr. P. Jayanthi
Assistant Professor, PG Department of Commerce-CA
Nallamuthu Gounder Mahalingam College, Pollachi, Tamil Nadu, India
jayanthi.saraswathy@gmail.com

Abstract

Artificial intelligence (AI) is increasingly recognized as a transformative tool in addressing the world's most pressing challenges. Beyond its industrial and commercial applications, AI holds promise for mitigating climate change, optimizing resource management, and reducing social inequality. However, these promises come with challenges, including environmental costs, algorithmic bias, and uneven access across the Global North and South. This paper examines the dual role of AI as both an enabler of sustainable development and a potential contributor to systemic risks. Through an exploration of AI applications in climate prediction, renewable energy, agricultural systems, and inclusive social infrastructures, the paper highlights the technology's opportunities and challenges. It argues that AI can serve as a pathway toward a greener and fairer future only if guided by principles of sustainability, transparency, and equity.

Keywords: *Artificial Intelligence - Climate Change - Resource Management - Social Inequality - Sustainability*

Introduction

Artificial intelligence (AI) is often described as the defining technological revolution of the 21st century. Its rapid development has reshaped economies and societies, with applications spanning healthcare, agriculture, energy, education, and governance. PwC (2018) projected that AI could add up to $15.7 trillion to the global economy by 2030, underscoring its economic significance. Yet, as the international community faces escalating climate change, unsustainable consumption of resources, and widening social inequalities, AI is increasingly being considered not just an economic asset but also a potential instrument for sustainable development. At the same time, AI presents a paradox. On one hand, it enables efficiency, predictive capacity, and smarter decision-making. On the other, the energy intensity of large-scale AI systems contributes to greenhouse gas emissions, and biased datasets risk reinforcing social inequities (Strubell et al., 2019; Noble, 2018). These complexities highlight the necessity of situating AI not as a neutral tool but as a socio-technical system that reflects human values, governance structures, and power relations. This paper investigates AI's role in addressing three interconnected challenges: (1) mitigating and adapting to climate change, (2) managing finite natural resources, and (3) reducing social inequality. By analyzing emerging research, policy initiatives, and real-world case studies, it demonstrates both the transformative potential and limitations of AI in advancing sustainability and justice.

AI and Climate Change

Climate Modeling and Prediction

AI enhances traditional climate models by processing vast and complex datasets at unprecedented speed and scale. Machine learning algorithms improve forecasts of extreme weather events—such as hurricanes, floods, and wildfires—helping governments prepare and

mitigate risks (Rolnick et al., 2019). For example, IBM's "Green Horizon" project uses AI to model air quality and predict pollution in urban areas, assisting policymakers in designing interventions.

Renewable Energy Integration

The transition to renewable energy requires intelligent systems that can handle fluctuating supply and demand. AI enables smart grids that dynamically balance renewable inputs such as solar and wind energy, ensuring stability and efficiency (Gielen et al., 2021). Companies like Google have applied DeepMind AI to optimize energy consumption in data centers, reducing cooling energy use by 40% (Evans & Gao, 2016). Scaling such applications across industries could significantly reduce global emissions.

Emissions Tracking and Accountability

AI tools can monitor carbon emissions from factories, transportation, and agriculture by analyzing satellite imagery and sensor networks. This contributes to greater transparency in meeting climate agreements such as the Paris Accord (UNEP, 2023). Moreover, AI models can identify patterns of illegal deforestation in the Amazon and Southeast Asia, strengthening enforcement and conservation efforts.

Challenges

While AI supports climate action, its environmental footprint is non-negligible. Training large-scale natural language processing models, for instance, can emit over 284 tons of CO_2—equivalent to the lifetime emissions of five cars (Strubell et al., 2019). Unless mitigated by green AI practices, these costs risk undermining climate goals.

AI in Resource Management

Agriculture and Food Security

AI is transforming agriculture through precision farming. Drones equipped with machine vision assess crop health, while predictive analytics recommend optimal irrigation and fertilization schedules. These innovations reduce water and pesticide use while increasing yields, which is critical as global food demand is projected to rise by 70% by 2050 (Kaur & Rampal, 2021). For smallholder farmers, AI-based mobile platforms such as PlantVillage provide diagnostic support for crop diseases, improving livelihoods in the Global South.

Water Resource Management

AI-based models are increasingly applied in hydrology to optimize water distribution and predict shortages. The World Bank (2021) reported successful AI pilots in Sub-Saharan Africa where predictive analytics helped allocate scarce water resources for both agriculture and households. Integrating climate and demographic data enhances the resilience of water infrastructure against droughts and floods.

Waste Management and Circular Economy

Machine learning and robotics enhance recycling efficiency by identifying and sorting materials more accurately than human labor (Pattnaik et al., 2022). Predictive algorithms also anticipate material flows, enabling industries to design circular systems where waste is minimized and reused. Such innovations reduce landfill dependence and align with the Sustainable Development Goals (SDGs).

Risks of Uneven Benefits

Although AI-driven resource management improves efficiency, benefits often concentrate among large corporations with capital to adopt advanced technologies. Without equitable policies, small-scale farmers and low-income communities risk being left behind.

AI and Social Inequality

Education Access and Equity

AI platforms such as adaptive learning systems personalize education to suit individual learning styles and paces. In low-resource settings, AI-enabled remote learning can bridge gaps where teachers are scarce. However, unequal access to digital infrastructure can exacerbate divides between urban and rural or wealthy and poor populations (UNDP, 2021).

Healthcare Access

Telemedicine powered by AI diagnostics provides affordable and timely healthcare in underserved communities. AI models detect diseases such as malaria or tuberculosis from images, offering cost-effective alternatives to traditional diagnostics (OECD, 2021). Yet, over-reliance on AI in healthcare may risk errors if systems are not culturally and contextually adapted.

Financial Inclusion

AI-based credit scoring systems expand financial services to unbanked populations, enabling microloans for small entrepreneurs. Predictive analytics also help identify underserved markets, boosting inclusive economic growth. However, algorithmic bias in lending decisions may reinforce systemic discrimination if datasets are skewed.

Algorithmic Bias and Inequities

Noble (2018) demonstrated how algorithms used in search engines replicate racial and gender biases. Similarly, biased datasets in predictive policing or recruitment can disproportionately affect marginalized groups. Addressing these risks requires transparent data governance, ethical frameworks, and human oversight.

Discussion

AI's applications across climate, resource, and social domains reveal both opportunities and tensions:

Climate Benefits vs. Environmental Costs: AI contributes to climate solutions but generates significant carbon emissions in model training.

Efficiency vs. Equity: AI boosts agricultural and water efficiency but may entrench corporate dominance and exclude smallholders.

Inclusion vs. Bias: AI expands education, healthcare, and finance access but risks amplifying structural inequalities if not ethically governed.

To reconcile these tensions, policymakers and researchers advocate for Green AI—designing energy-efficient architectures, sharing pretrained models, and encouraging carbon-neutral computing (Pattnaik et al., 2022). Global governance frameworks, such as UNESCO's Recommendation on the Ethics of AI (2021), emphasize fairness, inclusivity, and sustainability.

Conclusion

AI is not inherently good or bad—it reflects the priorities and systems within which it operates. As shown in its applications to climate change, resource management, and inequality, AI has transformative potential to support sustainability and justice. However, realizing these benefits depends on deliberate action. Governments must establish policies that embed sustainability into AI research and deployment, industries must adopt responsible practices, and researchers must prioritize equity and energy efficiency. Ultimately, AI's role in shaping the future is not predetermined; it will depend on whether humanity steers it toward ecological balance and social justice.

References

1. Evans, R., & Gao, J. (2016). DeepMind AI reduces Google data centre cooling bill by 40%. DeepMind Blog. https://deepmind.google/discover/blog/deepmind-ai-reduces-google-data-centre-cooling-bill-40
2. Gielen, D., Boshell, F., Saygin, D., Bazilian, M. D., Wagner, N., & Gorini, R. (2021). The role of renewable energy in the global energy transformation. Energy Strategy Reviews, 24, 38–50. https://doi.org/10.1016/j.esr.2019.01.006
3. Kaur, A., & Rampal, P. (2021). Artificial intelligence in agriculture: A sustainable approach. Journal of Cleaner Production, 315, 128210. https://doi.org/10.1016/j.jclepro.2021.128210
4. Organisation for Economic Co-operation and Development. (2021). AI in society: Tackling inequalities. OECD Publishing. https://doi.org/10.1787/ai-society-2021
5. Pattnaik, P., Dutta, S., & Ghosh, S. (2022). Green AI: Reducing the carbon footprint of artificial intelligence. Journal of Cleaner Production, 351, 131567. https://doi.org/10.1016/j.jclepro.2022.131567
6. PwC. (2018). Sizing the prize: What's the real value of AI for your business and how can you capitalise? PwC Global. https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf
7. Rolnick, D., Donti, P. L., Kaack, L. H., Kochanski, K., Lacoste, A., Sankaran, K., ... & Chayes, J. (2019). Tackling climate change with machine learning. arXiv Preprint arXiv:1906.05433. https://arxiv.org/abs/1906.05433
8. Strubell, E., Ganesh, A., & McCallum, A. (2019). Energy and policy considerations for deep learning in NLP. Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics, 3645–3650. https://doi.org/10.18653/v1/P19-1355
9. United Nations Development Programme. (2021). AI and inequality: Harnessing artificial intelligence to reduce disparities. UNDP. https://www.undp.org/publications
10. United Nations Environment Programme. (2023). Artificial intelligence and the sustainable development goals. UNEP. https://www.unep.org/resources/report/artificial-intelligence-and-sustainable-development-goals
11. World Bank. (2021). Water management and artificial intelligence. World Bank. https://www.worldbank.org