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THE IMPACT OF AI ON CIRCULAR ECONOMY AND SUSTAINABILITY

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Abstract. The fast evolution of artificial intelligence (AI) is transforming the sustainability agenda and accelerating the transition to a circular economy (CE). The CE paradigm challenges the linear "take, make, dispose" paradigm. Instead, it emphasizes the reuse of resources, minimizing waste, and encouraging regeneration. AI increases productivity, decision-making, and resource use in sectors such as manufacturing, agriculture, energy, and waste management. Globally, AI applications such as computer vision, machine learning, and predictive analytics enhance material productivity, energy efficiency, and waste segregation. AI-based energy management systems optimize consumption and use of renewable materials. Predictive maintenance minimizes waste and downtime. With a rising population and industrialization, AI provides enormous potential for sustainable development in India. Its application in irrigation and smart city initiatives is evident in government initiatives such as "AI for All" by NITI Aayog. Nevertheless, several issues persist, including a lack of qualified professionals, high costs of implementation, and inadequate data infrastructure. Effective governance, transparency, and intersectoral collaboration are critical to achieve environmentally sustainable and just outcomes. To tap the full potential of AI in facilitating CE principles, capacity-building investments are required. The integration of AI and circular economy models represents a significant leap forward in achieving sustainable and resilient economic growth for the global economy and developing economies such as India.

Keywords: Artificial intelligence, Circular Economy, Resource Optimisation, Sustainable Development

Introduction. The study examines the increasing significance of Artificial Intelligence (AI) in advancing sustainability via the Circular Economy (CE). The old "take, make, dispose" linear models are no longer working because of more waste, less resources, and more environmental problems. The circular economy is all about using resources again, recycling them, and making them new again. AI is a key enabler because it makes things more efficient, helps people make better decisions, and helps businesses make better use of their resources in fields like agriculture, energy, and waste management.

The purpose of the work. The primary objective of this research is to examine the role of AI in facilitating the attainment of sustainability objectives via circular economy practices.

Formulation of the problem. Despite the potential of AI in supporting sustainability, several challenges hinder its effective implementation like limited awareness and adoption of circular economy practices, high cost and technical complexity of AI technologies.

Solving the problem. The research suggests multiple solutions to address these challenges like Adoption of AI technologies, Policy support and government initiatives, Investment in skill development, Improvement in data infrastructure for better AI implementation, Collaboration between government, industry, and academia to ensure responsible and inclusive growth, Promotion of circular practices like recycling, reuse, and smart waste management using AI.

These solutions can help transition towards a sustainable and resilient economy by maximizing the benefits of AI in circular systems.

Based on Fig. 1, the data shows how much carbon dioxide is expected to be released each year from 2024 to 2030 in different situations. Over time, emissions go up steadily. By 2030, the highest scenario will reach about 44.1 Mt, while the lowest will stay around 24 Mt. The mid-case scenario shows moderate growth, which means that emissions are going up in a controlled way. The dotted trend line shows that people are trying to stabilize emissions, but the overall growth shows that stronger sustainability measures are needed.

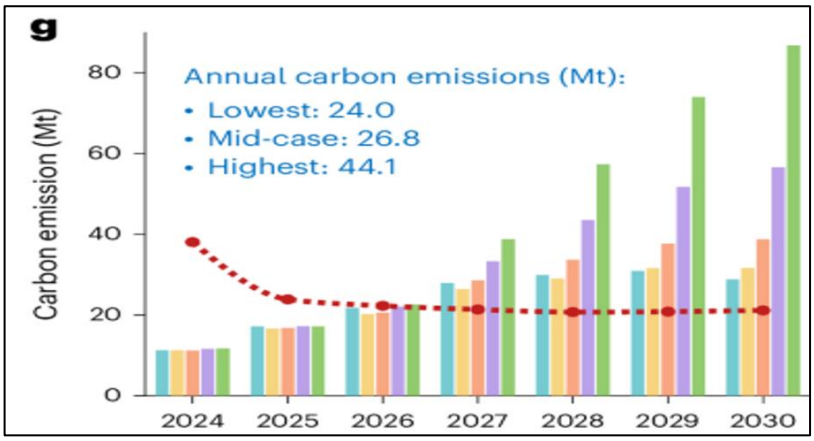

Fig. 1. Annual Carbon Emissions.

The data in Fig. 2, shows that energy use will steadily rise every year from 2024 to 2030 in all scenarios. The most likely scenario shows a sharp rise, reaching about 244.9 TWh by 2030. The least likely scenario, on the other hand, grows more slowly. The mid-case shows that energy demand will grow steadily and at a moderate rate. Overall, the upward trend shows that energy needs are growing and that managing energy in a way that is both efficient and long-lasting is important.

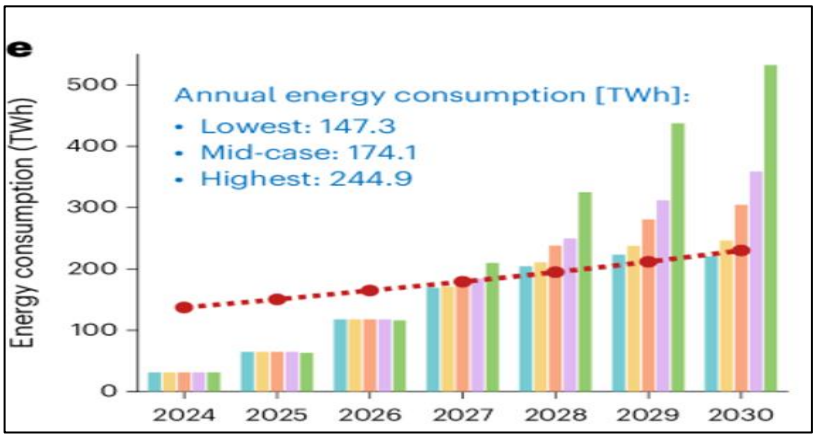

Fig. 2. Annual Energy Consumption.

Conclusion. The study concludes that Artificial Intelligence (AI) plays a crucial role in promoting the Circular Economy (CE) and fostering sustainability. AI enables efficient use of resources, reduces waste, and improves energy management. This technology helps transition from a linear to a circular economic model. Applications like predictive analytics, machine learning, and smart systems show significant promise in areas such as agriculture, manufacturing, and waste management. These advancements lead to both environmental and economic gains.

However, the research also points out important challenges. High implementation costs, a shortage of skilled workers, and poor data infrastructure are major issues, especially in developing countries like India. To fully benefit from AI in sustainability, we need strong policy support, investment in skill development, and cooperation among government, industry, and academia. With the right approaches, AI can be a powerful tool for achieving sustainable and resilient economic growth.

References

1. Noman, A. A., Akter, U. H., Pranto, T. H., & Bahalul, H. (2022). Machine Learning and Artificial Intelligence in Circular Economy: A Bibliometric Analysis and Systematic Literature Review. arXiv preprint. arXiv
2. Acerbi, F., Forterre, D. A., & Taisch, M. (Year). Role of Artificial Intelligence in Circular Manufacturing: A Systematic Literature Review. Politecnico di Milano. Re-public

3. Bashynska, I., & Prokopenko, O. (2024). Leveraging Artificial Intelligence for Circular Economy: Transforming Resource Management, Supply Chains, and Manufacturing Practices. Scientific Journal of Bielsko-Biala School of Finance and Law, 28(2). Asej
4. Sikander, A. (2024). Artificial Intelligence and the Circular Economy: How AI Advances Waste Reduction. Green Environmental Technology, 1(2), 23-34. Research Corridor
5. Hosmani, A., & Mithun, D. J. (Year). Impact of AI on Sustainable Circular Economy: Harnessing Artificial Intelligence. EPRA Journals. EPRA Journals
6. Raja R., R., & Khanna, G. K. R. (2025). Life Cycle-Based Sustainability Assessment and Circularity Mapping for Packaging Materials: Integrating Artificial Intelligence. Journal on Artificial Intelligence, 7, 301-327. Tech Science
7. Artificial intelligence in support of the circular economy: ethical considerations and a path forward. (2022). AI & Society, 39, 1451-1464. SpringerLink
8. Artificial Intelligence and the Circular Economy: AI as a Tool to Accelerate the Transition. (2019). McKinsey & Company / Ellen MacArthur Foundation Report. Sustainability
9. Achal, D. K., & Vijaya, G. S. (2025). AI-Enhanced Circular Economy and Sustainability in the Indian Electric Two-Wheeler Industry: A Review. World Electric Vehicle Journal, 16(11), 638. https://doi.org/10.3390/wevj16110638
10. Aggarwal, R. K. (2024). Installation and Performance Evaluation of a Solar Steam Cooking System for 1500 Students in the Hills– A Case Study. Current World Environment, 18(3), 1337. https://doi.org/10.12944/cwe.18.3.33
11. Ahmed, A. H. (2025). Next-Gen Instrumentation: Enabling Smarter and Sustainable Engineering Solutions. International Journal for Research in Applied Science and Engineering Technology, 13(6), 2515. https://doi.org/10.22214/ijraset.2025.72662
12. Annual report 2023/24. (2024). Veterinary Record, 195(4), 165. https://doi.org/10.1002/vetr.4636
13. Azer, M. A., & Samir, R. (2024). Overview of the Complex Landscape and Future Directions of Ethics in Light of Emerging Technologies. International Journal of Advanced Computer Science and Applications, 15(7). https://doi.org/10.14569/ijacsa.2024.01507142
14. Benk, M., Kerstan, S., Wangenheim, F. von, & Ferrario, A. (2023). Twenty-Four Years of Empirical Research on Trust in AI: A Bibliometric Review of Trends, Overlooked Issues, and Future Directions. arXiv (Cornell University). https://doi.org/10.48550/arxiv.2309.09828
15. Bhalla, N., Brooks, L., & Leach, T. (2023). Ensuring a 'Responsible' AI future in India: RRI as an approach for identifying the ethical challenges from an Indian perspective. AI and Ethics, 4(4), 1409. https://doi.org/10.1007/s43681-023-00370-w