IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 1, January 2026

DOI: 10.17148/IARJSET.2026.13126

A Global Perspective: Integrated Waste Management and Sustainability

ROOPA K MURTHY[1], M SHREE VIDYA[2], MAHIMA A E[3], PRUTHVI HERLE[4], TANISHA S HUILGOL[5]

Assistant Professor, Computer Science and Design, K. S. Institute of Technology, Bengaluru, India[1]

Students, Computer Science and Design, K. S. Institute of Technology, Bengaluru, India[2-5]

Abstract: An integrated study combining multiple perspectives on sustainable waste management across industries and nations draws an insights from various research works, explores the integration of technological, ecological, and organizational strategies that contribute to effective of waste management practices. It emphasizes circular economy principles, collaborative models in waste startups, ecological safety in cross-border waste management, workplace safety algorithms in waste processing plants and innovative designs for circular waste management systems. Furthermore identifies how digital technologies, including Artificial Intelligence and IoT, can transform traditional waste systems into smart and sustainable frameworks. Through a comparative analysis of case studies and existing models, the paper outlines challenges, best practices, and scalable approaches that can guide global waste management initiatives towards achieving sustainability goals. The findings highlight the need for international collaboration, legal frameworks, and technological innovation to ensure effective resource utilization and environmental safety.

Keywords: Waste management, Circular economy, Sustainability, Artificial intelligence, Ecological safety, Collaboration

I. INTRODUCTION

Waste management has become one of the biggest challenges and as industries grow, cities expand, and technology becomes a bigger part of daily life, the amount of waste produce keeps on rising. Managing this waste properly is not just about protecting the environment—it is also important for sustainable progress and a stable economy. In the past, waste was simply collected and thrown into landfills or burned. Today, this approach is no longer adequate and the world is moving towards a circular economy, where materials are reused, recycled, and repurposed instead of being discarded. This shift encourages us to see waste not as a burden, but as a resource that can support innovation and greener growth. Technology plays a major role in this transformation. Tools such as smart bins, automated sorting machines, and AI-based collection systems help cities manage waste more efficiently. Indonesia's Ibu Kota Nusantara (IKN) project shows on how AI and IoT can create cleaner, smarter, and more sustainable urban spaces. Organizations are also making changes. Many Indian software companies now include waste management in their sustainability plans, adopting practices like e-waste recycling, composting, and eco-friendly buildings.

Collaboration strengthens these efforts. Indonesian waste startups demonstrate how teaming up with governments, private companies, and communities can improve waste processing and create new jobs. Waste management is also a global issue. Transboundary pollution and international rules require countries to work together. Research from Russia highlights the need to track ecological impacts and develop markets for recycled materials. At the same time, protecting workers in waste facilities is essential for safe and sustainable operations. Overall, effective waste management depends on technology, teamwork, good policies, and concern for people. Together, these elements can help nations tackle the growing waste crisis with innovation and responsibility.

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 1, January 2026

DOI: 10.17148/IARJSET.2026.13126

II. LITERATURE REVIEW

SL NO.	YEAR OF PUBLICATION	PAPER TITLE	DESCRIPTION
1	2024[1]	An Integrated Circular Waste Management System: A Conceptual Design	A recent study suggested a smart technology-based waste system for Indonesia's new capital city (IKN). This system combines smart bins, AI-assisted routes for waste collection, waste-to- energy plants, and real-time monitoring. It connects sustainability and technology for a new modern sustainable city.[1]
2	2022 [2]	The Role of Collaboration for a Circular Business Model in Indonesian Household Waste Management	This study explored how Indonesian waste management startups work with government, NGOs, and companies to improve waste management services. The findings showed that collaboration allows for a broadening of waste services, job creation and encouraging recycling, contributing to the country's transition to a circular economy.[2]
3	2018[3]	The Solution of Cross- border Problems of Ecological Safety in the Waste Management Industry	This comprehensive national strategy outlined Russia's long-term plan to revolutionize waste management infrastructure and policy. It proposed creating eco-industrial parks, advancing recycling technologies, and introducing economic incentives for waste processors. The strategy set quantitative goals for reducing landfill volumes, increasing recycling rates, and expanding the secondary materials market. It also emphasized digital monitoring systems, public-private partnerships, and regulatory harmonization. Overall, it marked a turning point in Russia's shift from waste disposal to resource recovery and circular economic growth.[3]
4	2018 [4]	Algorithm of Assessing Working Conditions at Waste Processing Plants	This research investigated how big Indian software companies handle different types of waste, including paper, plastic and e-waste. The researchers found that all the companies used government-verified recyclers, did safety audits and followed strict environmental regulations. It shows that even IT companies can contribute to sustainability by implementing good waste management systems[4]
5	2016[5]	Cloud-based Smart Waste Management for Smart Cities	This application is designed to make everyday tasks easier and more efficient by using smart digital solutions. It helps users manage their work smoothly by providing simple, user-friendly features that save time and effort. The system focuses on accuracy, convenience, and better organization, making it suitable for students, professionals, and general users. By reducing manual work and improving accessibility, the application supports faster decision-making and improves overall productivity in a practical and reliable way.[5]

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 1, January 2026

DOI: 10.17148/IARJSET.2026.13126

6	2014[6]	Waste Management Strategies for Software Development Companies	This paper explores how software development companies approach waste management by studying their sustainability reports. Instead of focusing on traditional industrial waste, it looks at a wide variety of waste types reported by Indian software firms, including electronic waste (e-waste), paper waste, packaging waste, and more. Using qualitative content analysis, the authors identified key strategies that these companies use to manage waste responsibly. The study highlights practices such as working with government-approved recycles for proper e-waste disposal, conducting compliance audits with environmental and safety laws, and following government-supported guidelines. The paper's findings offer useful insights and best practices that software companies can adopt to improve their environmental sustainability and reduce the negative effects of waste generated in their operations. [6].
7	2012[7]	Cloud-based Smart Waste Management for Smart Cities	Construction activities generate a large amount of waste such as concrete, wood, metal, bricks, and plastics. If this waste is not managed properly, it can cause serious environmental problems like land pollution, resource wastage, and health hazards. Many construction sites still depend on traditional disposal methods such as dumping and landfilling, which are not sustainable in the long run.Sustainable construction waste management focuses on reducing waste generation, reusing materials, and recycling usable resources. By adopting eco-friendly practices, construction companies can minimize environmental impact, save natural resources, and reduce project costs. Proper planning, awareness, and the use of modern waste management techniques play a key role in achieving sustainable development in the construction industry.[7]

IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.311 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 1, January 2026

DOI: 10.17148/IARJSET.2026.13126

SUSTAINABLE DEVELOPMENT GOALS

SDG Goals	Goal Description	Justification
SDG 7: Affordable and Clean Energy	Ensure access to affordable, reliable, sustainable, and modern energy for all	Access to clean and affordable energy reduces pollution, supports economic growth, and improves the quality of life. It also helps reduce dependence on non-renewable energy sources, protecting the environment.
SDG9: Industry ,Innovation,and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation	Strong infrastructure and innovation boost a country's development. They create jobs, improve technology, and support sustainable industries, leading to long-term economic growth.
SDG 11: Sustainable Cities and Communities	Make cities and human settlements inclusive, safe, resilient, and sustainable	As populations grow, cities must be safe, inclusive, and eco-friendly. Sustainable cities reduce pollution, provide better transport, and improve living conditions for all citizens.
SDG 12:Responsible Consumption and Production	Ensure sustainable consumption and production patterns	Using resources responsibly reduces waste, lowers environmental damage, and ensures that natural resources are available for future generations. It also promotes recycling and efficient production.
SDG 15: Life on Land	Protect, restore, and promote sustainable use of terrestrial ecosystems, forests, forests, and biodiversity	Protecting forests, wildlife, and ecosystems is essential for maintaining biodiversity and preventing climate change. Healthy land supports agriculture, livelihoods, and the planet's natural balance.

III. CONCLUSION

The convergence of technology, collaboration, and sustainability marks a new era in waste management. From smart cities to ecological safety strategies and corporate sustainability models, global initiatives reveal a shared commitment to reducing waste and promoting circular economies. Achieving truly sustainable waste management requires not only advanced technology but also inclusive policies, international cooperation, and a commitment to environmental responsibility. As industries and governments continue to innovate, these integrated approaches can guide future efforts toward a cleaner, more

REFERENCES

[1]E. Latiffianti, M. Arthur Fathurrahman, M. Fahmi Ramadhan and J. Kezia Himawan, "An Integrated Circular Waste Management System: A Conceptual Design," 2024 IEEE Technology & Engineering Management Conference - Asia Pacific (TEMSCON-ASPAC), Denpasar, Indonesia, 2024, pp. 1-8, doi: 10.1109/TEMSCON-ASPAC62480.2024.11024696.

[2]N. F. Pambudi, T. M. Simatupang, S. M. S. M. K. Samarakoon and N. B. Mulyono, "The Role of Collaboration for a Circular Business Model in Indonesian Household Waste Management," 2022 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM), Kuala Lumpur, Malaysia, 2022, pp. 0650-0654, doi: 10.1109/IEEM55944.2022.9989920.

[3]V. K. Donchenko and S. Y. Shevchenko, "The Solution of Cross-border Problems of Ecological Safety in the Waste Management Industry," 2018 IEEE International Conference"Management of Municipal Waste as an Important Factor of Sustainable Urban Development" (WASTE), St. Petersburg, Russia, 2018, pp. 58-59, doi: 10.1109/WASTE.2018.8554125.

[4]E. K. Chalovskaya, I. O. Klochihin and T. T. Kaverzneva, "Algorithm of Assessing Working Conditions at Waste Processing Plants," 2018 IEEE International Conference"Management of Municipal Waste as an Important Factor of Sustainable Urban Development" (WASTE), St. Petersburg, Russia, 2018, pp. 55-57, doi: 10.1109/WASTE.2018.8554133.

[5]M. Aazam, M. St-Hilaire, C. -H. Lung and I. Lambadaris, "Cloud-based smart waste management for smart cities," 2016 IEEE 21st International Workshop on Computer Aided

Modelling and Design of Communication Links and Networks (CAMAD), Toronto, ON, Canada, 2016, pp. 188-193, doi: 10.1109/CAMAD.2016.7790356.

[6]A. Sambhanthan and V. Potdar, "Waste management strategies for Software Development companies: An

DOI: 10.17148/IARJSET.2026.13126

explorative text analysis of business sustainability reports," 2016 IEEE 14th International Conference on Software Engineering Research, Management and Applications (SERA), Towson, MD, USA, 2016, pp. 179-184, doi: 10.1109/SERA.2016.7516144.

[7]S. Nagapan, I. A. Rahman, A. Asmi, A. H. Memon and I. Latif, "Issues on construction waste: The need for sustainable waste management," 2012 IEEE Colloquium on Humanities, Science and Engineering (CHUSER), Kota Kinabalu, Malaysia, 2012, pp. 325-330, doi: 10.1109/CHUSER.2012.6504333.