

Editorial

Resource Recovery from Unused Resources for Balancing Environmental Protection and Economic Growth

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It is with great enthusiasm and a sense of profound responsibility that we present the inaugural edition of the *Waste Management and Recycling Technology Journal*. This newly launched journal emerges at a time when the need for sustainable solutions in waste and resource management is more critical than ever. Global challenges, including climate change, biodiversity loss, overconsumption of finite resources, and rising inequality, are increasingly interconnected. In this first issue, we place at the center of our editorial theme the concept of resource recovery from unused resources as a key strategy for reconciling the dual objectives of environmental protection and economic growth.

We stand today at a crossroads in human development. The legacy of the linear economy—take, make, dispose—has left behind mountains of solid waste, alarming levels of plastic pollution in oceans, and vast pools of underutilized or neglected resources ranging from industrial by-products to agricultural residues, e-waste, and municipal solid waste. At the same time, population growth and increasing consumption patterns continue to place immense pressure on the planet’s natural systems.

Within this context, the notion of “unused resources” has evolved far beyond its traditional connotation of discarded or residual materials. These now represent untapped potential for new forms of value creation. Be it urban mining from landfills, waste heat from industrial processes, nutrient recovery from wastewater, or biomass residues from agriculture, the ability to extract value from what was previously considered valueless is not only technologically viable but increasingly economically attractive.

Framing the Challenge: Beyond Waste, Toward a Circular Future

A core objective of this journal is to reframe how we think about waste—not as an inevitable by-product of progress, but as a resource in disguise. It requires a shift in mindset that transcends traditional boundaries of engineering, economics, and policy.

This issue’s theme reflects a growing consensus that resource recovery is not just a technical challenge, but an integrated solution space that encompasses material innovation, supply chain redesign, socio-political acceptance, and systemic circular thinking. Circularity in this sense is not only about recycling, but also about designing waste out of the system entirely—keeping materials in use for as long as possible and regenerating natural systems in the process.

While recycling as an end-of-pipe solution is necessary, upstream interventions—such as eco-design, modularity, and digital tracking of materials—are equally vital. The move toward resource recovery thus demands interdisciplinary innovation and a collaborative approach involving scientists, engineers, policymakers, businesses, and civil society.

Technological Advances and Innovation Frontiers

In recent years, rapid developments in materials science, bioengineering, artificial intelligence, and nanotechnology have accelerated the potential for high-value recovery from previously unusable waste streams. Pyrolysis and gasification technologies, for instance, have transformed plastic waste and biomass into biochar, syngas, and other energy-rich intermediates. In the water sector, nutrient recovery technologies such as struvite precipitation and algae cultivation are closing the loop on phosphorus and nitrogen cycles.



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Emerging concepts such as “waste valorization”, “urban symbiosis”, and “industrial ecology” further underline the promise of integrated systems in which waste streams from one sector become feedstock for another. Similarly, digitalization tools—including blockchain-enabled traceability systems, AI-powered waste sorting, and digital twins for material flow analysis—are beginning to bridge the gap between theory and practice.

However, these technological developments must be matched by system-level governance, robust infrastructure, and financial instruments to accelerate adoption. Only then can they move beyond laboratory success to real-world implementation at scale.

Balancing Environmental Protection and Economic Development

One of the most persistent arguments against stringent environmental regulations has been the perceived trade-off with economic growth. Yet, the success stories emerging from both developed and developing economies now refute this false dichotomy.

In countries like Sweden, South Korea, and Singapore, green economic models based on resource efficiency and circular innovation have shown that environmental protection can be a driver of economic competitiveness. In many cases, resource recovery not only reduces environmental pollution but also creates new business opportunities, jobs, and export potential.

The transition to circular resource flows supports decoupling economic development from environmental degradation—a fundamental objective of the United Nations’ 2030 Agenda. By diverting waste from landfills, reducing virgin resource extraction, and regenerating value from materials that would otherwise be lost, resource recovery becomes a bridge between ecological integrity and socio-economic progress.

For lower- and middle-income countries, where waste collection rates are often low and landfilling remains the dominant disposal method, the opportunity is even more significant. Circular practices offer a way to leapfrog to more sustainable systems without replicating the environmental mistakes of industrialized nations.

Social and Ethical Dimensions of Resource Recovery

Technological advancement alone cannot guarantee sustainability. Resource recovery practices must be designed to be socially inclusive, ethically responsible, and context-sensitive. Informal workers in waste sectors—often the invisible backbone of recycling systems in cities across Africa, Asia, and Latin America—need to be acknowledged and integrated into formal systems through fair wages, social protection, and capacity-building programs. Similarly, gender, age, and community impacts must be considered in designing recovery systems that are just and equitable.

Public acceptance and behavioral change are also crucial. Even the most sophisticated technology cannot succeed without community buy-in, regulatory compliance, and transparent stakeholder engagement. Hence, resource recovery is not just about what is technologically possible, but about what is socially desirable and politically feasible.

A Platform for Interdisciplinary Dialogue

This journal is born out of the conviction that interdisciplinary collaboration is no longer optional—it is imperative. The *Waste Management and Recycling Technology Journal* aspires to be a knowledge hub where scientists, engineers, policy analysts, urban planners, environmental economists, and innovators can meet at the confluence of waste valorization, systems thinking, and sustainable development.

Our editorial mission is to:

- Publish high-quality, peer-reviewed research that advances both theory and application in waste and resource management.
- Highlight case studies from across the globe—particularly from the Global South—where resource recovery solutions are being piloted or scaled.
- Support emerging scholars, practitioners, and thought leaders working at the intersection of environment and technology.
- Facilitate dialogue between science, industry, and policy for evidence-informed decision-making.

Looking Ahead: Our Role in Shaping the Future

As we launch this journal, we are acutely aware that we are not merely chronicling the state of waste management; we are helping to shape its future. The knowledge we curate, the voices we amplify, and the values we embed into our editorial choices will influence how society responds to one of the most pressing challenges of our time: how to live within the ecological limits of our planet while ensuring human dignity and prosperity.

This inaugural edition brings together contributions that reflect the multidimensional nature of the resource recovery challenge. From studies on landfill mining and circular construction materials to advances in bio-waste transformation and decentralized waste-to-energy systems, our contributors demonstrate the ingenuity, resilience, and creativity needed to turn problems into possibilities.

As Editor-in-Chief, I invite you—the readers, contributors, and critics—to engage actively with this platform. Whether you are developing a new technology, crafting legislation, managing industrial processes, or teaching the next generation of engineers, your participation is crucial in building a community of practice committed to sustainable transformation.

Closing Reflections

In closing, I recall a quote from the late architect and systems theorist Buckminster Fuller:

“Pollution is nothing but the resources we are not harvesting. We allow them to disperse because we’ve been ignorant of their value”.

Let this be a reminder of our collective task: to see waste not as a liability, but as an opportunity for innovation, equity, and renewal.

The road ahead is filled with complexity, but also with immense promise. Let us walk it together—with curiosity, rigor, and unwavering commitment to a better future.

Conflicts of Interest

The author declares no conflict of interest.