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Transition to Circular Economy: A Review of Recent Initiatives taken by India

Dr. Megha Thakur

Assistant Professor, Department of Commerce, Government Mohindra College, Patiala, Punjab

Email Id: meghathanks1200@gmail.com

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ABSTRACT

The shift from a linear to a circular economy (CE) has emerged as a global response to the pressing need for sustainable development. While advanced nations pioneered the early transition, developing countries, including India, are now integrating CE principles into policy and practice. India has largely introduced CE under the broader umbrella of resource efficiency (RE), with an emphasis on technological and business-oriented approaches. This paper reviews India's journey towards CE, examining key policies, strategies, and progress while identifying critical gaps. It also explores the potential for incorporating neglected sectors—such as agriculture, transport, construction, tourism, and fashion—into CE frameworks. Examples from other developing economies highlight possible models for regenerative agriculture, food waste management, and circular consumption. The paper concludes that inclusive stakeholder participation, citizen awareness, fiscal incentives, and institutional support are essential for India to successfully achieve long-term sustainability through CE.

1. Introduction

1.1 The Importance of Circular Economy

The World Economic Forum in 2012 popularised the concept of CE through reports from the Ellen MacArthur Foundation and McKinsey. CE had been introduced as an alternative to the linear "take–make–dispose" model, which extracts resources, consumes them, and then generates waste. This

unsustainable pattern has placed immense pressure on finite natural resources and ecosystems. CE aims to break this link by promoting restorative and regenerative systems.

Its framework focuses on three goals: eliminating negative externalities such as pollution and waste, keeping products and materials in circulation through reuse, repair, remanufacture, and recycling, and regenerating natural systems by reducing reliance on non-renewable resources. Through the "4R" principle—reduce, reuse, recycle, recover—CE maximises resource life cycles while minimising environmental harm. CE functions at three levels: micro (firms and consumers), meso (industrial ecosystems), and macro (cities, regions, and nations). At each level, it encourages business models that extend product longevity, promote sharing systems, and design for reparability. Unlike the linear economy, CE creates economic value without exhausting natural resources, positioning itself as a model of resilience for sustainable development.

1.2 Sustainable Goals and Circular Economy

The UN's Sustainable Development Goals (SDGs) aim to create a better, more equitable world by 2030. Though CE is not explicitly listed in the SDG framework, it aligns closely with several goals, especially SDG 12 (responsible production and consumption) and SDG 11 (sustainable communities). Both SDGs and CE strive for reduced poverty, better living standards, and mitigation of climate change.

While the linear economy measures sustainability largely through efficiency gains, CE goes further—seeking to achieve positive ecological and social outcomes alongside economic growth. CE thus complements SDGs by tackling global challenges such as rising resource demand, volatile raw material prices, and rapid population growth. The COVID-19 pandemic reinforced the urgency of CE by underscoring humanity's dependence on ecological balance for resilience.

1.3 The Relevance of Resource Efficiency

Resource Efficiency (RE) is central to CE. It aims to generate more value from fewer resources, minimising environmental costs while meeting economic needs. Between 1970 and 2010, global material extraction nearly tripled, with Asia recording the steepest increase. This surge has driven climate change, biodiversity loss, and resource depletion. Resource Efficiency strategies emphasise recyclability, reparability, and durability. Together, RE and CE contribute to sustainable development by ensuring equitable access to resources, reducing greenhouse gas emissions, and creating intergenerational fairness

in resource use. India's policymakers recognise that building resilience requires strong markets for low-impact goods, innovation in waste management, and supportive governance.

1.4 Adopting Circular Economy in a Developing Country Framework

Developing nations face unique hurdles such as population growth, food and water scarcity, rapid urbanisation, weak institutions, and limited finances. Nevertheless, CE offers a pathway to address these challenges by closing production loops and adapting consumption patterns. Several developing countries have incorporated CE principles—through eco-industrial parks, waste reuse systems, and energy recovery. However, barriers remain in form of lack of technology, limited financing, weak policy implementation, and societal reluctance to accept recycled products. Institutional shortcomings further hinder circular transitions. Despite these obstacles, CE can be adapted to local contexts, provided governments lead policy reforms and innovators pioneer change.

2. Mainstreaming Circular Economy and Resource Efficiency in India

2.1 Resource Extraction Process in India

India's rapid economic development has intensified resource extraction. Domestic consumption has increased more than fourfold since 1970, making India the third-largest material consumer globally. By 2030, demand is expected to reach 14.2 billion tons, largely dominated by minerals and fossil fuels. Yet, India's recycling rate remains only 20–25%, compared with 70% in developed nations. High water use, extensive land degradation, and rising CO_2 emissions add to sustainability concerns. These trends underline the urgent need for India to embrace CE to ensure long-term environmental security and economic stability.

2.2 Shifting from Environment Policy To Resource Efficiency Strategy

India's policy journey began with the National Environment Policy (2006), which stressed sustainable growth. Since then, a series of laws and frameworks—covering solid waste, e-waste, plastics, renewable energy, design policy, and electric mobility—have shaped India's gradual shift towards CE. The creation of the Indian Resource Panel (2015) and Resource Efficiency Cell (2018) marked turning points. These institutions assessed gaps, encouraged recycling industries, and promoted awareness. The National Resource Efficiency Policy (2019) further advanced CE by aiming for efficient material use across lifecycles.India's framework combines national and state-level coordination, producer

responsibility organisations, and integration of the informal sector. It also promotes technology-driven recycling, citizen awareness, skill development, and circular public procurement. Despite its breadth, implementation often lags due to weak enforcement and limited incentives.

2.3 Performance in Circularity and Sustainability Initiatives

Potential benefits of CE in India are significant: cost savings in manufacturing, reduced import dependency, new jobs in recycling industries, better health outcomes in mining-affected communities, and preservation of natural ecosystems. For example, the steel sector alone could save millions of tons of raw material annually by 2025. Nevertheless, India's performance on SDGs 11 and 12 shows a clear gap between targets and achievements. While waste collection systems have improved, issues such as low sewage treatment capacity, heavy fossil fuel dependence, and inadequate hazardous waste recycling persist. Moreover, most CE efforts remain confined to waste management, neglecting broader aspects like consumer behaviour, community participation, and circular urban planning.

3. Discussion

India's transition to CE reflects a mix of progress and challenges. Policies have been developed, but implementation is uneven. Learning from other countries can offer useful insights. Brazil demonstrates regenerative agriculture, African nations show innovation in waste reuse, and European models highlight urban circularity.

3.1 Potential Sectors for Circular Action beyond Manufacturing

3.1.1 Agriculture

Agriculture is central to India's economy yet highly resource-intensive. CE in agriculture can focus on regenerative practices—such as reduced tillage, crop rotation, composting, and integration of livestock with farming. Brazil's adoption of regenerative farming has boosted sugarcane production while maintaining soil health. Similarly, bio-gas from agricultural waste presents a viable energy option for India. Policies must encourage farmers, especially smallholders, to adopt such practices through digital platforms, subsidies, and training.

3.1.2 Transport and Automobile Sector

India's vast transport sector offers scope for Circular Efficiency by shifting from product ownership to service-based models, adopting electric and alternative fuel vehicles, and improving circularity in manufacturing. European nations have pioneered circular aviation and inland transport hubs; India can adapt these models by incentivising clean fuel use, investing in Research and development and promoting shared mobility.

3.1.3 Construction and City Planning

The construction industry contributes significantly to waste and emissions. Circular approaches include using recycled plastics and fly ash in construction materials, and promoting sustainable urban planning. The concept of circular cities—integrating digital systems, green infrastructure, and localised resource loops—can transform India's urban landscape, improving liveability and resilience.

3.1.4 Fashion Industry

India's fast-growing fashion industry relies heavily on linear "use and dispose" models. Circularity here could involve clothing rental systems, recycling textiles, and encouraging durable designs. However, this requires behavioural change among consumers, which remains a neglected area in India's CE policy discourse. Promoting circular consumption could extend CE beyond producers and regulators, making it a shared societal responsibility.

3.2 Some Missed Agenda

Despite significant steps, India's CE agenda has overlooked several critical areas. Tourism and hospitality, both major waste generators, remain outside the CE framework. Policies for food waste reduction and composting could have been prioritised. Moreover, micro, small, and medium enterprises (MSMEs) have been sidelined, despite evidence that environmental incentives and social pressure can make them active CE participants. Cities, which are major centres of consumption and waste generation, have not been systematically integrated into CE planning. Finally, consumer acceptance of recycled products remains low, posing a challenge to closed-loop supply chains. Overemphasis on techno-centric and business-driven solutions risks sidelining governance, awareness, and community engagement—all of which are crucial for meaningful transformation.

4. Conclusion

India's CE journey is still evolving. While the government has laid out extensive policies and frameworks, achieving true circularity requires broader participation. Agriculture, transport, construction, fashion, tourism, and hospitality must be integrated into the CE agenda. Urban areas should adopt circular city models, supported by consolidated national and state-level policies. Financial incentives, including taxation reforms, investment in R&D, and support for recycling industries, are essential. Dedicated federal bodies could strengthen coordination and monitoring, avoiding failures seen in past policies like the plastic ban. Most importantly, citizens must embrace circularity. Behavioural and lifestyle changes, supported by education and awareness campaigns, can complement government efforts. CE is not merely a technical shift but a cultural transformation rooted in stewardship, intergenerational equity, and environmental responsibility. India's path to CE may be challenging, but with a balanced mix of policy reforms, institutional support, and citizen participation, it can become a model for sustainable development in the Global South.

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