



From Trash to Treasure: Circular Economy Models for Climate Resilience

July-September 2025

From the Director's Desk

The imperative of tackling climate change necessitates solutions that transcend traditional development paradigms. The circular economy offers a transformational approach, viewing waste not as a liability but as a useful asset. By embracing the notion of "From Trash to Treasure," we can establish climate-resilient economies that protect both livelihoods and ecosystems.

At BIRD, we assert that financial institutions (FIs) are key to this change. Circular economy funding is not a marginal CSR endeavour; it is a strategic necessity that enhances risk management, creates new market opportunities, and guarantees long-term portfolio stability. By incorporating circular practices into their credit, investment, and advisory frameworks, FIs can catalyse India's transition to a regenerative, low-carbon economy. The circular economy transcends environmental concerns; it encompasses farmer welfare, financial inclusion, and national competitiveness. It connects climate action with economic development, in accordance with the Paris Agreement and the Sustainable Development Goals (SDGs). BIRD is dedicated to enhancing capacities, cultivating partnerships, and developing financial innovations that promote circular models in agriculture and rural sectors as we go.

The message is clear and impactful: financing the circular economy equates to supporting climate resilience and financial stability. Let us collaboratively delineate a future in which sustainability and prosperity coexist. By turning waste streams into value streams, financial institutions can safeguard asset quality, open green revenue channels, and contribute to a climate-resilient economy.

What is Circular Economy?

The circular economy (CE) is a production model that emphasizes the reduction or elimination of waste throughout all phases of the product life cycle, including raw

material extraction, manufacturing, disposal, and reuse. The government's dedication to enhancing the manufacturing sector through 'Make in India' can be augmented by incorporating circular economy ideas into industrial production, thereby improving resource efficiency, lowering costs, and generating green employment opportunities. Embracing circular models is both an ecological imperative and a strategic economic advantage.

Given the accelerating effects of climate change, evidenced by catastrophic weather events, resource depletion, and ecological degradation, re-evaluating our production and consumption methods has become imperative. The CE is a systemic approach to production and consumption that moves beyond the traditional "take-make-dispose" linear model. By focusing on restorative and regenerative design, CE emphasizes the prolonged utilization of products, materials, and resources to minimize waste and decouple economic growth from finite resource consumption.

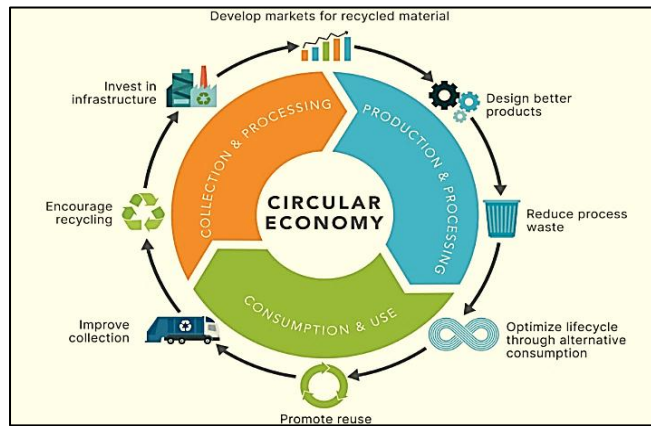
India's circular economy is anticipated to have a market value of \$2 trillion by 2050, generating 10 million jobs and highlighting the prospects for economic advancement and sustainability. This strategy emphasizes waste reduction, optimal resource utilization, and the encouragement of reuse and recycling, in accordance with India's traditional principles of conservation and resourcefulness. Initiatives like the National Circular Economy Framework (NCEF) 2024 and several waste management regulations (plastic, e-waste, battery) underscore the government's dedication to this shift.

(Ministry of Environment, Forest and Climate Change, 2025: <https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=2108165>).

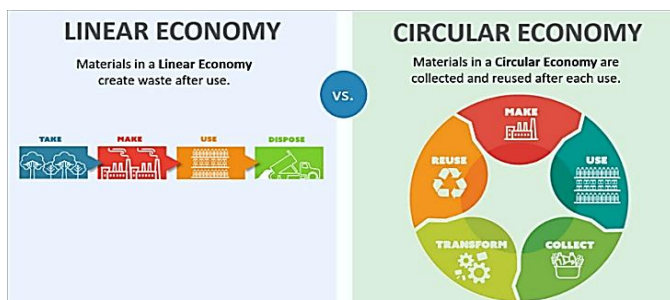
Importance of circular economy in the context to climate resilience

The circular economy transcends mere waste management, serving as a tool for climate resilience. By completing material loops, diminishing reliance on virgin resources, and rehabilitating ecosystems, it provides a pragmatic approach

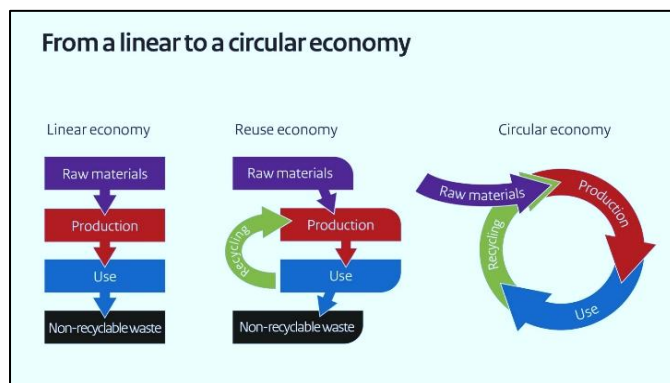
to alleviating climate risks while generating green employment and enhancing community resilience.



Source: <https://pressbooks.bccampus.ca/cicancarpentryproject/chapter/circular-economy-and-life-cycle-approach>



Source: Hicone: Consumption, Sustainability and Circular Economy



Source: <https://www.government.nl/topics/circular-economy/from-a-linear-to-a-circular-economy>

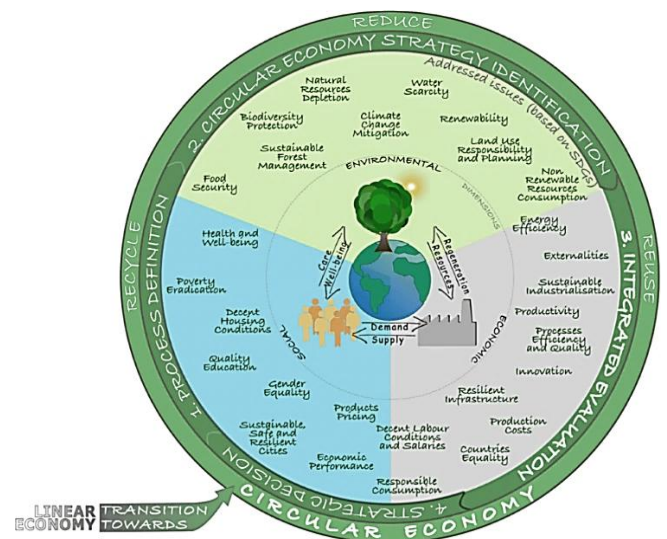
Concept of circular economy vs. linear economy (take–make–dispose)

The circular economy is revolutionizing agriculture and finance by transitioning from the "take-make-dispose" paradigm to a regenerative framework. It fosters resource efficiency, minimizes waste, and enhances climate resilience—essential for food security and sustainable development.

Why Circular Economy Strengthens Climate Resilience?

1. Mitigating Greenhouse Gas Emissions: Each phase of a product's lifecycle from extraction and production to disposal—exhibits a carbon footprint. Through the practices

of reusing, repairing, remanufacturing, and recycling materials, we may substantially diminish emissions linked to production and waste decomposition. Reusing a product in its original form is the most resource-efficient option in the waste hierarchy, as it avoids the energy and emissions of manufacturing new products and new materials entirely. It also shortens the supply chain and lowers the carbon footprint from transporting new goods over long distances. By keeping items in circulation for longer, reuse prevents them from entering the waste stream prematurely, which in turn reduces the emissions that would have occurred during their disposal or decomposition. The energy required to repair an item is typically a small fraction of the energy needed to produce a new one. This reduces the industrial pollution and greenhouse gases associated with manufacturing. By reusing existing cores, remanufacturing bypasses the emissions associated with extracting, processing, and transporting raw materials.



Source: www.worldbank.org

2. Safeguarding Natural Capital: Circular models diminish the necessity for raw material extraction, safeguarding forests, aquatic ecosystems, and biodiversity—ecosystems that function as natural buffers against climatic disturbances such as floods and droughts. A circular economy Reduced demand for virgin timber, pulp, and land for monoculture plantations helps conserve forests and their soil. As intact forests function as natural carbon sinks, they are a vital buffer against climate change. Less mining and processing of raw materials prevents the release of heavy metals and other pollutants into rivers and streams. This protects aquatic ecosystems, which regulate water quality and quantity to help mitigate floods and droughts. By designing out waste and pollution, circular models prevent harmful substances from entering and contaminating ecosystems. This allows nature to regenerate and maintain its natural defences.

3. Establishing Economic Stability During Periods of Crisis:

Circular economy promotes economic stability during a crisis by reducing reliance on vulnerable global supply chains and volatile raw material markets. By prioritizing local resource loops, reuse, and recycling, it helps insulate businesses from shocks and creates new, more resilient revenue streams. It provides resilience against external shocks. Insulates from supply shocks by minimizing dependence on extracting finite raw materials from geographically distant or politically unstable regions. In a crisis, the circular economy fosters innovation by pushing companies to create new business models based on sustainability. This includes product-as-a-service, repair, and refurbishment, which create new revenue streams and job opportunities that are not tied to traditional, linear consumption.

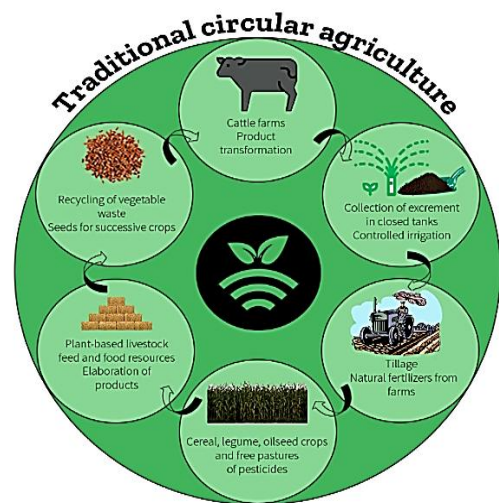
4. Reducing Waste and Pollution: In a circular economy, products are designed for durability, repair, and reuse, eliminating the concept of "waste" from the outset. For example, reusable containers replace single-use packaging, and electronics are designed for easy disassembly and component recovery. The circular model emphasizes using renewable energy and returning biological materials, like organic waste, to the earth in the form of compost to regenerate soil health. This practice actively improves the environment rather than depleting it. By minimizing the need for new raw materials, the circular economy reduces the environmental disruption and pollution caused by mining, logging, and other extraction activities. This also leads to a reduction in greenhouse gas emissions from energy-intensive production.

Implementing Circular Economy: Transforming Waste into Value

1. Agriculture and Food Systems

Transforming Waste into Soil Vitality: Agricultural wastes and food wastes can be composted into nutrient-dense organic fertilizers that boost soil structure, improve water retention, and sequester carbon. For example, composting mimics natural decomposition and converts organic waste into a valuable soil amendment known as humus. This process provides numerous benefits for both the environment and agriculture. Composting diverts organic waste from landfills, which are a major source of methane, a potent greenhouse gas. Decomposing organic matter in landfills anaerobically produces methane, whereas composting uses an aerobic process that produces significantly less methane. Compost helps increase the organic carbon content in soil, effectively locking carbon in the ground and removing it from the atmosphere.

Bioenergy Solutions: Livestock manure and agricultural leftovers can be transformed into biogas, hence diminishing reliance on fossil fuels. Biogas production uses anaerobic digestion to convert organic waste into a renewable energy source. This simultaneously solves waste management problems while creating clean, sustainable energy. Anaerobic digesters capture methane, which would otherwise be released into the atmosphere from decomposing manure in lagoons or storage tanks. By trapping and using this gas for energy, biogas production helps mitigate climate change. Biogas offers a circular economy model where waste is converted into a valuable energy source, reducing reliance on fossil fuels and providing a sustainable waste management solution.



Source: www.plantae.garden: Sustainable CIRCULAR agriculture-Traditional and Intensive

2. Manufacturing and Industry

Product-as-a-Service Models: Companies may lease things rather than sell them, thereby maintaining accountability for maintenance, reuse, and recycling. Product-as-a-Service (PaaS) and material recovery are key strategies within a circular economy, which aims to design out waste and pollution, keep products and materials in use, and regenerate natural systems. By contrasting with the traditional linear "take-make-waste" model, these strategies create a regenerative system that minimizes resource consumption and environmental impact. For example: Rolls-Royce offers "Power by the Hour" for its jet engines, where airlines pay for the time the engine is running rather than purchasing the engine itself. This incentivizes Rolls-Royce to produce the most durable and fuel-efficient engines possible, which it then services, repairs, and recycles.

Material Recovery: Industrial waste such as metal scrap, building debris, or textile remnants can be reintroduced into the manufacturing cycle. In the construction industry, demolition waste like bricks, concrete, and metal is collected, sorted, and reprocessed for new building

applications. This both reduces landfill use and lowers the energy-intensive demand for new materials.

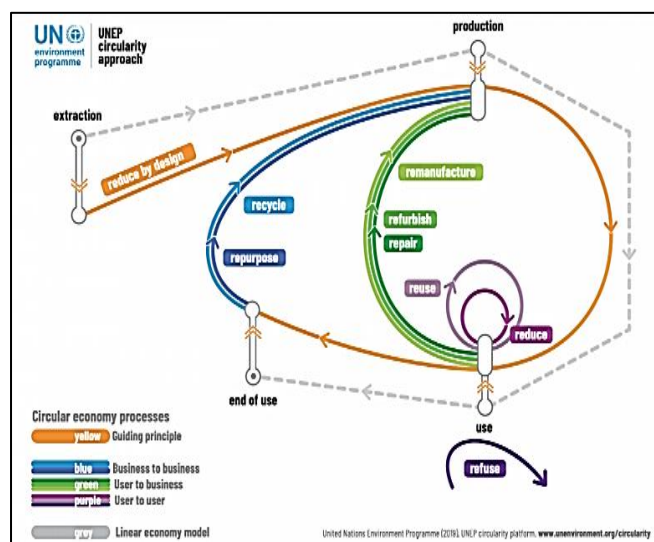
3. Urban trash Management: Urban trash management within a circular economy transforms waste into a valuable resource by implementing strategies like reduction, reuse, and recycling, moving beyond a linear "take-make-dispose" model. Achieving urban circularity requires holistic, integrated approaches that include robust collection, sorting, and processing systems, often facilitated by public-private partnerships, to foster resource efficiency and minimize waste.

4. Apparel and Consumer Products

Take-Back Programs: The fashion industry has a massive environmental footprint, from resource-intensive production to the enormous amount of textile waste generated annually. Circular fashion aims to combat these issues through a variety of strategies: Brands gather used clothing, renovate or recycle them, and resell at discounted prices.

Sustainable Materials: Sustainable materials like recycled polyester, organic cotton, and biodegradable fibers support the circular economy by diverting waste, conserving virgin resources, and reducing pollution. Technologies that can separate blended fabrics, like polycotton, facilitate closed-loop recycling, allowing materials to be depolymerized and repolymerized into new products, further reducing the need for new resources.

The "From Trash to Treasure" philosophy – turning waste into resources.



Source: UNEP Circularity Platform (2019): www.unenvironment.org/circularity

Circular economy in India: opportunities, challenges, and initiatives

India is advancing significantly towards adopting a circular economy, a revolutionary framework designed to reduce waste and optimize resource use. This methodology prioritizes the reengineering of products and processes for longevity, reuse, repair, and recycling, departing beyond the conventional linear "take-make-dispose" paradigm. As India is anticipated to emerge as the world's third-largest economy by 2030, sustainable development represents both a potential for the nation to exhibit worldwide thought leadership and a necessity for the well-being and security of its populace. A viable approach to sustainable development is the circular economy. India has implemented legislation and institutional steps for a circular economy; yet, progress is still fragmented, inefficient, and sluggish.

The Circular Economy Cell (NITI Aayog), Swachh Bharat Mission, Jal Jeevan Mission, and Vehicle Scrapping Policy are all examples of government efforts aimed at promoting sustainability. To fully thrive, India must shift from incremental recycling to product redesign, reuse, remanufacturing, and closed-loop systems. Transitioning to CE in these areas will not only assist meet the SDGs and the Paris Agreement goals, but also boost India's economic resilience and resource security, paving the way for a #VibrantBharat.

Key Statistics

- Approximately 30–40% of food is wasted globally each year, but circular models have the potential to reclaim \$1 trillion in value by 2030 (FAO, Ellen MacArthur Foundation, 2025).
- Banks that finance circular agricultural techniques can mitigate climate risk exposure by as much as 25% (Making Climate Finance Work in Agriculture, World Bank Report, 2023).
- India's overall sustainable debt market grew significantly by 186% between 2021 and the end of 2024, reaching \$55.9 billion. This includes green bonds, social bonds, and sustainability-linked debt, reflecting a strong trend toward sustainable finance. (<https://www.climatebonds.net/>)
- The transition to a circular economy could help mitigate climate change by reducing resource extraction, which accounts for 70% of global GHG emissions. By 2050, circular practices could reduce India's GHG emissions by 40%. (Circular Economy in India: Rethinking Growth for Long-Term Prosperity, Ellen MacArthur Foundation, 2025)

Scaling Up Circularity: While India has a strong foundation, scaling up circular economy practices requires overcoming legal and policy constraints, improving waste management infrastructure, and ensuring effective implementation of Extended Producer Responsibility (EPR) frameworks.

Evolving Consumption Patterns: Encouraging responsible consumption and reducing reliance on single-use plastics and other unsustainable products is crucial.

Financing and Investment: Attracting investments in circular economy technologies and businesses is essential to drive innovation and adoption. Overall, India has the potential to be a leader in the circular economy, leveraging its cultural heritage, growing economy, and government initiatives to create a more sustainable and prosperous future.

Economic Growth and Job Creation: India's circular economy could generate a market value of over \$2 trillion and create close to 10 million jobs by 2050 (NCEF, 2024).

Resource Efficiency and Waste Management: To reduce dependency on virgin resources, the circular economy prioritizes waste reduction, resource reuse, and material recycling.

Government Initiatives

- **National Resource Efficiency Policy (NREP):** A draft policy aiming to create a framework for circularity in key sectors such as automotive, plastic packaging, construction, and electronics. However status is still required.
- **Extended Producer Responsibility (EPR):** This framework holds producers responsible for the end-of-life management of their products, incentivizing circular design and waste reduction. EPR regulations are in place for various waste streams like plastic, e-waste, and batteries.
- **Swachh Bharat Mission-Urban (SBM-U):** A flagship program promoting urban sanitation and waste management, emphasizing the 3R principles (Reduce, Reuse, Recycle). The SBM Waste to Wealth PMS Portal facilitates project monitoring and resource sharing for waste transformation initiatives.
- **GOBAR-Dhan Scheme:** Promotes waste-to-wealth initiatives through biogas and organic waste processing.
- **City Investments to Innovate, Integrate and Sustain (CITIIS 2.0):** A component of the Smart Cities Mission integrating circular economy principles into urban development projects.
- **Right to Repair:** A framework aimed at empowering consumers to repair products and extend their lifespan. Launched in July 2024 by the Department of Consumer Affairs, this portal provides access to repair information and helps consumers find local repair services.

- **National Action Plan on Climate Change (NAPCC):** Working on a comprehensive strategy for addressing climate change in India, with a focus on emissions reduction and climate change adaptation.
- **Circular Economy Action Plans:** Action plans have been finalized for 10 waste categories, with regulatory and implementation frameworks under development.
- **International Cooperation:** India actively participates in global discussions and forums on the circular economy, including hosting the 12th Regional 3R and Circular Economy Forum in Asia and the Pacific. India has also expressed interest in hosting the World Circular Economy Forum in 2026.
- **Cultural Roots:** India's traditional practices of reuse and repair, evident in the role of scrap traders (kabadiwalas) and community initiatives, provide a strong foundation for circular economy principles, according to CEEW. (Unlocking India's Circular Waste Economy Potential for Sustainability, 2024).

Banking perspectives of Circular Economy

For the financial sector, climate change is no longer a distant environmental concern—it is a material financial risk. Disruptions to supply chains, raw material shortages, and disaster-related losses are already translating into credit defaults, non-performing assets, and reduced portfolio stability.

Circular Economy Matters for Financial Stability



The circular economy offers a compelling framework for banks and financial institutions to address these risks proactively while unlocking new lending, investment, and advisory opportunities. By promoting business models that keep resources in use, design out waste, and regenerate natural systems, the sector can contribute directly to climate resilience while building robust, future-proof portfolios.

Circular Economy Opportunities in Banking: A Snapshot

1. Agriculture & Rural Lending

- **Composting & Bioenergy:** Finance farmer cooperatives to convert crop residues and dairy waste into compost or biogas, improving farm incomes and reducing methane emissions.
- **Agro-Processing Waste Utilization:** Support MSMEs that turn fruit peels into nutraceuticals or husks into biochar.

2. MSME & Manufacturing Finance

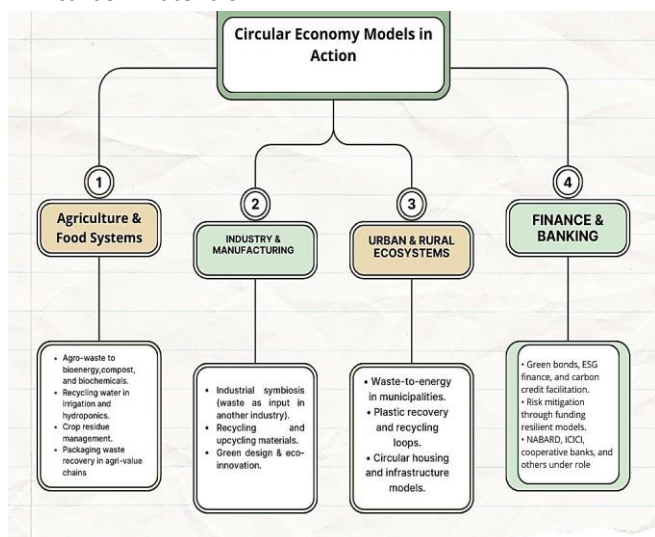
- **Equipment Leasing Models:** Fund machinery for product refurbishment or remanufacturing under leasing/Pay-as-you-use schemes.
- **Industrial Symbiosis:** Provide working capital to MSMEs integrating waste from one industry as raw material for another.

3. Retail & Consumer Banking

- **Green Consumer Loans:** Offer preferential rates for purchasing refurbished appliances or recycled-material products.
- **Digital Marketplaces:** Finance platforms enabling peer-to-peer resale, rental, and sharing economies.

4. Infrastructure & Project Finance

- **Material Recovery Facilities:** Finance centralized hubs for waste segregation, recycling, and resource recovery.
- **Circular Construction:** Support projects using recycled aggregates, modular building components, and low-carbon materials.



5. Role of Banks in Policy & Capacity Building

- **Advisory Services:** Guide clients in integrating circular business models to enhance bankability and long-term profitability.
- **Data & Risk Tools:** Develop credit assessment models incorporating climate resilience indicators.

- **Stakeholder Partnerships:** Collaborate with local bodies, NGOs, and private players to scale circular solutions in priority lending sectors.

Banks stand at a strategic intersection between capital flows and sustainable transformation. Financing the circular economy is not merely CSR—it is prudent risk management, a portfolio diversification strategy, and a regulatory alignment tool.

In the era of climate uncertainty, the most profitable investment is in systems that regenerate, not deplete.

6. Financing Models to Accelerate Circular Transition



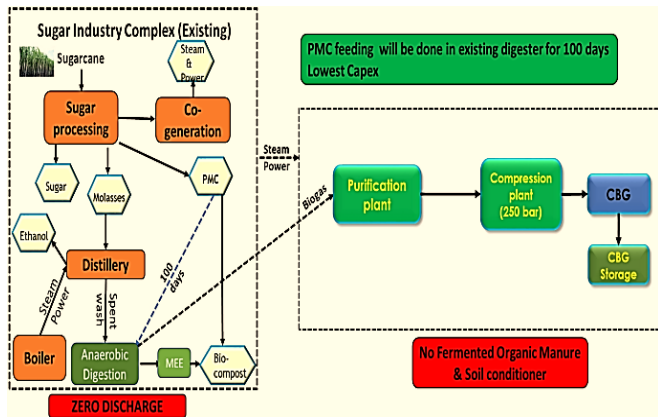
Circular Economy Case Studies from India

Case Study	Bank / FI	Circular Economy Intervention	Bank Finance Approach	Climate & Resilience Impact	Banking Benefit
Bio-CNG from Sugar Mill Waste – Maharashtra	NABARD	Bio-CNG plant using press mud & spent wash from cooperative sugar mill	Refinance support for renewable energy & waste-to-fertilizer units	Renewable energy + organic fertilizer; reduced methane emissions	Dual revenue streams improved repayment stability
E-Waste Recycling – Karnataka	SBI	Recovery of precious metals from discarded electronics	Term loans under SBI Green Fund Scheme	Reduced mining demand & emissions; responsible e-waste disposal	Strong ESG alignment; appeal to green investors
Waste Picker Cooperative Microfinance – Madhya Pradesh	HDFC Bank	SHG-led door-to-door collection, sorting, and recycling	Micro-credit & working capital facilities for SHGs	Social inclusion + landfill reduction	Low default due to community-based lending
Plastic Recycling MSMEs – Gujarat & Tamil Nadu	SIDBI	Post-consumer plastic converted to recycled granules	PRSF concessional finance lines	Reduced virgin plastic use; circular manufacturing inputs	Access to global green credit lines (GCF, KfW)
Paddy Straw Management – Punjab	Indian Bank	Collection & sale of paddy straw to biomass & paper units	Term loans for Happy Seeders & balers to FPOs	Reduced stubble burning; biomass energy generation	Rural portfolio strengthening & pollution-related NPA mitigation

- **NABARD – Financing Bio-CNG from Sugar Mill Waste (Maharashtra):** NABARD extended refinance support to a cooperative sugar mill for setting up of a Bio-CNG plant using press mud and spent wash as feedstock. Waste by-products were converted into renewable energy, which was used for captive power and sold to the grid. Slurry residue was marketed as organic fertilizer. Stable cash

flows from dual revenue streams improved loan servicing capacity, reducing credit risk.

- NABARD: Financing Biomass & Circular Agriculture:** NABARD provides refinance support to banks for financing of biomass-based power plants, composting units, and agro-waste utilization projects. In Punjab and Haryana, it funds biomass plants using paddy residues to generate renewable electricity. These projects reduce stubble burning, create rural jobs, and diversify farmers' incomes. NABARD illustrates the role of development finance in accelerating circular agriculture.



Source: Springer.Com: Bio-Circular Economy: An Opportunity for Diversification of Sugar Industries in CBG and Organic Fertilizer Production

NABARD's Climate Resilient Agriculture Project (CRA): Under NAFCC, NABARD has supported integrated farming, composting, and water recycling in Maharashtra, Odisha, and Madhya Pradesh. Grant support and micro-credit empower farmers and SHGs to adopt circular farm-level enterprises like vermicomposting and biogas. This reduces vulnerability to climate shocks.

NABARD's Waste-to-Wealth through FPOs: NABARD supports FPOs in biofertilizer units, oilseed cake processing, and organic input businesses using agro-waste. In Madhya Pradesh, soybean residues are converted into animal feed and bio-manure. This boosts rural entrepreneurship and reduces dependence on synthetic fertilizers.

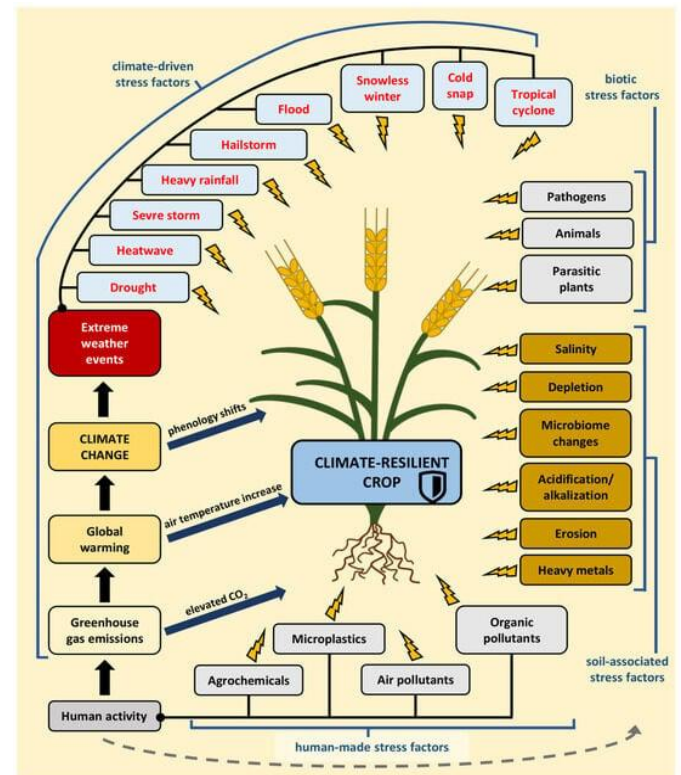
NABARD's Biomass Briquetting Units: In Bihar and Chhattisgarh, NABARD financed entrepreneurs to set up briquetting units that compress paddy husk and sawdust into bio-briquettes. These replace coal in industries, reducing emissions while generating rural jobs and income.

ICICI Bank – Green Agri-Loans for Circular Practices: ICICI Bank offers green loan products for solar pumps, micro-irrigation, and organic farming certification. By linking credit to sustainable practices, it reduces climate risk exposure and enables farmers to tap into carbon credit markets. This strengthens farmer resilience while aligning banking with circular agriculture.

State Bank of India (SBI) – Green & Sustainable Financing: SBI issued Green Bonds to finance renewable energy, waste-

to-energy, and circular agriculture projects. It supports biogas plants, solar cold storage, and irrigation systems. These initiatives reduce GHG emissions while providing farmers access to sustainable technologies.

SBI – Funding E-Waste Recycling Units (Karnataka): SBI sanctioned term loans under its Green Fund Scheme to SMEs engaged in dismantling and recycling electronic waste. Recovery of metals like gold, copper, and palladium reduced dependence on mining, cutting emissions and resource extraction costs. Asset-backed financing with strong ESG alignment, attracted green finance investors.



Source: MDPI: Climate Change: The Rise of Climate Resilient Crops

Yes Bank – ESG & Circular Economy Lending: Yes Bank pioneered India's first Green Bond (2015), financing waste recycling, bio-CNG plants, and circular packaging industries. By integrating ESG scoring into loan approvals, it drives private investment into circular projects, linking sustainability with profitability.



Source: MSWIPE: Efficient e-Waste Management Solutions with Mswipe

HDFC Bank – Parivartan Program: Through its Parivartan CSR initiative, HDFC Bank funds waste segregation, composting, and recycling projects in peri-urban areas. It also finances rural households for biogas and solar cookstoves, promoting a circular energy economy. This improves health outcomes and empowers women in waste-to-income projects.



A CAPACITY BUILDING TRAINING WAS CONDUCTED ON NADEP COMPOSTING, VERMICOMPOSTING, AZOLLA CULTIVATION, AND BIO-PESTICIDES, INCLUDING NEEMASTRA, JIVAMRIT, BEEJAMRIT, AND AGNASATRA. THE TRAINING SAW THE PARTICIPATION OF 20 FARMERS AT TATAYA HOKONAMUKH, ASSAM



SIDBI – Funding Plastic Recycling MSMEs under PRSF Scheme: SIDBI supported MSMEs in Gujarat and Tamil Nadu that convert post-consumer plastic waste into recycled granules used in packaging and furniture. Reduced virgin plastic production, lowered oil dependency, and diverted tonnes of waste from landfills. Access to concessional credit lines from international green funds (e.g., GCF, KfW) was arranged for better viability of recycling units.

WASTE TO WEALTH

Plastics can be grouped in two categories: thermoplastics and thermosets. While thermoplastics can be remoulded 2-3 times into any shape after being heated and are therefore easy to recycle, thermosets can be moulded only once. Here are the different kinds of plastics, their uses and recyclability

THERMOPLASTICS



POLYETHYLENE TEREPHTHALATE (PET)

Used in: Disposable water bottle, polyester cloth, ropes, binding straps, covering seats

Recyclability: Yes, widely recycled



POLYVINYL CHLORIDE (PVC)

Used in: Pipes, weather-resistant clothes, medical devices, toys, kitchen cling wraps, wires, shoe soles

Recyclability: Often not recyclable



HIGH DENSITY POLYETHYLENE (HDPE)

Used in: Shampoo bottles, jerry cans, chairs, bottle crates, fertiliser bags

Recyclability: Yes, widely recycled



POLYPROPYLENE (PP)

Used in: Bottle caps, plastic cutlery, takeaway food containers, raffia bags, buckets, mugs, tubs, chairs, automobile parts

Recyclability: Often not recyclable

Source: India Today: India is the world's biggest plastic polluter: what it means for our health

Punjab Straw Management Initiative: Punjab's Cooperative Banks, NABARD, and government agencies jointly promote straw management machinery and biomass energy projects. Farmers supply paddy stubble for biomass-based power plants rather than burning it. This turns waste into bioenergy, reduces carbon emissions, and creates rural employment. Financing for straw collection and processing equipment makes it a sustainable circular model.

AREA UNDER HAPPY SEEDERS (in Punjab and Haryana)
 2016: 20,000 ha
 2017: 75,000 ha
 that's 17% of area under rice in Punjab, Haryana, west UP

WHAT IS A HAPPY SEEDER
 A seeding implement that sows without the need to remove (paddy) stubble from field. Works best with straw spreader attached to combine harvester that evenly spreads paddy residue

AREA UNDER RICE
 Punjab | 2.9 mha
 Haryana | 1.3 mha
 * Figures provided by Borlaug Institute for South Asia

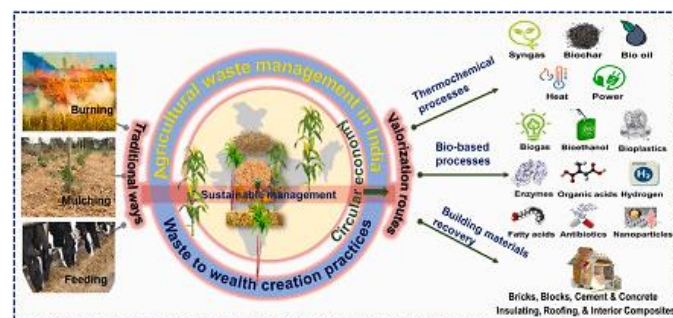
WHY LEAVE RESIDUE IN FIELD
 Residue decomposes, providing nitrogen, carbon and nutrients, improving soil health. Retains moisture that saves farmer one round of watering. Crops grow longer roots, making them stronger in facing weather hazards

What Govt Can Do
 Increase subsidy to happy seeder, straw spreader
 Buy these and make them available through various bodies
 Promote startups that hire out happy seeders to farmers

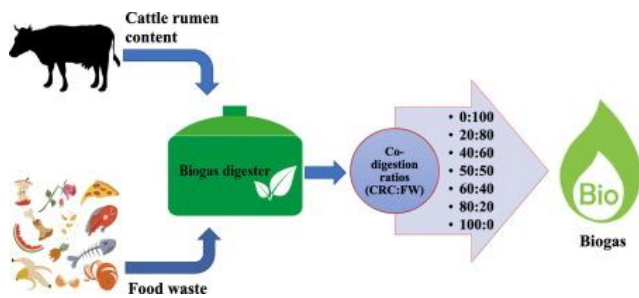
Source: The Economic Times

Term loans for purchase of Happy Seeders and baling machines to farmer producer organizations (FPOs) was extended which facilitated collection and selling of paddy straw to the paper mills instead of being burnt in the field. This also strengthened the rural credit portfolio while mitigating climate-related loan impairment from pollution-related crop losses.

ITC's Waste-to-Wealth Model in Paperboards & Agri Value Chains: ITC Limited has pioneered a waste-to-wealth model by integrating circular economy principles into its paperboards division and agricultural value chains. The company sources agro residues such as wheat straw, paddy stubble, and other crop wastes that would otherwise be burned or discarded and converts them into high-quality paperboards. This not only reduces dependence on virgin wood pulp but also provides farmers with an additional income stream. By preventing stubble burning, ITC reduces emissions, promotes resource efficiency, and strengthens climate resilience.

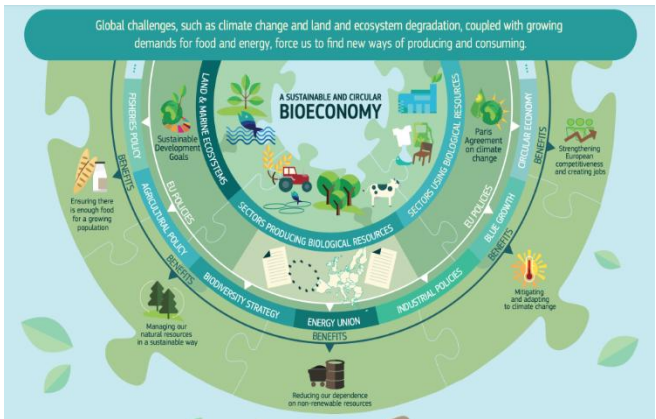


Amul – Dairy Waste into Biogas & Biofertilizers: Amul converts dairy effluents and cattle dung into biogas and organic fertilizers. Biogas powers milk processing units and rural households, while slurry enriches soils. This closed-loop dairy model reduces methane emissions, lowers waste discharge, and improves farm income. Amul’s cooperative network scales this model nationally.



Source: EnviroZyme: Money in Manure

3. Kenya: Circular Agri-Waste & Green Financing: In Kenya, microfinance institutions and innovators are enabling farmers to convert coffee husks and maize stalks into bio-briquettes, providing a clean energy alternative. Banks also offer green loans at concessional rates for solar irrigation and renewable energy adoption. This resulted into affordable clean energy, reduced deforestation, and improved climate adaptation in rural communities. (Kings Biofuels (2024), ICFI (2025))



Source: Anteja: Biosources in Circular Bioeconomy

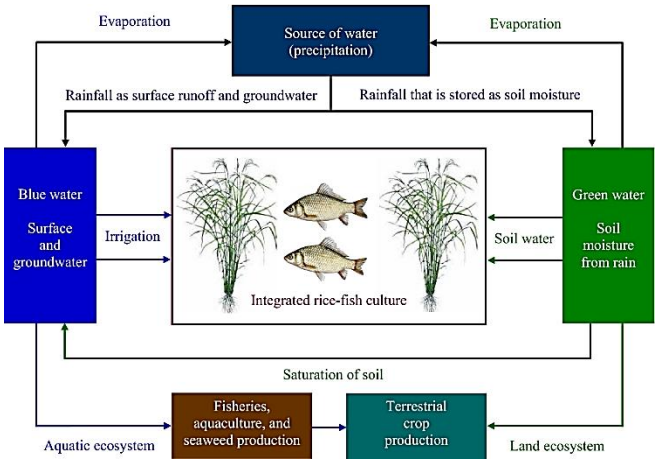
Global Case Studies: Circular Economy for Climate Resilience

The circular economy (CE) is emerging as a critical pathway to achieving both climate resilience and sustainable development. By moving beyond the traditional “take–make–dispose” model, circular practices focus on resource efficiency, waste minimization, and regenerative systems. Across the world, banks, governments, and industries are increasingly financing circular agriculture, waste-to-energy systems, and bioeconomy solutions. The following case studies highlight global best practices.

1. Rabobank (Netherlands): Financing Circular Agriculture: Rabobank, one of the world’s largest agri-banks, has pioneered financial models to promote circular agriculture. By offering favorable lending conditions, it supports farmers who adopt regenerative practices such as closed-loop dairy systems, manure-to-biogas projects, and nutrient recovery solutions. This facilitated reduction of methane emissions, higher farmer incomes, and stronger food system resilience. (Rabobank & CEFC (2025). Environmental Planting Loans for Carbon Sequestration)

2. European Investment Bank (EU): Circular Bioeconomy Funding: The European Investment Bank (EIB) has been a major global player in financing circular bioeconomy. It has committed over €5.1 billion (2020–2024) to circular projects and launched the European Circular Bioeconomy Fund (ECBF) with a €250 million target, now expanded to €300 million. Investments include bioplastics from agricultural residues, waste-to-energy initiatives, and biodegradable packaging solutions. Reduced fossil fuel dependence minimized waste pollution, and enhanced innovation in Europe’s bioeconomy. (EIB (2020, 2025); ECBF (2025))

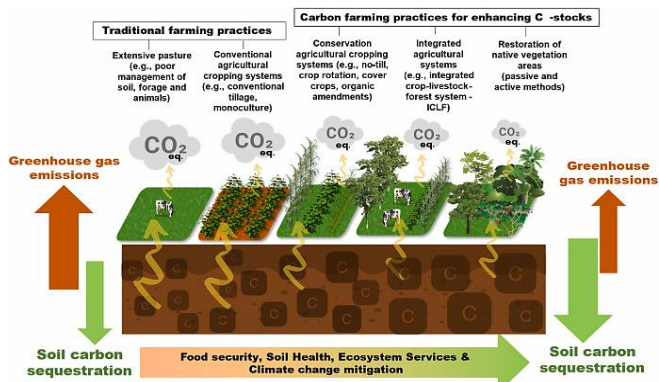
4. China: Circular Rice Farming & Water Recycling: In Jiangsu Province, circular models integrate straw recycling, rice–fish farming systems, and irrigation water reuse. The Agricultural Development Bank of China provides low-interest green credit lines to scale these initiatives. The impact of the intervention has been in the form of reduced agricultural emissions, enhanced water efficiency, and sustainable rural livelihoods.



Source: Springer Nature: Blue Green Water Utilization in Rice Fish Culture

5. Brazil: Banco do Brasil’s Low Carbon Agriculture (ABC Program): Banco do Brasil launched the ABC Program, providing subsidized loans for crop–livestock–forestry integration, waste-to-energy plants, and biofertilizer production. The program has financed thousands of farmers adopting regenerative and circular systems. Large-scale

adoption of low-carbon agriculture, resilience to droughts and floods, and improved soil health were the visible impacts of the programme. (Banco do Brasil (2022), FAO (2023))

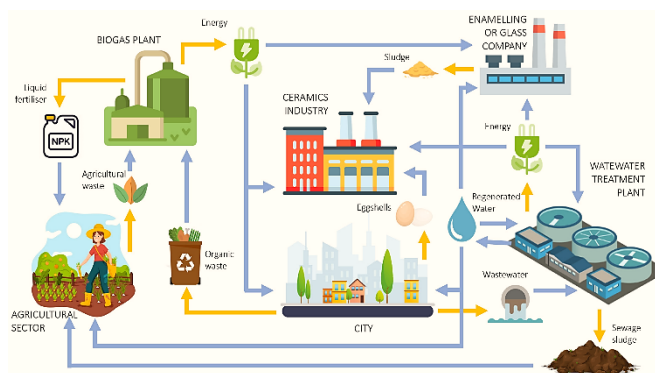


Source: Science Direct.Com: Carbon Farming in Brazil

6. Australia: Westpac & Circular Agri-Finance: Westpac Bank supports circular agriculture through sustainability-linked loans, targeting renewable energy adoption, waste recycling, and regenerative grazing. Example: financing farms that convert cattle manure into biogas for local power grids. Lower methane emissions, higher profitability, and stronger energy self-reliance for farms. (Westpac Sustainability Report (2024))

7. Netherlands: Circular Farming with Zero Waste Loops: The Netherlands has set a goal of “zero waste loops” by 2030, positioning itself as a global leader in circular agriculture. Practices include manure-to-energy biogas, greenhouse circularity with closed water cycles, and food-to-feed recycling. The intervention helped in GHG emissions, enhanced food security, and export of sustainable agri-tech models worldwide. (Dutch Ministry of Agriculture (2022))

8. Denmark: Kalundborg Industrial Symbiosis: Kalundborg hosts the world’s first large-scale industrial symbiosis, where industries exchange waste streams as inputs. Surplus heat from power plants warms homes and greenhouses, gypsum by-products are reused in cement, and biomass residues feed bioenergy plants. This led to carbon emission cuts, waste minimization, and cost savings for industries. (Ellen MacArthur Foundation (2021))



Source: MDPI: Industrial Symbiosis: A Mechanism to Guarantee the Implementation of Circular Economy Practices

9. Japan – Recycling-Oriented Society (3R Principles): Japan has institutionalized the “3R model—Reduce, Reuse, Recycle” with strong policy frameworks like the Basic Act for Establishing a Recycling-Based Society. Food waste is recycled into animal feed and fertilizers, and Agricultural plastics (mulching films, greenhouses) are systematically collected and recycled. Over 84% of agricultural plastic waste is recycled, reducing reliance on imports and enhancing climate resilience. (Government of Japan (2023))



These case studies—from Dutch farms to Danish industries and Japanese recycling systems—demonstrate that the circular economy is not just a theoretical framework but a proven pathway to resilience, competitiveness, and sustainability. By financing circular agriculture, bioeconomy, and industrial symbiosis, financial institutions and governments worldwide are showing how climate action can align with economic growth.

Benefits of Circular Economy for Climate Resilience

The concept of a circular economy (CE) has emerged as a transformative approach to achieving both sustainability and climate resilience. Unlike the traditional linear model of “take–make–dispose,” the circular model emphasizes resource efficiency, recycling, reuse, and regenerative practices. This transition plays a vital role in mitigating greenhouse gas (GHG) emissions, enhancing adaptive capacities, and creating sustainable economic opportunities.

1. Reduced GHG Emissions and Improved Carbon Sequestration: Circular practices such as recycling, remanufacturing, and waste valorization significantly reduce GHG emissions by minimizing the demand for virgin raw materials and lowering industrial energy consumption (Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The Circular Economy—A new sustainability paradigm? Journal of Cleaner Production, 143, 757–768; FAO (2021). Circular Economy and Food Systems. Food and Agriculture Organization of the United Nations.)

2. Enhanced Food, Water, and Energy Security: The CE model strengthens the resilience of food, water, and energy systems by optimizing resource use and reducing waste. For example, nutrient cycling from organic waste back into agriculture reduces fertilizer dependency, while water recycling technologies address increasing water stress (Ellen MacArthur Foundation, 2019). Similarly, renewable energy integration and waste-to-energy systems diversify energy portfolios, reducing reliance on fossil fuels vulnerable to climate shocks. (Ellen MacArthur Foundation (2019). Completing the Picture: How the Circular Economy Tackles Climate Change)

3. Lower Vulnerability to Climate Risks: Circular strategies reduce exposure to climate risks by localizing supply chains, promoting renewable energy, and enhancing material efficiency. By reducing dependence on virgin resource extraction—which is highly sensitive to climate variability: circular systems lower systemic vulnerabilities. For instance, urban resilience is enhanced through construction material recycling and decentralized renewable energy, which reduce susceptibility to extreme events. (Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular economy: The concept and its limitations. Ecological Economics, 143, 37–46)

4. New Green Jobs and Economic Opportunities: The shift toward circularity fosters innovation-driven employment across multiple sectors, including renewable energy, recycling industries, sustainable agriculture, and eco-design. The International Labour Organization (ILO, 2018) projects that circular economy initiatives could generate millions of green jobs globally while simultaneously reducing poverty and inequality. For developing economies, localized repair, refurbishment, and recycling businesses provide inclusive economic opportunities and strengthen community resilience. (International Labour Organization (ILO) (2018). World Employment and Social Outlook 2018: Greening with Jobs)

	blended finance, tech transfer & innovation grants	subsidized loans for low-carbon, circular farming
Fragmented Policies & Weak Frameworks	Develop national CE roadmaps, tax incentives, subsidies, EPR schemes, mandatory recycling targets	EU – Circular Economy Action Plan with binding targets and financing mechanisms
Weak Integration in Climate Strategies	Embed CE in NDCs, SDGs, biodiversity policies, and climate adaptation plans	Kenya – Integrated CE financing models (green loans for solar irrigation, bio-briquettes) into climate-smart agriculture strategies

Way Forward:

Strengthening Agriculture–Banking Linkages for Circular Projects

- Develop specialized credit products for biogas, composting, agro-waste recycling, and regenerative practices.
- Introduce sustainability-linked loans where farmers/enterprises receive interest rebates upon meeting circular economy milestones.
- Strengthen refinance and risk mitigation mechanisms to encourage banks to fund CE projects.

Scaling Up Decentralized Waste Management Models

- Promote community-driven composting units, bio-briquette production, and decentralized recycling hubs.
- Provide concessional financing for rural entrepreneurs and FPOs adopting decentralized CE solutions.
- Encourage local governments to integrate CE financing into district-level climate action plans.

Incentivizing Industries for Circular Innovation

- Policy-led incentives such as tax rebates, credit priority, and subsidies for industries adopting CE models.
- Encourage banks to extend green loans to agri-processing and renewable energy industries engaging in waste-to-resource projects.
- Promote blended finance and PPPs (Public–Private Partnerships) for scaling CE technologies.

Promoting Multi-Stakeholder Collaboration

- Strengthen government–bank–community partnerships by integrating CE in schemes like NABARD’s Rural Infrastructure Development Fund (RIDF).

Challenges & Policy Needs

Challenge	Policy Need	Example Country Case
Awareness & Capacity-Building Gaps	Launch national awareness campaigns, integrate CE in curricula, establish training hubs & demo projects	Japan – Integrated 3R principles into national education and local government training programs
Financial & Technological Constraints	Green credit guarantees, concessional loans,	Brazil – Banco do Brasil’s ABC Program offering

- Foster partnerships between banks, cooperatives, FPOs, and private investors for circular innovation.
- Establish capacity-building hubs to train stakeholders on CE financing models.

Policy Recommendations

1. Establish a National Circular Agriculture Finance Mission with targeted funding support from government and banks.
2. Launch Green Credit Guarantee Schemes to de-risk CE investments in agriculture.
3. Integrate CE into priority sector lending norms to ensure widespread adoption.
4. Create knowledge-sharing platforms, with BIRD as a nodal agency, to showcase successful CE models.
5. Mainstream circular economy principles into national and state climate strategies (NDCs, SDGs, SAPCCs).

Conclusion

The shift to a circular economy (CE) is no longer an option, but rather a requirement for assuring climate resilience, resource efficiency, and sustainable lifestyles. Agriculture is one of India's most vulnerable sectors to climate change and contributes heavily to greenhouse gas emissions. Circular models in agriculture, such as waste-to-energy, nutrient recycling, and regenerative farming, provide viable solutions. However, widespread adoption necessitates strong agricultural-banking links.

The circular economy aims to turn "trash into treasure" and pave the way for enterprises that are climate resilient, not just manage waste. Societies can concurrently attain environmental sustainability, farmer wellbeing, and financial stability by integrating circular methods into agriculture, industry, and finance. Circular economy financing is becoming a key risk management approach, a growth opportunity, and a financial stability protection for the banking industry, rather than a supplementary CSR endeavour. Banks can safeguard their portfolios and hasten India's shift to a low-carbon, regenerative economy by incorporating circular models into their credit, investment, and advising offerings.

The message is unambiguous: funding circular economy solutions entails funding both economic stability and climate resilience. Integrating the concepts of the circular economy into finance and climate policies can be a key component of sustainable, inclusive, and competitive futures as countries work to meet the Sustainable Development Goals (SDGs) and the promises made in the Paris Agreement.

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