



Circular Economy in Agriculture: Reducing Waste and Enhancing Sustainability

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Abstract

The agri-food supply chain faces numerous challenges, making its current linear economic model unsustainable. To address these issues, the circular economy offers a promising alternative by promoting sustainable production and consumption practices. This article explores the principles and importance of the circular economy in achieving a more environmentally and economically viable system. The three R's of reduce, reuse, and recycle serve as guiding principles, encouraging the extension of product life cycles, reduction of waste generation, and efficient use of resources. India, as one of the world's fastest-developing economies, presents significant opportunities for circular economy adoption. The country's strong focus on technology and innovation, coupled with a cost-centric market and cultural acceptance of circular practices, positions India to lead the global circular economy revolution. Embracing the circular economy can unlock economic growth while safeguarding the environment and resources. India has a unique opportunity

to embrace circular principles, create innovative solutions, and pave the way for a more sustainable and resilient future for its agricultural sector and beyond.

Keywords: agri-food supply chain, circular economy, sustainability, India, innovative solutions.

Introduction

The existing agri-food supply chain is plagued by a variety of social, economic, social, and environmental issues, rendering it unsustainable. Among the potential answers, the circular economy provides tools to improve and optimise production and consumption in order to achieve a more sustainable paradigm (Jurgilevich, 2021). Over the last decade, there has been an increase in interest in this new concept, which aims to provide an alternative to the current conventional economic model (Ghisellini, 2016).

Given the environmental, economic, and social consequences of food waste, the first step towards achieving greater sustainability is to adopt an environmentally friendly producing and consuming approach rather than focusing solely on the last segment of the supply chain (Papargyropoulou, 2014). The circular economy can be a winning strategy for intervening and mitigating the externalities caused in the agri-food sector by offering activities and solutions to readmit wastes and byproducts in the manufacturing chain (Giroto, 2015). However, it will only explore the circular economy as an alternate path to a more effective waste management system. It involves a broader and more extensive examination of the design of radically different solutions spanning the whole life cycle of any process, as well as the interaction between the process, the environment and economy in which it is embedded.

A circular economy has numerous environmental and economic benefits. A circular economy can assist to alleviate the effects of climate change, safeguard natural resources, and prevent environmental degradation by minimising waste and pollution. At the same time, a circular economy can provide new economic

opportunities, new jobs, and encourage innovation and entrepreneurship. A circular economy keeps resources in use for as long as feasible, resulting in a closed-loop system that minimises waste and maximises resource value. This can reduce the requirement for raw materials, lower production costs, and improve supply chain resilience. A circular economy can lessen the detrimental effects of resource extraction and disposal by reusing and recycling resources. The benefits of adopting circular economy from food point of view can be viewed as:

- i. **It regenerates natural systems**
- ii. **It combats climate change**
- iii. **It can improve access to nutritious food**
- iv. **It can support local communities**
- v. **It saves money and creates value**

reclaiming and regenerating them at the end of their life cycle. This concept relies on the three Rs: reduce, reuse, and recycle.

- The reduce principle involves minimizing waste and pollution by designing products that are durable, repairable, and can be reused or repurposed.
- The reuse principle involves extending the life of products and materials through reuse, repair, and refurbishment.
- The recycle principle involves recovering materials and energy from waste and turning them into new products.
- The refuse principle involves the use of a product again and again and

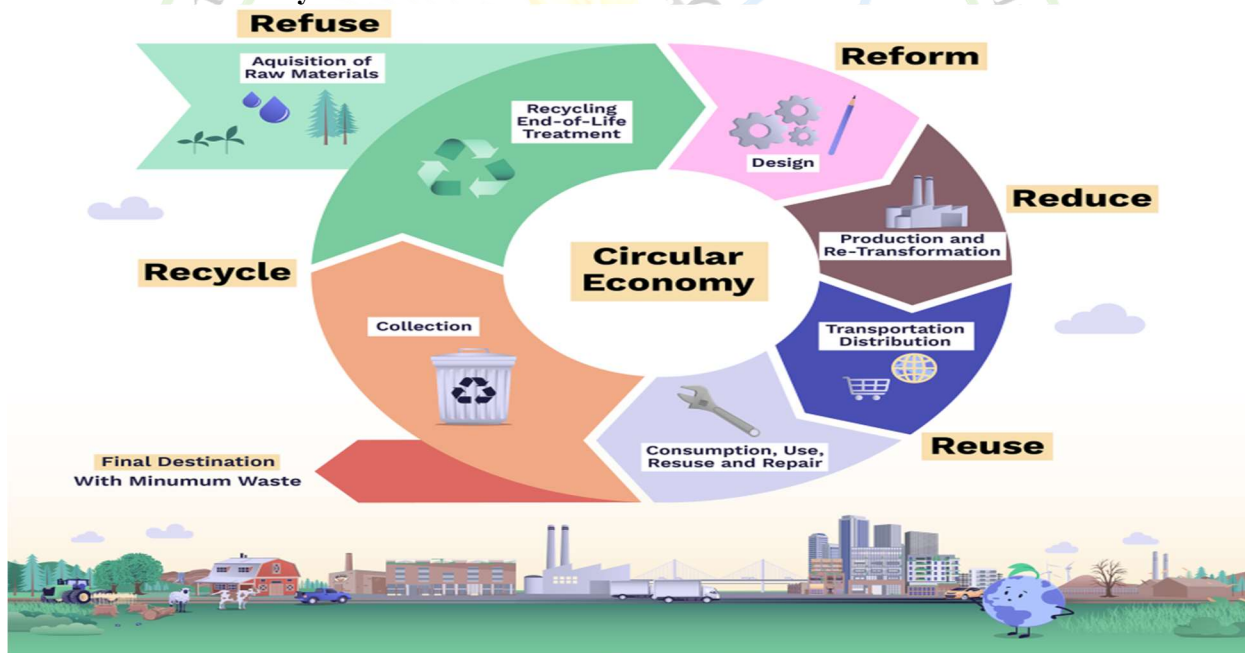


Fig. 1. Diagrammatic representation of a circular economy. (Source: media.licdn.com)

Circular Economy and its importance

The circular economy (CE) has evolved as a method that can reduce resource influx and waste creation, lessen the negative impacts of agricultural ecosystems, and increase economic performance (Velasco-Muoz et al., 2021). It is an economic model which aims to keep the various individual and grouped resources in a utilisable form as long as possible, make the most of it and generate as much value from them as possible before

derive maximum benefits possible from that commodity till it is discarded.

- The reform principle helps in changing the current form of the product and make it usable again which in turn improves it utility in different forms.

A circular economy presents a new way of thinking about the use of resources and the design of products and systems. By reducing waste and promoting reuse, a circular economy can help to mitigate the environmental and economic challenges of



traditional linear economies. The circular economy is not only about recycling but also about rethinking the way we design and use products, resources, and systems. By embracing the principles of a circular economy, we can create a more sustainable and resilient future for all.

Here are some ways that a circular economy can help achieve sustainable food business growth without negatively impacting the planet.

- **Reduce food waste:** Food waste is viewed as a beneficial resource rather than a problem in a circular economy. Enterprises are able to conserve money and lessen their environmental effect by decreasing food waste. This can be accomplished by improved inventory management, improved supply chain logistics, and the use of technological innovations to monitor and handle food waste.
- **Design for sustainability:** Companies may create more sustainable and circular products, packaging, and processes from the start. This involves the use of renewable and biodegradable materials, the reduction of packaging waste, and the design of items that are readily fixed, reconditioned, or recycled.
- **Adopt regenerative agriculture:** Regenerative agriculture is an agricultural practise that places a premium on soil health, biodiversity, and ecosystem services. Businesses can reduce their environmental impact, enhance yields, and strengthen the resilience of their supply chains by implementing regenerative agriculture practises.
- **Place a premium on local and seasonal foods:** By buying food locally and seasonally, businesses may decrease their carbon footprint while also supporting local farmers and communities. This can also aid in the development of more resilient and diverse supply networks.

- **Adopt a circular business model:** A circular business model is one that is intended to reduce waste while increasing resource efficiency. This can include tactics like product-as-a-service, in which customers pay to use a product rather than owning it outright, or closed-loop supply chains, in which things are recycled or repurposed at the end of their life.

Circular Economy in India

The Circular Economy seeks to eradicate all forms of rubbish from the market, with "junk" referring to any wasteful use of resources or assets. It is a restorative strategy to manufacturing and consumption that entails rethinking, recovering, and reusing items and resources to lessen environmental impact. Circular models strive to reduce four types of waste, which are as follows:

- **Wasted Resources** - Materials and energy that cannot be successfully recycled over time
- **Wastage Capacities** – Underutilized products and assets.
- **Wasted Lifecycles** - Products that reach the end of their useful life prematurely due to deliberate obsolescence or a lack of second-life choices
- **Wasted Embedded Values** - Components, materials, and energy not recovered from waste streams are examples of wasted embedded values.

The move to a circular economy might increase global economic output by \$4.5 trillion by 2030. Furthermore, compared to the existing economic scenario, "a circular economy development path in India could generate an annual value of 14 lakh crore (US\$ 218 billion) in 2030 and 40 lakh crore (US\$ 624 billion) in 2050." This conclusion is based on a cost comparison of the three focus areas (agricultural, mobility, and construction). According to the calculations, the expenses to supply the same level of utility in the circular development scenario would be much lower. Savings equal 11% of the present-day GDP in 2030 and 30% in 2050 (Sarma et al., 2023).



Possibilities for a Circular Economy

In India, there are numerous prospects for a circular economy. The country is predicted to be:

- **A technological and innovation powerhouse**

India is well-positioned to employ digital technology to establish innovative and cutting-edge circular enterprises, given its existing IT dominance and abundance of IT talent. This might propel India to the forefront of the global circular economy revolution.

- **Early success in comparison to other global economies**

India is one of the world's fastest growing economies, and it may readily seize possibilities to adopt circular techniques of production while creating sustainable designs. Because mature economies have a linear lock-in, switching costs would be prohibitively expensive and time-consuming. As a result, as a developing country, India has a competitive edge over mature economies.

- **Circular items are widely accepted.**

Several circular characteristics, such as vehicle over-utilization and repair, or substantial recovery and recycling of post-use materials at the household level, are deeply embedded in Indian attitudes. In India, for example, the average period of car ownership is 9-12 years, compared to 7-8 years in the United States. As a result of this widespread cultural acceptability, India has become a larger market.

- **Cost-centric Market**

The cost of delivering services to customers will be lower for those that follow the circular path rather than the old take-make-waste approach. By 2050, incorporating circular practises in India could save US\$ 624 billion in development, agriculture and food production, and mobility. This would help to spread acceptance, especially with India's cost-conscious consumers.

Case Study (Sustainable Packaging) - TATA Salt Brand (India).

Tata Chemicals' consumer products segment requires 4,000 tonnes of multi-layer film made of plastic per year for product

packaging. This multilayer plastic is really hard to recycle, and the majority of it ends up in landfills, where it emits pollutants and harms the environment. As part of the company's sustainability drive, able to break down and biodegradable packaging materials were examined. The obstacles, such as the scarcity of 100% biodegradable packaging material, as well as suitable segregation and decomposition conditions, render this solution financially unviable. The packaging team then worked together with Dow Chemicals to create a PE (Polyethylene)-based film that could match the exact same printing performance and other technical standards as the PET used in the current packs. The new recyclable pack is a bonded laminate composed of the same polymer (PE-PE) as the old packets, with identical aesthetics and shelf life. Recycling organisations successfully compose the laminate because it is made of a single polymer. As a result, the pack's single polymer structure makes it more easily recyclable by converting it to energy via a variety of techniques that include gasification, combustion, a process known as anaerobic digestion, and recovery of landfill gases. (TCPL Sustainability Report, 2021)

Initiative's Impact

This project benefited the company by attracting new investors, boosting revenue growth, and raising customer and market environmental consciousness. Including recyclable packaging in commercials and campaigns will capitalise on existing brand equity. It would also lower the danger of noncompliance with the government's plastic waste management regulations. This project would be beneficial to the country, the environment, the local people, and the brand.

Challenges in Achieving the Vision of a Circular Economy

The transformation of India to a circular economy is hampered by a number of obstacles. The lack of awareness and comprehension of circular economy principles among politicians, corporations, and consumers is the most serious of these. It is difficult to execute the appropriate rules and regulations in order to shift away from



the classic linear economic model without a thorough understanding of its potential benefits. To incentivise repair, reuse, and the usage of recycled materials in products, legislators must be reoriented towards supporting the circular economy's vision.

Another important obstacle is the waste management sector's inefficiencies, where a large informal workforce frequently resorts to polluting waste disposal methods, impeding the incorporation of circular economy principles. Circularity must be distinguished from conventional recycling; policies should emphasise waste reduction and the preservation of material and component value through recycling, reusing, refurbishment, and remanufacturing models in addition to recycling. A multi-stakeholder strategy is critical for systemic change, fostering collaboration among government agencies, industry, non-governmental organisations (NGOs), and consumers to promote information sharing and investment in circular infrastructure and technology. Adequate investment in garbage collection trucks, sorting facilities, and waste management technologies can address the problem of inefficient waste collection and segregation, which causes environmental and health risks.

Finally, incentives and research and development are required to help firms shift to circular practises while also encouraging innovation and the growth of circular solutions. Addressing these issues is critical to achieving a resilient and environmentally sound circular economy in India.

Conclusion

The agri-food supply chain faces multifaceted challenges that render the current linear economic model unsustainable. Embracing the circular economy offers a promising solution to enhance production and consumption practices, promoting a more sustainable paradigm. The principles of the circular economy, such as reducing, reusing, and recycling resources, can lead to a closed-loop system that minimizes waste and maximizes resource value. India, as a rapidly developing economy, presents significant opportunities for adopting

circular practices, with its focus on technology, cultural acceptance of circularity, and cost-centric market. By transitioning to a circular economy, India can achieve economic growth while safeguarding the environment and resources. The circular economy has the potential to revolutionize India's approach to production and consumption, creating a resilient and sustainable framework for the agricultural sector and beyond. Case studies, like the sustainable packaging initiative by TATA Salt Brand, illustrate the positive impact of circular practices on businesses, consumers, and the environment. By embracing the circular economy, India can unlock a prosperous and environmentally conscious future.

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