

CIRCULAR ECONOMY MODELS IN AGRICULTURE

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Acknowledgements

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EXECUTIVE SUMMARY



Despite the lack of a common definition for circularity, there are some core principles to help us identify the concept:

- i. Minimising waste and pollution**
- ii. Preserving and regenerating natural ecosystems while dealing with waste and residue**
- iii. Promoting fairness and inclusivity across local communities that bear the social costs of inefficient waste management.**

These principles find direct and indirect relevance to the Sustainable Development Goals (SDG) for 2030 and have witnessed increasing interest.

Due to the **extreme interconnectedness of agriculture with other industrial sectors of the economy**, applying circularity across agri-based industries could help transform many other strategic industries and sub-sectors like textile, wood, and furniture and reduce their carbon footprint.

A significant opportunity lies within **post-harvest interventions across food-based value chains**. This global opportunity has been pegged at around **USD 4.5 trillion** building on many favourable economic factors. Business models like product-as-service, lease, sharing, recycling, and upcycling are potential opportunities to explore.

To progress and accelerate the transition towards more circular economy models across agricultural value chains, relevant stakeholders need to come together and build a uniform call for action.

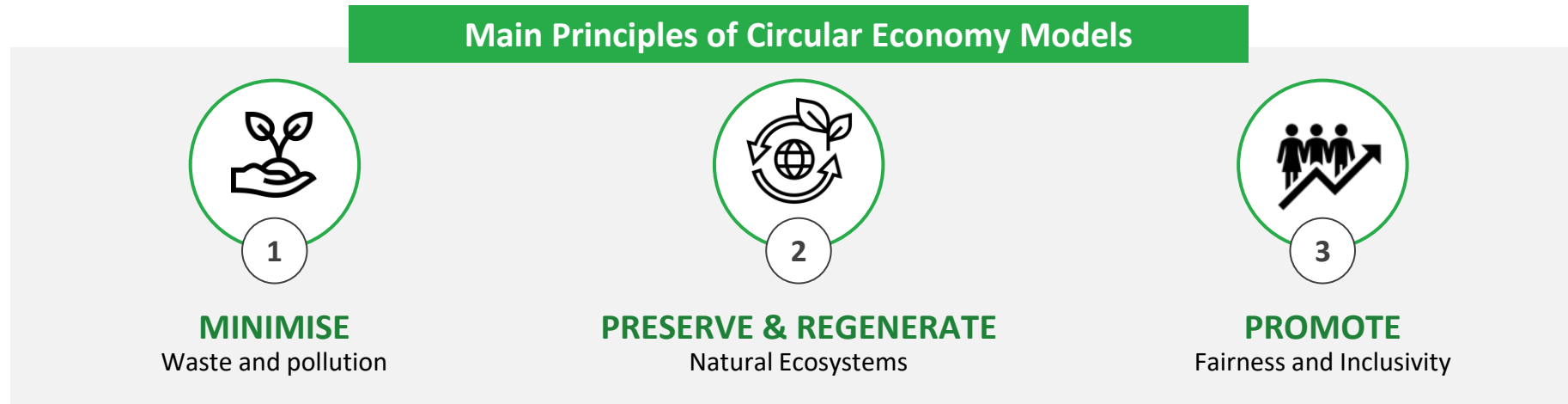
Actions to incorporate circular economy models require deliberate collaboration and implementation of strategic roadmaps which can ensure success. This would mean **taking advantage of the tailwinds** that can help drive and sustain this change in the future, the increasing awareness of societies towards the resource and climate crisis, technological disruptions that are changing the face of innovation, emerging business models for circularity, and the incentivisation of the government.



THE EMERGING NEED FOR CIRCULARITY



A **circular economy** refers to business models that give incentives to reuse raw materials, rather than disposing resources as waste after first use (UNCTAD).



When incorporated across agricultural value chains, there are certain **objectives that circular economy business models can help us achieve:**



Promoting Resource Efficiency

Utilising available resources in an optimal manner across agricultural value chains.



Enabling Food Security

Preventing losses and waste across the value chains to optimise for food availability and access



Adapting with Climate Change

Enabling climate mitigation and adaptation measures to reduce emission contributed by agriculture.

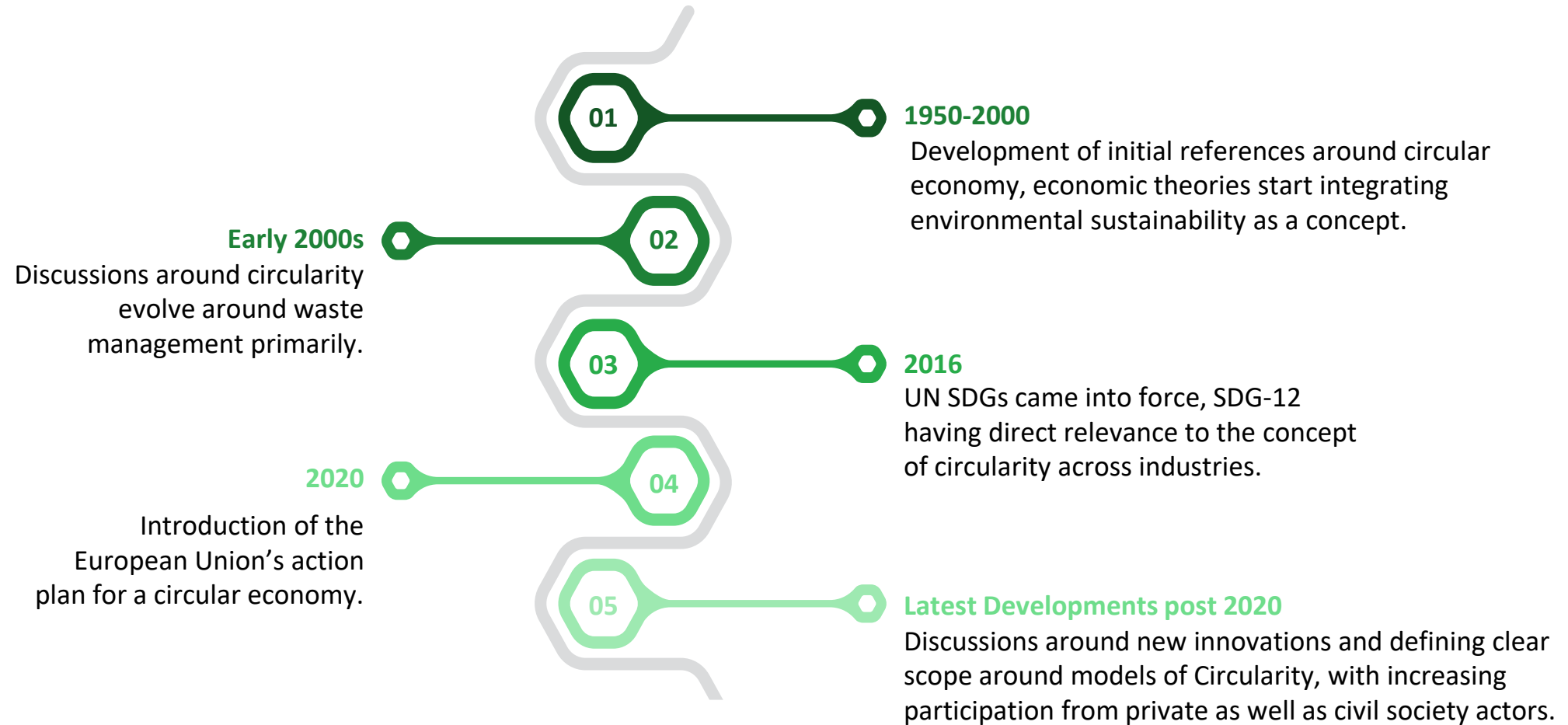


Strengthening Agri-based Economies

Integrating innovative business models within local economies that can tap undelivered potential and opportunities.



Definitions around circular economy have evolved with the need for innovations and participation in this space increasing over time.

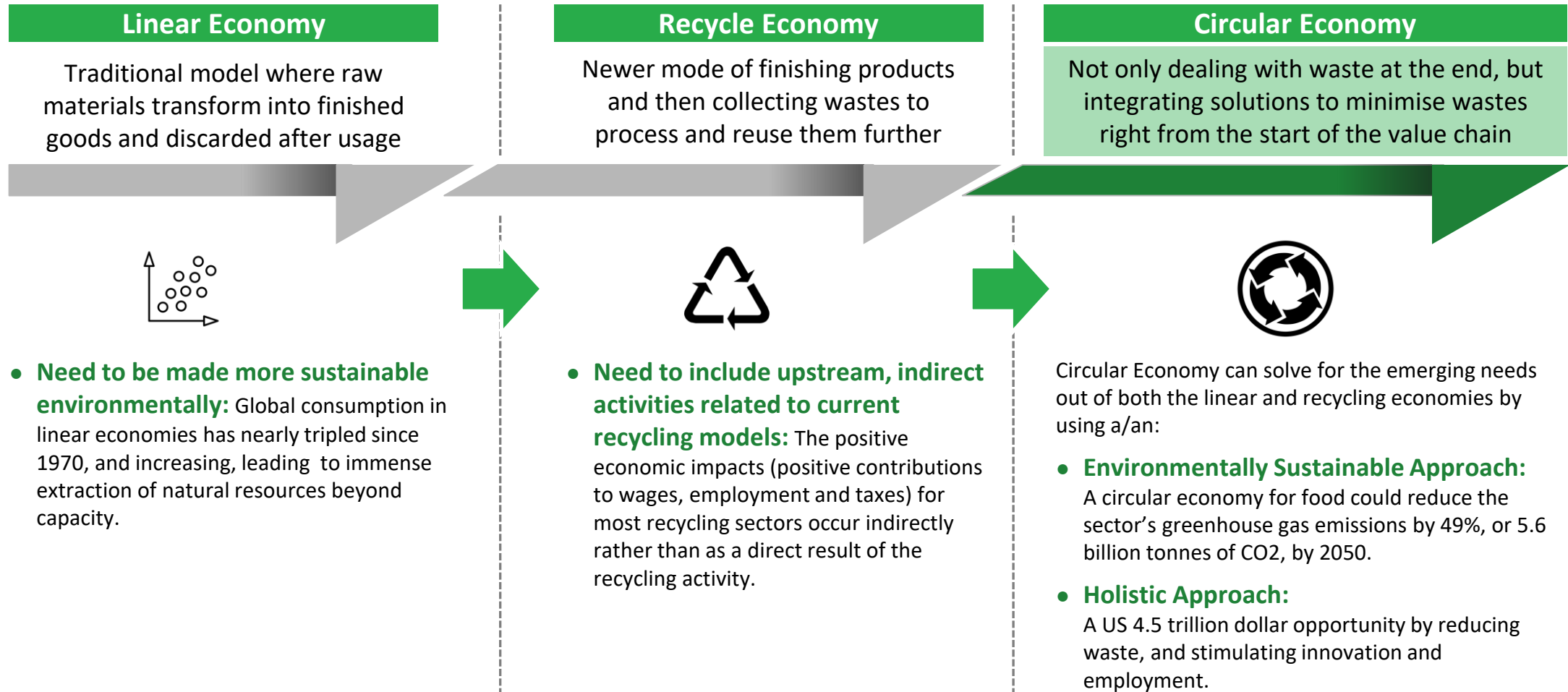


The concept of circularity across agricultural value chains holds direct as well as indirect relevance to the UN SDGs set for 2030.

Relevant UN SDGs	12 RESPONSIBLE CONSUMPTION AND PRODUCTION 	13 CLIMATE ACTION 	8 DECENT WORK AND ECONOMIC GROWTH 	2 ZERO HUNGER 	6 CLEAN WATER AND SANITATION 	3 GOOD HEALTH AND WELL-BEING 	15 LIFE ON LAND 
How circular economy is relevant to these UN SDGs?	<p>Reduces food waste, new uses for by-products and waste streams, and promotes sustainable food production and consumption.</p>	<p>Uses renewable energy to reduce greenhouse gas emissions and promotes sustainable farming practices that improve soil health.</p>	<p>Help to create jobs and economic opportunities for farmers and rural communities and promoting social and economic equity.</p>	<p>Improves food security and reduces food waste by recycling nutrients and organic matter and finds new uses for by-products and waste streams.</p>	<p>Improve water management by recycling water and using closed-loop systems, such as, harvesting, greywater recycling, and more.</p>	<p>Improve the health and well-being of rural and farm communities by promoting safer practices and creating jobs and economic opportunities.</p>	<p>Conserve natural resources by using closed-loop systems, e.g. integrated crop-livestock systems, composting, vermiculture, etc.</p>



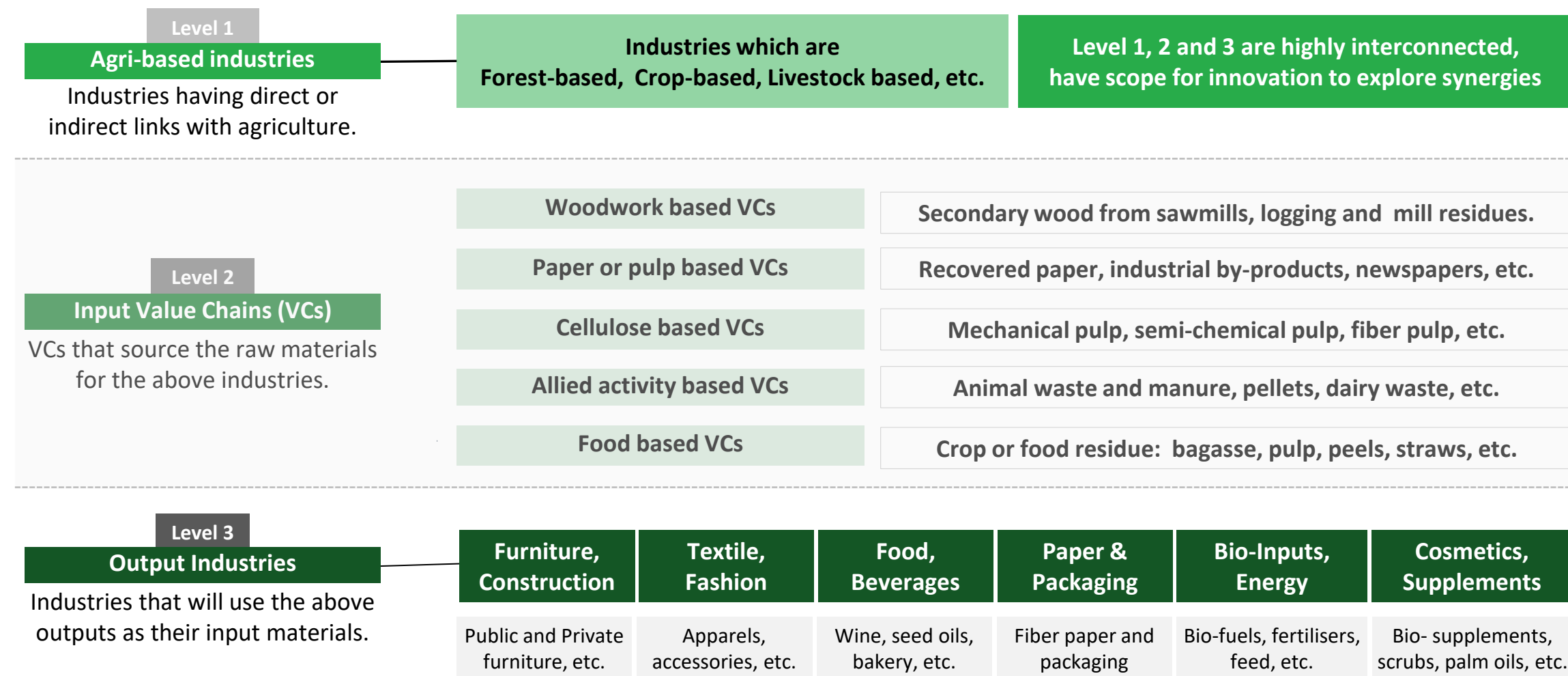
Rising patterns of unsustainable resource usage have necessitated the rise of **circular economy models** beyond linear and simple recycling models.








APPLICATION OF CIRCULAR ECONOMY MODELS IN AGRICULTURE



Applying circularity across agri-based industries can help transform many other strategic industries and sub-sectors due to high interconnectedness.



Based on agricultural losses, the sector can **reuse, reduce, recycle and use closed loop systems** to incorporate circularity across value chains.

Value chain stages	Types of Losses
 Agricultural Production: Pre-harvest, harvest, breeding.	Crop Residue (CR): Rice and wheat straw, corn cover, soybean straw, etc. Food Waste (FW): Grain spillage, fruits and vegetables loss. Others: Manure waste.
 Post-harvest Handling: Handling, storage, transport.	FW: Discarded produce and spillage, discolouration and quality loss. Others: Wasted milk, poultry, meat, etc.
 Processing: Canning, packaging, transformation.	FW: Fruit peel: orange peels, potato peels, rice bran, etc. Others: Metal, paper, textile loss, etc. Agri-Industrial Waste: Sugarcane bagasse, seed cakes, powerlosses, etc.
 Retail/ Distribution: Retail, transport.	FW: Expired, discarded products, etc. Agri-Industrial Waste: Products discarded after quality checks.
 Consumption: Preparation, disposal.	FW: Cooked and packaged waste in homes, restaurants, cafes, etc.

Potential incorporation of Circularity	
Principle - What?	Application - How?
Reduce, reuse and recycle waste generated to create inputs for the agricultural industry and for other industries.	Recycle and recreate new products like organic fertilisers, manure, textile, paper, packaging material, etc.
Rejuvenation, revegetation, reforestation, and regeneration of degraded ecosystems.	Use rain water harvesting, solar power, organic landscaping, sustainable farming on barren land, water recycling, integrated crop-livestock systems, sustainable sourcing, crop residue and organic waste, integrated pest management techniques, etc.
Using closed loop and integrated systems.	



Agricultural
Production

1

One-acre farm uses a symbiotic relationship to create a **mixed-farming circular economy system** (Ellen MacArthur Foundation 2010).



Emma's uses her **one-acre farm as a symbiotic circular economy model**. The farm is divided into 4 zones.

For example, maggots are grown on pig waste to feed to chickens and fish. The waste is further broken down by worms, then combined with cattle and pig urine to provide fertiliser for perennial crops such as matooke.

Key Highlights

1. One-acre farm is currently operating in **Uganda**.
2. **Nothing goes to waste, everything gets utilised within the farm.**



Impact



80% Reduction in
feed input costs



HIGH Quality of
Nutritious Food



\$10,000/year Revenue
Generated





Fruit circular economy: 'Unnati Program' launched by Coca Cola India enhances farm-level productivity using modern Package of Practices (PoP).



- **Project Unnati by Coca-Cola India** was launched in 2011 with the goal of improving the efficiency in production of the widely consumed fruits. It introduced new products like Minute Maid to avoid wastage of major fruits produced.
- Ever since 2011, the project has extended widely in over 12+ Indian states and contributed to **increasing income levels of over 0.35 million farmers** (The Coca Cola Company 2011).

Key Highlights

1. **Operational in 12 states in India, including Tamil Nadu, Bihar, and Uttarakhand.**
2. **Deals with five fruit commodities: apples, litchi, grapes, mangoes.**



Impact



0.35 Million Farmers Impacted



1 Million+ Minute Maid Units Sold



Budgeted Value: **41.3 Million**

Note: 2021-2022 data





Post-harvest
Handling

3

50% of what farmers produce in Uganda and Kenya never gets to the market. Agricycle uses the market, the network and technology to enable linkages.



Agricycle works with farmers to improve farm-based technologies to upcycle food which would otherwise be wasted.

Their technology improves durability of food through on-farm processing, and they use solar dehydrators to extend the shelf life of fruits. These dehydrators are cost efficient, durable and reusable (Agricycle 2021).

Key Highlights

- 1. Agricycle works in the Sub-Saharan Africa region.**
- 2. Major commodities are pineapple and jackfruit.**



Impact



74,576 kg

Waste
Diverted



6787

Livelihoods
Generated



\$825,000

Global
Investment





Processing

4

De Clique works towards zero-waste cities in which all residual flows and waste products are reused.



De Clique collects food by-products like orange peels, coffee grounds and other waste products, which are then sold to manufacturers and innovators who transform them into new products like:

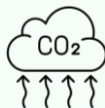
- Peelpioneers, produces cleaning products and hand soap from orange peels.
- De Leckere, produces orange beer from orange peel (Ellen MacArthur Foundation 2022).

Key Highlights

1. **De Clique originated in the Netherlands.**
2. **Major food waste like coffee grounds and orange peel is utilised.**



Impact

**4.6 kg**Carbon Emissions
Avoided**10 tonnes
/month**Total Food
Waste
Converted**50+
organisations**No. of
Actors

Retail/
Distribution

5

BioPak solves the problem of single-use plastic packaging by implementing renewable plant-based packaging model.



BioPak's packaging model uses plant based material for producing compostable packaging. By providing collection and composting services, BioPak has created a circular model.

Since its launch, **200 companies have joined together**, diverting 660 tonnes of compostable packaging and food scraps from landfill and creating 66,000 bags of nutrient-rich compost (BioPak Packaging 2002).

Key Highlights

1. Packaging models being implemented in Sydney, Australia.
2. One of the **biggest traders of tomatoes** in the country.



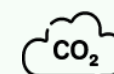
Impact



7,800 kg

Waste
Diverted

5,460 kg

Compost
created

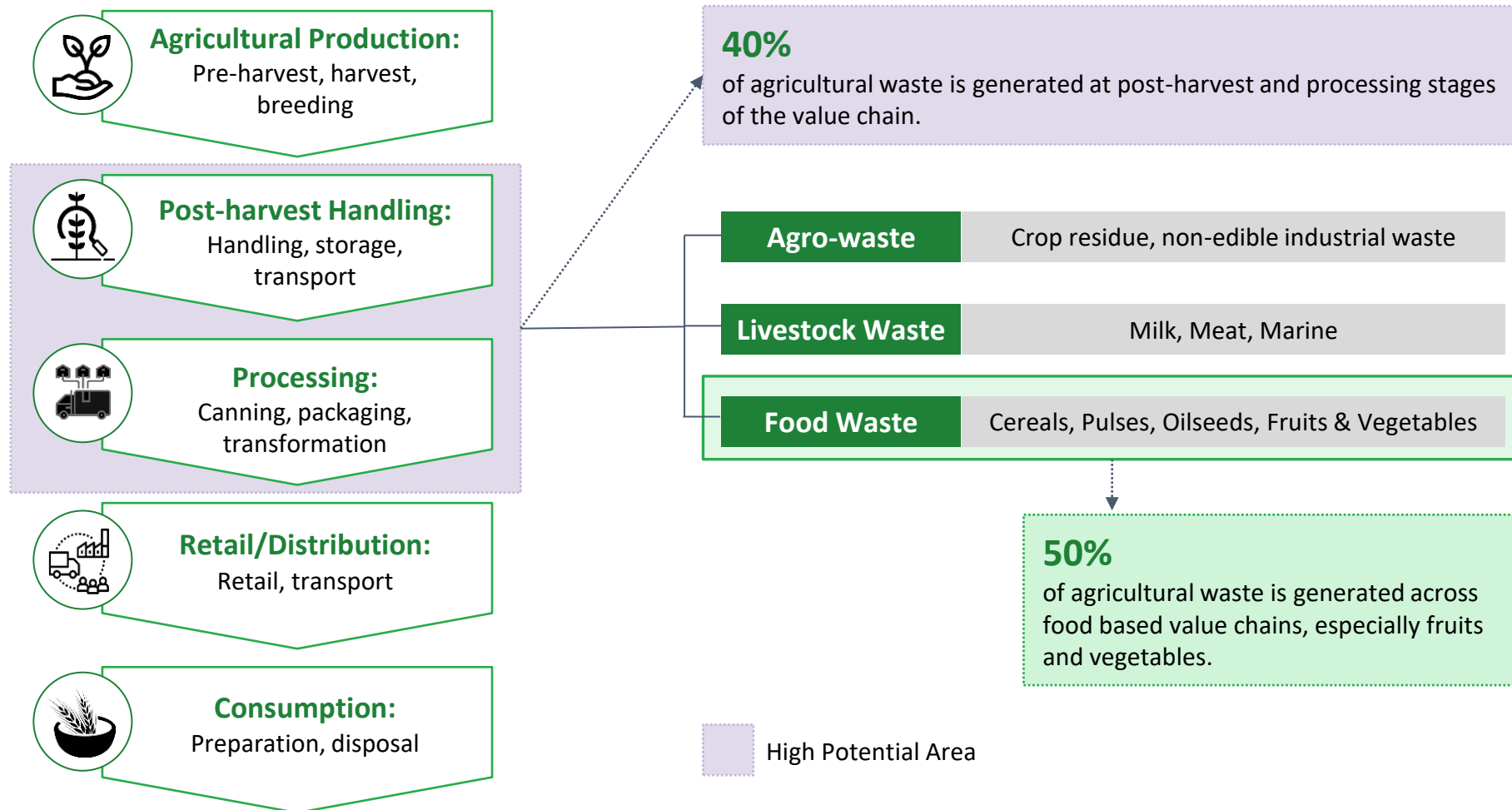
3.9 tonnes

Carbon
Avoided

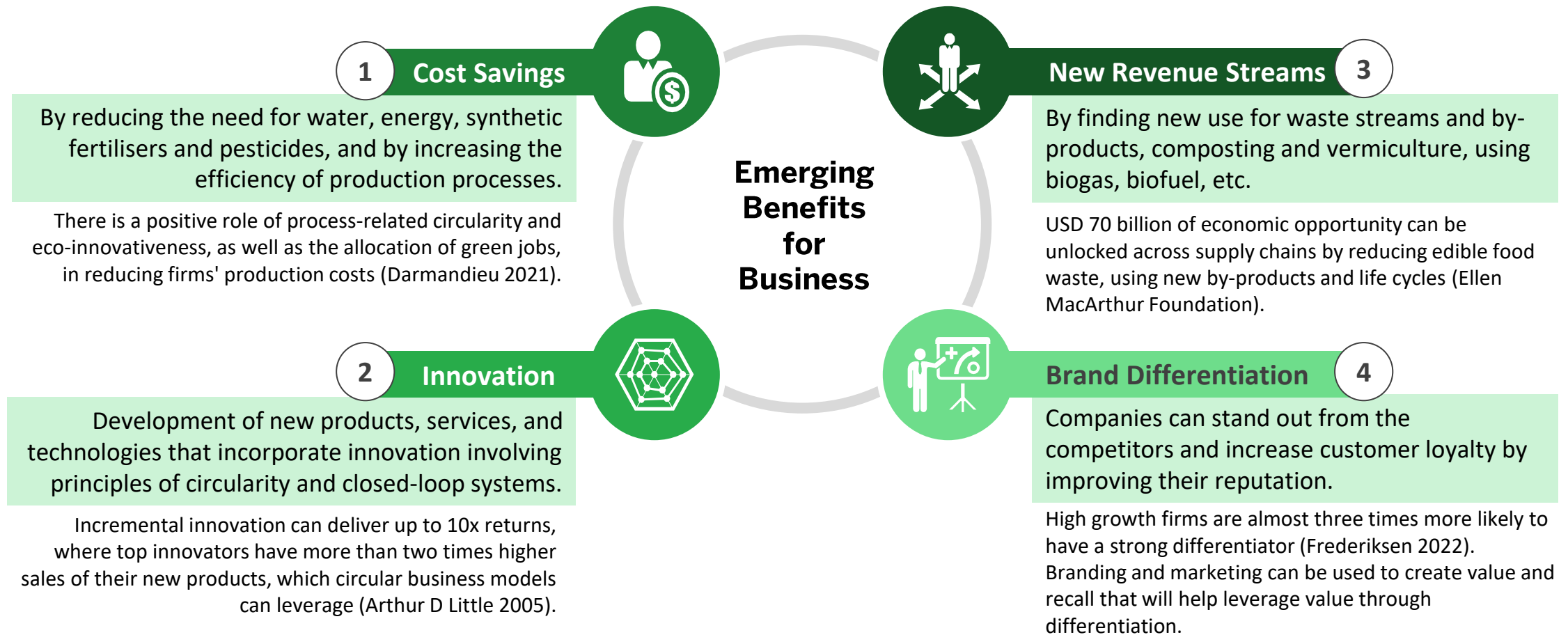
BUSINESS OPPORTUNITIES FOR CIRCULAR ECONOMY MODELS



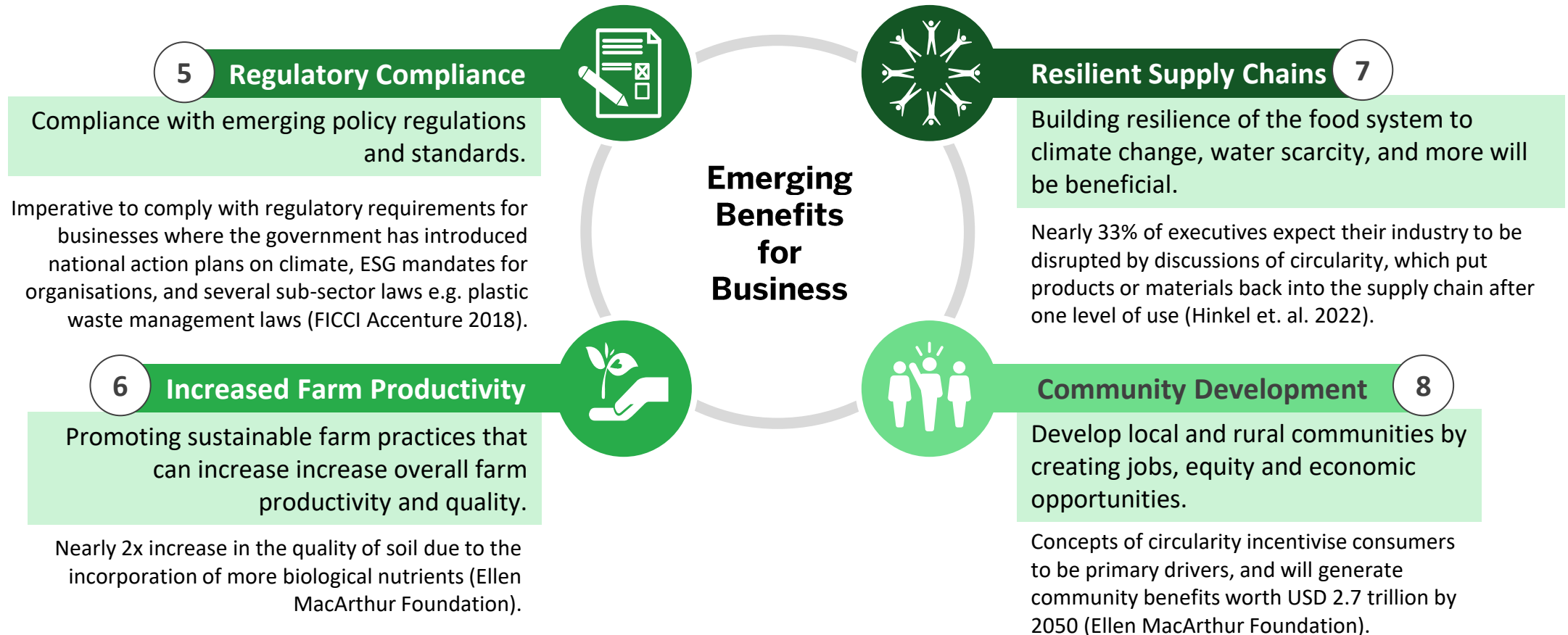
Agricultural waste worth Rs 92,651 crores is generated across Indian farms, with post-harvest and food-related losses having the highest untapped potential (PIB 2016).








The global opportunity for the circular economy is expected to touch **USD 4.5 trillion** by 2030 and has significant emerging benefits for business (Kalaari Capital) (1/2).



The global opportunity for the circular economy is expected to touch **USD 4.5 trillion** by 2030 and has significant emerging benefits for business (Kalaari Capital) (2/2).



Circular economy models can be **integrated into the micro strategies of organisations through a range of business models.**

Business Model	 <p>1</p> <p>Product-as-Service Model</p>	 <p>2</p> <p>Lease Model</p>	 <p>3</p> <p>Sharing Model</p>	 <p>4</p> <p>Recycling Model</p>	 <p>5</p> <p>Upcycling Model</p>
Idea	<p>Customers access a product as a service, do not own it, but rent the service for a fee.</p>	<p>Customer pays for continuous access to the product over an agreed period of time.</p>	<p>Collaborative marketplace for renting, sharing and leasing products or services.</p>	<p>Reusing materials to make new products, less demand for fresh raw materials.</p>	<p>Extending the life of products for repurposing and high-end recycling.</p>
Benefit	<p>Reduce waste, maximise resource use.</p>	<p>Reduces waste and extends reach.</p>	<p>Reduces environmental footprint and extends reach.</p>	<p>Balances capacity constraints, reduces costs.</p>	<p>Balances capacity constraints, reduces costs and extends value of products.</p>



OVERVIEW OF STAKEHOLDERS AND THEIR ROLE
























Government organisations and big multilateral organisations have the ability to drive systemic change and enable institutional support.

Stakeholder Type		Main Role	Examples
Government Organisations	Ministries and departments within the Indian government	For scale and systemic change	
	Other government agencies	To create an enabling policy and regulatory environment	
Multilateral Organisations and Forums	Research & development of definitions and frameworks	Policy guidance and technical support	
	Mobilising international stakeholders	Global research on promoting agricultural circularity	
		Identifying synergies and dialogues to transform agri food systems	





Agribusinesses have significant potential to encourage sustainable and more localised procurement of agricultural raw materials.

Stakeholder Type		Main Role	Examples
Philanthropic Organisations	International and domestic funders	Support and provide capital to innovative circular economy projects	  
Private Sector Corporations	Agribusiness corporations and other private companies using agricultural outputs as inputs	<p>Integrate circularity principles within their organisational decisions - e.g., sustainable packaging, labelling and waste management</p> <p>Investment in local infrastructure, consumer education, supplier engagement, partnership modelling</p>	                 



Research institutes and think tanks constantly develop knowledge, and innovators or creative service providers devise practical implementation of solutions.

Stakeholder Type		Main Role	Examples
<p>Research institutes and think tanks</p>	<p>Academic organisations and private think tanks</p>	<p>Provide technical support, research, and evidence</p>	
<p>Innovators and solution providers</p>	<p>Individual and ground-level innovators who are bringing solutions to real-life waste problems</p>	<p>Utilising technologies and science to work on dealing with waste and related problems</p> <p>Create networks within local communities to bring maximum impact</p>	



TAILWINDS FOR THE FUTURE



Drivers for circularity will be shaped by increasingly relevant factors like **pressing climate change issues, more innovation, technological advancements and so on...**

Major Tailwinds for the Future



1

Increasing awareness for end-level stakeholders

Consumers across all generations, especially Gen X, have shown increased interest in sustainable and organic shopping (Forbes 2022).



2

Positive policy push and increased funding

A national action plan on climate change (comprising National Mission on Sustainable Agriculture) aims to reduce the carbon footprint of agriculture.



3

Advancements in technology and innovation

Emerging technologies like digital (AI/ML/Blockchain), physical (Robotics, Energy & Transport) and biological (Bio-energy, Genetic Engineering, etc.)



4

Increasing business opportunities

Businesses using models of circularity to deal with their waste, private equity funds and venture capitalists showing increasing interest towards investing in CE models.



5

Visible effects of climate crisis

Unsustainable extraction and processing of raw materials, fuels and food, leading to increased costs to society.



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