

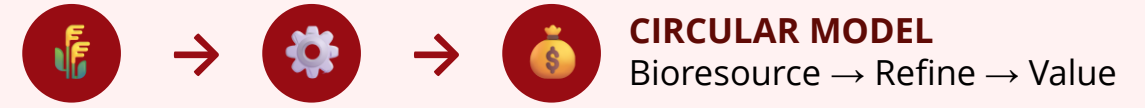


Food Sidestream Opportunity Study

Executive Briefing

September 2026

The USD 1·10¹² business opportunity



The Bioresource Opportunity

 **30–40% of biomass is lost** — treated as a disposal cost today.

 **High retained value** — proteins, fibers, bioactives.

Why Now — Drivers & Objective

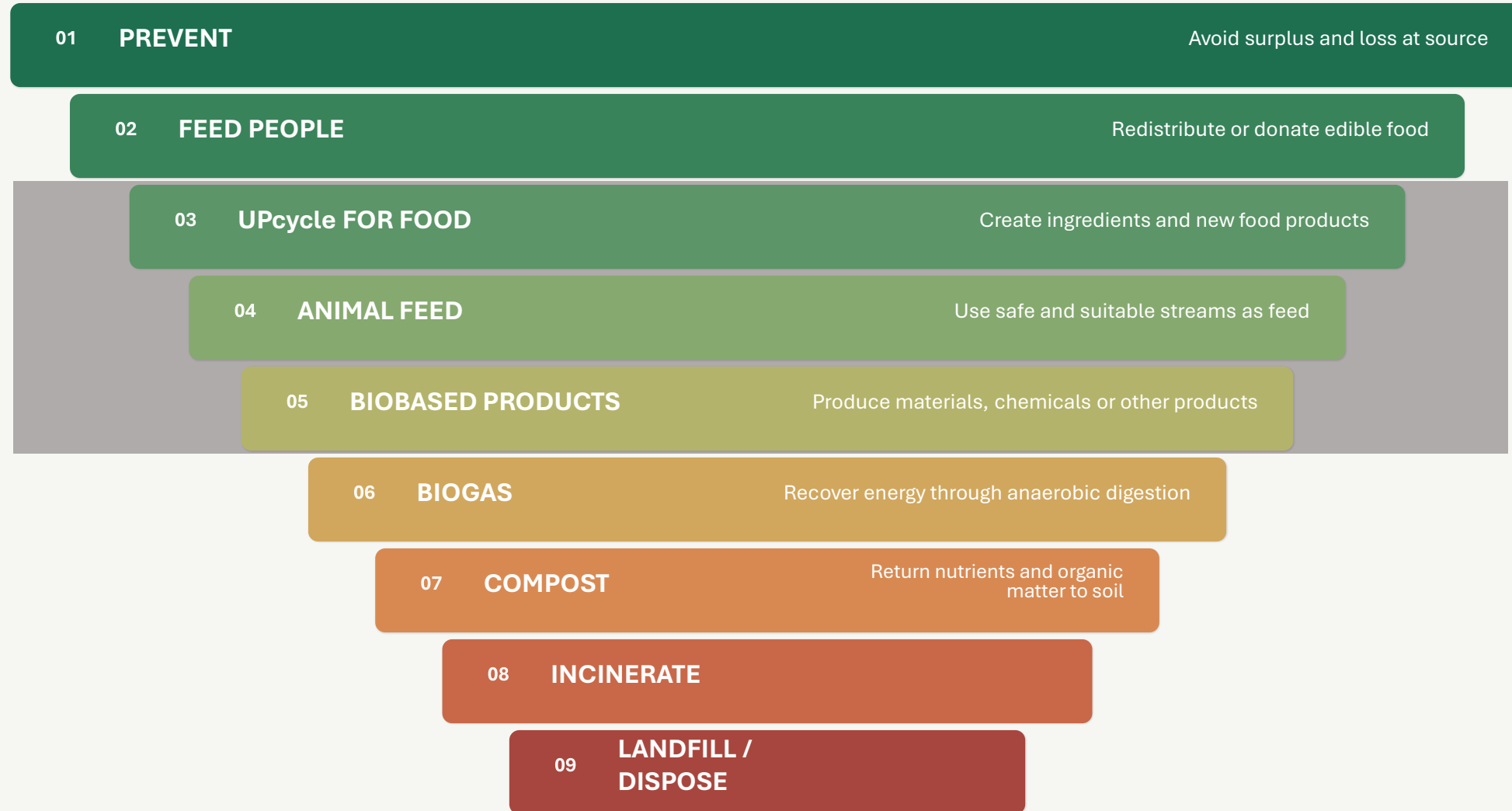
 **Climate & ESG pressure** — Scope 3 targets rising.

 **Margin expansion** — cost → revenue conversion.

Food Loss & Waste Hierarchy

Decision principle

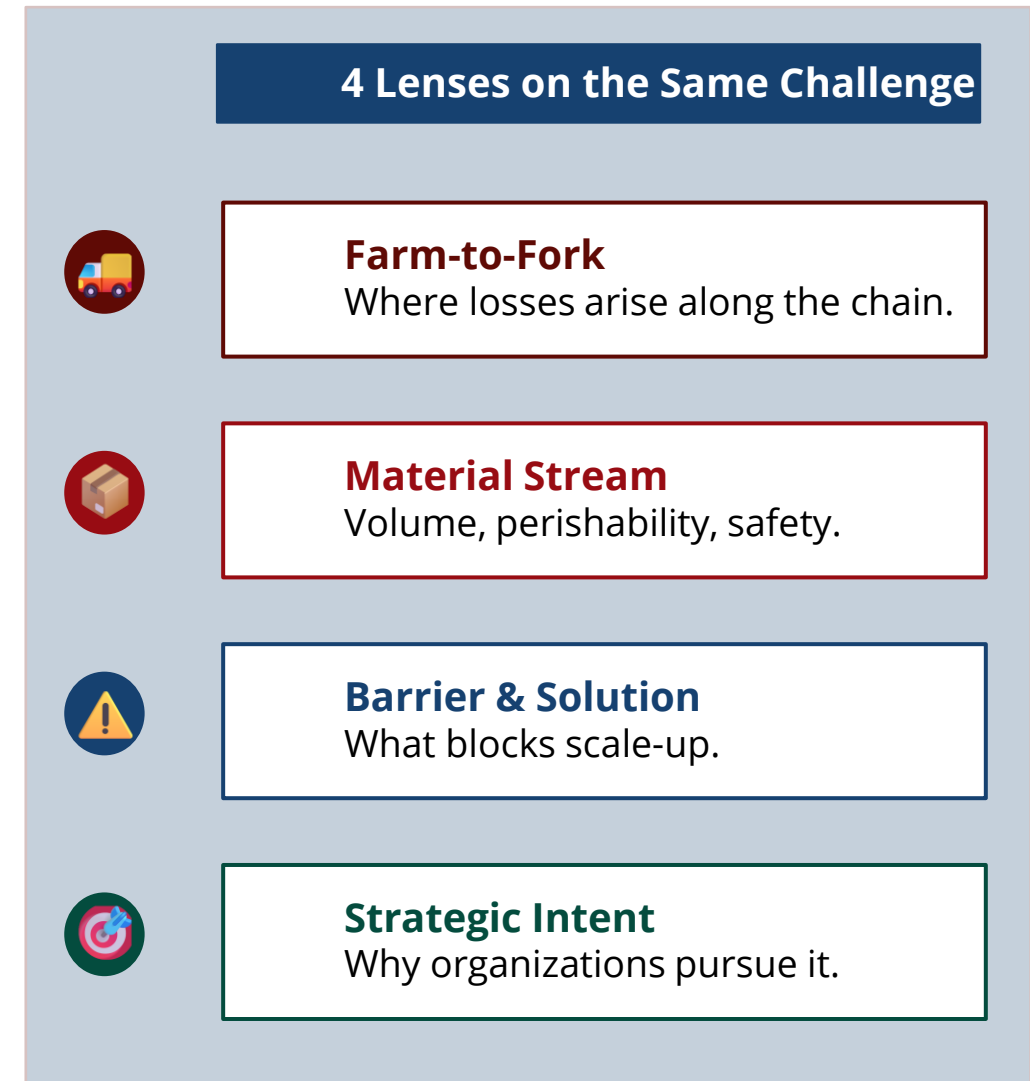
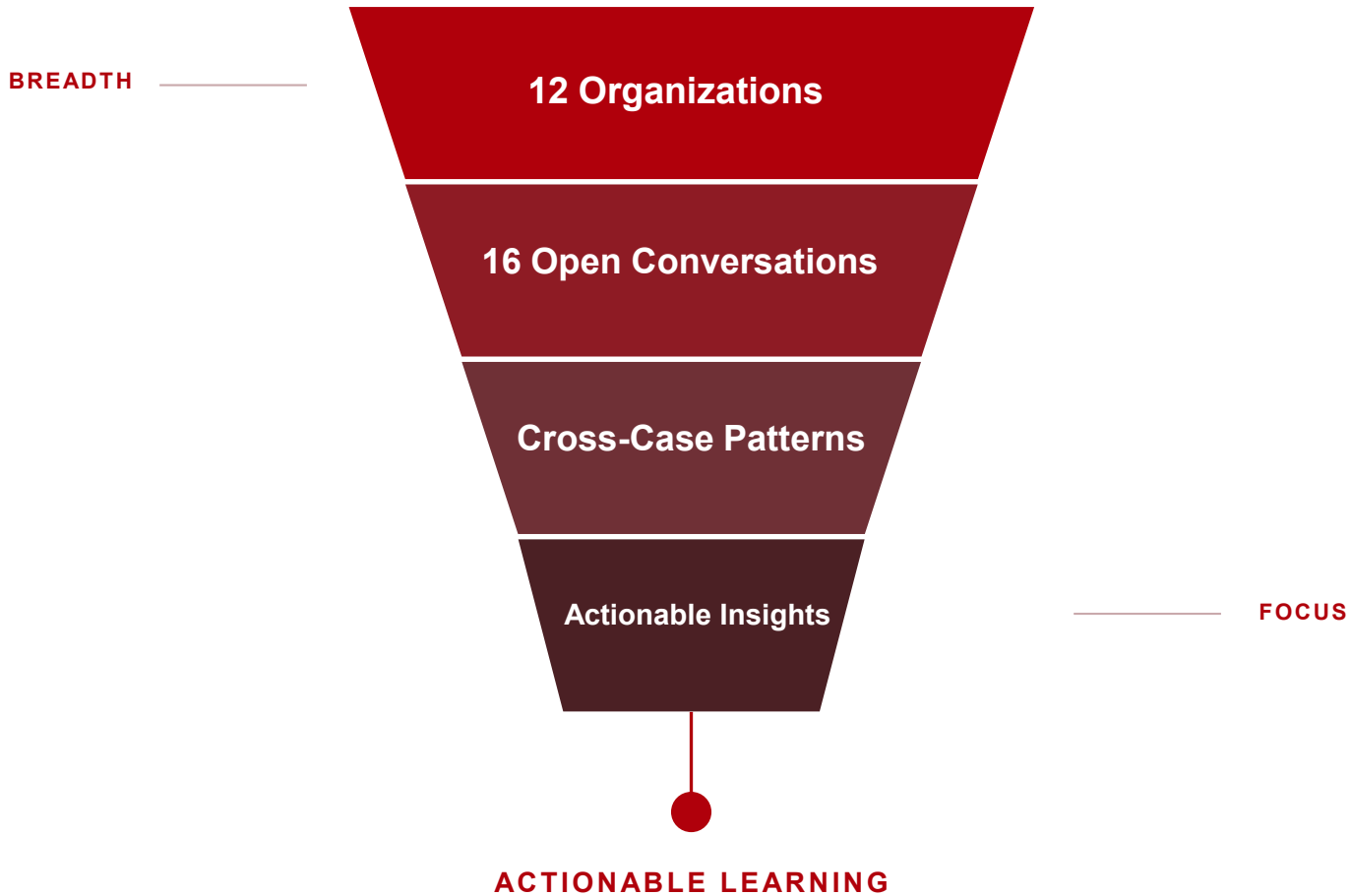
Keep food and biological resources at their highest feasible value for as long as possible.



Talking to the Ecosystem

From organizations to actionable insights

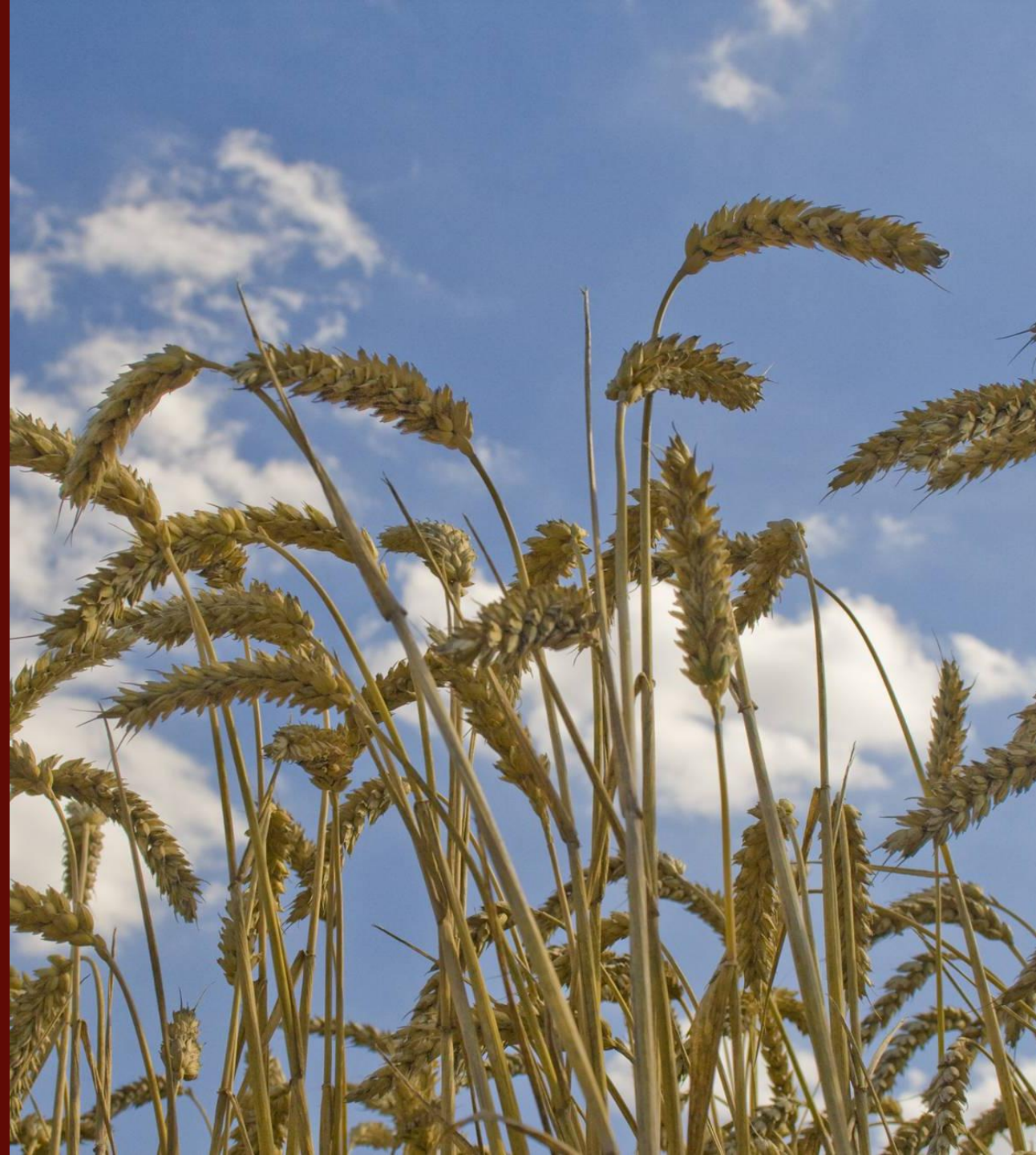
A structured path from open dialogue to cross-case learning



Farm to fork

Valorization opportunities exist throughout the value chain and not only at a single stage.

Crop value systems (Bayer, Novonesis).



Material stream

Characteristics of material streams influence valorization more than place in the value chain.

Must be steady, abundant and consistent (empirical, Oterra, Nestlé).



Barrier and solution

Rarely technical alone but rather a combination of economic, informational, organizational and market-related impacts.

Resourcemappping · data sharing · partnering · technological best practice · market creation · ecosystem building.



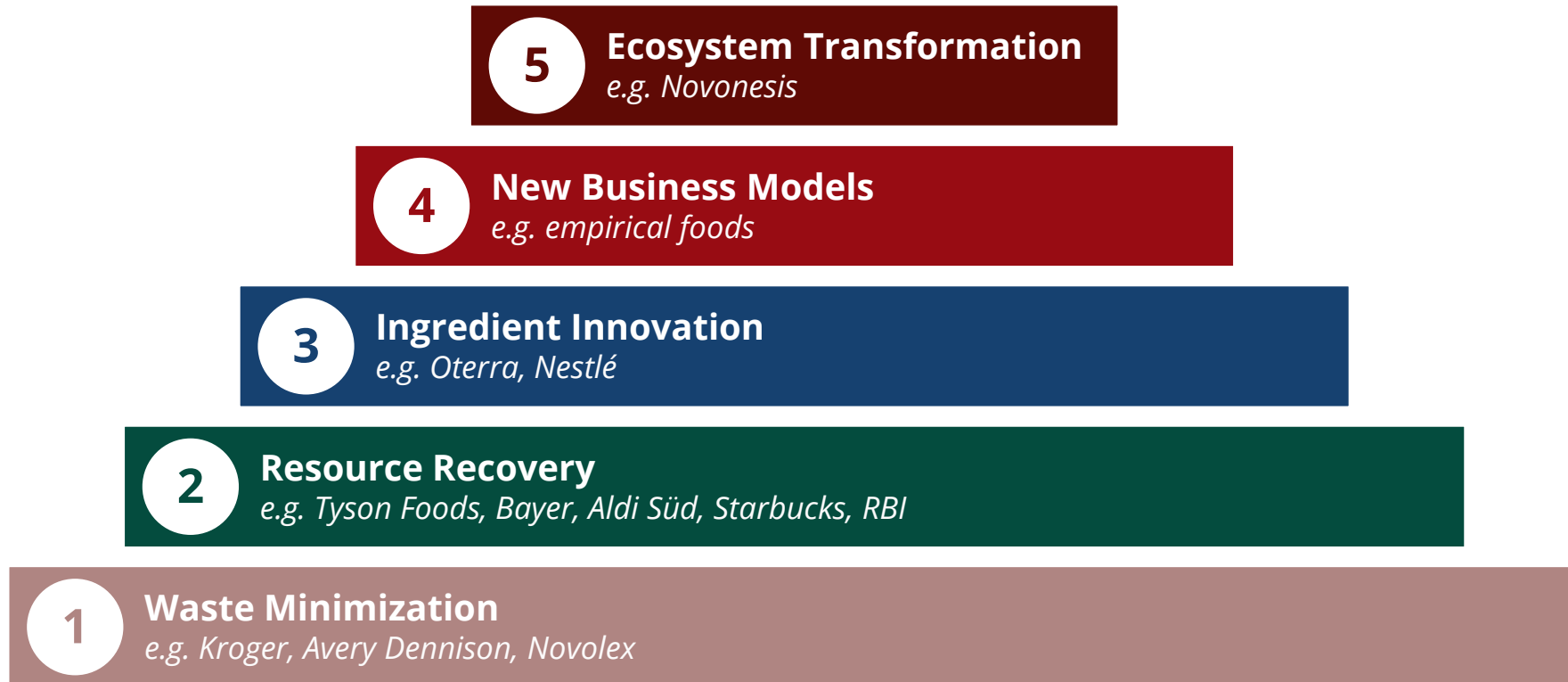
Strategic intent

**Operational efficiency,
sustainability, growth platform
and transformation agenda.**

**Not mutually exclusive and
should be addressed
simultaneously.**



The Valorization Maturity Hierarchy



Five Key Findings



Mindset before technology

Valorization starts by reframing residuals as strategic assets, not waste.

e.g., Empirical Foods, Oterra



Visibility is foundational

You can't valorize what you don't measure or track.

e.g., Avery Dennison, RBI



Business models scale it

Technology enables, commercial models make it stick.

e.g., Novonesis



It's an ecosystem challenge

No single company can do it alone; partnerships are key.

e.g., Aldi Süd, Novonesis



Economics decide the outcome

Sustainability opens the door, ROI keeps it open long-term.

e.g., across all 12 organizations studied

AI-driven, multi-product biorefining platforms

Biological



- Biorefining, fermentation & enzymatic conversion
- Insect bioconversion (BSFL)

Mechanical



- Centrifugal separation & membrane filtration
- Spray drying to shelf-ready powders

Digital



- Sensors, AI & automation
- End-to-end traceability

Hygiene & Safety



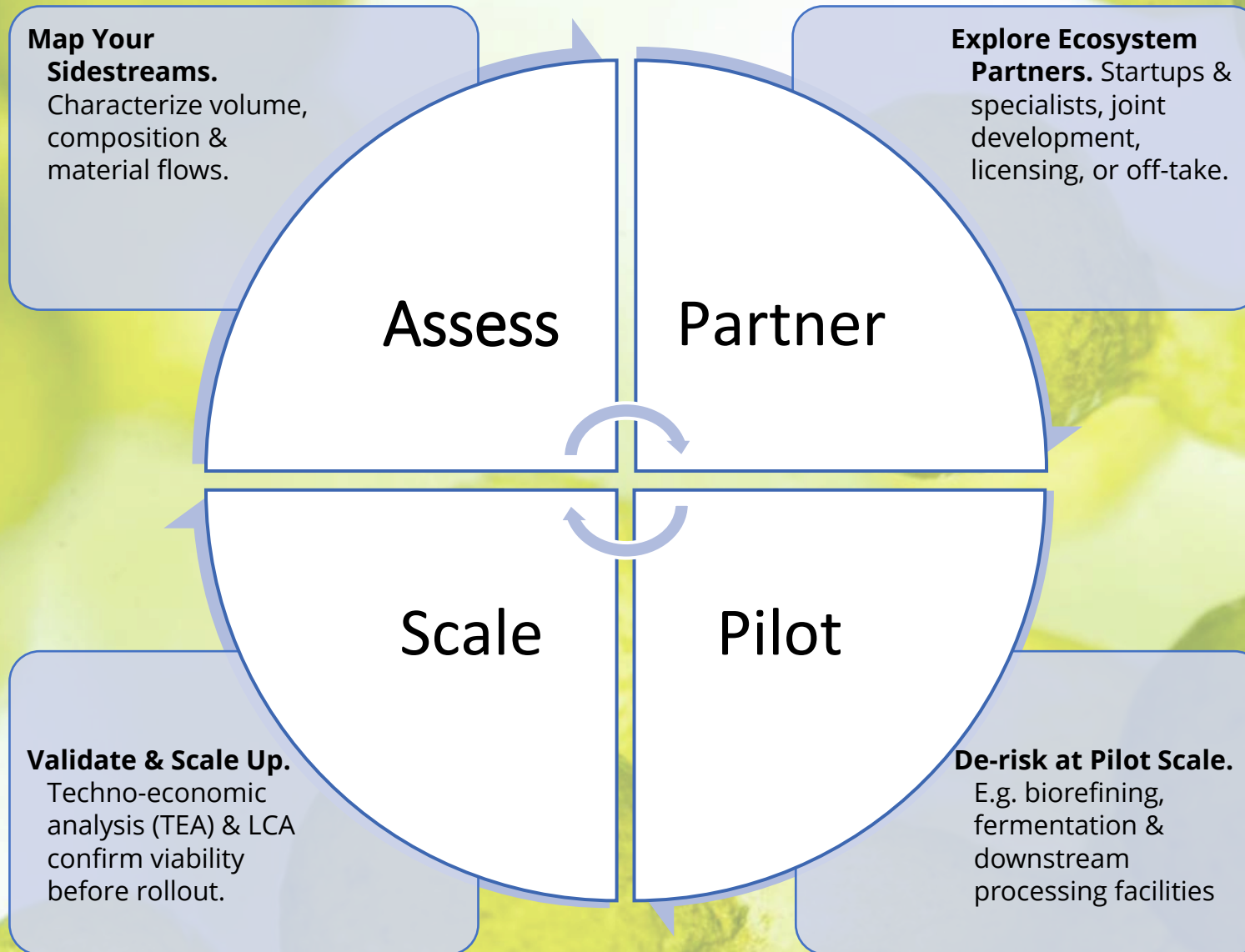
- Pasteurization & hurdle technologies
- CIP & shelf-life validation

Material-Based



- Biomaterials: cellulose, chitin, proteins
- Biodegradable packaging & films

A Path Forward



Concluding Points: From Residue to Resource



Reframe Waste as Strategic Capital

Shift from defensive waste management to proactive value creation.



Anchor Technology in Sound Economics

Validated, techno-economic tools bridge pilot to industrial scale.



Pioneer Ecosystem Collaboration

No single company can scale circularity alone.



Align Rigor with Market Demand

Combine LCA & food-safety rigor with market-ready value propositions.

"The pathways from sidestream to high-value product are proven and achievable."



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There is no silverbullet – only determination

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1. How do you secure holistic buy-in from your organization?

2. How do we address the barriers?



CAPEX & risk-sharing Who co-invests in biorefining infrastructure?



Logistics & perishability How do we aggregate before spoilage?



Consumer trust How do we remove the upcycled stigma?

3. Where are the biggest opportunities?



High-margin bio-ingredients Peptides, fibers, precision fermentation.



Cross-sector symbiosis Materials, packaging, personal care.



Winning business models Startups, majors, or integrated players?