NYU STERN

Center for
Sustainable Business

Improving Food Waste Management: Proposed Benefits & Monetization Methods

April 2023

ROSI™ Framework

Return on Sustainability Investment (ROSI™) Framework

By embedding ESG risk and opportunities within core business strategy, the return on sustainable investment can be quantified, delivering the possibility of both financial value and positive societal impact.

Overview of Food & Agriculture Framework

NYU Stern CSB is developing a ROSI™ framework for food & agriculture with publicly available monetization tools to help the industry understand where and how sustainability can unlock financial value.

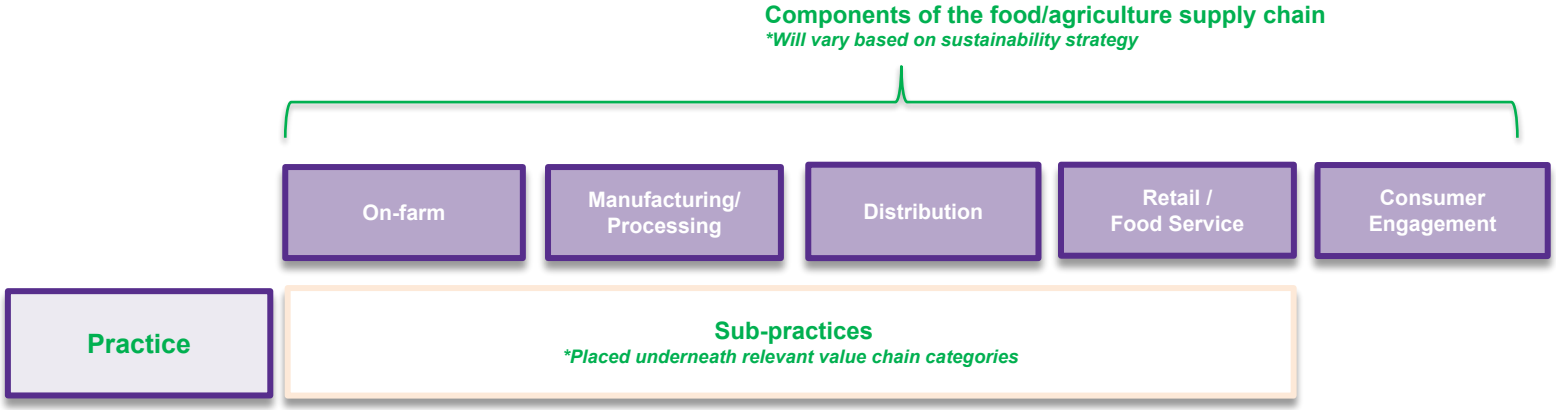
Based on research, experience, and engagement with industry leaders, we have identified the following sustainability strategies* used by the industry to include in the framework:

Water security	Soil health	Climate change	Chemical management
Biodiversity and ecosystem conservation	Animal stewardship	Food waste management	Sustainable sourcing
Food safety and nutrition	Sustainable packaging	Employee and supplier well-being	Brand marketing and communications

Identified Sustainability Practices and Sub-Practices

Framework Layout

- Through our research, we identified key sustainability practices and sub-practices food and agriculture supply chains are implementing to achieve their sustainability strategies
- Each strategy includes sub-practices which are mapped under the relevant components of the food/agriculture supply chain, (if not relevant to a part of the supply chain, it is excluded)
- There are some benefits that are referenced across multiple strategies
- Compliance / enforcement practices are not explicitly listed in this framework but should be considered when implementing the twelve strategies
- Please see diagram below of the framework layout, which is illustrated for each strategy in the subsequent slides



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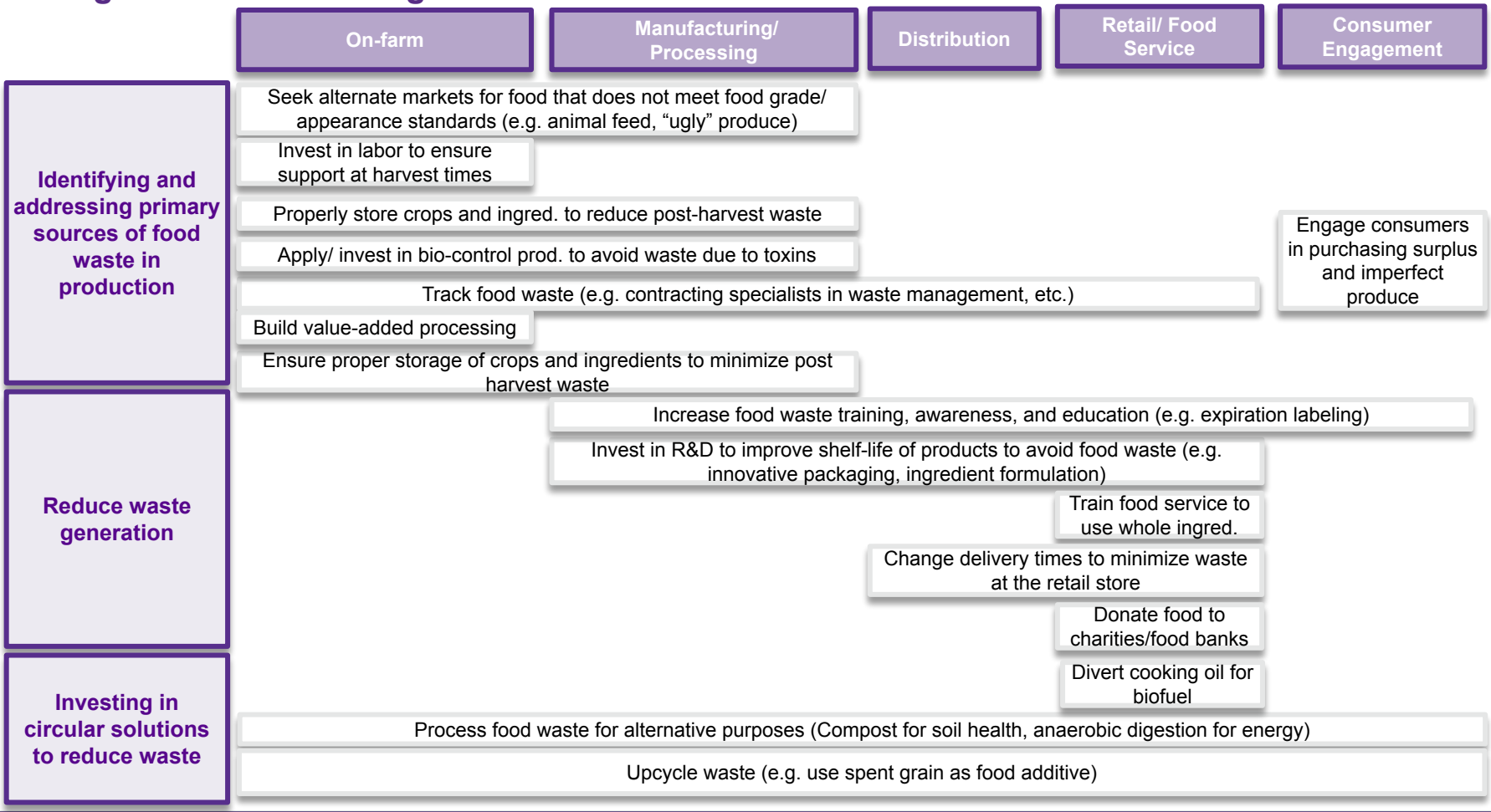

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Monetization Approach

Improving Food Waste Management

Overview of Sustainability Strategy and Relevant Impact Categories

In the following slides, we will be focusing on benefits from the *Improving Food Waste Management* strategy, which are categorized based on the relevant impact categories highlighted below

Sustainability Strategy Definition

Improving Food Waste Management	**Food and Agriculture supply chains are investing in strategies to reduce waste production through process efficiencies or repurposing it using circular solutions**

Relevant Impact Categories

	Benefits that…
Operational Efficiency (OE)	**Optimize corporate and supply chain efficiencies to lower cost and increase profits**
Sales and Marketing (SM)	**Increase volume of sales through brand and marketing policies**
Customer Loyalty (CL)	**Attract an increasing community of conscious buyers & consumers, while reducing retention costs**
Risk Management (RM)	**Encourage risk mitigation and resilience within the value chain**

Improving Food Waste Management

Overview of Sustainability Strategy and Relevant Impact Categories

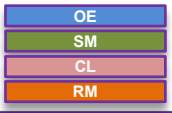
In the following slides, we will be focusing on benefits from the *Food Waste* sustainability strategy, which are categorized based on the relevant impact categories highlighted below

Relevant Impact Categories	Benefits that…
Stakeholder Engagement (SE)	Improve goodwill among the broader stakeholder community (i.e. NGOs)
Talent Management (TM)	Attract and retain high-quality internal talent
Supplier Relations (SR)	Improve upon the relationships between the company and its suppliers
Media Coverage (MC)	Increase a company's media presence with the development of traditional and social media content
Innovation (IN)	Create new revenue streams using sustainable business models

Investing in Addressing Food Waste in Production, ON FARM

Overview of Benefits and Monetization Methods

Practice	Sub-Practice	Metric #	Proposed Benefits	Impact Category	Suggested Monetization Methods
Address primary sources of food waste in production	Seek alternate markets for food that does not meet food grade or appearance standards (e.g. animal feed, energy sources, imperfect/ugly produce)	FW-1	Increased revenue due to diversified sales streams (either through incremental sales or sales to higher priced buyers)	SM	Estimate additional revenues from new sales into alternative markets minus associated costs of diversification
	Investing in labor force to ensure support at critical harvest times (e.g. living wages, visa support, training local labor)	FW-2	Avoided cost of labor shortages (i.e. spoiled crop)	OE, RM	Compare labor costs and viable yield under optimum labor participation versus instances of labor shortages
	Track food waste (e.g. contracting specialists in waste management, etc)	FW-3	By identifying waste, farmers can develop plans to address and minimize it	OE	Estimate incremental yields from practices identified to prevent crop degradation and multiply by average selling price, less costs associated with implementing practices



= Impact categories based on color coding illustrated on previous slides

Investing in Addressing Food Waste in Production, ON FARM

Overview of Benefits and Monetization Methods

Practice	Sub-Practice	Metric #	Proposed Benefits	Impact Category	Suggested Monetization Methods
Address primary sources of food waste in production	Ensure proper storage of crops and ingredients to minimize post harvest waste	FW-4	Investment in new and/or upgraded storage facilities leads to greater output to maximize sale price	SM, OE	Compare historical sales data (volume, average sale price and margins) for both high and low product sales before and after new storage implementation and subtract costs associated with investment
	Investing and applying bio-control products to avoid waste due to harmful toxins	FW-5	Investment in bio-control can leads to greater output volumes to sell at optimum price	SM, OE, IN	Compare sellable volumes before and after application of bio-control and multiply by price to estimate sales lift. Subtract associated investment costs to determine net benefit.
	Build value-added processing (e.g. packing houses and salsa kitchens) to produce additional product offerings	FW-6	Increased revenue due to diversified sales streams	SM	Estimate additional revenue by summing revenue from new sales streams minus associated costs of diversification
	Adopt greenhouse production for select products to eliminate waste driven by weather impacts	FW-7	Avoided crop loss or less yield volatility due to extreme weather events	OE, RM	Identify historical crop yield volatility and quality impacts due to extreme weather. Estimate cost savings by multiplying the average yield loss times price per sales channel before and after adopting greenhouse production, less costs associated with investment

Investing in Circular Solutions, ON FARM

Overview of Benefits and Monetization Methods

Practice	Sub-Practice	Metric #	Proposed Benefits	Impact Category	Suggested Monetization Methods
Investing in circular solutions to reduce waste	Compost food waste	FW-8	Composing reduces the need for chemical fertilizer	OE	Quantify the amount of fertilizer used before and after composting program was initiated and multiply by average fertilizer cost, less costs associated with transition
		FW-9	Composting reduces the amount of organic waste in landfills, associated carbon emissions	RM	Quantify the amount of waste sent to landfill before and after composting program was initiated. Multiply the reduction amount by the estimated cost of carbon emissions to calculate the avoided cost
		SH-4	Composting increases carbon sequestration on-farm	OE, SM	Use a research based estimate for amount of carbon reduced/sequestered per acre related to a specific soil health practice adoption and multiply by impacted acres. Multiply the total amount of carbon reduced/sequestered by an estimate of market value to parties seeking carbon offsets to quantify the benefit

Investing in Circular Solutions, ON FARM

Overview of Benefits and Monetization Methods

Practice	Sub-Practice	Metric #	Proposed Benefits	Impact Category	Suggested Monetization Methods
Investing in circular solutions to reduce waste	Compost food waste	SH-5	Composing reduces soil erosion and leads to reductions in nitrogen and phosphorus runoff minimizing water use and pollution	RM	Estimate water use volumes before and after adoption of composting to identify volume change. Multiply volume change by associated costs to estimate cost savings and subtract associated investment required for compost transition
		SH-9	Composting increases soil biota and improves soil fertility leading to improved yields	OE	Compare average yields per acre for periods before and after composting and multiply yield differential by average price and number of acres, less costs associated with investment
		SH-8	Composting reduces volume of fertilizer needed to be purchased	OE	Calculate fertilizer cost before and after implementing practices to improve soil biota and divide by the # of acres farmed during each period to get cost per acre. Multiply difference in cost per acre by total acres, less costs associated with investment

Investing in Addressing Primary Sources of Food Waste, COMPANIES

Overview of Benefits and Monetization Methods

Practice	Sub-Practice	Metric #	Proposed Benefits	Impact Category	Suggested Monetization Methods
Identifying and addressing primary sources of food waste in production	Seek alternate markets for food that does not meet food grade standards (e.g. animal feed, energy sources)	FW-1	Increased revenue due to diversified sales streams	SM	Estimate additional revenue by summing revenue from new sales streams minus associated costs of diversification
	Track food waste (e.g. contracting specialists in waste management, etc)	FW-3	By identifying waste, companies can develop plans to address and minimize it	OE, SM	Estimate volume of waste and multiply by average selling price, less costs associated with implementing practices
	Ensure proper storage of crops and ingredients to minimize post harvest waste	FW-4	Investment in new and/or upgraded storage facilities leading to reduced waste and higher sales prices or reduced input costs	OE	Compare historical sales data (volume, average sale price and margins) for both high and low product sales before and after new storage implementation and subtract costs associated with investment
	Investing in bio-control products to avoid waste due to harmful toxins	FW-5	Investment in bio-control can leads to greater supply stability	RM	Calculate risk of supply volatility by comparing prices of primary supplier to alternative markets multiplied by the volume needed, less costs associated with investment in bio-control (e.g. may incur extra transportation or logistics costs)
	Engage consumers in purchasing surplus and imperfect produce	FW-10	Selling less than perfect product through "ugly food" channels increases revenues	SM	Multiply volume of imperfect food by the premium price received for selling to imperfect food channels as opposed to lower-margin markets (e.g. feed)

Investing in Reducing Post-Production Waste, COMPANIES

Overview of Benefits and Monetization Methods

Practice	Sub-Practice	Metric #	Proposed Benefits	Impact Categ.	Suggested Monetization Methods
Reduce post-production waste generation	Increase food waste training, awareness and education (e.g. expiration labeling, utilizing whole ingredients)	FW-11	Reduced costs associated with waste management (e.g. transportation costs)	SM	Estimate costs of waste management before and after investment in training, less the costs associated with this investment
		FW-12	Cost savings related to managing food volumes more effectively	OE	Compare volume of food waste before and after training and multiply by market price per item to estimate cost savings. Subtract associated training costs
	Investing in R&D to improve shelf-life of products to avoid unnecessary food waste (e.g. innovative packaging, ingredient formulation)	FW-13	Increased revenue due to diversified sales streams	SM	Estimate additional revenue by summing revenue from new sales streams (e.g. products with longer shelf life) minus associated costs of diversification
		FW-14	Reduced costs associated with waste management (e.g. transportation costs)	OE	Estimate costs of waste management before and after investment in training, less the costs associated with this investment
	Change delivery times to minimize waste at the retail store	FW-15	Cost savings related to managing food volumes more effectively	OE	Compare volume of food waste before and after delivery time adjustments and multiply by market price per item to estimate cost savings. Subtract associated costs (e.g. transportation)
	Donate food to charities/food banks	FW-16	Donating food can generate tax deductions and reduce dumpster fees	OE	Compare value of tax deductions and avoided dumpster fees before and after donation strategy is implemented

Investing in Circular Solutions, COMPANIES

Overview of Benefits and Monetization Methods

Practice	Sub-Practice	Metric #	Proposed Benefits	Impact Categ.	Suggested Monetization Methods
Investing in circular solutions to reduce waste	Diverting cooking oil for biofuel	FW-17	Cost savings related to repurposing food waste	OE	Estimate cost of biofuel before and after diverting cooking oil for use
	Process food waste for alternative purposes (Compost for soil health, anaerobic digestion for energy)	FW-18	Reduced carbon emissions associated with organic waste in landfills	OE	Estimate volume of organic waste to landfills and associated carbon emissions before and after composting. Multiply the volume of carbon emissions by the market price as a proxy for the cost avoided from having to buy carbon offsets for this amount of emissions
		FW-19	Selling compost or energy can increase revenue due to diversified sales streams	SM	Estimate additional revenue by summing revenue from new sales stream (e.g. compost) minus associated costs of diversification
	Upcycle waste (e.g. spent grain as food additive)	FW-20	Increased revenue due to diversified sales streams	SM	Estimate additional revenue by summing revenue from new sales streams minus associated costs of diversification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