

White Paper

Regenerative Practices in the Food Processing Sector Promoting Climate Action and Business Gains



Calibration of the milk pasteurizing machine at Zagol Milk, Melkam Endale, AINFP Client in Ethiopia

► Overview

This white paper explores the importance of adopting regenerative practices in the food processing sector to enhance climate resilience and sustainability. By examining real-world experiences and survey findings, this white paper aims to provide policymakers and programs with an understanding of the potential benefits and challenges associated with regenerative practices in the food processing sector.

► Introduction

The changing climate poses a significant threat to food systems in sub-Saharan Africa, with rising temperatures, extreme weather events, and changing rainfall patterns already impacting agricultural production, leading to [decreased and more variable yields and increased food insecurity](#). Meanwhile, food systems themselves contribute to climate change, with roughly [one-third](#) of human-caused greenhouse gas emissions linked to food. The negative impacts of food systems extend beyond climate change. Food systems are the [primary contributor](#) to biodiversity loss. To address these challenges and improve the resilience of our food systems, proactive mitigation and adaptation practices are crucial. While the focus has primarily been on promoting climate-smart and regenerative practices in the agriculture sector, it is imperative to consider other components of the food system that play significant roles in driving climate and environmental efforts as well as those vulnerable to climate shocks



Key definitions

Regenerative practices:

Practices that aim to minimize waste and pollution, maximize resource and energy efficiency, restore natural systems and resources, and capture additional value by reusing, recycling, and transforming materials.

Climate-smart agriculture:

A set of practices which aim to boost agricultural productivity, while simultaneously reducing greenhouse gas emissions and improving resilience.

Climate adaptation: The shifting of practices to become more resilient to the shocks and stressors caused by climate change.

Climate mitigation: Preventing and reducing the release of greenhouse gases to slow climate change.

and stressors. Food processors play a central role in food systems, connecting food production to end-consumers. By working through food processors to adopt regenerative business practices, we can promote improved climate mitigation and adaptation, as well as economic growth amongst food systems actors. This expanded approach is essential for catalyzing climate resilience across the food system.

In this brief, we look at the opportunities in the food processing sector, presented by findings and experiences from the [Alliance for Inclusive and Nutritious Food Processing \(AINFP\)](#) program in working with over 240 food processors. AINFP is a partnership program between [USAID](#), [TechnoServe](#), and [Partners in Food Solutions \(PFS\)](#) that aims to create a more competitive and resilient food processing sector, and in turn, positively affect food systems in Ethiopia, Kenya, Malawi, Tanzania, and Zambia.

► Background and Purpose:

Little documentation exists regarding the risks faced by food processors in the global south if they fail to adapt to climate change, as well as the commercial benefits that regenerative practices offer. In this brief, AINFP delves into the opportunities and risks that food processors encounter in the face of climate change. The brief presents findings from a recent survey conducted with food processors regarding their adoption or interest in adopting regenerative practices—such as interest in adopting practices in waste management, water management, energy use, and sustainable sourcing. The survey was conducted by AINFP in September 2023 with 16 food processors to understand their awareness and adoption of regenerative business practices, aiming to shed light on the current landscape of regenerative practices among food processors in AINFP's target countries - Ethiopia, Kenya, Malawi, Tanzania, and Zambia. It is important to note that the survey was conducted with a relatively small sample size. As such, future initiatives should aim to delve deeper into the motivations of food processors in their program.

These findings are coupled with AINFP's experiences in supporting food processors to adopt regenerative practices, and even moreso, learning from food processors on what they are



Future initiatives should aim to delve deeper into the motivations of food processors in their program.

Worker collecting flour from a flour processing machine at Yumi Milling, AINFP Client in Zambia. Photo: Bobby Neptune

already doing and what challenges and opportunities they see in the sector in adapting to and mitigating climate change. Furthermore, the recommended regenerative solutions are based on AINFP's expertise in conducting Initial Environment Assessments (IEAs) and Regenerative Business Diagnostics with food processing clients. The program team also conducted factory assessments for all the food processors, which encompassed energy usage, water treatment, and food safety. This included practices related to the use of pesticides, fertilizers, and other chemicals or contaminants, both on-farm and at the factory level.

► Fostering Regenerative Practices in the Food Processing Sector

In this brief, we present the benefits—to processors, local communities, other food systems actors, the climate, and the environment—in adopting regenerative practices across four main opportunity areas: waste management, water management, energy use, and sustainable sourcing.

► Waste Management

Food processors produce waste from their operations, including organic and non-organic materials, such as food, plastics from packaging, and chemicals. Improved waste management practices, including reducing waste and diverting waste from landfills [can reduce greenhouse gas emissions, food waste, and negative environmental effects](#). From AINFP's rapid survey with 16 food processors, 100% of the food processors reported having packaging waste, such as plastics and other food packaging

material, 80% reported having wastewater, and 60% reported having food waste from their processing activities. Importantly, many of the food processors are already implementing waste diversion practices. For example, 70% are actively engaging in waste diversion, primarily through recycling, 50% repurpose waste products, notably in plastic recycling and byproduct utilization, and 60% track waste diverted from landfills or incineration, predominantly through the volume of waste diverted.

The following waste management practices could be implemented to reduce waste and positively impact the climate, environment, and/or local communities, as well as food processors:

Regenerative Waste Management Practices

Potential solution(s)	Climate/environmental and/or human benefit	Food processor benefit
- Use organic by-products to produce other processed foods - Use organic by-products to create biochar and compost - Use organic by-products to create biofuels - Improve on-plant efficiencies to reduce waste of materials - Use recyclable packaging materials instead of non-recyclable	Reduce organic and inorganic loss that contributes to greenhouse gas emissions and/or environmental pollution; improve the availability of regenerative inputs that improve soil nutrition, aeration, and water filtration; increase the availability of cleaner fuel options; job creation and additional revenue streams by processing by-products into other products.	Improve profits by selling additional products and/or by reducing inefficiencies within the processing line that require purchasing of additional input materials to make the product; decrease costs by using reusable packaging material; attract more clients with regenerative practices and improved packaging; decrease fuel costs through the use of biofuels from by-products



Examples from AINFP clients: In aiming to support food processors to be more profitable and competitive, AINFP provides customized technical assistance (CTA) to understand how food processors can improve their efficiencies, reduce waste, and thereby reduce costs. These can also have important impacts for climate change mitigation, by reducing the inorganic and organic use. For example, in Kenya AINFP provided CTA to BeeCare, a honey processing company, to document their processing practices in compliance with food safety standards. This resulted in BeeCare identifying which practices were causing inefficiencies and enabled them to reduce their waste from 15% to 5%. Additionally, AINFP worked with Food and Us Limited to reduce their inorganic material waste, by supporting the food processor to adopt reusable plastic trays for yogurts, rather than single-use versions, and by stopping their practice of shrink-wrapping their products with polythenes. In Ethiopia, AINFP provided support to Prime Meat, a meat processor, in developing innovative products utilizing meat by-products that were previously unused. This collaboration led to the successful formulation of three new by-products derived from previously wasted parts. Additionally, multiple AINFP food processing clients, as well as food processors supported under other



Energy Bio digester at Zagol milk, AINFP Client in Ethiopia.
Photo: AINFP

TechnoServe projects, have converted organic by-products into biofuel, in order to replace or reduce charcoal or wood use. For example, Zagol Milk in Ethiopia installed the country's first bio-digester, converting cow waste into energy to power their milk and cheese processing plant. AINFP provided technical guidance, leading to enhanced efficiency of the bio-digester and ultimately reducing Zagol's on-grid power costs by 80%.

► Water management

Quantifying water wasted in the food supply chain and during food processing in sub-Saharan Africa is difficult, as little quantification has occurred and most reports focus on countries in North America and Europe. Nonetheless, the importance of water access and responsible use is understood and an estimated [1 in 3](#) people in Africa live in water-scarce areas. Given that rising temperatures are expected to worsen these patterns by affecting precipitation levels and [exacerbating water scarcity](#), it is crucial for market systems to adapt to these anticipated conditions. By doing so, these systems can avoid contributing to water scarcity in their communities while also building resilience to the impacts of climate change.

In addition to water consumption, it is important to consider how food processors treat and dispose of water used in their food processing activities, as untreated water can produce negative environmental and human health consequences. Overall, 70% of the surveyed food processors indicated a strong interest in improving their wastewater management practices. Considering improved water efficiencies, 40% of the surveyed food processors reported implementing practices trying to recycle or reuse water from their production. Treating water used in production is important for environmental and human health to reduce the pollutants released into municipal water systems or into the environment, 50% of respondents reported treating water before disposal.

The following water management practices could be implemented to reduce waste and positively impact the climate, environment, and/or local communities, as well as food processors:

Regenerative Water Management Practices		
Potential solution(s)	Climate/environmental and/or human benefit	Food processor benefit
- Adopt water-saving technologies, such as water-efficient cleaning systems, dry sanitation processes, closed-loop cooling systems, and water flow meters - Adopt treatment before release practices - Conduct leak checks to reduce water consumption - Improve the factory layout to improve water management, especially for vegetable processing	Reduce total water use and minimize contribution to water scarcity; reduce environmental pollution by treating water before release	Reduce operational costs from water-saving practices; improve trust and relationships with the community by the reduction of pollution; repurposed water used for production



Before untreated factory water and after water treatment and reuse for tomato growing at Zanto Foods, AINFP Client in Tanzania.
Photo: AINFP

Examples from AINFP clients: In Tanzania, Shambani Milk Dairy and Zanto Food Products Company have implemented strategies to repurpose water from their processing activities to support local crop production. For instance, Zanto Food Products Company treats the water utilized in the production of their tomato sauce and then diverts it to irrigate the tomato fields situated adjacent to their processing facility. This resourceful practice not only reduces overall water consumption but also capitalizes

on the utility of water used in food processing activities, allowing for its dual utilization. In dairy processing, water is essential for cleaning, disinfecting, and heating, resulting in wastewater containing pollutants that require treatment before release. Demka Dairy Limited in Kenya utilizes biological wastewater treatment with lagoons to remove organic and inorganic materials from the water and further repurposes the treated effluent for crop irrigation near their processing facility.

► Energy Use:

The pursuit of renewable energy and efficiency isn't just an environmental choice; it's a strategic economic decision. Processors are increasingly recognizing the cost benefits of upgrading to high-efficiency equipment, optimizing processes, and closely monitoring energy usage to drive down operational expenses and enhance sustainability. Furthermore, food processors can enhance their resilience by incorporating renewable energy sources that are not dependent on the grid for electricity. This is particularly important because food processors may experience frequent power outages from on-grid power, which can lead to product loss due to spoilage or stoppages in their operations. These disruptions can strain relationships with



Promoting off-grid energy solutions - understanding the risk:

Off-grid energy solutions may not be suitable in all cases due to challenges such as limited capacity of off-grid systems to meet the high energy demands of food processing operations and the (in some instances) lack of technical expertise and support for operating and maintaining off-grid systems. It is crucial to carefully assess off-grid solutions as supplemental energy sources in such situations.

farmers and consumers, as the food processors may not be a reliable market. From the survey, respondents primarily rely on non-renewable energy sources, with 60% using on-grid electricity, followed by 20% using bio-energy, 15% using solar energy, and the other 5% using diesel generators or charcoal/wood burning operations. Importantly though, 81% of the respondents indicated a strong interest in expanding or utilizing renewable energy sources. Further, 50% of respondents are currently implementing energy efficiency measures (e.g., upgrading equipment to reduce energy use, improving production efficiencies to reduce energy required) and 30% expressed interest in adopting energy efficiency measures in their production.

The following energy practices could be implemented to reduce non-renewable energy use and positively impact the climate, environment, and/or local communities, as well as food processors:

Regenerative Energy Use Practices

Potential solution(s)	Climate/environmental and/or human benefit	Food processor benefit
- Transition to renewable energy - Use by-products from other processing activities for bio-fuel (e.g., briquettes) - Improve on-plant efficiencies and reduce overall energy use	Reduce greenhouse gas emissions by shifting to cleaner energy sources and/or reducing total energy consumption	Reduce energy costs from on-grid usage and by reducing expensive diesel back-up systems; Reduce spoilage from loss of refrigeration during power outages; Improve productivity and profits by experiencing less power outages



AINFP experiences: Similar to improved waste management practices, AINFP has found that food processors are interested in adopting practices to reduce their energy costs to improve profits, as well as improve their resilience long-term to be less vulnerable to power outages and rising energy costs. AINFP has assisted several processors in adopting renewable energy. For example, AINFP supported Profate Dairy in Tanzania with technical expertise that resulted in the installation of 18-kilowatt solar panels to sustainably run the dairy cooling system and ultimately reduced production costs, all while ensuring quality and safe milk products. This has resulted in reduced food loss, as the processor has a more reliable power source that keeps their milk and dairy products at the necessary temperatures, even when the on-grid



Solar panels installed at Profate Dairy, AINFP Client in Tanzania
Photo: Profate

electricity is experiencing a power outage. Additionally, this switch has resulted in a 60% reduction in Profate Dairy's energy bill.

COMACO in Zambia, which produces peanut butter, corn soya blend, and texturized soy protein, uses peanut byproducts, specifically shells, to produce briquettes, which can be used in place of charcoal. Specifically, COMACO uses the briquettes to roast their peanuts

and support other energy needs in the plant. By using briquettes in place of charcoal, COMACO has managed to reduce their energy costs by an impressive 86%. For example, to process 75 kilograms (kg) of peanut butter, COMACO uses 10 briquettes, weighing 6kg, that would normally require 30 kg of charcoal. On average, the cost of briquettes is \$0.15 per kg, while charcoal costs \$0.22 per kg. As a result, the energy cost savings for processing 75 kg of peanut butter using briquettes amounts to \$5.68. Similarly, in Kenya, Eagleways uses macadamia nut shells, which are waste generated in macadamia nut processing, as a source of biofuel. The use of macadamia shells has lowered their cost of fuel by about 70% as their energy conversion rate is higher than firewood which is an alternative energy source

► Sustainable sourcing practices:

Agriculture is a large contributor to greenhouse gas emissions, deforestation, and environmental degradation. On the other hand, farmers are particularly vulnerable to climate shocks and stressors, such as rising temperatures, droughts, and increases in pests and diseases, which can negatively affect productivity and therefore livelihoods. Further, these changes in productivity and susceptibility to shocks, put food processors' raw material

supply at risk. Food processors can support the farmers to adapt to climate change, as well as mitigate their impact on climate change, by promoting farmers to adopt regenerative agricultural practices. From the survey, 70% of the food processors reported already having a sustainable sourcing program in place and 62% reported an interest in improving their sustainable sourcing practices.

The following sustainable sourcing practices could be implemented to support a more regenerative agriculture sector to positively impact the climate, environment, and/or local communities, as well as food processors:

Sustainable Sourcing Practices		
Potential solution(s)	Climate/environmental and/or human benefit	Food processor benefit
- Support and incentivize farmers to adopt regenerative farming practices (e.g., organic fertilizer, efficient application of fertilizer; use of improved seed varieties; solar irrigation systems; reduced tillage for soil health) - Implement improved aggregation models to better connect farmers to food processors - Support farmers to adopt improved post-harvest and storage practices	Improve soil health, which will support farmers to grow high-quality produce for longer, reduce susceptibility to climate shocks and stressors, increasing the sustainability of their agricultural revenue stream; reduce food loss by improving connectivity between farmers and processors, which can reduce greenhouse gas emissions—potentially opening them up to carbon credits—as well as increase farmers' incomes; reduce food loss from poor post-harvest and storage practices	Increase the quantity, quality, and safety of raw materials food processors receive from their farmers; increase the resilience of farmers and therefore increase the reliability of their supply chain of raw materials from farmers



Farmer green houses as a source of raw products for herbal teas and juices processed by Thantwe Enterprises, AINFP Client in Malawi
Photo: AINFP

Examples from AINFP clients: As consumer demand for organic products rises, food processors are adapting their product offerings and therefore their sourcing practices. In Malawi, Thantwe Enterprises Limited, through the support of AINFP, developed action plans for how they could improve their sourcing of organic raw materials for their herbal teas and fruit juices. As of 2023, Thantwe Enterprises Limited was sourcing from 1,500 women farmers who are supplying organic hibiscus, ginger, and garlic among others. In Tanzania, AINFP linked

grain processor AA Nafaka with grant opportunities to purchase hermetic bags for the smallholder farmers they procure from to improve grain storage, while eliminating the use of agri-chemicals for storage. In Kenya, AINFP supported Delish and Nutri, with the development and implementation of the inclusive business plan to improve local sourcing of peanuts. Specifically, Delish & Nutri has provided smallholder farmers with climate-smart seeds. Furthermore, Agventure Limited in Kenya has provided training to the farmers on climate-smart agriculture.

► Moving forward: Promoting the adoption of regenerative practices

Understanding if and why food processors are interested and motivated to adopt regenerative practices is important to inform activities that aim to support food processors. Positively, the findings of AINFP's rapid survey reveal a significant level of interest among food processors in adopting regenerative practices. Food processors were asked to rate their interest, on a scale of 1 to 5 (1 being not interested at all and 5 being very interested) in various regenerative practices. The results were overwhelmingly positive, with average scores above 4 for all practices including improving waste management and diversion, water management, energy use, and sustainable sourcing. Notably, improving waste management and diversion received the highest average rating of 4.7, while improving sustainable sourcing had a slightly lower rating of 4.2. The survey respondents noted needing technical assistance and access to finance to purchase technologies (e.g., biogas technology, closed-loop water cooling systems) to adopt these practices. The following recommendations encapsulate AINFP's reflections on what needs to happen to promote a food processing sector that is regenerative, supporting food systems actors to adapt to and mitigate climate change. These reflections pull from AINFP's technical assistance to food processors, but also in listening and hearing what food processors are already doing and what enabled them to do so, or what barriers they are running into.

► Recommendations for Promoting the Adoption of Regenerative Practices:

Demonstrate the business case:

Food processors, being primarily for-profit businesses, often operate on thin profit margins, making it imperative for programs promoting the adoption of regenerative practices to demonstrate tangible business benefits. These may include securing a reliable supply of raw materials, transitioning to cost-effective energy sources, reducing waste through repurposing and creating new revenue streams, and upgrading to more durable and energy-efficient machinery. Further, by adopting regenerative practices that positively impact the environment and society, or at least reduce harm, food processors can become eligible for climate-specific financial products and grants.

Understand food processors' current practices:

To build the business case for regenerative practices in the food processing sector, understanding current practices is crucial. Identifying inefficiencies allows for targeted improvements, leading to cost savings. This knowledge can be used to align efficiency enhancements with the promotion of regenerative practices. AINFP has found that after implementing factory assessments and initial environment assessments with food processing clients, it is easier to jointly identify inefficiencies that are resulting in profit losses. This in turn lends towards an increased likelihood that the food processor will adopt specific regenerative practices that can address those inefficiencies. An essential aspect of this approach is to enhance the capacity of technical teams supporting food processors, given this is an emerging field. Accordingly, to provide quality technical support on regenerative practices for food processors, the AINFP technical team program was trained on conducting Environmental Impact Assessments to equip them with the necessary knowledge and skills to support food processors. Support food processors to track performance indicators: By providing support to food processors in enhancing their measurement and evaluation processes, they can gain a clearer understanding of their

potential climate and environmental impacts, as well as the effect of their practices, if they adopt regenerative practices. Additionally, better measurement and evaluation enable processors to set meaningful targets for improvement. Food processors can then use this information to apply for climate and environmental financial products and grants.

Provide technical assistance and build regenerative implementation practices:

As previously explored in the brief, the surveyed food processors noted needing technical assistance in order to adopt regenerative practices. Future programs should support food processors in understanding their current practices, recommend specific and actionable adaptations and solutions, and support them in implementing these practices. For instance, Tawonga Cooking Oil Processing Enterprise in Malawi mentioned in the survey that they require technical assistance to produce animal feed from their soybean processing activities. TechnoServe has developed a global regenerative practice that addresses processing waste management, water management, energy usage, and sustainable sourcing practices for food processors.

Support food processors to access finance:

The survey results demonstrate that food processors require assistance in accessing finance to adopt regenerative practices. AINFP has found that this is not only an issue with regenerative programming, but that it is also a general challenge facing food processors. Therefore, it is crucial for future programs and policies to include opportunities to support food processors in accessing finance, particularly for expensive upgrades required for regenerative practices, such as solar technology. Furthermore, embracing regenerative practices can enhance food processors' access to finance, as credit, loans, and grant programs are increasingly targeting private-sector entities that demonstrate climate and sustainability metrics.

*TechnoServe Business Advisor engaging
with a factory worker at Omega Foods,
AINFP Client in Zambia*



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