

Advancing Agriculture Supply Chains through Postharvest Technologies



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Problem Statement

Ghana experiences an annual economic loss of approximately \$1.9 billion due to postharvest wastage, with tomato farmers alone losing 40% of their produce before reaching markets(Agric in Ghana F&F 2016_Final.Pdf, n.d.). This spoilage issue leads to a short shelf life, posing challenges for retailers and consumers.

The core issue lies in the inefficiencies within the food supply chain, leading to substantial losses and, at times, food shortages and inflated prices.

Problem Landscape

Farming in Ghana:

Ghana's agricultural landscape primarily consists of smallholder farms, especially in the production of perishable items like fruits and vegetables. For instance, there are 11,728 tomato farmers spread across nine regions in Ghana(Amoako-Adusei, n.d.). The main production areas(Techiman North) are distant (365 kilometers) from the major markets in Accra, namely Makola Market and Agbogbloshie(Amoako-Adusei, n.d.).

Economic Impact:

Agriculture accounts for 44.7% of employment in Ghana(Guyson, 2023). Despite being a significant source of employment, the sector faces supply chain challenges, especially for smallholder farmers who loss 40% of their produce before it is reaching the market. Creating significant losses for them although employed by agriculture. These challenges include inadequate transportation infrastructure, leading to prolonged travel times and increased spoilage rates.

Postharvest Losses:

Postharvest losses are exacerbated by factors such as poor packaging, lack of ready markets, breakdowns during transportation, and adverse weather conditions. These issues contribute to substantial losses at various stages of the supply chain.

Systems and Stakeholder Supply Chain Map:

Role of Regulatory Bodies:

Regulatory bodies like the Ghana National Tomato Traders and Transporters Association play a dual role, **overseeing transportation** regulations and occasionally acting as **wholesalers** by directly purchasing tomatoes from farmers for later resale to retailers. They influence production practices, wholesale prices, and the volume of tomatoes available in the retail market(Guyson, 2023).

Challenges Faced by Producers and Retailers:

Both producers and retailers operate with limited bargaining power. Producers struggle due to the distance between farms and markets, leading to prolonged transit times and reduced product lifespan. Retailers face losses as they receive products with short shelf lives, and consumers have limited time to consume the goods, especially without proper storage facilities.

The Supply Chain Map

The Techiman North tomato farmer's supply chain faces multifaceted challenges, with potential impact at the third, fourth, and fifth level of the chain, this can be observed in *figure 1*. This supply chain could be used by other small-scale farmers that deal with food

crops with long distance from markets (Mpanza, 2015).

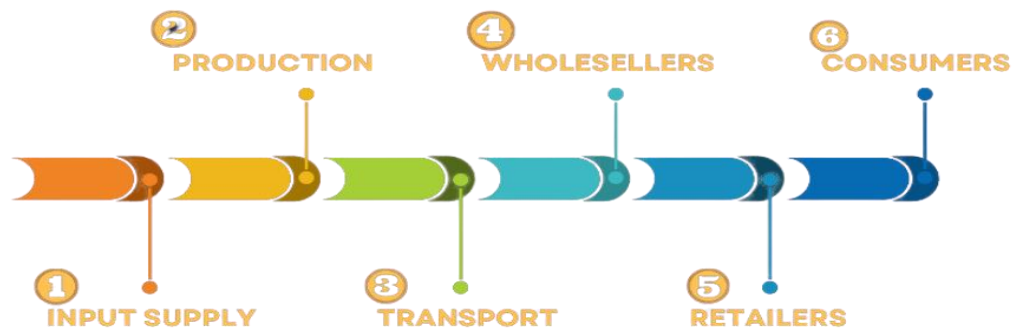


Figure 1; Showing the Agrofood supply chain of Techiman food crops to main markets like Accra in Ghana

Business Model for Solutions in the Ghanaian Context:

The proposed business model is tailored to the specific needs of Techiman tomato farmers, particularly small-scale tomato farmers. It encompasses multiple services aimed at reducing postharvest losses, enhancing farmers' productivity, and improving the overall tomato supply chain.

1. Waaalsbag - Postharvest Packaging Solution:

Product Description: The Waaalsbag is a specialized postharvest packaging solution designed to prolong the shelf life of tomatoes and other fruits. It consists of multiple layers, including an innermost layer with a spore-like transparent material, a second layer coated with powdered activated carbon (an ethylene absorber) (Qanytah et al, n.d.), and an outermost transparent layer. This unique design prevents the production of ethylene, thereby delaying the ripening of the produce. **Revenue Model:** Revenue is generated through the sale of Waaalsbags to farmers. Pricing is adapted to the local context to make it affordable for small-scale farmers.

2. Smart Tracking App:

Product Description: The premium package includes a mobile application that enables farmers to track the ripening rate of their produce within the bag during transportation and even within the coolboth. This app provides real-time information on the status of the tomatoes, allowing farmers to make informed decisions about harvesting and market timing.

Revenue Model: This app could be offered on a subscription basis or as part of a package with the Waaalsbag and the Cool both. Revenue can also be generated through in-app advertisements or data analytics services.

3. Cool both Rental Service;

Product Description: Cool both is a service that offers refrigerated storage facilities located within or near farming communities. Small-scale farmers can rent space in these Cool both facilities to store their produce temporarily, ensuring it remains fresh and minimizing postharvest losses. **Revenue Model:** Revenue is generated through rental fees paid by farmers for using Cool both facilities. Pricing should be competitive and adapted to the local context.

Impact Gap themes

The solutions, when implemented effectively, contribute to multiple UN SDGs, making progress towards a more sustainable and equitable future for Techiman and other farmers.

Reduced Food Loss and Waste (SDG 12): The innovative solutions, such as the Waaalsbag and the Smart Tracking App, directly address SDG 12 by reducing food loss and waste in the tomato supply chain. These technologies help in monitoring ripening, thereby allowing farmers to make more informed decisions about when to harvest and market their produce.

By optimizing harvest timing, the solutions reduce food waste, aligning with the target 12.3 of halving global food waste per capita.

Agricultural Productivity and Livelihoods (SDG 2): The enhanced productivity facilitated by these solutions contributes to SDG 2, which aims to achieve Zero Hunger. By reducing postharvest losses and extending the shelf life of tomatoes, more produce becomes available for consumption, improving food security. This, in turn, positively impacts the livelihoods of small-scale farmers as they can sell a higher proportion of their harvest.

Climate Resilience and Environmental Impact (SDG 13): While not explicitly mentioned, the reduction in food waste resulting from improved ripening monitoring aligns with the broader environmental goals of SDG 13 (Climate Action). Less food waste means a smaller carbon footprint associated with agriculture. Additionally, through sustainable agricultural practices, such as those promoted by these solutions, a more climate-resilient approach is adopted, contributing to climate mitigation and adaptation.

ROLE OF TECHNOLOGY

Data-Driven Decision Making: Technology provides access to data that enables farmers to make informed decisions about when to harvest, how to store, and when to market their produce, reducing losses.

Sustainability: Technology-driven solutions, such as Cool both, contribute to environmental sustainability by reducing energy consumption and greenhouse gas emissions.

Empowerment: Technology empowers small-scale farmers by providing them with tools and knowledge to mitigate postharvest losses, thereby improving their livelihoods.

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