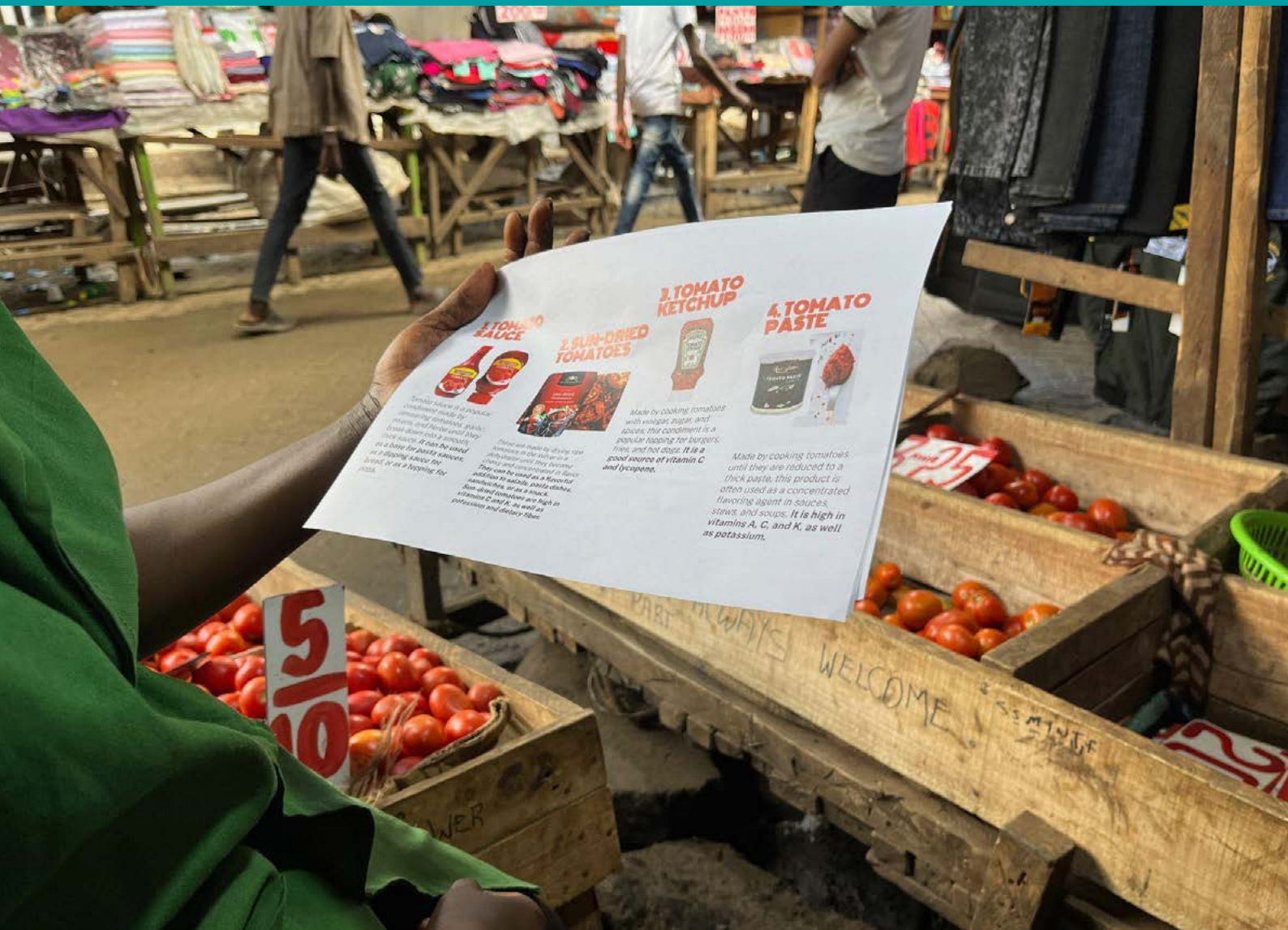




Nourishing Through Innovation

Insights on Food Systems Transformation



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1. Executive Summary

This report seeks to equip food systems practitioners with insights into how to develop safe, nutritious, and affordable food products made from excess fruits and vegetables, and how to create enabling environments in which such products can succeed. It draws on two case studies: the development of nutritious tomato paste and of dried African Leafy Vegetables (ALV) under NutriSave, a TechnoServe-led program in Kenya funded by the Gates Foundation and UK International Development. Though the specific products were ultimately found to be unviable, these deep-dive examples illuminate insights for others pursuing such innovation in the field. They also serve as archetypes for a broader potential set of paste and dried vegetable products that address challenges like nutrition security and food loss and waste while delivering commercial value.

These insights are presented at two levels of detail. For businesses and implementing partners engaged in the technical work of formulating, manufacturing and marketing such products, the account of NutriSave's tomato paste and dried ALV journeys will be instructive. Section 3 details the specific steps taken in pursuit of each innovation and the insights that emerged.

For a wider range of food systems actors like policymakers, agrifood businesses, financial players and development partners, the report highlights key opportunities to strengthen the enabling environment for introducing competitive, safe and scalable nutritious products targeted toward low-income consumers. Section 4 highlights these calls to action; in summary, they are:

- **Policymakers** should reward businesses who supply, manufacture and sell nutrient-dense food products; set standards and labeling tied to genuine nutritional content; strengthen regulation and enforcement of food safety; and support local farmers and businesses to strengthen the domestic market for fresh nutritious food.
- **Agrifood businesses** should formulate products for nutrition rather than using fillers, draw on local surplus through farmer contracts, pursue creative and patient financing, and design to consumer preferences and seasonal realities.
- **Financial institutions** should provide non-traditional forms of capital that can be more creative, patient and linked to impact outcomes. There is commercial opportunity where such funding can be de-risked and tied to outcomes, matched to how the money realistically flows and paired with implementer-led technical assistance.

- **Development partners** should fund entrepreneurial exploration, support development of paste and dried vegetable products and share lessons. Particular opportunities include applying NutriSave's lessons to other nutritious products, advocating for food safety, building measurement systems that support results-based financing and cross-pollinating insights across countries.

This report is the second publication in NutriSave's Learning Series, complementing an earlier Playbook for implementing partners. The examples featured here are among six promising innovations NutriSave identified; two others were set aside and two are being actively piloted. These insights are offered to spark more informed action, collaboration and investment toward safe, innovative food products that tackle nutrition insecurity alongside reducing food loss and waste.





2. Introduction

Kenya's food system carries a hidden, costly contradiction. On one side, a great deal of what the country grows never reaches a plate. Roughly 30 to 40 percent of the food produced in Kenya is lost or wasted, most of which is fruits and vegetables (FAO, 2025). This loss is not only a matter of volume; it drains value from the system at every level, eroding the livelihoods of farmers, undermining the businesses that handle and trade produce and exacting an environmental toll through inputs, land, water, and greenhouse gas emissions.

On the other side of that same system lies a stark gap in nutrition access. Only a very small share of the population eats the recommended daily amount of fruit and vegetables (Kenya Ministry of Health, 2025; FAO, 2024). Closing that gap is not simply a question of food availability in the country; it is a question of affordability for a large and price-sensitive population. In Nairobi alone, roughly 3.4 million low-income consumers, about 66 percent of the city, live on a median monthly household income near KES 30,000, about USD 230 (Busara, 2023). With an average household size of 3.4 people, they spend around 38 percent of that income on food (Busara, 2023), which equates to roughly 110 KES per person per day. By comparison, the average cost of a healthy diet across Africa is estimated at 3.57 PPP dollars* per person per day, equivalent to approximately KES 166 in Kenyan purchasing-power (FAO, 2023; World Bank, 2021 PPP conversion factor). Thus, the cost of a healthy diet is approximately 1.5x the current food expenditure of the low-income households profiled for NutriSave's work. For these households, any path towards better nutrition must widen access without substantially raising costs.

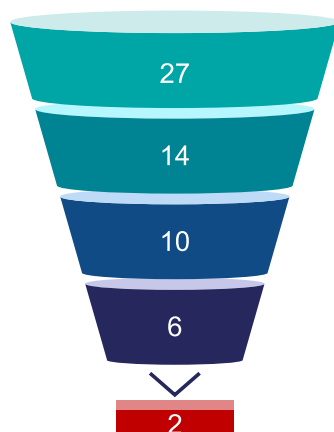
Considered together, these two problems point to a single opportunity. The same fruits and vegetables that are being wasted could be redirected or reformulated to increase access to nutrition, including through the creation of affordable products in the marketplace. Where such products can be formulated, produced and sold at a price the consumer base can sustain, the waste burden and the nutrition gap can be addressed together.

This is the essence of the NutriSave program, implemented by TechnoServe in Kenya with funding from the Gates Foundation and UK International Development. The program works to reduce food loss and waste while improving nutrition in Kenya's low-income communities, particularly in urban and peri-urban areas. Programmatic activities across three phases – exploration, piloting, and commercialization – are described in the [Waste Less, Nourish More Playbook](#), the first product of this NutriSave Learning Series.

* Purchasing Power Parity (PPP) is a way of comparing purchasing power across countries by accounting for differences in local price levels. A PPP or “international” dollar represents the amount of local currency needed to purchase broadly the same quantity of goods and services that US\$1 would purchase in the United States. PPP values are therefore converted into Kenyan shillings using an appropriate PPP conversion factor, rather than the market USD/KES exchange rate.

NutriSave's exploratory phase encompassed a broad set of activities considering a vast variety of value chains, encompassing efforts such as Human-Centered Design (HCD), food loss and waste hotspots analysis and academic research on viable value chains.

Among its outputs was a thoughtful prioritization of six innovation opportunities:



- Two of these — a business-to-business digital platform and a “wash-cut-peel-pack” approach — have since advanced to the pilot phase, and their emerging insights are being documented elsewhere.
- Two ideas were set aside: mango juice, where the ambition to safeguard nutrition through a high juice content collided with the cost competitiveness of less nutritious alternatives; and the transport of surplus produce to areas of scarcity, which depended on social-protection funding rather than standing on its own commercial footing.
- The remaining two innovations, carried forward for deeper investigation, are the deep-dive examples at the heart of this report: tomato paste and dried African Leafy Vegetables (ALV).

NutriSave and its partners set out to test whether these two products could be sourced, formulated, packaged and marketed at scale in a way that satisfied four criteria: consumer desirability, technical feasibility, market viability, and positive impact. Rather than theorize about the prospects, they committed to an exploratory journey into both. Each product was conceived for Kenya's low-income consumers and made from produce that would otherwise have gone to waste, and each was designed to serve NutriSave's central goal: safe, nutritious, and affordable food for those who need it most.

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Importantly, insight into these innovation journeys offers value beyond the two products themselves. Each stands as an archetype. The paste explored by NutriSave is made from tomatoes, but the same approach could be applied to other crops, such as orange-fleshed sweet potato, pumpkin and carrot; the dried vegetable is ALV, but it could be any number of others. Across varied geographic and demographic contexts, there is opportunity to draw on the lessons shared here: how to repurpose surplus produce into nutritious pastes and dried vegetable products for low-income populations in many parts of the world.

As the following section explains, both tomato paste and dried ALV were ultimately deprioritized at the close of NutriSave's exploratory phase. Yet TechnoServe and its partners, true to their entrepreneurial outlook, do not regard this as failure. They see it instead as a success of a different kind: the rigorous, shared pursuit of two product opportunities, approached with agility, iteration and a genuine willingness to learn. That spirit is carried into this report and reflects the partners' commitment to generating insights that strengthen their own practice and that of the wider field.



3. Innovations Deep Dive

3a. Tomato Paste

NUTRISAVE STEPS AND COLLABORATION

Understanding the Problem

NutriSave's work on tomato paste began not with a product but with a problem to understand. The team started with a focus on production. Erratic rainfall, prolonged dry spells and rising temperatures are steadily reducing farm productivity nationwide, including a recent 39 percent drop in national tomato production (Kenya Meteorological Department, 2026; State of the Climate Report, 2025). When a season's output cannot be reliably forecasted, buyers, aggregators, and processors have little basis to plan capacity for either a glut or a shortfall. This unpredictability is compounded by the tomato varieties most smallholder farmers plant, many of which are selected for fresh-market traits such as shelf life and disease resistance rather than for the higher solids content a processing operation requires (Kenya Agricultural and Livestock Research Organization). Together, these factors contribute to high volatility and weak market linkages at the farm level.

TechnoServe and its partners then set out to map the tomato value chain in detail and what they found made the case for action. In 2020, Kenya produced roughly one million metric tons of tomato, almost all of it grown by smallholders and sold fresh on the domestic market (TechnoServe, 2023). By volume, tomatoes ranked as the country's third-largest fruit or vegetable (Kenya Horticulture Crop Directorate, FAOSTAT). Yet at every step along the value chain, a portion of that harvest was lost. NutriSave's analysis traced where and why.

The largest share disappeared at the farm gate, where losses of about 33 percent followed from unstable demand and the absence of formal contracts that might have given farmers a reliable buyer. Transport and aggregation claimed a further 19 percent, the result of factors like overstacked crates and rough roads. Wholesalers accounted for roughly 21 percent, due to issues like weak quality discernment and thin market infrastructure, and informal retailers lost approximately 27 percent, due to barriers like access to finance for cold storage.

Taken together, these figures described a chain losing value at nearly every link, with the total loss reaching 32 percent of the entire volume of tomato production (TechnoServe, 2023). Hidden in that leakage was an opportunity to recover food that might instead nourish people.

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► From Problem to Product

It was this innovation, the team concluded, that best combined nutritional promise, everyday usefulness and the potential to absorb surplus tomato at scale.

With the shape of the problem clear, the team turned to potential solutions. Following several Human-Centered Design (HCD) steps, they prototyped several innovations, such as shelf-stable tomato powder and bouillon cubes, designed to capture tomatoes that would otherwise be wasted and to put them within reach of low-income consumers. Such innovations targeted attributes that are desirable to low-income consumers such as convenience of access, ease of use, familiarity and other factors. Each prototype was accompanied by educational materials explaining how the products were made, what benefits they offered and how to use them. These prototypes were not ends in themselves but tests of where the strongest prospect lay. Through the HCD process, supported by further research into consumer needs and behavior, tomato paste sold in small sachets emerged as the leading candidate. It was this innovation, the team concluded, that best combined nutritional promise, everyday usefulness and the potential to absorb surplus tomato at scale.

► Building the Business Case

Choosing paste was the beginning of the far more demanding question: whether nutritious tomato paste made of excess tomatoes could be commercially viable. To answer this, NutriSave commissioned a full business case analysis, anchored in a five-year financial model and a market study that examined the opportunity from several angles. The work looked at the raw tomato market that would supply the product and at the paste market itself across global, African and Kenyan levels. It quantified import volumes and pricing and built a competitor scan that catalogued processors, brands, pack sizes, prices, import origins and nutritional content. This was the evidence base against which a domestically produced, more nutritious paste would have to prove itself. Ultimately, as detailed below, while the initial business case looked promising, it ultimately failed to satisfy both the “feasibility” and “viability” tests for a robust commercial product.

► Forming the Partnership

NutriSave then joined with a local food manufacturer, TruFoods, to develop a nutritious, affordable tomato paste sold in the sachet format. The collaboration divided the work according to each party’s strengths. TruFoods took responsibility for the commercial and operational core: pilot testing, recipe formulation, manufacturing, operational implementation and quality assurance. NutriSave contributed recipe and nutrition support, linkages to tomato producers upstream and to low-income markets downstream, consumer awareness efforts and the coordination that held the partnership together.



▶ Putting the Product to the Test

The partners first tested consumer demand, with TruFoods leading and NutriSave supporting. Rather than commit to local production on the strength of projections alone, the processor first imported pre-packaged sachets to test whether consumers would buy them. Only after that test returned a positive signal did the processor invest in a local sachet-filling line. That investment established the downstream packaging capability.

From there the partners moved from analysis into the practical mechanics of production. Working alongside traders and processors, they ran rescue trials, recovering tomatoes that would otherwise have been lost and testing whether existing equipment could be turned to the task of processing them. Many of the concentrators in use were built for jam rather than paste, so the team ran conversion tests to gauge the cost and feasibility of repurposing them. The partners scoped the full set of equipment (a concentrator paired with aseptic packaging) that a competitive paste operation would ultimately demand.

From there the partners moved from analysis into the practical mechanics of production. Working alongside traders and processors, they ran rescue trials, recovering tomatoes that would otherwise have been lost and testing whether existing equipment could be turned to the task of processing them.

These trials brought into focus the precise shape of the production challenge. To achieve long-term viability and efficiency, this process integrates two critical postharvest management stages. First, the paste undergoes concentration to optimize volume and minimize storage space requirements. The heating also reduces the microbial load. Second, it is transferred to aseptic bag storage to guarantee microbiological safety and extend product shelf life. The partner processor was well positioned for the second stage, possessing the dilution and packaging

capability, but lacked the equipment required for the first. Closing that gap would have meant a significant capital investment of USD 2 million in a concentrator and aseptic bagger. This challenge would prove to be one of the defining constraints of the tomato paste innovation endeavor.

▶ Reaching a Verdict

Ultimately, NutriSave determined it would not pursue tomato paste further. The key reason lay in the equipment gap. Competitive local production required the concentrator and aseptic line the partner processor did not have, and the capital to acquire them proved difficult to access on terms that justified the investment against uncertain returns. This led NutriSave and its partners to judge the tomato paste innovation commercially unviable in the Kenyan market at this time, notwithstanding its strong prospects for impact. The opportunity to nourish was real but the conditions to sustain it commercially were not yet in place.

LESSONS AND IMPLICATIONS FOR PASTE

NutriSave's journey to explore tomato paste offers wider lessons and implications for practitioners pursuing the innovation of “nutritious paste” more broadly, whether for tomato or other nutritious fruits and vegetables.

Desirability

- **The tomato paste market in Kenya is sizable and expanding.** Several forces point in the same direction, such as population growth that increases demand volume, urbanization that prioritizes convenience, rising incomes that strengthen purchasing power and the broader growth of Kenya's food-processing sector, which strengthens industry capacity. Together they describe a market opportunity that is not only real but widening over time. Importantly, this is not a matter of projection alone. When the partner processor imported pre-packaged sachets to test whether consumers would actually buy, the result was positive enough to justify investing in local filling capacity — a concrete signal that demand for an affordable, sachet-format paste exists at the point of sale, not merely in market projections.

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- **Consumers cannot readily tell higher- from lower-nutrition tomato paste.** Low-income consumers tend to associate better flavor with better nutrition and they respond to products that are sweet and red. This can reward cosmetic attributes like color, or additives like sugar over nutritional quality. At the same time, consumers cannot readily judge how much tomato a 50g or 100g sachet should contain, so NutriSave and its partners experimented with design concepts for the packaging that could show consumers the accurate number of tomatoes that the packet contained. These insights carry direct implications for formulation, labeling and broader standards for pastes.

Feasibility

- **The key barrier is the scale, seasonality and structure of capital.** NutriSave found that locally made paste is roughly 13 percent cheaper than imported paste, as raw tomatoes can be recovered at about 12–16 KES/kg and a competitive acceptance price sits below roughly 14 KES/kg. The binding constraint is the processing equipment: the concentrator and aseptic line needed to make the tomato concentrate. Financing that equipment is made harder by seasonality, since the tomato glut lasts only about five months, slowing returns and pushing processors to fill the off-season with other products like jam. And when the full picture is modeled over five years, the same theme recurs in financial terms: the operation is viable at the operating level relatively early, but financing costs drive losses in the first years before achieving a return on investment between 4 to 7 years out. This can make conventional commercial debt difficult to secure. The problem, in short, is not whether the product can be made and sold at a competitive unit cost, but the scale, seasonality and structure of the capital required to start.



- **Reliable, contracted local supply reduces loss and improves quality.** NutriSave's research revealed high volatility in tomato production volumes, linked to climate change, which led to unpredictable shortfalls and gluts. And the value-chain analysis located the single largest share of loss at the farm gate, driven by a mismatch in the tomato varieties

produced and those in demand, and the absence of formal contracts between farmers and buyers. Securing local supply through offtake contracts therefore addresses the biggest loss point directly, while also stabilizing the quality on which a processor depends. That quality risk is not hypothetical: in NutriSave's journey, one batch of recovered tomatoes arrived infested and had to be rejected. Contracting also bolsters the thin farmer linkage that otherwise leaves local processing without a dependable base of supply, turning a fragile, spot-market relationship into a more predictable foundation for production.

Validating demand cheaply before committing to capital-intensive processing reduces exactly the early-stage risk that makes financing so hard to secure.

► **Viability**

- **Demand can be de-risked before capital is committed.** The sequence the partners followed is itself a transferable lesson. Rather than build local processing on the strength of projections, the processor first imported finished sachets to test real demand, and only invested in local capacity once that test returned a positive signal. Validating demand cheaply before committing to capital-intensive processing reduces exactly the early-stage risk that makes financing so hard to secure and offers a sensible default sequence for similar ventures: prove the market first, then build for it.

► **Impact**

- **The “paste” archetype illustrates opportunities with multiple vegetables.** Because this tomato paste journey functions as an archetype, its lessons invite exploration of other vegetables that might be turned into nutritious pastes, such as orange-fleshed sweet potato, pumpkin and carrot. Each product will need its own innovation process: nutrient delivery in a finished paste depends heavily on the crop, the formulation and the processing method, so the opportunity is to investigate and verify these options through modeling and prototyping, rather than to assume that any of them would prove nutritious or viable.
- **NutriSave modeled a replicable partnership pairing commercial capability with programmatic reach.** Pairing a commercial actor able to bear capital and operational risk with a program able to supply nutrition expertise and market linkages offers a transferable template for other organizations and their partners.



b. Dried African Leafy Vegetables

NUTRISAVE STEPS AND COLLABORATION

► *Understanding the Problem*

The second NutriSave innovation journey began, as with tomato paste, by understanding a problem rather than reaching for a product. The team turned its attention to a set of indigenous greens known as African Leafy Vegetables (ALV). This diverse set, including varieties such as African nightshade, amaranthus and cowpea leaves, is valued both for their wide availability across Kenya and for their high nutritional content.

The team mapped where losses occur along the chain and the constraints that shape availability, affordability and consumption. The picture that emerged echoed the tomato story in its essentials. Of roughly 300,000 metric tons produced in 2020, about a third is lost each year, valued around USD 24 million. The bulk of that loss occurs during the glut season. Broken down by stage, losses ran to about 15 percent at production, roughly 3 percent at aggregation and about 16 percent at offtake, together accounting for the one-third loss figure.

► *From Problem to Product*

As with the tomato journey, NutriSave then employed various tools, including HCD, to understand the ecosystem of players and dynamics around the ALV supply chain and to ideate a long list of potential solutions that might bridge the nutrition and waste issues through a commercially-viable concept that met local dietary preferences. This process zeroed in on a particular product for ALV: a dried powder that could be pre-mixed into porridge. The team determined that there was high potential in this innovation to redirect some ALV loss and deliver nutritional value, in stable form, into low-income diets.

This process zeroed in on a particular product for ALV: a dried powder that could be pre-mixed into porridge.

► *Building the Business Case*

With the opportunity identified, the partners moved to test whether it could work commercially. They commissioned a full business case built on a five-year financial model and a market analysis. The analysis covered ALV production and loss, the fortified-porridge market into which a dried-vegetable ingredient might flow and a competitor scan of fortified-flour brands and their pack prices. The product to be sold to consumers was a fortified, pre-mixed porridge flour. Beneath the projections sat a careful cost analysis that traced the economics step by step — the raw-ALV purchase price, the drying yield (only about one-tenth of the raw weight is recovered as powder), and the processing,



packaging, and machinery costs — to arrive at a landed cost per retail pack. That cost was then benchmarked twice over: against the cheaper fortified premixes already on the market and against what a low-income household can realistically spend in a single day. Both comparisons would later prove decisive, as the dried ALV product would fall short on desirability, feasibility and viability considerations.

▶ **Forming the Partnership**

The business case also defined the collaboration needed to manufacture and market this product. NutriSave partnered with SLS, a Kenyan drying-and-aggregation agribusiness, to produce the powder, and with Unga, an established miller with a recognized brand called Famila, to integrate that powder into porridge. The pairing was deliberate: it joined a specialist in drying and aggregation with a trusted consumer brand downstream.

▶ **Putting the Product to the Test**

Before committing further, the team set out to understand whether consumers would want such a product. They researched demand, assessing the drivers that would govern uptake: affordability, convenience, access and desirability. The insights surfaced key demographic differences; for example, adults' preferences are more fixed and thus they are less likely to desire the dried ALV taste as part of a porridge.

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From there the work turned to the product itself and to a feasibility question at the heart of the innovation: how much dried ALV a porridge could carry. Working alongside the miller's product development team, the partners blended ALV flour into porridge at successively higher inclusion levels: 2 percent, then 3, then 5 and finally 8 percent, cooking each blend and scoring it. Higher percentages of ALV inclusion represented a more nutritious product.

The team then built a high-fidelity prototype. They developed packaging and produced a finished prototype porridge, then placed samples with the segments most likely to adopt it: school feeding programs and new mothers with young children. Adults, who showed particular resistance to green porridge, were not the primary target. During this round of testing, the prototype retailed at roughly 100 to 120 KES for a 400-gram pack. By comparison, at that time 1 kilo of maize flour cost between 80-95 KES (Kenya National Bureau of Statistics, 2023).

The trials were designed to answer two questions at once: how much ALV consumers would accept before the porridge's color, taste or texture began to degrade, and whether each blend held together as a coherent product at all. Embedded in this exercise was a tension that would shape the project's viability: the more ALV the blend carried, the greater its nutritional contribution, but also the greater the risk to palatability and the lower its physical cohesion.

To inform these efforts, the team also looked beyond Kenya for inspiration, reviewing porridge and flour products from Ethiopia and Senegal, among them one that masked milder vegetables within dried milk. The review delivered insights on insufficient standards monitoring: laboratory testing of several of these products found that their labeling concealed added sugar and milk, a reminder of how readily a nutritional claim can mask the true content of the product.

Reaching a Verdict

Ultimately NutriSave and its partners deprioritized dried ALV, for three reasons that compounded one another. The first was limited impact: because taste and porridge cohesion allowed only a low percentage of dried ALV in the blend, the nutritional contribution the product could ultimately make, and the volume of “saved” produce, was quite modest. The second issue was food safety risk. *Aspergillus flavus* and *Aspergillus parasiticus* are naturally present in soil, crop residues, dust, and the air. Their microscopic spores can reach crops such as maize or African Leafy Vegetables. Thus, food safety management is critical at farm level. This implied a high exposure risk for any commercial partner, and a company like Unga would, reasonably, need to have greater control and oversight over a broader portion of its supply chain than with other products, a dynamic that would ultimately prove commercially untenable in operational and financial terms. The third and final factor was cost: the pre-mixes already on the market were simply more cost-competitive than a dried-ALV porridge could be.

As with tomato paste, the conclusion was not that the dried ALV idea lacked merit, but that the conditions to sustain it — nutritionally, operationally, and commercially — were not yet in place.

LESSONS AND IMPLICATIONS FOR DRIED VEGETABLES

The journey of developing dried ALV offers insights for a broad potential range of dried nutritious vegetables.

Desirability

- **ALV's flavor is too strong to use them in porridge in a meaningful quantity.**
ALV's taste, smell, and color are pronounced and difficult to mask within a blended product. In testing, consumers accepted only the lowest inclusion level. As a result, only a very small amount of ALV can be integrated before consumers reject the product, undermining both the nutrition and waste reduction rationales for the innovation. The product people will accept, and the product that would do the most good, pull in opposite directions.

In testing, consumers accepted only the lowest inclusion level. As a result, only a very small amount of ALV can be integrated before consumers reject the product, undermining both the nutrition and waste reduction rationales for the innovation.

- **The domestic market prefers fresh ALV.** Low-income consumers prefer fresh greens when available, and ALV are broadly available for much of the year. They regrow within about two weeks of rain, keeping fresh supply cheap and plentiful across long stretches of the calendar. A dried version therefore competes against an abundant, inexpensive fresh alternative, leaving little domestic appetite for it.

Feasibility

- **The blend holds together only at the lowest ALV inclusion.** Setting taste aside entirely, the product encountered a separate physical limit. Beyond the lowest inclusion level of 2 percent, the dried-ALV flour would not bind into the porridge and instead separated out. This mattered independently of preference: even where a higher percentage of ALV would have been palatable, the porridge simply would not hold. Taste and texture thus produced the same conclusion from different directions, both requiring an ALV percentage too low to carry much nutrition or redirect much food excess.

A transparent dried-vegetable product therefore competes not only against cheaper alternatives but against those whose labels fail to list all ingredients, widening the affordability gap with a transparency gap.

safety liability suggested it should manage such activities itself rather than entrust it to a third party, which implied responsibilities like investing in its own dryers and extending its engagement further than normal up the supply chain. This was deemed too cumbersome and costly.

- **Food safety issues elevated commercial risk exposure and public health concern.** The prospect of managing food safety issues created reasonable concern for NutriSave's milling partner. As a large and established player, Unga had sound reasons to approach the venture carefully: its food

Viability

- **The product was not sufficiently cost competitive with fortified premixes.** The dried product is relatively expensive to make, and its shelf life of about six months compares poorly with the roughly two years of the cheaper fortified premixes it would compete with. On a straight comparison, the product could not match what was already available more cheaply and with far longer life.
- **Lab testing revealed a standards problem.** Such competitiveness, however, is not playing out on level terms. When the team reviewed analogous porridge and flour products for inspiration, laboratory testing revealed that several had added sugar and milk that was not revealed on their packaging. A transparent dried-vegetable product therefore competes not only against cheaper alternatives but against those whose labels fail to list all ingredients, widening the affordability gap with a transparency gap. This points beyond the single product to the need for labeling and quality standards that allow a highly-nutritious product to be recognized as such.

Impact

- **There is likely an opportunity in milder dried vegetables.** Read as an archetype, the dried-ALV journey points toward where different dried vegetables might more readily succeed. A central obstacle here was ALV's potency; milder vegetables such as carrot carry far less of that burden and might be accepted at meaningfully higher inclusion levels, allowing a dried product to deliver more nutritious before taste becomes an issue.



4. Calls to Action

The innovation journeys above have centered on NutriSave and its collaborators. Yet innovation rarely succeeds on the strength of any single effort; it depends on the enabling environment that surrounds it. Policy, infrastructure, the business environment, access to appropriate capital and strategic development partner engagement together create the conditions in which innovation flourishes or fails. NutriSave's experience with tomato paste and dried ALV points to clear recommendations for other actors. Pursued in earnest, these actions would serve the interests of those actors while advancing the kinds of innovation explored here.



Government and Policymakers

Policymakers use many levers to shape whether a food system thrives: extension and advisory services, access to quality inputs and seed, market access and infrastructure, food safety and quality standards and trade and fiscal policy. NutriSave's experience highlighted select ways that policy and regulation can strengthen the enabling environment for nutritious paste and dried vegetable products:

- 1 Set standards that reward real nutritional content, and require labels that tell consumers what they are buying.** Food standards should verify precisely what is present in a food product and assess its nutritional content, rather than passing it on surface attributes alone. Labeling should require products to state what they actually are (a formulated or fruit-free product should not be able to claim “100%”) and to convey value in terms a shopper can act on, such as how much tomato a sachet represents. Together these protect consumers, reward genuine nutritional value and level the field for producers who invest in real ingredients.
- 2 Strengthen food safety regulation across the value chain.** Policymakers should set and enforce controls around food safety practices at farm level, support food management protocols, back certification and treat safe-drying know-how as a shared public resource rather than one firm's advantage, so that smaller processors can meet the standard.
- 3 Reduce exposure to import shocks by shoring up the local market.** Reliance on imports leaves Kenya exposed to external price shocks. This strengthens the case for resilient local production. One practical route is demand-side: the government can champion an “Eat and Drink Kenyan” style campaign that builds demand for local, in-season produce and Kenyan-made products, pulling consumption toward domestic value chains and giving local processing a more stable market to grow into.



- 4 Designate co-located growing and processing zones.** Among the insights generated through NutriSave's business case analysis was a review of the successful policy practices of the largest global exporters of tomato paste. One promising approach, seen in Egypt, is to pair production with nearby processing, water, and extension support so that produce is processed close to where it is grown. Co-location reduces transport losses, raises the utilization of processing capacity and avoids transport-stranded outcomes seen in some West Africa cases where processing was built far from supply.
- 5 Lower energy and input costs, and enable safe processing across the value chain.** The government should help reduce electricity and input costs for farmers and processors to close the competitiveness gap with imports. This is also a food safety lever: controlling moisture content of crops like maize and ALV is critical at farm level. Appropriate drying and cold-chain practices depend on reliable, affordable energy, so lowering energy costs underpins safe processing across the value chain, not only competitiveness.
- 6 Address single-use sachet waste.** The paste innovation reaches low-income consumers through small single-use sachets. This is the format consumers prefer, leaning toward the smallest sizes. Yet that format creates a plastic waste and landfill burden. Governments can incentivize alternatives such as refill or dispenser models, or more sustainable packaging materials, prompting manufacturers to account for end-of-life waste, so that an innovation designed for affordability does not become an environmental liability.



Private Sector Actors

The private sector is central to any durable solution to food loss and weak nutrition access. Agriculture and food businesses hold influence over many of the points where losses occur and their choices about formulation, pricing, distribution and marketing largely determine whether low-income consumers can access affordable nutritious food at all. That position gives private sector players the means to innovate, invest in and scale what works. NutriSave's findings illuminate several calls to action for agriculture and food businesses:

- 1 Seek creative financing to boost processing capacity.** Businesses should pursue blended, de-risked, or results-based financing to fund capex needs like concentrator and aseptic-packaging capacity needed for the tomato paste. For that innovation the binding constraint was not unit conversion cost, but this upstream investment. Actively seeking capital priced for a nutrition-and-food-loss venture, rather than standard commercial terms, could unlock progress and become a competitive advantage for companies seeking to stand out in the marketplace amidst growing demand for nutritious and convenient products.



- 2 Pursue innovation to make equipment more accessible.** As the tomato case study shows, a USD 2 million capex requirement for an existing model of concentrators and aseptic baggers is financially non-viable even for large-scale regional agribusinesses. Developing smaller, modular and affordable alternatives within the reach of mid-tier enterprises and small-scale processors is essential for market systems sustainability.
- 3 Source local surplus instead of imports.** Food businesses can substitute imported inputs with local fruits and vegetables, turning excess that would otherwise be lost into product inputs. One example, from a different NutriSave innovation journey, is replacing imported sweeteners and concentrates with Kenyan surplus fruit such as mango. The same logic applies to tomato paste: processing local, surplus tomatoes rather than diluting or repackaging imported concentrate builds genuine local value-add and a strong link back to farmers. This also bolsters resiliency in businesses' supply chains.
- 4 Engage with farmers through contracts.** Offtake contracts and service-level agreements, matched with the right seeds, can enable farmers to more effectively grow a particular crop for a specific processor. This stabilizes both supply and quality and directly addresses the largest tomato loss driver (farm-gate losses of about a third, caused by unstable demand and the absence of formal contracts) and weak farmer linkages that leaves local processing without a reliable base.
- 5 Reformulate for nutrition, not fillers.** Businesses should build products for nutrient density rather than meeting only the cosmetic standard, or satisfying demand cheaply with starch, sugar and color. Formulating for real nutritional content builds durable consumer trust and aligns the product with where standards and labeling are heading.



Financial Institutions and Investors

The capital problem here is structural, not incidental. Capital underserves precisely the kind of businesses this report addresses—small and medium agri-processors making nutritious, affordable food for low-income consumers—because mainstream funds skew toward higher-value crops and higher-income markets, and conventional lenders find loans to smaller players both too risky and too costly to serve. Innovative financial institutions and investors can change that calculus, and because no single actor closes a gap this size, the central mechanism is catalytic capital that crowds in commercial money rather than substitutes for it. Drawing insight from these innovation journeys, financial players can:

- 1 Provide non-traditional capital.** Blended, concessional or otherwise de-risked, nutrition- and climate-sensitive capital can fund such innovations more effectively than standard commercial vehicles. Such capital should be time-limited and non-distortive, building toward a sustainable private market rather than a permanent subsidy. Two considerations should shape its design. First, cover both the risk and the cost: lending to small and medium agri-processors is riskier and more expensive to administer, so risk cover (guarantees, first-loss) must be paired with incentives that offset the cost of small loans. Second, match capital to stage and segment: early, higher-risk ventures need patient, catalytic capital, with commercial debt and equity following once a model proves itself.
- 2 Use results-based and outcome-linked structures.** Financial players can tie payment or pricing to measurable progress through results-based financing, sustainability-linked loans, or other outcome-linked structures. This helps bridge the trust gap between commercial players, development partners and practitioners. The enabling condition is measurement: nutrition and food-loss outcomes are hard to price, partly because they are largely public goods and partly because the sector lacks agreed metrics. Investors and partners can advance collaboration to adopt shared impact metrics that capture what these products deliver. NutriSave's two examples make this concrete: for tomato paste, the measure that matters is real tomato (and so nutrient) content; for dried ALV, it is retained nutrients and food safety.
- 3 Match financing to the realities of agriculture.** These businesses do not earn evenly. Cheap raw produce arrives in a short season—about five months for tomatoes, with a comparable glut-season concentration for ALV—and the processing or drying equipment takes years to pay for itself, so repayment schedules built for steady, year-round businesses do not fit. Lenders should set repayment timelines and grace periods that follow the seasonal cash flow and keep short-term financing for buying produce in season separate from longer-term financing for equipment.
- 4 Partner with implementing organizations to deliver technical assistance.** Capital alone rarely succeeds to create and scale a successful product like the ones in focus here. The food businesses, processors and aggregators who might become involved in such initiatives are often strong on product but need help to strengthen financial management, meet food safety and quality standards and become investable. Financiers and investors should partner with implementing organizations with on-the-ground reach and sector expertise to provide that technical assistance alongside the money, so that capital deployed can truly deliver.



Development Partners

Development partners play a distinctive role: catalytic support for solution-finding at the intersection of public-interest goals like reducing food loss and waste and improving nutrition security, and market-based solutions capable of scale. This is especially true where a problem is too conceptual, risky or costly for private actors alone, yet a viable commercial model is essential to meaningful impact. NutriSave demonstrates this ethos; insights from these case studies can inform not only its own donors: the Gates Foundation and UK International Development, but a broad range of other development partners seeking to play a meaningful catalytic role for innovations like nutritious paste and dried vegetables. Development partners should:

- 1 Fund innovation the entrepreneurial way: prototype and let the evidence decide.** NutriSave tested prospective products through low- and high-fidelity prototyping and used stage-gate (go/no-go) decision points that scored each concept against desirability, feasibility, viability and impact before any larger investment was committed. Development partners should operate in this mode, through flexible, learning-oriented funding that supports experimentation, with built-in reflection points and the freedom to stop or pivot as evidence emerges.
- 2 De-risk private sector investment so commercial capital can follow.** Innovations like these carry early-stage technical, market, and financial risks that private actors are often unwilling or unable to absorb alone, even where a viable commercial model may be within reach. Development partners are well placed to shoulder a share of that risk. They can fund the prototyping and stage-gated evidence-gathering that resolves technical and market uncertainty before commercial capital is sought, and they can deploy catalytic instruments such as grants, guarantees and first-loss positions that lower the risk private financiers face.
- 3 Build the measurement systems that make outcomes-based financing work.** Results-based and outcomes-linked financing depends on credible measurement, which development partners are well placed to support. For that financing to scale, someone has to design, monitor, assess and iterate the metrics and learning systems that let capital accurately price nutrition and food-loss outcomes. The sector still lacks broadly agreed metrics for these. Development partners can keep co-developing and field-testing shared measures and stewarding the monitoring infrastructure around them. This could turn results-based financing from a promising idea into a viable solution at scale.
- 4 Explore other paste and dried-vegetable opportunities.** Dried vegetables hold genuine promise for advancing nutrition security while reducing food loss and waste, by concentrating surplus produce into a shelf-stable, nutritious form. There remains significant scope to explore ALV further, particularly once food safety issues are addressed. And there is opportunity to pursue dried vegetables other than ALV, and paste made of vegetables other than tomatoes, for the reasons discussed above.



- 5 Build food safety into programming, partnerships and advocacy.** Safety protocols and practices should be a deliberate thread through how development partners work. They can design this topic into programs (funding the spread of food safety management know-how as a shared public good), into partnerships (requiring capability and standards in the businesses and value chains they back), and into advocacy (pressing for sector-wide standards and certification).
- 6 Share and apply comparative lessons across countries.** NutriSave learned significantly from analogous research and from the policy and business practices of other countries, drawing on comparative experience from Egypt and Nigeria for tomato processing, and on analogous porridge and flour products from Ethiopia and Senegal when testing whether ALV could be made palatable. Development partners, especially those with a multi-country presence, are uniquely placed to gather and cross-pollinate this kind of insight: surfacing what has worked and what has failed elsewhere, and channeling it to the programs and partners positioned to act on it.



5. Conclusion

NutriSave's collaborative work on tomato paste and dried ALV offers more than a record of two experiments. It illustrates a broader set of innovation opportunities in paste and dried vegetable products, opportunities that hold genuine promise precisely because they sit where social need and commercial logic meet. They respond to pressing social challenges: improving nutrition and widening access to safe, nutritious food for low-income populations, while reducing the food that is lost or wasted along the way. At the same time, they open a real commercial opportunity in the creation of viable, feasible products for a growing market.

For those engaged in the technical work of sourcing, manufacturing and marketing products of this kind, NutriSave's experience can help strengthen the desirability, feasibility, viability and impact of what they build. And for those in government, business, the financial sector and the donor community, there is an imperative to take up the calls to action set out in these pages, accelerating toward a more nutritious, sustainable, and resilient food system.



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