

Tanzania

Hermetic Storage Solutions: Investment Brief

Climate Adaptation Market Opportunities
Agriculture & Food Systems

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ABOUT THE GLOBAL CENTER ON ADAPTATION

The Global Centre on Adaptation (GCA) is an international organisation, hosted by the Netherlands, which works as a solutions broker to accelerate action and support for adaptation solutions from the international to the local, in partnership with the public and private sector, to ensure we learn from each other and work together for a climate resilient future.



ABOUT AFRICA ADAPTATION ACCELERATION PROGRAM

GCA is providing technical assistance under the Africa Adaptation Acceleration program (AAAP), a joint initiative launched by the GCA and the African Development Bank in 2021.

In close collaboration with:



Consultants:



CONTEXT

This investment brief is part of a regional analysis undertaken by the Global Center on Adaptation, developed in close coordination with partners including CGAP and GCA’s downstream financial institution partners under the Africa Adaptation Acceleration Program (AAAP), in collaboration with the consulting firm Pegasys. The analysis showcases rapid, national level climate risk assessments and climate adaptation opportunities for private sector players across Tanzania, Zambia, Kenya and Democratic Republic of Congo in agriculture and food systems. It also estimates the market size for five climate adaptation investment opportunities in Tanzania and Kenya through an investment brief series (**Tanzania: solar irrigation, hermetic storage and cold storage for dairy, Kenya – solar dryers and digital climate advisory services**). Building on these results, the present brief aims to provide a decision-support resource for *commercial banks, microfinance institutions, and other lenders seeking to assess and integrate climate-related risks and opportunities within their agricultural portfolios*.

Across agriculture and food systems, climate variability is increasingly translating into material credit risk. Erratic rainfall, rising temperatures, and more frequent extreme events affect yields, input efficiency, and post-harvest outcomes. These impacts weaken borrower cash flows and asset values, with direct implications for both clients and lenders, including deteriorating portfolio performance, elevated non-performing loan ratios, and increased volatility in agricultural lending.

The analytical framework underpinning this investment brief series reframes climate adaptation measures as risk-adjusted investment opportunities. It identifies discrete, technologies and services across value chains and assesses their bankability through market sizing, borrower segmentation, and business model analysis. Each brief is structured to align with financial sector requirements, including compatibility with existing lending instruments (e.g. asset finance, value chain finance) and applicability across borrower archetypes such as smallholder farmers, cooperatives, and agri-SMEs.

The investment brief series, focused on **Climate Adaptation Market Opportunities in Agriculture & Food Systems**, aims to support financial institutions in systematically integrating adaptation into core lending operations, with a view to strengthen client and portfolio resilience while capturing emerging market opportunities.

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INVESTMENT BRIEF: HERMETIC STORAGE SOLUTIONS IN TANZANIA

Executive Summary

Climate risk is now a credit risk in Tanzania's food system. Erratic rainfall and sustained humidity are driving an average of **20–30% post-harvest losses (PHL)** across staple crop value chains (maize 30 – 40%, pulses 15 – 35%, rice 20 – 25%). This accounts for nearly **~USD 300–400 million** in value loss each year, eroding collateral quality, weakening income streams and thus, by extension, bankability for the **3.7 million** smallholder farmers in Tanzania (CGIAR, 2025) and the cooperatives and SMEs that serve them. Aflatoxin contamination further depresses market prices, constrains exports, and raises health costs. For lenders with sizable agri-exposure, PHL is a **systemic, recurring source of arrears** rather than a seasonal anomaly.

Hermetic storage technologies are a proven fix. Airtight bags, metal silos, and modular systems reduce losses from **20-30% to less than 5%**, extend shelf life up to nine months, and enable price-timed sales that lift margins by **10–15%** for producers and aggregators. The result is more stable borrower cash flows, higher debt-service coverage, and preserved collateral, turning adaptation spend into **portfolio risk mitigation**.

The market is **large, segmented, and financeable**. 2025 estimates point to a **~USD 530m TAM (Total Addressable Market)** and **>USD 100m SAM (Serviceable Available Market)**, growing toward **USD 706m TAM** and **~USD 350m SAM** by 2030 as policy support, adequate financing flows, and distribution deepen. Demand spans four bankable archetypes, **smallholders, cooperatives, Agri-SMEs, and traders/off-takers**, each with clear ticket sizes and repayment profiles, allowing banks to deploy familiar products at scale.

Product fit is straightforward, leveraging instruments banks already run:

- **Asset finance / PAYG** for smallholders and groups, short tenors (6–12 months), small tickets (USD 50–100 per household), seasonal repayment;
- **Cooperative lending** for 50–500 tonne shared storage, 12–24 month terms;
- **Value-chain and warehouse-receipt finance** for SMEs, inventory-backed working capital and CAPEX;
- **Leasing** for larger modular systems at traders/processors.

Borrower economics are compelling. Typical smallholder CAPEX of **USD 20–30** (~10 100kg-bags) preserves **USD 70–90** (value of avoided losses) of grain in one season, often **paying back in a single harvest**. While this demonstrates a strong ROI, it is critical to acknowledge that many smallholders cannot realize these benefits since they often lack the liquidity to store produce and must sell immediately after harvest to meet urgent cash needs and repay debts. Thus, hermetic storage financing works best for farmers who can afford to store, those with buffer savings, and secondary incomes. For liquidity-constrained farmers, financing should be bundled with seasonal credit that aid their ability to meet immediate cash needs while storing for higher prices. For cooperatives, a 200-tonne facility reducing losses by just 10% adds **USD 15–20,000** in saleable grain annually (AGRA, 2021). SMEs earn quality premia and stabilize throughput, improving IRR and covenant compliance.

De-risking is available today. **PASS Trust guarantees, Aceli Africa** first-loss incentives, and **African Guarantee Fund's Green Guarantee Facility** are active or accessible, while Technical Assistance from PASS, Aceli, GCA, FAO and others lower origination and monitoring risk. Together these tools **shift risk-adjusted returns** in lenders' favour without requiring the design of a new financial product.

Development and climate dividends are material. Scaling hermetic storage significantly improves **food security, women’s economic participation, and rural liquidity**, while reducing food-waste and related emissions, and aligning with **ASDP-II, the National Climate Change Response Strategy, and SDG 2, 5, 8, 13.** These co-benefits make hermetic storage ideal for green or sustainability-linked portfolios.

Call to action for banks

Finance hermetic storage to tap a **>USD 100m** near-term market, lower NPLs linked with agrifood sector actors, and advance ESG targets. With guarantees and TA in place, this is a **low-competition, high-impact entry point** where **every dollar financed preserves multiple dollars of value**, strengthens client resilience, builds a more stable, climate-aligned portfolio and enhances the adaptive capacity of smallholder farmers in the face of climate change.

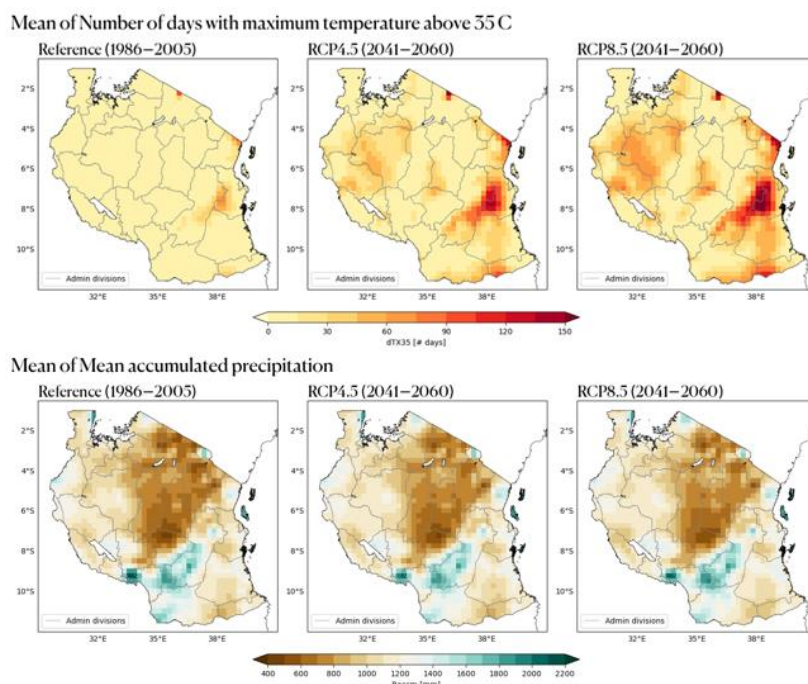
The Adaptation Challenge

Climate risk is now a credit risk

Tanzania’s agriculture is the backbone of its economy, contributing around **28% of GDP** and supporting the livelihoods of over **two-thirds of its population**, ~48 million people, according to Tanzania National Bureau of Statistics (2025) and FAO (2024) reports. However, it is increasingly exposed to a changing climate that threatens both food and financial stability. Over the past three decades, **average annual temperature has risen by about 1.0–1.2°C**, while the **frequency of heavy rainfalls has doubled** (Tan3). Across Tanzania, rainfall patterns have become more erratic, with delayed onset, shorter rainy seasons, and more frequent heavy rainfall events observed over the past three decades—trends documented by the Tanzania Meteorological Authority and the Government’s National Climate Change Strategy (Tanzania Meteorological Authority (TMA), 2023).

Climate change projections indicate a complex intensification of multiple physical hazards across Tanzania. **Extreme heat** is set to surge, particularly along the coast, central plateau, and northern highlands, bringing very hot days exceeding 35 °C. **Drought** hazard is concurrently projected to intensify modestly, especially in the western and southern provinces, as temperatures rise and drive high evapotranspiration, offsetting localized rainfall gains leading to increased water stress. **Excessive rainfalls** (1-day intensity) will become more prevalent nationwide, with the largest increases expected along the coast, islands (Pemba, Tanga), and the south-western highlands, raising urban and flash-flood potentials. This rise in rainfall intensity, combined with continued exposure in existing high-risk areas like Morogoro, Tabora, and Pwani, is set to exacerbate **river flooding** (fluvial), notably increasing flood extent in regions like Arusha, Manyara, and Morogoro, putting over 100,000 people in Morogoro, Tanga, and Pwani at risk of 1-in-50-year events by 2050. Finally, **wind gusts** are expected to slightly intensify , especially in highland pockets and along Pemba.

Figure 1: Climate hazard projections for Tanzania¹



These climatic shifts are quietly draining value from Tanzania’s food system. Each year, **30-40% of maize**, **15-35% of pulses and oilseeds**, and **20-25% of rice** (CRDB, CRDB Interview, 2025) are lost after harvest, representing economic losses of **~USD 300-400 million** (GCA estimates). For maize alone, losses of **~1.5-2 million tonnes annually** mean that a significant portion of national production never reaches markets or storage facilities. As fungi producing aflatoxin thrive in warm, humid environments, **40-60% of grain samples** in the Lake and Coastal zones exceed the permissible 10 parts per billion (ppb) aflatoxin limit (FAO & WHO, 2021).

The result is food unfit for trade or consumption, inventories that lose collateral value, and borrowers whose repayment capacity is directly undermined. Climate change, encompassing both increasing physical risks (e.g., extreme heat, flooding, drought) and transition risks (e.g., policy changes, technological shifts), translates directly into financial risk for financial institutions. For banks, this materiality is realized primarily as heightened credit risk, but also as operational and market risk, demanding proactive risk management and capital allocation adjustments. The impact is not uniform across the borrower base; rather, it is highly dependent on the intersection of climate hazards, asset **location**, and value chain **sensitivity**. For instance, our analysis confirms that borrowers operating in high-exposure areas, such as the rain-fed maize systems in arid zones, face significantly greater credit deterioration potential than those using irrigated, diversified crops in less vulnerable regions. This differential impact, determined by the borrower’s specific value chain characteristics and geographic profile, is the key insight derived from the comprehensive Climate Risk Assessment (CRA) deliverable and underscores the need for granular, location-specific adaptation finance.

Who is affected

The human story beneath these figures is stark. Over **4.8 million smallholder households**, most cultivating less than two hectares, depend on maize, beans, and rice for both income and nutrition. **Women, who**

¹ Find more climate hazard maps and climate risk information for Tanzania in: GCA (2026). Tanzania: Rapid Climate Risk and Adaptation Investment Opportunity Mapping. Agriculture and food systems. Partnership: CGAP. Consulting firm: Pegasys Consulting. Developed under the AAAP. Available at <https://gca.org/climate-adaptation-investment-markets-in-africa/>

make up about 60% of the agricultural labour force, carry the heaviest post-harvest responsibilities, drying, shelling, and bagging grain. When late rains or high humidity spoil stored grain, women lose both household food stocks and the modest surpluses that fund school fees, medical care, or loan repayments

Losses ripple up the value chain. **Aggregators and cooperatives** that bulk grain for sale to processors or institutional buyers face price deductions of **TZS 70-100 per kilogram** when aflatoxin or pest damage is detected. In major production hubs such as **Dodoma, Morogoro, Tabora, and Rukwa**, traders report losing **10-20% of stored volumes** within a single quarter. Along **Lake Victoria and Lake Tanganyika**, farmers balancing crops and fisheries endure dual losses from spoiled grain and fish dried in humid air, undermining both food availability and local trade liquidity. These crucial agricultural hubs are clearly evidenced by the concentration of agricultural activity on the map below.

Figure 2: Key crop production and livestock areas in Tanzania



Systemic impacts

The ripple effects of climate-induced post-harvest losses extend through Tanzania's **food and finance systems**, reducing resilience at every level.

- **Smallholders typically lose 20–30% of stored grain each season under traditional methods**, substantially reducing both income and household food reserves. Evidence from Purdue's PICS trials and AGRA's Tanzania impact assessments shows that adopting hermetic storage can reduce losses to below 5% and increase the quantity of maize available for sale or consumption by 30–40% (Purdue PICS and AGRA, 2020)
- **Loan repayment stress** is rising, as CRDB and NMB assessments attribute **15-20% of agricultural loan arrears** to post-harvest, quality or storage-related losses.
- Food security and price volatility are directly affected. **Chronic losses of up to 1.8 million tonnes of grain each year have eroded strategic domestic reserves**, leaving the market highly vulnerable. Additionally, the uncertainty surrounding the precise timing and severity of these losses leads to unpredictable domestic supply. Consequently, even minor supply shocks can trigger extreme price volatility and push food inflation into double digits (NBS 2023).
 - At the **macroeconomic level**, the value of marketed cereals declines by roughly **USD 0.5 billion annually**, reducing agriculture's GDP contribution and foreign exchange earnings. (United Republic of Tanzania, Ministry of Agriculture, 2019)
- **Health and trade impacts** compound the challenge, as aflatoxin contamination contributes to **over 3,000 liver cancer cases each year** in Tanzania (WHO 2021) and constrains regional maize exports, weakening the country's competitiveness within East African Community markets.

A challenge of adaptive capacity

At its core, this is a crisis of **adaptive capacity**, the ability of Tanzania's farmers, cooperatives, and Agri-SMEs to protect their harvests from intensifying climate stress. Traditional woven sacks, mud silos, and open-air drying have largely been the default method for drying. However, due to increased climate pressures the short comings of these methods are being exacerbated. Without resilient storage systems, even climate-smart advances in production, improved seeds, irrigation, and mechanization, fail to translate into stable incomes or reliable loan repayments.

Despite being the backbone of Tanzania's economy, agriculture receives only about 8–10% of formal credit, making it one of the most financially underserved sectors (Bank of Tanzania, 2022). With millions of households reliant on grain production, climate-induced post-harvest losses amplify this financing gap while simultaneously weakening borrowers' repayment capacity.

Hermetic Storage Technology: Product Types and Mechanism

Hermetic storage technology seals grains in an oxygen-free environment, eliminating insects and moisture-induced mould (which causes aflatoxin) without chemical treatment. This hermetic seal serves two critical functions: it **keeps out external moisture and oxygen** while simultaneously **retains carbon dioxide** naturally produced by the stored grain and any internal pests. This self-generated, modified atmosphere suppresses insect respiration and reproduction, thereby eliminating pests and degradation.

In Tanzania, hermetic principles are applied across various scales, offering flexible solutions for smallholder farmers to large commercial entities. The most widely adopted solution is the **hermetic bag**, such as the Purdue Improved Crop Storage (PICS) bag, which is suitable for storing small quantities (50-100kg) at the farm level. For mid-scale storage, **hermetic cocoons** and **silos** provide larger-capacity, reusable solutions. At the commercial and institutional level, the technology scales up to **modular warehouses** or grain storage structures that utilize the same airtight principle to preserve large volumes of commodity, often acting as temporary or permanent bulk storage solutions. Defining the product clearly as hermetic storage from the outset provides a precise technical foundation for subsequent discussions, eliminating the need for descriptive approximations.

Financing **hermetic storage systems**, airtight bags, hermetic metal silos, and modular warehouses that exclude oxygen, humidity, and pests, offers a practical pathway to **reduce climate-induced vulnerability** and **strengthen borrowers' adaptive capacity**. Field evidence shows hermetic technologies can **cut grain losses from 20-30% to below 5%** (World Bank, 2021), extend shelf life by up to **nine months**, and enable farmers to sell when prices peak, improving profit margins. For lenders, every kilogram preserved represents income recovered and credit risk reduced.

Market Inefficiencies and Suboptimal Investment Context

Despite clear economic and social returns, **adaptation investments in post-harvest storage remain far below potential**. Several interlinked inefficiencies continue to constrain market growth and financing flows:

- **Structural inefficiencies:**

Tanzania's grain market remains **highly fragmented**, with thousands of smallholders forced into selling ungraded or semi-dried produce to informal traders, often within days of harvest. Only about **15–20% of grain produced nationally passes through structured aggregation points or certified storage facilities** (AGRA, 2021). The lack of reliable aggregation means that quality segregation, grading, and storage investments rarely achieve economies of scale.

Local **fabricators and distributors of hermetic storage** technologies, including suppliers of PICS, AgroZ, and GrainPro bags, operate with limited production capacity and thin distribution networks. Most produce **between 100,000 to 300,000 bags per year**, compared to potential domestic demand exceeding **2 million bags annually** (AGRA, 2020). These SMEs face persistent challenges accessing working capital and trade finance to import liners, sealants, or sheet metal,

with input prices rising **30–40%** since 2021 due to global resin shortages and shilling depreciation.

The market for hermetic storage technology is defined by a massive gap between potential and realized demand across its buyer segments. The **Smallholders** segment represents the largest opportunity, with potential demand exceeding **2 million bags annually**, yet active adoption is only around 30–40%. This limited uptake is due to the high upfront cost, poor availability in remote areas, and eroded trust caused by counterfeit products. Conversely, the current **realized demand**, estimated at approximately **300,000 bags sold annually**, is primarily driven by the **Cooperatives and Farmer Groups** segment. These groups consist of commercial-minded producers who leverage their membership to access training, financing, and extension services, enabling them to store high-value grain until market prices rise.

At the same time, **public extension services remain under-resourced**, limiting the ability to train farmers and cooperatives on the use of hermetic technologies and safe storage practices.

- **Financial barriers:**

While banks are gradually expanding agricultural lending, **most loan products remain poorly aligned to smallholder cashflows and post-harvest investment cycles**. Typical input or seasonal loans have **repayment periods of 6–9 months**, often maturing before farmers sell stored grain when prices peak. For hermetic technologies, which require upfront investment (USD 20–25 per bag or USD 200–500 for small silos) but deliver returns over multiple seasons, this mismatch discourages uptake.

Collateral requirements remain another major barrier: **over 70% of smallholders lack registered land titles or formal assets**, forcing them to rely on group guarantees or informal cooperatives. Banks such as **CRDB and NMB** have piloted value-chain lending and warehouse receipt systems, but these models still reach **very few small-scale producers**.

Moreover, dedicated climate or adaptation finance lines remain scarce. While instruments such as ACELI Africa's first-loss incentives or deal origination benefits and PASS Trust's credit guarantees **have successfully pioneered transactions and demonstrated the viability of these financing models**, they are not yet mainstreamed within banks' risk frameworks or product design processes.

- **Information and capacity gaps:**

Both banks and borrowers face an **information asymmetry problem**. For lenders, data on how hermetic storage affects borrower repayment performance or portfolio resilience remains limited. Few institutions track adaptation-related key performance indicators (KPIs), and climate risk assessment tools are rarely integrated into agricultural credit scoring models.

At borrower level, **awareness and trust gaps** persist. While **over 60-70% of farmers** (based on representative sample surveys of smallholder farmers) **are aware** of hermetic bags, only **30–40% actively use them** (Purdue, 2020), citing uncertainty about product quality, inconsistent availability, and lack of after-sales support. Counterfeit or low-quality imitations further erode trust, for example, in 2022, local media reported that several low-cost bag suppliers entered the market with non-airtight products, leading to grain spoilage and loss of confidence in the technology.

Without systematic farmer education, distribution incentives, or aftersales monitoring, the market remains **underdeveloped and unevenly penetrated**, particularly in regions beyond the Southern Highlands and Lake Zone. This uneven access is primarily concentrated among better-connected, higher-income farmers and members of professional associations, **while lower-income, geographically remote smallholders face significant barriers due to high upfront cost, poor local distribution, and limited access to specific training** on the technology.

- **Underinvestment gap:**

Despite the clear economic rationale for improved post-harvest storage, **current financing for hermetic storage solutions in Tanzania remains very limited**, with most activity driven by donor and government programmes rather than commercial credit.

Donor-led procurement dominates the market, where large-scale deployment of hermetic bags and small silos has primarily occurred through **donor- or project-linked procurement** programmes such as such as AGRA’s Post-Harvest Management program, FAO’s “Save Food Initiative,” or World Bank’s ASDP-II. These programmes distribute storage technologies through cooperatives, extension services, and humanitarian channels, **not through bank-financed lending**, limiting commercial market development. **Commercial lending for post-harvest assets remains nascent**. Banks provide **very limited direct finance** for on-farm storage assets (hermetic bags, small silos, modular units), due primarily to collateral constraints and lack of product-level performance data. Where lending does occur, it is concentrated in **early-stage pilots** embedded within broader climate or agriculture programmes – for example, Climate-smart agriculture lending under the Tanzania Climate-Smart Agriculture Project (TACATDP), supported by the World Bank; Agri-SME financing supported by PASS Trust guarantees, supported by PASS Trust guarantees and Loans benefiting from Aceli Africa’s incentive and first-loss mechanisms. These initiatives demonstrate emerging traction but remain **small relative to national demand** and typically target SMEs and cooperatives rather than mass smallholder adoption.

The financing gap remains substantial, where against a **Serviceable Addressable Market (SAM) of above USD 100 million** for hermetic storage solutions (see annex for estimates and model), annual financing flows remain only a **fraction** of potential demand. Most hermetic technologies are still purchased **out-of-pocket** or via donor subsidy rather than bank lending, leaving a large, addressable space for commercial financing to grow.

These inefficiencies have created a suboptimal equilibrium, a high-impact, low-competition space where the **latent** demand for climate-resilient storage is clear, though currently constrained by a lack of scaled financing, but the financial ecosystem has yet to mobilize at scale. The market remains unevenly penetrated. The customers driving this realized demand are typically **small-to-medium-scale maize and legume producers** who are often members of farmer associations and have received technical training. They represent the subset of farmers able to absorb the relatively high upfront cost (often five times that of conventional bags) to secure essential household consumption and future seed stock against devastating post-harvest losses. For commercial banks, this represents not a barrier but a strategic entry point: a chance to lead in building an emerging adaptation market with measurable credit, social, and climate benefits.

Addressing this adaptation challenge through scalable, financeable hermetic storage systems protects both farmers’ harvests and banks’ balance sheets. It converts a silent climate liability into a tangible investment opportunity that aligns with Tanzania’s **food security goals, national NDC commitments, and commercial banks’ ESG and green finance mandates**.

Market Opportunity

Tanzania’s post-harvest storage gap represents over **USD 500 million adaptation investment opportunity** hiding in plain sight, within the country’s agriculture sector. With roughly **4.8 million smallholder** households cultivating maize, rice, and pulses, and less than 20% currently using improved or hermetic storage, the unmet demand for climate-resilient storage solutions is clear. As climate change intensifies rainfall unpredictability and humidity, the demand for resilient, sealed storage solutions is expanding far faster than current supply. The challenge that climate change has magnified has, in turn, created a financeable market that can deliver both resilience and returns. For banks and investors, this market is no longer experimental; **it is data-supported, segmented, and primed for financeable growth.**

From climate challenge to financeable demand

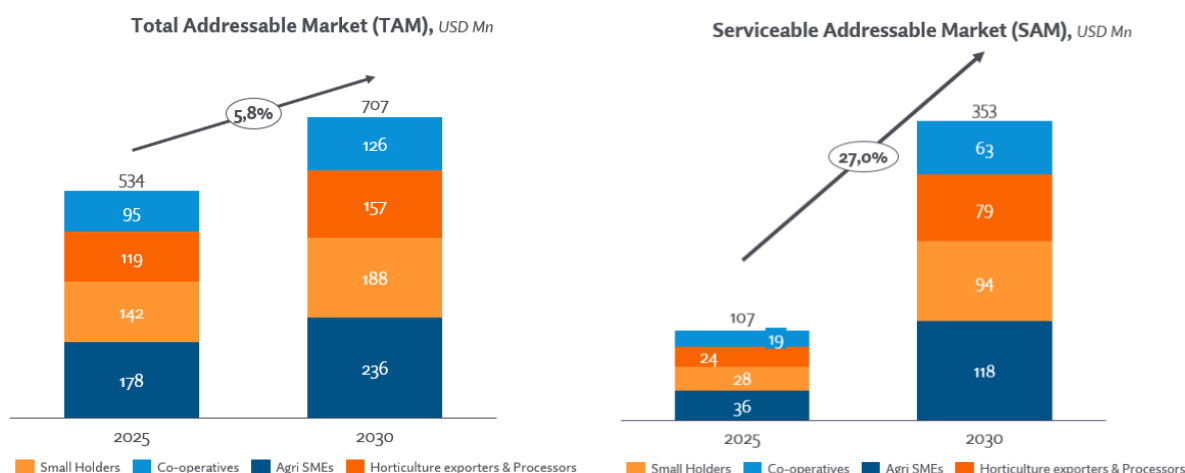
Based on our estimates, in **2025**, the **Total Addressable Market (TAM)** for hermetic storage solutions is **~USD 530 million**, with a **Serviceable Available Market (SAM)** of over **USD 100 million** based on current ecosystem readiness and finance reach, large enough to sustain commercial lending products and private-sector expansion. By **2030**, as policy support (such as the National Post-Harvest Management Strategy 2019 – 2029) and market infrastructure (warehousing receipt and commodity exchanges) mature, increased adoption of hermetic storage solutions could expand the market to **USD 706 million (TAM)** and **USD 353 million (SAM)**.

Figure 3: Profile and Use Cases of Different Hermetic Storage Solutions

	Hermetic Bags	Hermetic Cocoon	Hermetic Silos
Profile	Hermetic bags are triple-layer, airtight polyethylene storage systems (typically 50-100 kg capacity) designed to block oxygen and moisture exchange, preventing insect infestation and fungal growth without pesticides (Dijkink et al., 2022; Mutungi et al., 2020; AGRA, 2020).	Hermetic cocoons are flexible, multi-layer polyethylene or PVC enclosures (5-300 tonnes capacity) that create airtight, gas-tight storage for bulk grains . They maintain low oxygen levels, halting insect and fungal activity while preserving grain quality without pesticides (Mutungi et al., 2020; AGRA, 2020; Tanzania Ministry of Agriculture, 2019).	Hermetic silos are airtight, rigid metal or plastic storage structures with capacities ranging from 500 kg to over 100 tonnes . They provide long-term, large-scale grain preservation by maintaining low oxygen conditions and stable humidity, preventing pest infestation and spoilage (Mutungi et al., 2020; AGRA, 2020; Tanzania Ministry of Agriculture, 2019).
Use Case	Primarily used by smallholder farmers and households for on-farm or domestic grain storage , especially maize, beans and legumes. They suit short- to medium-term storage (3-12 months), providing low-cost, portable protection in non-refrigerated environments. 3 USD / 7350 TZS per 100kg bag (1 USD = 2,450 TZS)	Hermetic cocoons are used for medium to large scale grain storage by farmer cooperatives, traders and food reserve agencies . They suit bulk commodities such as maize, rice and pulses, often in warehouse or community settings, offering mobile, temporary alternatives to fixed silos. Customizable, typical investment values fall generally in the mid-range between hermetic bags and silos	Hermetic silos are typically used for large-scale or commercial grain storage by millers, traders and government reserves . They are ideal for maize, rice, wheat and other cereals requiring long-term preservation under controlled airtight conditions in warehouses or industrial facilities. 5000 – 5000 USD / 12.25m -122m TZS (50 – 100 tons)

Tanzania produces around **8 million tonnes of maize annually**, yet only **40%** of grain is stored in improved conditions today. Bridging this storage gap through hermetic technologies, bags, silos, and modular systems, can **recover significant lost value each year**, improve household income resilience, and stabilize agri-loan portfolios exposed to post-harvest volatility. Based on our estimates, even modest adoption of hermetic storage, reducing losses to 5-10%, could recover **USD 250–300 million in value** per year, improving household incomes and creditworthiness while expanding the revenue base for agri-finance institutions and improving their repayment capacity. For banks, this is a rare alignment where **climate adaptation, credit risk reduction, and portfolio growth** reinforce one another.

Figure 4: TAM and SAM Market Sizes for Hermetic Storage Solutions by Borrower Types in Tanzania



Segmenting the opportunity

The demand for hermetic storage spans multiple borrower segments, each representing a distinct financing profile and scale of impact:

- Smallholders:** Primary users of hermetic bags and small silos. Bank financing is typically extended to **cooperatives, off-takers, or farmer groups** that aggregate the individual smallholder demand, mitigating single-borrower risk. Smallholders make an initial average purchase of **5–10 bags (USD 10-30 capex)**, which typically lasts **three seasons**, a lifecycle distinction that is crucial for market analysis. While the **Aggregate TAM** reaches **USD 100-140 million** (representing the **Total Installed Base Value**), the bank's predictable, recurring annual credit demand is approximately **one-third of this amount, plus growth**. A clear credit demand is driven by two primary factors: **1. immediate income stability** through post-harvest loss reduction from **20–30% to less than 5%**, and **2. the ability to execute lean-season price arbitrage** by capturing **10–15% higher margins**. Together, these benefits avert a financial hit of **USD 70–90 per household annually**.
- Cooperatives and Farmer Groups:** Bulk storage for **50-500 tonnes per cycle**. Typical investment: **USD 5,000–50,000** per cooperative. **Aggregate TAM:** USD 80-95 million and **Aggregate SAM:** USD 18-20 million (Pegasys estimates). The primary drivers of demand for hermetic storage are the substantial collective benefits realized by **Producer Organizations and Cooperatives**. By investing in mid-scale storage solutions like cocoons or silos, these groups can first achieve crucial, collective **loss reduction**, reliably cutting post-harvest losses (FAO, 2022). Firstly, this preservation capability leads to a pooled **income uplift**; for instance, a group-operated 200-tonne facility realizing a 10% loss reduction can add USD 15–20,000 in saleable grain annually (CRDB, CRDB Interview, 2025). Secondly, the collective nature allows for **member cost reductions** through bulk purchasing, typically lowering the per-unit hermetic bag cost by 15–20% (CRDB, CRDB Interview, 2025). Thirdly and most importantly, coordinated storage enables **strategic price timing**—a collective marketing action that allows the cooperative to store bulk commodity until prices peak during the lean season, thereby maximizing returns for all members.
- Agri SMEs:** Operate at scale in collection, processing, and distribution. Typical financing requirement: **USD 100,000–500,000** for modular warehouses or climate-controlled units. **Aggregate TAM:** USD 150-180 million and **Aggregate SAM:** USD 30-40 million (Pegasys estimates). The demand for hermetic storage among **Agricultural SMEs** is driven by a blend of commercial necessity and financial optimization. First, compliance is rapidly becoming a **market-entry requirement**, as urban retailers and institutional buyers increasingly insist on guaranteed

quality grain. Hermetic systems directly ensure grain meets stringent standards, such as those of the EAC and EU, which in turn unlocks **higher-value markets** and allows SMEs to capture valuable **quality premiums**. Operationally, the technology provides essential **supply chain stability** by reducing input volatility, which is crucial for enabling reliable **forward contracting** with buyers. Ultimately, the combined benefits of earning quality premia and stabilizing throughput lead to tangible financial improvements, enhancing the **Internal Rate of Return (IRR)** and improving **covenant compliance** for the SMEs (CRDB, 2025).

- **Exporters & Processors:** Require warehouse-grade storage for stabilization and quality assurance. Potential for **leasing or collateral management partnerships** with banks. **Aggregate TAM:** USD 100-120 million and **Aggregate SAM:** USD 20-25 million (GCA estimates). The demand for high-grade storage among **Horticulture exporters and Processors** is fundamentally driven by the need for **non-negotiable quality compliance** and the mitigation of post-harvest losses. Accessing lucrative export markets, particularly the EAC and EU, requires strict adherence to Sanitary and Phytosanitary (SPS) standards and Maximum Residue Limits (MRLs). High-quality, warehouse-grade storage solutions, which stabilize product quality and temperature pre-shipment, are essential to meet these benchmarks, avoiding costly consignment rejections at borders. Furthermore, reliable storage is critical for enabling efficient processing schedules and securing reliable **forward contracting** with international buyers.

Together, these segments constitute a **financeable opportunity (SAM) exceeding USD 100 million annually**, directly aligned with banks' agri-lending products, ranging from **asset finance and working-capital loans to value-chain and warehouse receipt lending**.

Technical and Commercial Viability: A Proven Solution, not a Pilot

Hermetic storage has moved well beyond the pilot stage. Proven performance has improved adoption, and over the past decade, donor-backed programmes and private manufacturers have established a **strong domestic footprint**:

- **Adoption and performance:** With 35–40% of farmers now actively using hermetic storage bags, **adoption is increasing 15% per year** in maize and bean value chains—evidence of a rapidly growing market rather than a nascent one. **Surveys by GAIN & PACE (2021) and PICS (2020) show farmer awareness is high at 70%**. Field data confirm loss reductions from 20–30% to below 5% and income gains of 10–15% from price arbitrage. (Purdue, 2020) (World Bank, 2021) (FAO, 2022).
- **Local suppliers and capacity:** Tanzanian manufacturers such as **A-to-Z Textile Mills** (which produces bags under the brand **AgroZ**), AgroPride, and A-to-Z Textile Mills produce between 100,000–300,000 hermetic bags annually. For larger-scale options, international providers like **GrainPro** (manufacturer of the larger **Grain Cocoon** system) also have a presence. Distributors like Balton Tanzania and East Africa Grain Technologies are expanding rural reach through agro-dealer networks. The hermetic bags produced locally are typically durable and reusable for up to **three seasons** (or longer with careful handling), ensuring a recurring purchase cycle which supports a strong repeat-buyer model for financed sales (Purdue, 2020) (World Bank, 2021) (FAO, 2022).
- **Donor and DFI pilots:** Initiatives such as **USAID's Feed the Future Post-Harvest Project**, **WFP's Farm to Market Alliance**, and **AGRA's Post-Harvest Management Program** have validated hermetic technology performance and supported aggregation through cooperatives and SMEs.
- **Policy alignment:** The **Tanzania Post-Harvest Management Strategy (2019–2029)** and the **National Climate Smart Agriculture Implementation Plan (2022–2026)** explicitly promote hermetic storage as a core adaptation measure. Several local governments now integrate hermetic storage into extension and input-credit programs.

These developments establish hermetic storage as a **commercially viable and technically mature solution**, positioned for scale through blended finance and value-chain partnerships.

Competitive Positioning

Compared with conventional polypropylene or jute sacks, **hermetic systems** offer clear competitive advantages:

- **Reduced spoilage and contamination:** Losses below 5%, compared to 20–30% in traditional sacks.
- **Extended shelf life:** Up to nine months without chemical preservatives, reducing the need for fumigants and pest-control costs.
- **Lower lifetime cost:** Bags are reusable for up to three seasons, lowering per-tonne storage cost by 30–40%. Furthermore, they **eliminate the need for storage-level pesticides (e.g., acetylenic dust)**, which provides significant cost savings and reduces the risk of food contamination from pesticide over-application.
- **Trade and export compliance:** Grain stored in hermetic bags meets EAC and EU aflatoxin standards, unlocking higher-value markets for traders and processors. The EAC has harmonized aflatoxin standards for grains that set a maximum limit (ML) of 10 parts per billion (ppb) for total aflatoxins and 5 ppb for aflatoxin B1 in cereal grains and flours. These limits apply to maize, maize flour, groundnuts, sorghum, and similar cereals and oilseeds. Grain stored in hermetic bags meeting these EAC standards is thus considered safe for trade and consumption, unlocking higher-value markets for traders and processors that comply with these stringent food safety rules.

Figure 5: Competitive Positioning of Hermetic Storage Solutions



Together, these benefits make hermetic storage not just **cost-competitive**, but a **financially and environmentally superior alternative** that aligns with banks' **green-finance taxonomies** and risk-management objectives.

From value protection to value creation

Hermetic storage is not only a loss-prevention technology but also a value-creation tool. By enabling farmers and cooperatives to store grain safely for longer, they can sell during off-season price peaks, typically earning **10–15% higher prices** (FAO 2022; Purdue PICS 2021). For smallholders, this translates into **USD 50–80 of additional seasonal income**, driven by both preserved grain and better price timing. For cooperatives and Agri-SMEs that typically store **100–300 tonnes**, reducing losses from 20–30% to below 5% can recover **USD 5,000–20,000 annually** in saleable grain value. These gains strengthen borrower cash flows and repayment capacity, reinforcing the link between climate resilience and financial inclusion.

For Tanzania's financial institutions, the hermetic storage market represents a **high-impact, scalable lending opportunity** with measurable climate and credit benefits. Financing these systems enhances **borrowers' adaptive capacity**, stabilizes cash flows, and diversifies agri-lending portfolios. For every dollar invested in hermetic storage, the sector recovers multiple dollars in preserved grain value, reduced defaults, and strengthened borrower resilience, an investment proposition where **climate adaptation and financial prudence converge**.

Business Model and Value Proposition for Financial Institutions

The financing of hermetic storage systems in Tanzania offers a **commercially viable and strategically aligned entry point** for banks seeking to expand into climate adaptation lending. Unlike upstream production investments, which are directly exposed to yield loss from climate shocks like drought, **post-harvest finance is inherently less risky** because the asset financed (grain storage) directly protects value that already exists. **Crucially, when climate shocks (like drought) reduce overall yields and drive-up market prices, the preserved, pest-free grain held in storage becomes significantly more valuable, strengthening the borrower's repayment capacity through profitable price arbitrage.** While severe, localized events like flooding could potentially impact the stored commodity and thus repayment capacity, the storage loan is substantially decoupled from the primary production risk (low yield), offering a more stable and predictable repayment stream. The economics are compelling: small, repeatable loans with short payback periods, supported by proven technology and clear loss-avoidance benefits.

This is therefore not a call for experimental climate finance, but an invitation to mainstream a new **asset class of climate-resilient storage lending**, one that is technically mature, creditworthy, and aligned with national adaptation priorities and banks' green finance mandates.

Financing Pathways and Product Fit

Tanzania's hermetic storage market can be financed through **existing, well-understood financial instruments**. Banks do not need to design new financial products, instead, they can tailor familiar ones to fit borrower segments and transaction scales. The most relevant pathways are outlined below.

a. Asset Finance for Smallholders and Farmer Groups

Hermetic bags and small silos are ideally suited for **micro-asset finance** models, similar to those used for solar home systems or farm equipment.

- **Loan size:** Typically, USD 50–100 per household for 5–10 hermetic bags.
- **Tenor:** 12–18 months, strategically structured for flexibility, with the *expectation* that repayment will be generated much sooner (within 6–10 months) from the price premium achieved during the lean season. This extended term accounts for regions with a single annual cropping season where the farmer's ultimate income security relies on the cycle of the *following* year's harvest. It acts as a critical risk buffer, ensuring that the loan's maximum duration aligns with the next guaranteed annual income event.
- **Repayment:** Structured as seasonal bullet or instalment repayment post-harvest.
- **Partners:** Local agro-dealers, SACCOs, and NGOs can serve as distribution and repayment intermediaries.

This model mirrors the Pay-As-You-Go (PAYG) **approach** used successfully in solar energy access, small, recurring payments that match farmers' cash flow cycles. Trials by **Aceli Africa** and **NMB Bank's "Kilimo Biashara" program** show high repayment rates for similar agri-asset finance products, indicating strong credit discipline when cash flows are protected by tangible productivity or income gains.

b. Cooperative and Group Lending Models

Farmer cooperatives and AMCOS (Agricultural Marketing Cooperative Societies) are natural aggregators for collective storage investments.

- **Loan size:** USD 5,000–50,000 for mid-sized silos or shared warehouse facilities (50–500 tonnes capacity).
- **Tenor:** 12–24 months.
- **Repayment:** Group-based, often through pooled revenue from collective grain sales.
- **De-risking features:** Shared liability and internal savings mobilization reduce individual default risk.

Under **PASS Trust's Guarantee Program**, several cooperatives have financed **grain storage facilities, dryers, and processing units** with guaranteed coverage of up to **80% of principal**, demonstrating the viability of this channel. Such arrangements are particularly attractive for banks as they leverage **existing governance and aggregation capacity** within cooperatives.

c. Value-Chain and Warehouse Receipt Finance for SMEs

For **Agri-SMEs, aggregators, and traders**, hermetic silos or modular warehouses (the physical assets) can be financed through medium-to-long-term asset financing.

- **Loan size:** USD 100,000–500,000.
- **Tenor:** 1–3 years, depending on the asset's lifespan and collateral arrangements. This tenor is appropriate for the fixed asset acquisition (silos, modular systems).
- **Repayment:** Amortized monthly or quarterly, structured through trade contracts or inventory turnover cycles.
- **Risk management:** Banks take security over the asset and the associated revenue streams.

d. Inventory Working Capital via Warehouse Receipt Finance (WRS)

The stored commodity itself can be leveraged for short-term working capital. Tanzania's **Warehouse Receipt System Act (2022)** provides a strong legal basis for this.

- **Loan size:** Varies based on commodity value and margin (e.g., 70% of inventory value).
- **Tenor:** Typically, short-term (3–6 months). This period is aligned with the optimal post-harvest storage window, as the stored grain is the collateral and is expected to be sold before the next harvest.
- **Risk management:** The stored grain serves as collateral under the WRS, with quality and volume certified by licensed warehouse operators. Introducing hermetic modular systems within these value chains can **unlock additional collateralizable value** while improving compliance with **EAC quality standards**.

e. Distributor & Supplier Finance (The On-lending Model)

This model finances the distribution network, accelerating product uptake among smallholders by overcoming the upfront cost barrier.

- **Mechanism:** Financial institutions provide working capital or trade finance to manufacturers and large distributors (like AgroZ/A-to-Z Textile Mills) who then on-lend the bags to their affiliated smallholder farmers on credit.
- **Target:** Manufacturers and large distributors of hermetic technology.
- **Benefit:** Allows farmers to acquire the bags immediately and repay the distributor after they sell their first protected harvest. This dramatically increases market penetration and volume.

f. Leasing and Equipment-as-a-Service for Traders and Processors

For larger buyers and processors, **leasing models** provide an alternative to outright ownership of storage infrastructure.

- **Loan size:** USD 200,000–1 million for modular silos or climate-controlled units.
- **Tenor:** 2–5 years, structured as operational or finance leases.
- **Partners:** DFIs and impact investors can provide long-term capital to leasing companies (e.g., **Equator Leasing, EFTA Tanzania**) to expand climate-resilient equipment portfolios.

Such structures reduce upfront capital requirements, provide **predictable cash flow for banks**, and allow for **scalable deployment** of assets that maintain high resale or residual value.

g. Digital and PAYG Innovations

Emerging fintech platforms in East Africa (e.g., **Wakala, Farmster, and AgroZ App**) are enabling **PAYG** access to storage via mobile payment systems. Farmers or cooperatives can pay **per bag stored or per month used**, while ownership remains with the vendor or financier until full repayment. Early pilots by **A-to-Z Textile Mills** show that **digital microfinance** integration can increase adoption among cash-constrained farmers, particularly women-led households, by lowering entry barriers and improving repayment traceability.

Collectively, these models show that the financing architecture already exists, what's needed is not invention, but **adaptation of existing banking products** to serve a growing adaptation market. Banks can enter this space incrementally, starting with **low-risk, small-ticket financing**, and scaling toward **larger cooperative and Agri-SME portfolios** supported by blended finance and guarantee mechanisms.

Borrower Economics and Credit Fundamentals

a. Affordability and Cost Structures

Hermetic storage technologies offer a **low entry cost, short payback period, and strong cash flow fit** with the realities of Tanzanian farmers, cooperatives, and Agri-SMEs.

- **Smallholders:** The most common hermetic bag models (PICS, AgroZ, GrainPro) cost **USD 2–3 per 100 kg bag**, while a typical farmer requires **~10 bags per season**, an investment of **USD 20–30** (CRDB, 2025). The value of grain preserved (at an average maize price of TSh 700/kg) exceeds **USD 70–90 per season**, representing a **2–3× return within one harvest**.
- **Cooperatives and Farmer Groups:** Mid-scale investments in 10–50 tonne silos or bulk hermetic systems cost **USD 5,000–50,000**, financed collectively. Even a 10% reduction in post-harvest losses on a 200-tonne storage facility translates to **USD 15,000–20,000 of additional saleable grain annually**, generating full payback within **1.5–2 seasons**.
- **Agri-SMEs and Aggregators:** Modular warehouse systems cost **USD 100,000–500,000** but could reach to USD 2 million depending on configuration and climate-control features. These assets typically generate **internal rates of return (IRR) of 12–18%**, with repayment periods of **2–3 years**, driven by improved quality premiums and stable supply contracts. (Mussa & Mdoe, 2022)

Across all segments, **loss reduction (20–30% to <5%)**, improved quality, and better price timing combine to deliver measurable financial gains, while protecting stored grain from aflatoxin contamination that can otherwise erase entire revenues.

b. Income Uplift and Cash Flow Stability

Hermetic storage converts uncertain, perishable assets into stable, financeable inventory. Field evidence shows:

- **Farm-gate price improvement:** By storing grain for 3–6 months and selling during off-season peaks, farmers capture **10–15% higher prices** (FAO 2022, Purdue University).

- **Income uplift:** According to CRDB's internal estimates and other studies (AGRA, 2020) , the adoption of hermetic storage technologies could lead to an income increase of **25–30% for smallholders (15 - 20% from loss reduction; additional ~10% from price arbitrage)** and **35–40% for Agri-SMEs**.
- **Cash flow predictability:** Grain becomes a storable, collateralizable asset, allowing borrowers to smooth income across seasons and align repayments with post-harvest sales.

For lenders, these dynamics **reduce credit volatility** and create more consistent repayment behaviour, that has improved loan repayment rates by **60–70%**, according to Purdue University (Purdue, 2024), observed over CASH-Tz program that increased farmer's access to finance through a collateral management agreement (CMA), so they could afford to store their grain in hermetic bags and sell it when prices were higher.

c. **Creditworthiness and Collateral Value**

From a credit-risk perspective, hermetic storage systems strengthen borrower fundamentals in three key ways:

- **Collateral enhancement:** Stored grain maintains quality for up to nine months, preserving its collateral value and enabling **warehouse receipt finance** or inventory-backed loans. In addition preserving the value of grains used as collateral, Tanzania's Movable Property Security Rights Act allows physical assets like hermetic storage bags and silos to be registered as movable collaterals, and are, thus, useful assets (as direct collaterals) for accessing financing.
- **Default risk mitigation:** Reduced post-harvest losses directly lower default risk, CRDB's agri-loan data attributes **15-20% of arrears** to crop spoilage and quality issues.
- **Cash flow security:** With loss reduction (from ~30% PHL down to less than 5%) and higher prices (~10-20%), borrowers' **debt service coverage ratios (DSCR)** improve significantly. For smallholder and cooperative segments, DSCRs can rise from 1.0x to 1.5-1.8x (see annex for model assumptions and logics) after adopting hermetic storage, based on conservative pricing assumptions.

Thus, financing hermetic storage is not just socially beneficial, it is **credit enhancing**, protecting both the borrower's income and the lender's portfolio performance.

d. **Gender and Inclusion Dynamics**

Women farmers who handle up to **70% of post-harvest labour**, are key beneficiaries and borrowers. Studies by **GAIN (2021)** and **FAO (2022)** show that women-led households adopting hermetic bags experience **15–20% higher household food security scores** and **lower repayment default rates**, owing to more consistent grain management and cash discipline. For banks, this means a **gender-lens lending opportunity** with proven repayment strength and measurable social impact, a strong fit with ESG-linked finance objectives. Several DFIs (such as IFC, FMO, and 2X Fund) offer concessional co-financing for credit portfolios that target and demonstrably reach women borrowers. A hermetic storage portfolio with women targeting can unlock access to these facilities.

De-Risking and Blended Finance Mechanisms

Commercial banks in Tanzania often view adaptation technologies as niche or risky. Yet, recent experience from **Aceli Africa**, **PASS Trust**, and **IFAD's private-sector window** shows that structured de-risking mechanisms can make climate adaptation lending both viable and profitable. These tools are already operational in Tanzania's agri-finance landscape, **meaning banks can participate today without waiting for new programs to be created**.

Partial Credit Guarantees and First-Loss Facilities

- **Aceli Africa**, which operates incentive facilities with CRDB, NMB, and Amana Bank, provides origination incentives and Impact bonuses for loans to Agri-SMEs meeting climate and inclusion criteria. (ACELI, 2024).
 - Aceli's incentives boost net margins for commercial banks on Agri-SME loans, elevating net profits from 3.2% to 6.5% (ACELI, 2024) by taking away a portion of costly origination costs, lifetime service costs, and elevated cost of funds often associated with serving Agri-SMEs
 - Aceli's incentives play a crucial role in transforming non-bank financial institutions (NBFIs) financial position, shifting from a loss of 1.6% to a profitable margin of 2.8%. While Aceli works with both commercial banks and NBFIs, this dramatic margin shift highlights their specific importance for developing smaller financial partners.
 - Aceli's First Loss Cover (FLC) is also increasing risk appetite particularly for higher-volume lenders to reach underserved segments
 - Loans below USD200K account for 94% of loans by number, the USD10k-USD25k segment has experienced significant annualized growth of 60%, outpacing each of the larger loan size segments
- **PASS Trust**, supported by DANIDA and IFAD, provides **partial credit guarantees covering up to 80% of loan principal** for Agri-SMEs and cooperatives investing in post-harvest technologies (Business Insider, 2025).
 - PASS currently contributes 35% of all agricultural guarantees in Tanzania. Since inception, PASS has facilitated **over Tsh 2 trillion in loan guarantees** to 66,000+ agri-enterprises, impacting ~3.4 million people of which **51% are women** (Daily News TZ, 2023), with non-performing loans under **5%** (Business Insider Africa, 18 August 2025) (I, 2025), a strong proof point for credit reliability in this sector.
- The **African Guarantee Fund (AGF)** and **GCF-backed Green Guarantee Facility (2023)** also operate in Tanzania, targeting green and climate adaptation lending by local banks, providing **portfolio-level guarantees** and concessional backstops for climate-aligned investments.

Together, these facilities demonstrate that **credit risk in adaptation sectors can be significantly reduced**, often transforming unbankable deals into financeable ones without requiring full concessionally.

Technical Assistance and Pipeline Support

De-risking is not just financial, it's operational. **TA programs** lower origination and monitoring risk, helping banks build confidence and internal capacity.

- **Aceli Africa** provides TA for credit officers on SME due diligence and impact assessment, with participating banks reporting **reduced loan processing time and improved recovery**.
- **PASS Trust's Business Development Services** unit supports loan packaging for farmers and cooperatives, ensuring high-quality proposals reach lenders.
- The **GCA-AfDB partnership**, has also delivered landmark technical assistance to the Tanzania Agricultural Development Bank (TADB) to mainstream climate resilience across its lending portfolio. This is seen as a pioneering step toward making climate-related financial risk management a standard practice in African banking system (GCA, n.d.)

By combining financial de-risking with capacity building, these initiatives reduce both **default risk and transaction costs**, paving the way for scale lending.

Aggregation and Cooperative Models

Aggregation further reduces credit exposure by spreading risk across groups rather than individuals.

- Under the CRDB “Amcos Uzalishaji” program, cooperatives aggregate member demand for storage and input financing, achieving **lower default rates and easier monitoring**.
- Similar aggregation models supported by FAO and WFP’s Farm to Market Alliance in Dodoma and Singida have shown repayment rates exceeding **95%**, underscoring the benefits of lending to organised groups.

For banks, aggregation transforms micro-loans into **manageable, higher-ticket transactions** with predictable group-level repayment behaviour.

Strategic and Commercial Rationale for Banks

A Credit Risk Solution Disguised as an Adaptation Investment

For Tanzania’s banks, hermetic storage is not a philanthropic or experimental investment, it is a **credit risk mitigation tool** that directly strengthens portfolio quality. Each bag or silo financed protects stored value that would otherwise be lost to mold, pests, or humidity. Reduced post-harvest losses mean stronger borrower repayment capacity, lower non-performing loans (NPLs), and improved collateral value.

In a sector where **20–30% of agricultural arrears stem from storage-related losses**, financing hermetic storage is effectively **financing portfolio resilience**.

Profitability and Portfolio Diversification

The segment’s **short tenor and small-ticket loans** fit neatly into existing agri-finance products, from input loans to asset finance. These loans generate **quick portfolio turnover** and stable fee income with relatively low exposure. At the same time, scaling into post-harvest lending diversifies risk away from weather-dependent production loans, offering **non-correlated income streams** and improving risk-weighted asset profiles.

Evidence from **Aceli Africa portfolios** (ACELI, 2024) shows that climate-resilient SME and cooperative loans deliver **Returns on Assets (ROA) of 8–10%** after partial guarantee coverage and origination incentives, comparable to or better than standard agri-loans.

Alignment with Green and ESG Finance Mandates

Financing hermetic storage advances multiple strategic imperatives now shaping bank operations:

- **ESG and sustainability compliance:** Hermetic storage directly supports the mitigation of food loss (SDG 12.3) and adaptation to climate risk (SDG 13).
- **Regulatory and reputational value:** Aligns with Tanzania’s National Climate Change Response Strategy (2021–26) and NDC adaptation priorities, enhancing green finance credentials with regulators and DFIs.
- **Gender inclusion:** Women-led cooperatives and farmer groups represent a key customer base, supporting gender-lens investing and social performance metrics.

These co-benefits make hermetic storage an ideal candidate for **green or sustainability-linked loan portfolios**, where banks can earn both **financial and reputational returns**.

A Low-Competition, High-Impact Market Entry Point

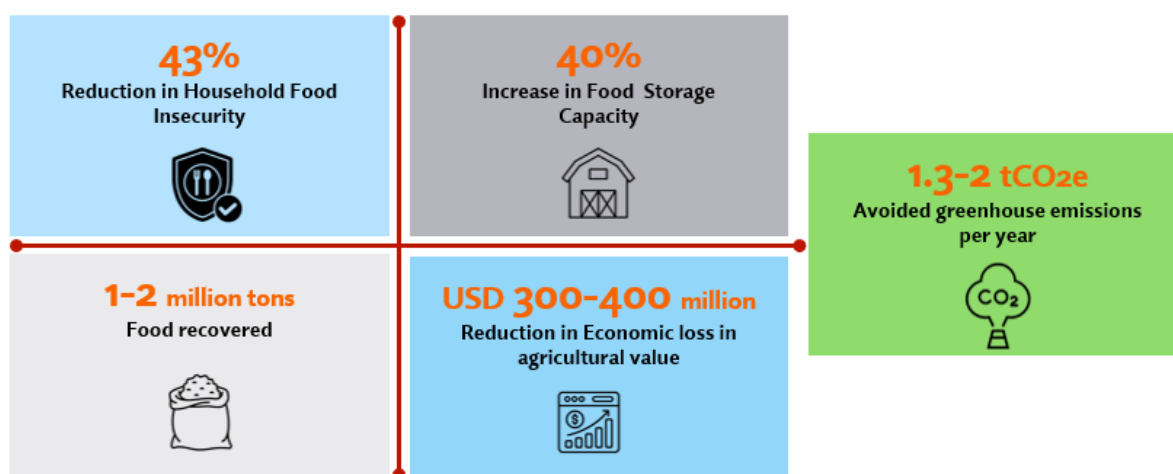
Despite its clear potential, the post-harvest finance market remains **largely untapped**, with limited investment flows against an estimated **USD 100 million serviceable demand**. This creates a **first-mover advantage** for banks willing to enter now, with DFIs, guarantees, and concessional partners already available to absorb early-stage risk.

In essence, hermetic storage finance is where **adaptation, inclusion, and profitability converge**, a practical, near-term opportunity to build a climate-resilient lending portfolio while strengthening the very systems on which agri-finance depends.

Development and Climate Adaptation Benefits

Beyond its financial and credit-strengthening potential, the scale-up of hermetic storage in Tanzania delivers **far-reaching development and climate resilience dividends**. By protecting harvests, empowering women farmers, and reducing food loss, this single intervention unlocks co-benefits across food security, income stability, and national climate goals. The impacts span from household to macroeconomic levels, cutting losses, preserving value, and aligning with Tanzania's commitments under its **NDCs and SDGs**. The following sub-sections summarise these interconnected benefits that make hermetic storage not only a sound investment but a transformative adaptation solution for Tanzania's agriculture and food systems.

Figure 6: Development and Climate Impact Benefits of Hermetic Storage Solutions



a. Enhancing Food Security and Reducing Post-Harvest Losses

Post-harvest losses (PHLs) remain one of Tanzania's largest avoidable drains on food security and rural income. By sealing out moisture, pests, and oxygen, hermetic storage cuts losses from **20–30% to below 5%** for key staples such as maize, rice, and beans (World Bank, 2017)(FAO, 2022).

- **Household resilience:** The adoption of hermetic storage technology (HSTs) is shown to decrease household food insecurity by 43% (Discover Agriculture, 2024). Each tonne of grain saved represents roughly **USD 300–400 of additional household value**, reducing the volatility that drives food insecurity and credit distress during lean seasons.
- **Increase storage capacity:** The adoption of HST is also shown to **increase maize storage quantities by 40%** (Discover Agriculture, 2024). Study of ~1200 households affiliated with maize producer's organizations in Rukwa and Ruwuma regions of Tanzania showed that adopters of HSTs stored an average of 1169.54 kg of maize. However, if they had not adopted HSTs, they would have stored only 701.55 kg, representing a 40% increase led by HST adoption.
- **Food recovered:** Nationwide adoption could preserve up to **1.5–2 million tonnes of grain annually**, equivalent to feeding more than **10 million people per year** (FAO, 2022; World Bank, 2021).
- **Nutrition gains:** Aflatoxin reduction in properly stored maize and groundnuts prevents severe health risks, particularly for children under five, while improving food safety for national and export markets.

b. Gender Empowerment and Inclusive Growth

Women are at the heart of post-harvest management, handling **60–70%** of grain drying, shelling, and storage activities (FAO, 2022). Hermetic storage provides direct and indirect benefits to them:

- **Time and labour savings:** Since women and youth are often involved in post-harvest processing and storage, using hermetic bags helps reduce their labour burden and contributes to **economic empowerment**. Airtight storage eliminates the need for repeated drying and sorting, freeing significant time for other income generating activities or household activities. (BORA GROUP, 2025)
- **Income autonomy:** Women-led cooperatives report **20–25% higher revenues** where hermetic storage enables aggregation and better price timing (AGRA, 2020). USAID funded program CASH-Tz launched in 2021, observed that adoption of hermetic bags allowed women traders to sell maize stored in PICS bags at a 20% premium over chemically treated maize, due to growing consumer demand for safe, chemical-free grains (PICS, 2024).

For banks, these outcomes translate to stronger social impact indicators within green or gender-lens financing portfolios.

c. Economic Efficiency and Market Stability

At the macroeconomic level, scaling hermetic storage would:

- Recover **USD 300–400 million annually** in lost agricultural value. (AGRA, 2020)
- Reduce food import dependence during deficit seasons, improving **trade balance stability**.
- Create demand for local manufacturing of hermetic bags and silos, supporting **employment and SME growth** in the agri-inputs and logistics sectors.

These ripple effects strengthen both **rural livelihoods** and **financial sector stability**, making hermetic storage an integral part of Tanzania’s adaptation and growth strategy.

d. Environmental and Climate Co-Benefits

Hermetic storage systems contribute directly to Tanzania’s **NDC adaptation and mitigation goals** by curbing avoidable emissions and resource waste:

- **Avoided GHG emissions:** Each tonne of grain saved prevents over **1.3–2 tonnes of CO₂e** associated with wasted production, transport, and replanting (ADAS, 2020) (WWF, 2022).
- **Reduced food waste footprint:** Hermetic bags and silos extend grain shelf life by up to **9–12 months**, delaying spoilage and reducing the need for additional production on marginal lands.
- **Environmental safety:** As hermetic storage eliminates the use of chemical pesticides, it reduces **toxic residue exposure** and soil degradation, aligning with **SDG 12.3 (Food Loss Reduction)** and **SDG 13 (Climate Action)**.

e. Alignment with National and Global Goals

Hermetic storage supports multiple national and global priorities:

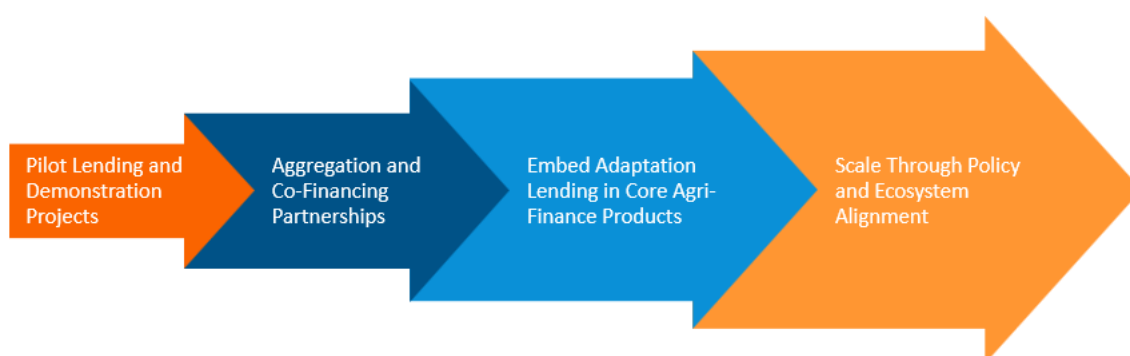
- **Tanzania’s National Climate Change Response Strategy (2021–26):** Prioritises climate-resilient post-harvest systems.
- **Agriculture Sector Development Programme II (ASDP-II):** Emphasises improved storage as a pathway to market efficiency and food safety.
- **Sustainable Development Goals:** Directly advances SDG 2 (Zero Hunger), SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth), and SDG 13 (Climate Action).

In sum, scaling hermetic storage is both a **development multiplier** and a **climate resilience accelerator**, enhancing adaptive capacity, stabilising rural incomes, and safeguarding food systems in an increasingly volatile climate.

Implementation and Scaling Pathway

Unlocking the full potential of hermetic storage in Tanzania will require a **structured and phased approach** that translates proven demand into scalable finance. With strong technical validation, policy backing, and risk-sharing mechanisms already in place, the opportunity now lies in moving from pilot lending to market mainstreaming. The following roadmap outlines **practical steps for banks, DFIs, and ecosystem partners**, from demonstrating credit viability through targeted pilots, to embedding adaptation lending into core financial products, and aligning with national policy frameworks for sustained scale. This approach ensures that climate-resilient storage transitions from donor-driven initiatives to a **self-sustaining, commercially financed adaptation market**.

Figure 7: Implementation and Scaling Pathway for Hermetic Storage Solutions



Step 1. Pilot Lending and Demonstration Projects

Banks can begin by launching **targeted pilot portfolios** in high-production regions such as **Dodoma, Morogoro, Rukwa, and Tabora**, where maize and pulses dominate and post-harvest losses exceed 25%.

- **Pilot design:** Focus on **cooperatives and farmer groups (AMCOS)** handling 50–500 tonnes per season, leveraging existing relationships through **PASS Trust** and **Aceli Africa** pipelines.
- **Ticket sizes:** USD 5,000–50,000 per cooperative for bulk hermetic bags or small modular silos.
- **Institutional capacity building:** As an essential component of the pilot, **training and institutional capacity building** must be provided to both bank staff (on hermetic technology, climate-credit risk, and dedicated loan tracking systems) and borrower groups (on proper product use and maintenance). This ensures high-quality credit performance data is reliably collected from the outset.
- **Financing structures:** Asset finance and value-chain loans, backed by **PASS guarantees** or **Aceli first-loss coverage** to reduce risk during proof-of-concept.
- **Goal:** Build credit performance data, repayment records, and proof of profitability to scale lending sustainably.

Step 2. Aggregation and Co-Financing Partnerships

To move from pilot to scale, banks should partner with **anchor buyers, cooperatives, and DFIs** to aggregate demand and co-finance larger portfolios:

- **Aggregation models:** Bundle multiple farmer loans under one cooperative or off-taker, reducing transaction costs and default risk.
- **Partnerships:** Coordinate with **GCF, AfDB, AGRA, and GCA** to **integrate concessional co-lending and Technical Assistance (TA) support within national resilience finance platforms**. This means securing external funding for initiatives like **matching grants, long-term concessional credit lines,**

and **risk-sharing mechanisms** that de-risk the portfolio for the commercial lender and reduce the cost of borrowing for the farm.

- **Leverage blended finance:** Combine commercial capital with concessional lines or guarantee cover to extend affordable loan terms and scale outreach.

Step 3. Embed Adaptation Lending in Core Agri-Finance Products

Once early pilots demonstrate viability, hermetic storage finance can be mainstreamed into existing **agriculture and MSME credit lines**:

- Integrate as an **eligible asset** under green finance products or sustainability-linked loans.
- Bundle financing for storage alongside inputs or mechanization, creating **multi-product resilience packages**.
- Use borrower performance data from pilots to design **risk-based pricing models** and internal credit scoring tools for scale lending.

Step 4. Scale Through Policy and Ecosystem Alignment

Sustained scaling will depend on enabling ecosystem coordination:

- **Policy alignment:** Leverage the **Agriculture Sector Development Programme (ASDP-II)** and **Tanzania's NDC implementation framework**, which prioritise post-harvest management and climate adaptation.
- **Market awareness:** Support farmer training and awareness campaigns with **FAO, GAIN, and AGRA** to drive adoption and ensure consistent demand.

Impact tracking: Integrate key KPIs into lending programs, loss reduction (%), repayment rate (%), and value preserved (USD), to measure adaptation impact and attract green capital inflows. The effectiveness of adaptation investments must be measured not only by initial uptake but by tangible outcomes linked to financial stability. To address this, key performance indicators (KPIs) for lending programs must integrate A&R outcome measurements that the bank can directly link to both credit risk reduction and customer resilience.

A&R Outcome Measurements for Financial Institutions:

Resilience Component	Outcome Metric (Customer Resilience)	Financial Translation (Bank Risk Reduction)
Reduced Sensitivity	Loss Reduction (%): Decrease in yield/asset loss from climate shocks (e.g., drought, flood) compared to a control or baseline, demonstrating reduced operational sensitivity.	Reduced Probability of Default (PD): Stabilized borrower cash flow, leading to improved repayment rate (%), lower default risk, and fewer restructured loans.
Increased Adaptive Capacity	Value Preserved (USD): Increase in market value of collateral or productive assets (e.g., livestock, equipment, harvested crops) due to protective measures (e.g., cold storage, irrigation).	Reduced Loss Given Default (LGD): Higher recoverable value of collateral and faster post-shock recovery time, minimizing potential loan losses.
Systemic Stability	Access to Services (%): Percentage of customers retaining access to critical services (e.g., digital advisory, energy, water) immediately following a major shock.	Portfolio Stability: Lower covariance of defaults across the portfolio during climate events, reducing systemic risk concentration.

Integrating these key A&R outcome measurements, such as **Loss Reduction (%)** and **Value Preserved (USD)**, into lending programs is essential. This not only allows the bank to internally track de-risking benefits but also serves as the necessary evidence base to attract concessional or green capital inflows from external investors who require demonstrable climate impact. This approach aligns with frameworks from organizations like GOGLA, which emphasize measuring the positive adaptation and resilience impact of investments to drive scale.

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