

Koolhome by Koolboks

Pay-as-you-go solution that makes refrigeration accessible to small business owners

The Koolhome is a solar-powered refrigeration solution that generates continuous cooling for up to 4 days, even under limited sunlight conditions. Designed and deployed by Koolboks, the pay-as-you-go (PAYG) enabled solution consists of different products, such as chest freezers and 'combo' fridge-freezers, designed to store energy in the form of ice and within lithium-ion batteries. In addition to cooling, Koolhome solutions also provide lighting and phone charging functions through USB ports. The solution primarily targets small business owners who deal in perishables and require continuous cooling. This case study describes the Koolhome solution, and how the business and financing model evolved to meet local market needs in Nigeria, whilst highlighting lessons learned and the potential for replicability.



Figure 1. A shop owner with her Koolhome solar chest freezer (Source: Koolboks, 2023)

General information

Project name	Koolhome by Koolboks, Nigeria operations (2018-2023)
Developer	Koolboks www.koolboks.com ; www.koolboksnigeria.com
Location	Primarily Southwest Nigeria
Focus dimension	Productive use of energy
Type of action	Productive use appliance business intervention
Financing sources	Equity, debt, grants
Technology	Off-grid Solar PV refrigeration

Introduction

An estimated 37 to 45 percent of Nigerian agricultural production that requires refrigeration is lost due to inefficient or non-existent cold chains (IFPRI, 2018). Food spoilage due to a lack of cold storage costs 93 million small farmers in Nigeria 25 percent of their annual income (Nigeria Health Watch, 2023). Many small business owners that deal in perishables and cannot afford generators must sell their perishables at low prices while they are still fresh to avoid spoilage. Others depend on petrol generators for refrigeration, but are increasingly impacted by the fuel prices -which tripled in 2023- and the cost of generator maintenance. Solar-powered cold storage solutions aim to address this challenge through innovative business models that meet the specific needs of small business owners.

Koolboks was founded in 2018 as a French start-up that provided outdoor camping smart coolers for the European market. However, the covid pandemic impacted the company's sales and operations and led to a pivot of their focus to sub-Saharan Africa (SSA), where the pandemic had also underlined

the challenge (and opportunity) for cold storage solutions. This resulted in the Koolhome, a PAYG cold storage solution for small business owners with limited or no electricity access. In Nigeria, Koolboks focuses on urban, peri-urban and rural small businesses that deal in perishables, particularly in Lagos, Oyo, Kwara, and Ondo states. The company also provides cold storage solutions for critical service providers such as healthcare facilities. Koolhome is also sold across 18 countries in SSA via distributors.

Technology and operational model

The key technological innovation that Koolhome units integrate is the use of [ice thermal storage](#) technology. Each cabinet is well insulated and contains compartments for ice production during the day when power is produced by the PV panels or available from the grid. At night, these 'ice batteries' are able to maintain the temperature of the cabinet until the next day when the sun is available. This energy storage system, which is complemented with integrated lithium-ion batteries, significantly decreases the cost of the appliance. Depending on the conditions, the Koolhome can generate continuous refrigeration for up to four days in the absence of electricity and with limited sunlight.

Koolhome solutions were originally only freezers and comprised a wide range of sizes – 108L, 158L, 208L, 538L, and 1028L capacities– intended to cater to the varied cold storage needs of its target rural and urban customers. However, Koolboks discontinued its 108L and 1028L freezer solutions due to low market demand resulting from these models being 'too small' and 'too expensive', respectively. Its 208L freezer has recorded the most demand, most likely as it provides a balance in capacity and cost.

Key figures

- 1,700 Koolhome solutions deployed to small business owners across the country, most of which are women
- 358 tonnes of food waste avoided through the use of Koolhome solutions to date
- 21,000 tonnes of GHG emissions avoided to date by displacing petrol and diesel generators



Figure 2. Ice compartments maintain the temperature of the freezer's cabinets (Source: Koolboks, 2023)

Powering the freezers requires between 1 and 4 350W solar PV panels, depending on the size of the freezer, which also informs the capacity of the battery.

In response to the needs of the market for solutions with both cooling and freezing functions, Koolboks added 'combo fridges' to its line of Koolhome solutions, which currently only come in a 128L capacity.

In addition to its primary cold storage function, Koolhome products are equipped with four USB ports able to power two external LED bulbs and two mobile phones, thus serving additional energy needs.

"Ever since, I got the Koolboks, my profit margin has increased. Life has been made easy. I pay my monthly instalments with ease."

Mrs. Aderinoye (Restaurant owner)

Their design also includes the 'powerfoot', a base compartment with wheels enabling the system to be easily mobile whilst incorporating all cables and other components elements. Incorporating these additional functions in addition to its primary cold storage function increases its value-added to the customer and the customer's willingness to pay.

Koolhome products incorporate a PAYG lease-to-own payment system supported by [Angaza's](#) Customer Relationship Management (CRM) solution. Customers make payments through their mobile phones or a Point-of-Sale (POS) agent upon which a code is sent to the customer's phone which serves to activate the unit.

The units are also equipped with small, low-cost sensors which allow Koolboks to connect to the solutions remotely using IoT technology, monitor key metrics and carry out preventive maintenance. In combination with billing data from the PAYG technology and CRM tool, this information also allows Koolboks to track customer usage and credit performance (GSMA, 2022). Koolhome products include a 3-year warranty.

Business and financing model

The initial business model evolved in order to adapt to the specific needs of the market. The original model aimed to leverage the platforms of commercial banks and e-commerce companies to sell their products and provide consumer financing. However, this was unsuccessful as small business owners had limited credit history and in some cases no bank accounts. This informed Koolboks' pivot towards the integration of PAYG solutions into product design, and towards developing robust sales and after-sales departments.

As with many off-grid solar solutions, the business model is designed to address the challenge of affordability among low-income customers. Koolhome's consumer financing approach is highly personalised and works as a lease-to-own model. Customers are able to pay in instalments for a period of 3 to 24 months, starting from approximately USD 10 per month, and also have the option of paying weekly. The wide range of options allows customers to choose the ideal solution for them based on their financial capacity and credit appetite, which differs across the urban, peri-urban, and rural areas.

Koolboks employs a [Know-Your-Customer \(KYC\)](#) system to evaluate credit risk of potential customers, works in partnership with credit bureaus, and has a dedicated credit collection team tasked with recovering debts from defaulting customers. The company considers that this three-pronged approach is the key to the low observed rates of credit defaults, which are estimated at 3.5%.

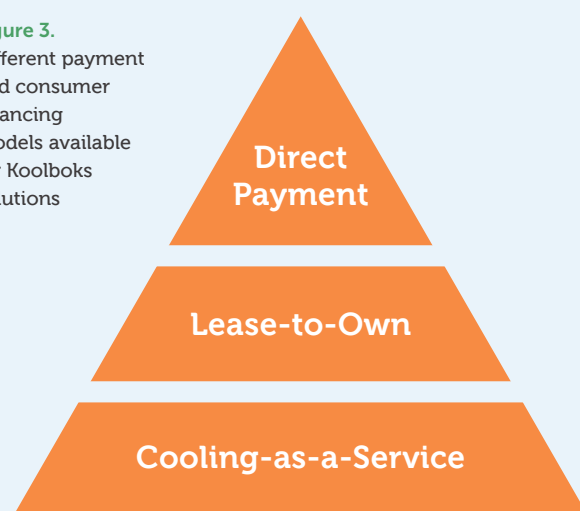
Koolboks also actively explores and leverages partnerships with local distributors, market cooperatives, associations, microfinance banks, and Fast-Moving Consumer Goods (FMCG) companies to scale the deployment of their solutions to their target market. A few examples include partnerships

with Coca Cola, Danone (producers of yoghurt drinks), and the [LAPO microfinance bank](#), through which they also provide consumer finance for their solutions while leveraging their nationwide client base. This significantly increases sales beyond their primary locations in Lagos, Ibadan, Ilorin, and Akure, without having to invest in setting up local presence.

Koolboks also partners with mini-grid developers to deploy Koolhome solutions (EAP, 2023). This is a potential win-win for both parties as the developer can maximise mini-grid utilisation through productive uses without the additional burden of investing in productive use appliances. On the other hand, Koolboks leverages the developers' community network and presence in rural locations with minimum logistical costs.

It is interesting to note that, for other customer segments, such as health facilities and other critical service providers, Koolboks utilises a 'cooling as a service' model which involves paying a monthly subscription for continued access to cooling, but not owning the product at any point (Figure 3).

Figure 3.
Different payment and consumer financing models available for Koolboks solutions



Koolboks has raised finance through a mix of debt, equity, and grants from impact investors, development partners and philanthropies. The first funding it obtained from the Powering Renewable Energy Opportunities programme (PREO) allowed the company to test consumer response to KoolHome solutions, and to then pilot the product with 300 fish and frozen food traders in Lagos markets, most of which were women. Koolboks then went on to raise significant investments, totalling USD 3.5 million (Tech Crunch, 2022). A major milestone was reached in November 2022, with a USD 2.5 million seed funding investment from a consortium investors: [Acumen's](#) Powering Livelihoods Using Solar (PEII+) initiative, [All On](#), [Aruwa Capital Management](#), [Blue Earth Capital](#), [GSMA](#), and others. To raise this investment, Koolboks made use of support available to solar off-grid companies, such as [GET.invest's Finance Catalyst](#), which helped strengthen its business plan (GET.Invest, 2023). The investors also carried out rigorous due diligence with the support of Power Africa (CrossBoundary, 2022). In late 2023, Koolbox secured a grant to support the set-up of a local assembly plant. Lastly, Koolboks is currently exploring the use of grants such as the results-based financing scheme of the [Nigeria Electrification Project \(NEP\)](#) to cater to their rural market.

Social and environmental impacts

Koolhomes has a range of social impacts, in particular where it relates to gender and financial inclusion. Koolboks has developed a solution to address the need for affordable and reliable cooling in a specific customer segment: small business owners. While 40% of small businesses in Nigeria are owned by women, Koolboks has observed that



Figure 4. The majority of Koolhome customers are women-led businesses (Source: Koolboks, 2023)

the majority of Koolhome customers are women-led businesses. Koolboks has incorporated the needs of its women customers with specific initiatives, including capacity building on financing literacy skills, which allows them to attract further financing for their businesses.

A key environmental impact of the Koolhome solution is the displacement of petrol-powered generators and their harmful local air and climate pollutants. The company also seeks to address environmental impacts in various ways:

- **E-waste:** Koolboks partners with [Scrapays](#), a scrap-4-new initiative that incentivises people to trade in their old end-of-life freezers for Koolhome solutions at a 15% discount on the product price.
- **Used batteries:** Koolboks partners with the [Alliance for Responsible Battery Recycling \(ARBR\)](#) and [Hinckley](#) for the disposal and recycling of their end-of-life lithium-ion batteries.
- The products use environmentally friendly refrigerants (GSMA, 2022).

Whilst it currently imports all its Koolhome solutions, the company plans to explore local assembly during 2024.

Replicability

The potential savings that could be achieved by reducing post-harvest losses through cold storage for fish, milk, orange, cashew, and tomatoes are estimated to be around USD 268 billion annually (Power Africa, 2022). This underlines the enormous market potential for new entrants into the Nigerian cold storage market.

Koolboks, and other solar cold storage companies, are demonstrating the viability of solar powered solutions in important segments of the market, and providing key lessons to new entrants. Further innovation in technology and business models will be required to meet the scale of the demand and overcome key constraints in the sector, such as poor access to finance. Macroeconomic constraints such as rising inflation and currency devaluation further constrain the growth of new and existing cold storage companies in Nigeria.

Some potential solutions include unlocking local sources of financing and increasing consumer awareness on sustainable cold storage solutions. Moreover, product affordability can be improved by, on the one hand, further localising the value chain through local assembly, and, on the other hand, reducing importation costs for sustainable cold storage appliances through import duty waivers.

Future Outlook

By 2027 Koolboks aims to:

- Impact 1 million Nigerians
- Empower 137,000 women small business owners
- Avoid 54,000 tonnes of food waste and 2.4 million tonnes of GHG emissions

By 2024, Koolboks aims to localise the assembly of Koolhome solutions in Nigeria

Lessons learnt

Several lessons can be drawn from Koolboks' experience in adapting to the needs and realities of the Nigerian cold storage market:

- Being responsive and flexible in adapting the product, business model and service delivery to consumer needs is essential to increasing product value add and adoption.
- Identifying and leveraging partnerships is a cost-effective way to scale in new markets, improve product value add and commercial viability of the company.
- A range of financing sources, data, and tools can be leveraged by new entrants in the Nigerian solar cold storage market, including for product development and piloting stages.

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Further resources

Koolboks Nigeria website:

<https://www.koolboksnigeria.com/>

Koolboks youtube channel: <https://www.youtube.com/channel/UCFjTO4s-zYbk7kEb89deEzQ>



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