

SOLAR-POWERED SMART COLD BOX

Name: David Obafemi, Christianah Ademola, Samuel Ojo, Joshua Adeyemi, Simileoluwa Adegboyega,

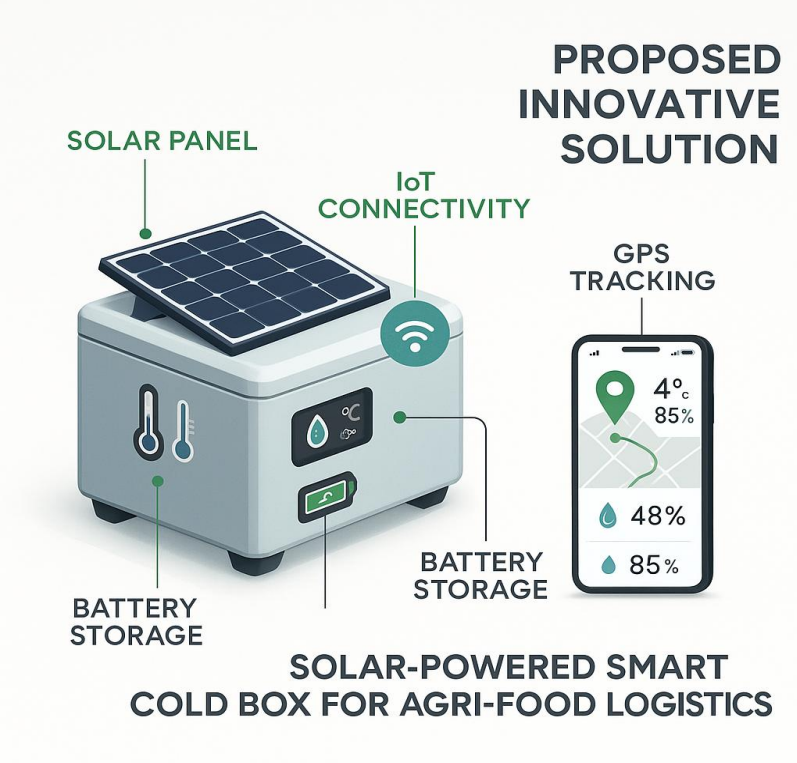
Affiliation: Federal University of Technology, Minna (Affiliated to Federal Polytechnic Offa)

Proposed Solution

To combat post-harvest losses, increase farmer income, and reduce food waste in the nation. We propose a solar-powered, smart cold box. The smart cold box is a mobile cold storage, powered by renewable energy and equipped with IoT sensors for real-time temperature, humidity, and location monitoring. This solution will keep produce fresh from the farm to the market. It's modular, affordable, and tailored to all categories of farmers & vendors. This System will reduce spoilage by up to 80%, enhance food security, and support youth employment in agri-tech and green energy. It's not just a storage- it's a way of **Revolutionizing the Nation's Agric-Food Supply chain**.

Technical Design

Leveraging on the principles of thermodynamics, the smart cold box is powered by solar photovoltaic (PV), connected to a Direct Current (DC) vapor compression cooling unit and a battery bank capable of 24-48 hours of backup. This unit is equipped with digital sensors to monitor temperature, humidity, and battery levels. These parameters are accessible in real-time via an onboard display, mobile app, or SMS alerts. With GPS integration. Constructed using insulated, food-grade materials while maintaining light weight and ruggedness. It supports modular upgrades, such as WiFi-enabled diagnostics, and multi-user cloud platforms and vehicle-mounted solar arrays.



Economic feasibility/Proposed Business Model

The Smart Cold Box is designed with economic inclusivity and long-term sustainability. With a modular pricing model, users can start with a basic package for under #500,000, and scale up as their needs and income grow. By reducing spoilage by up to 80%, users can recover up to #200,000 - #1 million in monthly value that would otherwise be lost, achieving payback within 12- 24 months.

STARTER PLAN (100L)	GROWTH PLAN (150L)	ENTERPRISE PLAN (200L)
Cold box with built-in solar panel	All of Starter plan	All of growth plan
Offline Monitoring via onboard display	Advanced IoT sensor with WiFi option	External solar integration with vehicle mount
Basic IoT Sensors	Real-time monitoring via mobile app	Extended GPS range & internet upload
SMS Alert system only	Basic GPS tracking (viewable on phone)	Multi-user cloud sync
24-48 hrs. Battery bank	Dual solar power sources	Remote diagnostics & predictive maintenance

Tiered plans, leasing or direct sales, with our modular design and flexible installment payment for small, medium, and large-scale farmers, aggregators, and market vendors.

Timeline for developing prototype/trial

Phase	Activities
Research & Design (1 week)	Confirm technical design & system requirement
Component Sourcing (2 weeks)	Procurement of materials
Prototype Fabrication (3 weeks)	Prototype Build & Component Integration
Software Integration (2 weeks)	Embedded Systems & IoT integration
Functional Testing & System Validation (1 week)	Performance testing and validation of system stability
Pilot Deployment, Real-world Evaluation & Feedback (3 weeks)	Deployment of prototype, monitoring real-time use, and gathering of performance data

In 12 weeks our solar smart cold box will be ready to use on farms, in market and other industries, and be ready to produce at scale.

Budget & Target User/Market/Scale

With a unit cost starting at #500,000, the smart cold box offers tiered pricing, leasing, and installment plans to reach smallholder farmers, vendors, and aggregators. It is targeting a #3.5 trillion annual loss market and aims to achieve a 80% reduction in spoilage across Nigeria supply chain.

References

- [1] BusinessDay 2024. Techstars Africa: Nigeria losses #3.5trn to post-harvest spoilage [Online]. Available: <https://businessday.ng/agriculture/article/Nigeria-can-tackle-n3-5trn-post-harvest-losses-with-effective-cold-chain> (Reference to a report)
- [2] FAO & IIR 2022. Refrigeration Sector Monitoring: Reducing post-harvest food losses in Sub-Saharan [Online] Africa. Available: <https://iifir.org/en/news/reducing-post-harvest-food-losses-in-sub-saharan-africa>

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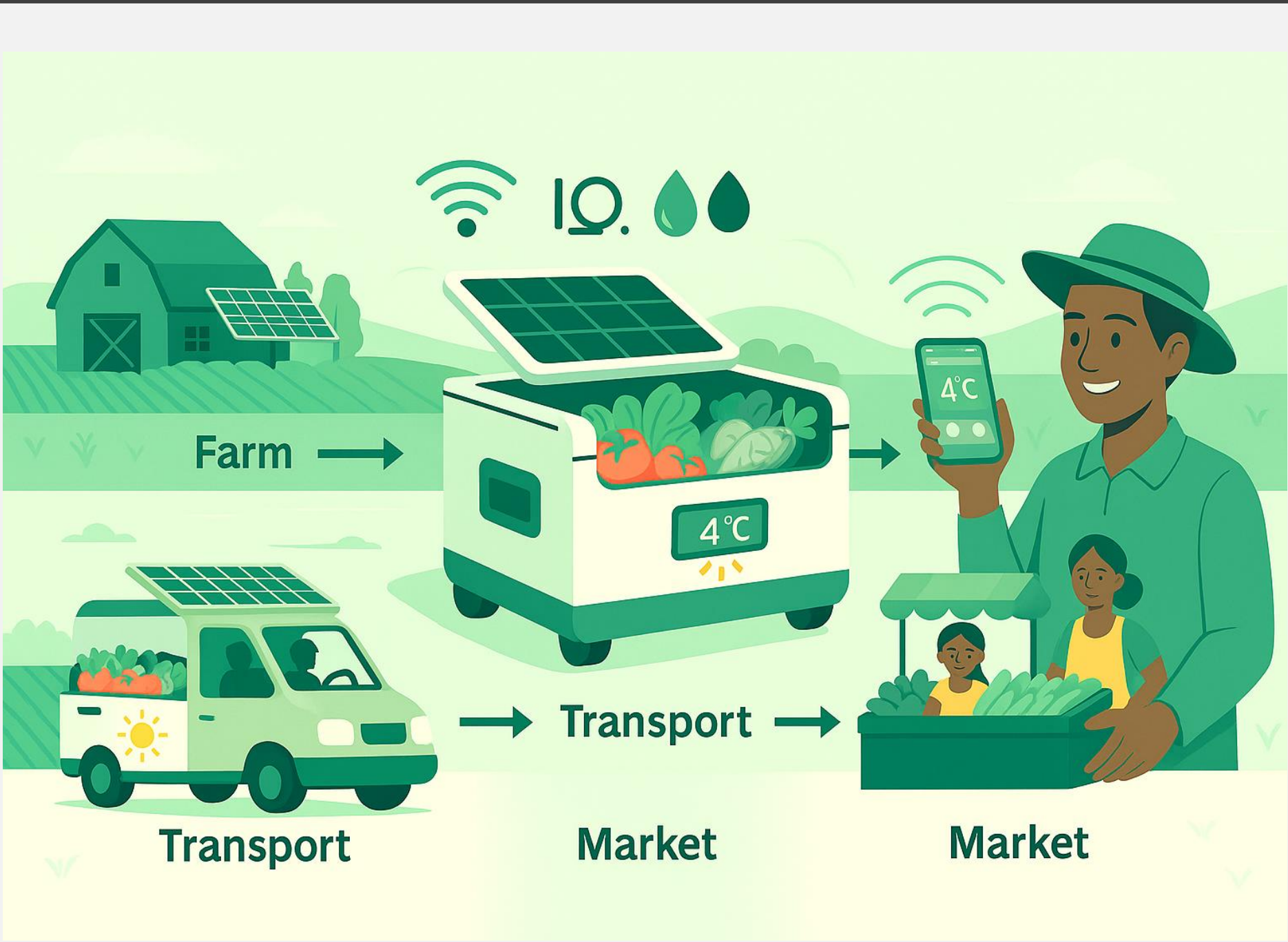


Fig. 1: Illustration of the Solar-Powered Smart Cold Box Integrated into the Agri-Food Supply Chain