Post-Harvest Loss Analysis Report

Project Title: Nigerian Post-Harvest Losses
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1. Overview

This analysis examines the key factors that contribute to post-harvest loss (PHL) and revenue loss in the agricultural value chain. Using Excel-based dashboards and PivotTable-driven metrics, we discuss how storage methods, transport type, market access, weather conditions, and capacity-building efforts affect spoilage and profitability. The goal is to provide actionable insights to reduce losses and improve outcomes for smallholder farmers and stakeholders in the agricultural sector.

2. Key Findings & Metrics

Crop-Specific Analysis

- Highest Spoilage Rate: Rice recorded the highest average PHL (19.58%).

Storage Methods

- Most Effective Storage: Farmers using Crates reported an average spoilage amount of 37.83 kg, compared to 39.03 kg for Open Shed.
- Conditional Effectiveness: Certain storage methods performed better under low humidity (< 39%) and moderate temperatures (< 25°C), suggesting that climate-appropriate storage solutions are critical.

Transport Type & Distance

- Highest Spoilage by Transport Type: *Motorcycles* were most associated with spoilage and revenue loss, especially over longer distances.
- Relationship Observed: A negative correlation was noted between longer transport distances and higher spoilage. Also, between transport distance and revenue loss.

Market Access

- Farmers with moderate market access (roads, infrastructure) reported high revenue losses (₦8,387.48 avg.) compared to those with good access (₦8,240.68 avg.) and poor access (₦8,090.19 avg.)

Capacity Building & Youth Involvement

- Trained Farmers: On average, farmers who received post-harvest handling training experienced more spoilage (39.24 kg avg.) and revenue loss (₦8,293.19 avg.).
- Youth Involvement: Regions with youth participation showed slightly higher post-harvest loss percent (19.32%).

Temperature & Humidity Effects

- Spoilage is significantly higher when average temperature > 35°C or relative humidity > 80%.
- Combo charts revealed a linear spoilage pattern, showing that as temperature and humidity increase, post-harvest losses rise steadily, especially for highly perishable crops such as tomatoes

3. Dashboard Features
Post-Harvest Loss (PHL) Dashboard

The interactive Excel dashboard includes:

- Slicers for Harvest Seasons and Years
- KPI tiles (in shapes) for:
    - Total Harvest (KG)
    - Total Spoilage (KG)
    - Average PHL (%)
    - Total Revenue Loss (₦)
    - Average Market Price (₦)
- Dynamic charts showing:
    - PHL vs. Region
    - PHL vs. Crop Type
    - Temperature vs Spoilage and PHL
    - Technology vs PHL
    - PHL vs Youth Involvement
    - Icons containing links to the insight in full

Spoilage Amount Dashboard

The interactive Excel dashboard includes:

- Slicers for Harvest Years, Market Access and Region
- KPI tiles (in shapes) for:
    - Total Harvest (KG)
    - Total Spoilage (KG)
- Dynamic charts showing:
    - Spoilage amount vs Transportation Type
    - Spoilage amount vs. Spoilage method
    - Humidity vs Spoilage amount and PHL
    - Spoilage vs Transport Distance
    - Icons containing links to the insight in full

4. Comprehensive Analysis

Production and Spoilage

Rice had the highest average post-harvest loss (PHL) percentage at 19.58%, making it the most vulnerable crop to loss, while Yam recorded the lowest average PHL at 19.08%. Among storage methods, farmers using **crates** reported the lowest average spoilage amount (37.83 kg), whereas those using **open sheds** experienced the highest (39.03 kg). Additionally, the **North East Region** recorded the highest average post-harvest loss across regions, at 19.57%.

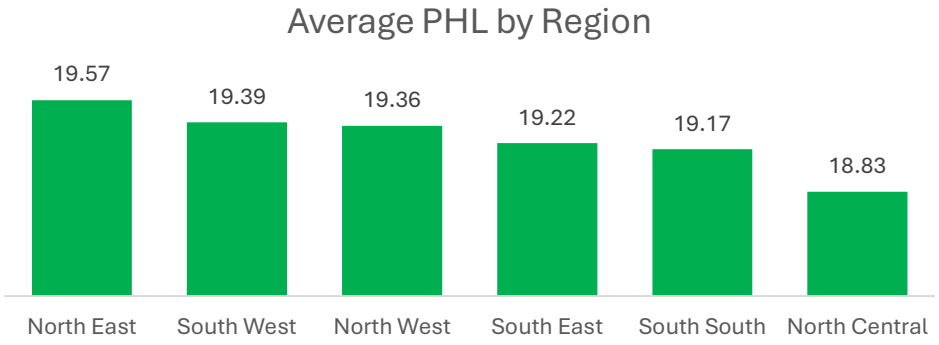

Figure 1. Relationship between post-harvest loss and Region in Nigeria

Logistics and Transportation

The average spoilage amount and revenue loss exhibit a nonlinear pattern. Notably, transport distances between **136 and 151 kilometers** recorded the highest average spoilage (55.10 kg) and revenue loss (₦13,227). Among transport types, **motorcycles** were linked to the highest average revenue loss (₦8,710.85) and spoilage amount (39.19 kg), while **trucks** recorded the lowest figures—₦7,917.12 in revenue loss and 37.47 kg in spoilage, making them the most reliable mode of transportation.

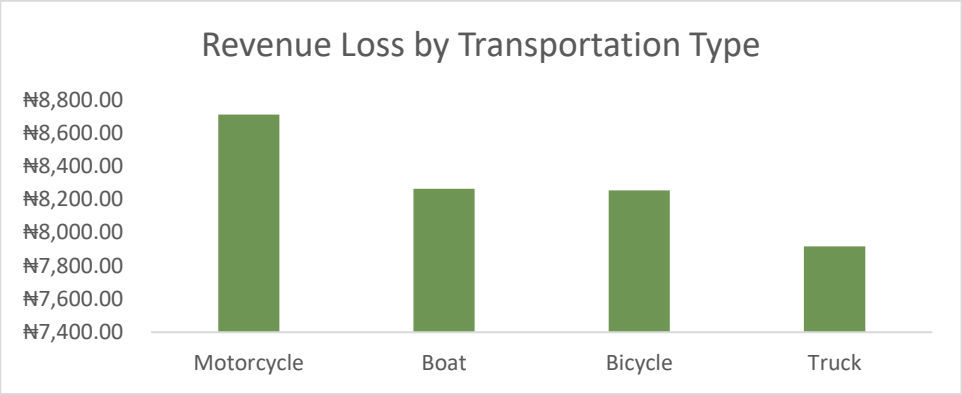

Figure 2: Relationship between Revenue Loss and Transportation Type

Table 1: Relationship between Spoilage Amount and Transportation Type

Transport Type	Average Spoilage Amount
Truck	37.47
Boat	38.88
Bicycle	38.93
Motorcycle	39.19
Grand Total	38.61

Market and Revenue

Pepper recorded the highest total revenue loss across all regions, while **Cassava** recorded the lowest. Farmers with **moderate market access** (in terms of roads and infrastructure) experienced the highest average revenue loss (₦8,387.48), compared to those with **good access** (₦8,240.68) and **poor access** (₦8,090.19). Across all regions, **Pepper** also had the highest average market price, followed by **Tomato**, while **Cassava** had the lowest.

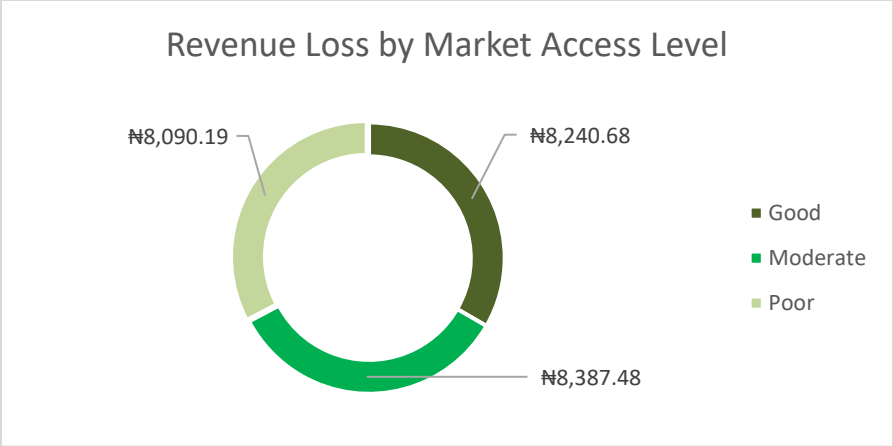

Figure 3: Relationship between Revenue Loss and Market Access Level

Youth Involvement and Training

Regions with **youth participation** recorded a slightly higher average post-harvest loss percentage (19.32%). Interestingly, farmers who received **post-harvest handling training** experienced higher average spoilage (39.24 kg) and revenue loss (₦8,293.19). Technology also plays a key role in reducing losses: the use of **hermetic bags** resulted in the lowest average post-harvest loss (18.76%), while farmers who **did not use any technology** recorded the highest (19.38%).

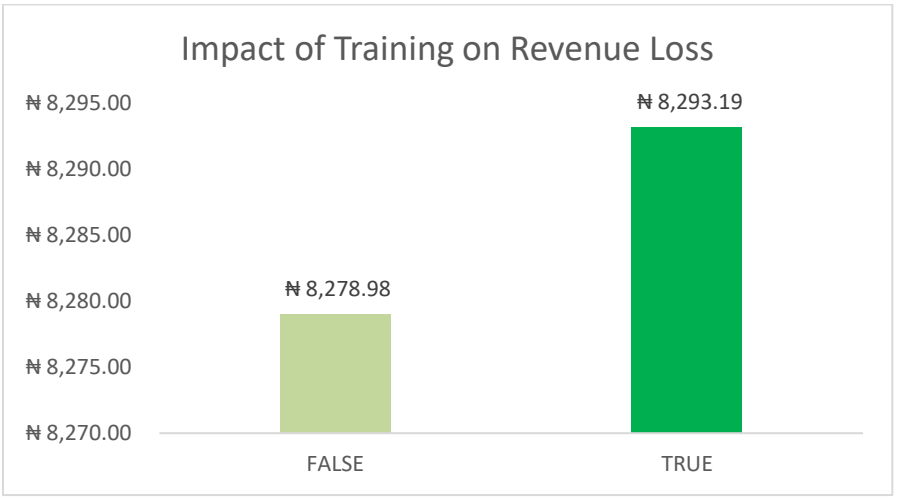

Figure 4: Impact of Technology on Revenue Loss.

Environment Factor

Spoilage and post-harvest losses (PHL) are significantly higher when the **average temperature exceeds 35°C** or **relative humidity rises above 80%**. Combo charts reveal a **linear pattern**, indicating that as temperature and humidity increase, spoilage and PHL rise steadily, particularly for highly perishable crops like **tomatoes**. The data also show that these losses occur **across all storage methods**, highlighting the widespread impact of extreme environmental conditions.

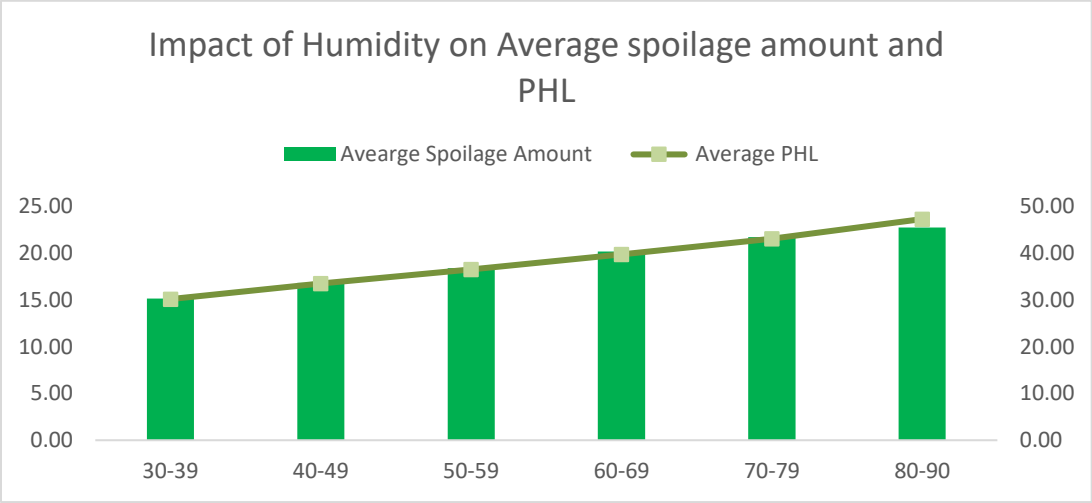

Figure 5: Impact of Humidity on Spoilage Amount and PHL

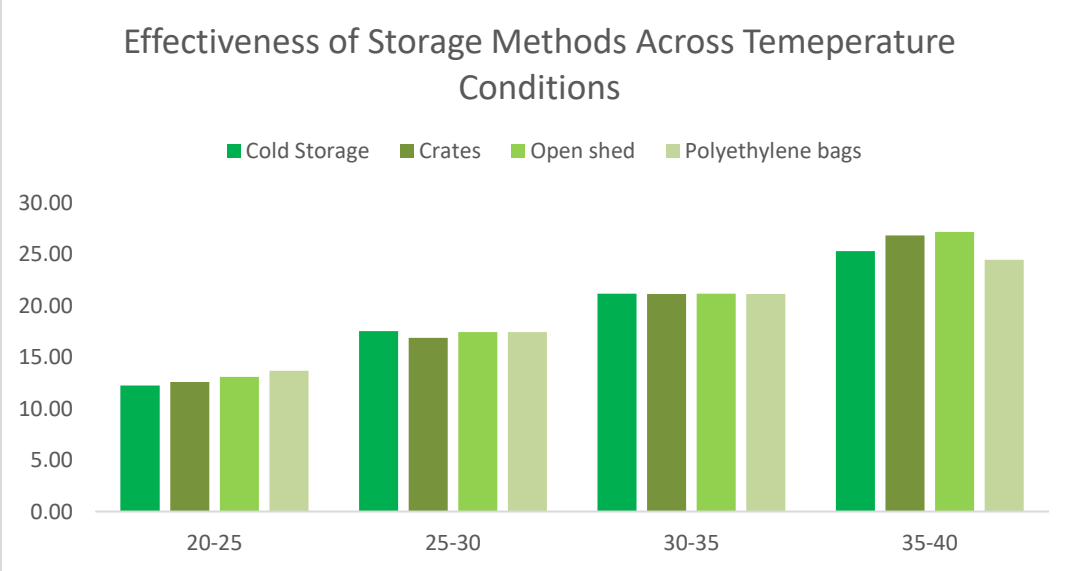

Figure 4: Effectiveness of Storage Methods across Temperature Conditions

5. Recommendations

Based on the findings of this analysis, here are some evidence-based recommendations that can be made to reduce losses and improve outcomes for smallholder farmers and stakeholders in the agricultural sector:

1. Promote the Use of Hermetic Storage Technologies
    - Since hermetic bags recorded the lowest PHL (18.76%), their adoption should be encouraged through subsidies, training, or partnerships with suppliers.
    - Consider scaling up distribution, especially in regions with high spoilage.

2. Improve Transportation Methods and Infrastructure
    - Motorcycles were linked to the highest spoilage and revenue loss, while trucks had the lowest. Where feasible, the use of trucks or safer transport options should be promoted.
    - Improve rural road networks and transport infrastructure, especially in areas with moderate access, which surprisingly showed higher losses than poor-access areas—possibly due to high volumes with inefficient handling.

3. Temperature and Humidity Monitoring
    - PHL increases above 35°C and 80% humidity, so implementing cool storage solutions (even low-cost evaporative cooling or shaded storage) is essential.
    - Encourage the use of weather monitoring tools or mobile alerts to help farmers and cooperatives plan harvest and storage better.
4. Rethink and Strengthen Post-Harvest Training
    - Farmers who received training experienced higher spoilage and revenue loss, suggesting that either the training was outdated, poorly implemented, or not suited to the farmers' actual context.
    - Review and revise training content to ensure it is practical, crop-specific, and includes hands-on demonstrations and follow-up support.
5. Focus on High-Risk Crops Like Tomatoes and Peppers
    - Since pepper and tomato show the highest PHL and revenue loss, interventions should be crop-targeted, such as:
        - Better packaging materials
        - Cooling and moisture-resistant storage
        - Training in early harvesting and quick market delivery

6. Engage Youth in Value-Added Post-Harvest Services
    - Youth involvement is linked to slightly higher PHL, possibly due to inexperience. Instead of discouraging youth participation, channel it into value-added activities like:
        - Aggregation centers

    - Digital tracking of spoilage
    - Startups around cold storage or last-mile delivery
    -
7. Support Regions with High Vulnerability
    - Regions like the North East, and those using open sheds, should receive targeted support through:
        - Infrastructure upgrades
        - Access to crates or better storage methods
        - Market linkages to reduce time in the supply chain

6. Limitations

- Analysis is based on available datasets; further validation with seasonal data is needed.
- Not all spoilage causes (e.g., pest damage, manual error) are fully isolated in the current dataset.

7. Conclusion

This analysis confirms that **reducing post-harvest loss** requires **multi-pronged action**: better infrastructure, farmer training, climate-aware practices, and youth-driven innovation. The insights provided should help stakeholders develop **targeted interventions** and measure impact over time.

8. Appendix

Table 2: Data Overview

Variable Name	Description	Data Type
Farmer_ID	Unique identifier for each youth agripreneur	Categorical
Region	Geographic location or administrative zone	Categorical
Crop_Type	Type of crop harvested	Categorical
Harvest_Season	Season of harvesting (could also use actual dates)	Categorical
Harvest_Date	Date of harvest	Date
Storage_Method	Method used to store the crop	Categorical
Storage_Duration_Days	Number of days the crop was stored	Numeric
Transport_Type	Mode of transport used	Categorical
Transport_Distance_km	Distance to market in kilometers	Numeric
Market_Access	Ease of access to market (Good, Moderate, Poor)	Ordinal
Temperature_C	Average temperature during storage/transport	Numeric
Humidity_Percent	Humidity level during storage/transport	Numeric
Spoilage_Amount_kg	Amount of crop lost/spoiled	Numeric
Total_Harvest_kg	Total weight of harvested crop	Numeric
PHL_Percent	Post-harvest loss percentage (calculated: Spoilage / Total Harvest * 100)	Numeric
Youth_Involved	Whether a youth group/individual was involved	Boolean
Training_Received	Whether farmer had any training on post-harvest handling	Boolean
Tech_Used	Technology or innovation used (if any)	Categorical
Market_Price_NGN_per_kg	Selling price per kg in market	Numeric
Revenue_Loss_NGN	Estimated revenue loss due to spoilage	Numeric