FEASIBILITY STUDY

ENHANCING AGRIBUSINESS WITH SMART HYDROPONICS: A TECHNOLOGICAL APPROACH TO TOMATO & VEGETABLE FARMING

1.0 Executive Summary

This project builds a modular smart hydroponic facility (500 m² footprint, 4-tier vertical racks → 2,000 m² effective growing area) to produce tomatoes and high-value leafy vegetables (priority: lettuce + cherry/cluster tomato). The design emphasizes low-cost greenhouse construction, vertical stacking, basic automation (pH/EC dosing, environmental sensors, remote monitoring), and premium-market off-take (supermarkets, restaurants, processors). Under conservative yield and price assumptions the model generates ~₦74.2M annual revenue, ₦40.8M EBITDA and achieves breakeven ≈ 1.23 years, meeting the 1st–2nd year breakeven target (detailed assumptions below).

2.0 Market Rationale and Opportunity

- Urban and peri-urban Nigerian demand for year-round fresh lettuce and quality tomatoes remains strong; premium/consistent supply fetches higher, stable prices.
- Hydroponics reduces seasonality, post-harvest losses and water use; premium buyers (supermarkets, hotels, processors) pay for consistency and quality.
- Risks: price volatility, power costs and buyer concentration. These are addressed in the mitigation section.

3.0 Technical Design (Summary)

- Structure: low-cost galvanized frame + UV greenhouse film; 500 m² footprint
- Growing system: vertical racks (4 tiers) using NFT/DWC for lettuce; trellis/NFT for determinate/cherry tomato varieties.
- Automation: pH & EC probes, nutrient dosing pump, temperature/humidity sensors, simple PLC or cloud-connected controller, remote dashboard.
- Utilities: hybrid power approach: grid + inverter + battery buffer + provision for future solar; water from borehole with filtration & reservoir. (Power cost risk noted below.)

4.0 Production plan and agronomy assumptions (conservative)

- Effective growing area (4 tiers): **2,000 m²** (500 m² × 4 tiers).
- Crop mix by effective area: Lettuce 60% (1,200 m²); Tomato 40% (800 m²).
- Yields (hydroponic conservative): Lettuce **35 kg/m²/yr**; Tomato **50 kg/m²/yr**.
- Annual production: Lettuce **42,000 kg**; Tomato **40,000 kg**. (Calculations in Appendix.)

Price assumptions (conservative, premium channels): Lettuce **₦1,100/kg**; Tomato **₦700/kg**. (Local wholesale/retail rates vary; model uses achievable premium channel prices.)

5.0 Financial Model (summary, NGN): Year 1 steady state (rounded)

CAPEX (₦50,000,000 total budget cap):
• Greenhouse, structure, racks & civil: ₦17M
• Hydroponic system (channels, reservoirs, pumps): ₦8M
• Automation & sensors (pH/EC, controllers, dashboard): ₦5M
• Water & filtration, plumbing: ₦3M
• Power (inverter, batteries, initial genset): ₦6M
• Seedlings, initial nutrient stock, consumables, packaging: ₦2M
• Training, permits, working capital (3 months): ₦5M
• Contingency (10%): ₦4M

Revenue (annual)
• Lettuce: 42,000 kg × ₦1,100 = **₦46,200,000**
• Tomato: 40,000 kg × ₦700 = **₦28,000,000**
Total revenue = ₦74,200,000

Operating costs (OPEX) : inputs, labour, utilities, packaging, maintenance, transport: assumed **45% of revenue = ₦33,390,000**.
EBITDA = ₦40,810,000 (**₦74,200,000 - ₦33,390,000**)
Net profit (illustrative margin 30%) = ₦22,260,000.

Breakeven (simple capex / EBITDA) = ₦50,000,000 / ₦40,810,000 ≈ 1.23 years — i.e., within the 1st–2nd year target.

6.0 How the Plan Meets the Budget & Fast Payback Target

1. **Vertical stacking × high-turnover crops** multiplies productive area without proportionally high frame cost — key to reaching high revenue in small footprint.
2. **Focused crop mix** on quick-turn, high-value produce (lettuce rotations + high-yield tomato varieties) shortens time-to-revenue.
3. **Modular build & local sourcing**: use local fabricators for frame and racks and phased automation (start with essential sensors + remote monitoring). This keeps capex within ₦50M. Farm-square recent guides show basic greenhouse setups in the low millions NGN range, supporting a conservative capex envelope for small modular facilities.
4. **Off-take strategy**: pre-sale agreements with supermarkets/restaurants/processors and a premium direct-to-consumer channel (subscription/boxes) secure prices and volumes.

7.0 Risks, Sensitivity and Mitigation

Power costs & reliability: electricity tariffs and generator/diesel costs are volatile in Nigeria; running costs could surge. Mitigation: battery buffer + efficient pumps, future solar capex pathway, and operational hours optimization.

Price / demand shocks: mitigate with diversified buyers, value-added products (washed/packed salad packs), and small processor contracts.

Technical failures (nutrient/sensor issues): SOPs spare parts, technician training and maintenance contracts.

Downside sensitivity example: a combined 20% yield shortfall and 20% price drop reduces revenue to ~₦47.5M, cutting EBITDA substantially and extending breakeven beyond 2 years

8.0 Social and Environmental Impacts

- Water savings versus open field (hydroponics typically 70–90% lower water use).
- Job creation: core team (manager, technician, 3 – 4 farmhands, sales/packaging staff) + training for local youth/agri-preneurs.
- Reduced post-harvest loss and more predictable supply into urban markets.

9.0 Implementation Roadmap (0–12 months)

Month 0–1: finalize site, permits, buyer LOIs, detailed design, supplier quotes.
Month 2–4: construction of greenhouse, racks, plumbing, power install.
Month 5–6: install hydroponic systems, automation, trial runs. Staff training starts.
Month 7–9: first commercial harvests, packaging setup, market launches & off-take fulfillment.
Month 10–12: stabilize production, refine SOPs, and pursue scale or solar investment.

10. Key Recommendations & next steps

1. **Obtain local supplier quotes** for structure, racks, pumps, sensors and power equipment to firm up the CAPEX line-items. (I can prepare an editable budget sheet.)

2. **Sign at least two binding offtake agreements** (supermarket + processor or hotel chain) before construction completes to lock minimum prices/volumes.
3. **Prioritise energy planning**: include battery/inverter in the initial build and reserve ₦/budget for solar in Year 2 to reduce operating volatility.
4. **Pilot & scale approach**: start exactly at the proposed modular size (500 m² footprint) and add capacity only after 6–12 months of proven demand and SOPs.
5. **Apply for blended finance/grants** (agtech or youth employment funds) to reduce equity burden and accelerate ROI.

11.0 Appendices — core calculations (rounded)

• Footprint: 500 m²; tiers: 4 → Effective area = **2,000 m²**.
• Crop areas: Lettuce 1,200 m²; Tomato 800 m².
• Yields: Lettuce 35 kg/m²/yr → **42,000 kg/yr**. Tomato 50 kg/m²/yr → **40,000 kg/yr**.
• Prices: Lettuce ₦1,100/kg; Tomato ₦700/kg.
• Revenue: Lettuce ₦46,200,000; Tomato ₦28,000,000; **Total ₦74,200,000**.
• OPEX (45%): ₦33,390,000. EBITDA: **₦40,810,000**. Breakeven: **~1.23 years**.

With strict cost control, vertical stacking and confirmed premium buyers, a **₦50M** modular hydroponic facility can feasibly reach breakeven between the **1st and 2nd year** under the assumptions above. The plan is sensitive to power and market prices.