Investment Analysis

Post Harvest Unit Study – Cherry and Stone Fruits

CCIAZ

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Overview of the Project.

Lebanese cherry and stone fruit farmers produce high-quality fruits with strong potential for both local consumption and export markets. However, they face several challenges that limit their competitiveness and profitability:

- **Restricted market access:** Lack of entry into new export markets due to limited compliance with international quality and safety standards.
- **High post-harvest losses:** Absence of modern cold chain and handling facilities leads to significant spoilage and reduced shelf life.
- **Labor sensitivity of cherries:** Cherries are highly delicate; if handled manually during grading, sorting, packing, or transportation, they bruise and lose market value. This creates an urgent need for a fully automated post-harvest line to minimize human handling.
- **Short shelf life & perishability:** Cherries cannot withstand long sea shipments. Without fast air freight logistics, export opportunities are lost, and fruit often perishes before reaching the market.
- **Low farm-gate prices:** Farmers are forced to sell at reduced prices due to oversupplied in local markets and limited marketing infrastructure.
- **Fragmented logistics:** Weak transportation and distribution channels limit timely delivery and reduce product freshness.
- **Limited income stability:** Without proper post-harvest solutions, farmers are unable to capture value, leading to financial losses and reduced incentives to invest in orchards.

Purpose of the Project

To address these challenges, the project proposes the establishment of a **Post-Harvest Unit (PHU)** dedicated to cherries and stone fruits. The PHU will provide integrated services for handling, sorting, cooling, packing, storage, and marketing. By ensuring compliance with both domestic and international standards, the PHU will:

- Reduce post-harvest losses and improve fruit quality.
- Introduce automation to preserve cherry quality and minimize damage.
- Open access to higher-value export markets.
- Enhance farm-gate prices and farmers' income.
- Contribute to rural economic development and job creation.

This study simulates **two options** for the PHU: one small-scale (PHU1) and one larger-scale (PHU2), offering decision-makers flexibility depending on investment capacity and market needs.

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Option 1 – Small-Scale PHU

The small post-harvest unit provides a compact, integrated facility tailored for farmers' immediate needs and smaller volumes of cherry and stone fruit production. It is designed to reduce post-harvest losses, introduce automation for delicate cherry handling, and open access to export markets. **The estimated capital expenditure (CAPEX) for this unit amounts to approximately USD 465,460**.

Key Features:

- Construction: 300 m² hangar including reception, office, and service facilities.
- Cold Storage & Reception: One cold storage room with 60-ton capacity, built with sandwich panels; plus a 100 m² cooled reception area for pre-storage handling.
- Processing Equipment:
  - Cherry sorting line with hydrocooling and washing system to quickly reduce field heat and improve fruit quality.
  - Stone fruit sorting machine for round fruits with brushing system.
- Transport & Logistics: One refrigerated truck (6-ton capacity), ensuring safe distribution to markets.
- Energy: A 30 kW solar system to reduce operational costs and reliance on the unstable grid.
- Maximum capacity: Total of 1100 tons of cherries and stone fruits.

Impact:

- Suitable for small to medium farmer groups or cooperatives.
- Provides the essential cold chain and automation needed for cherries, minimizing manual handling that causes bruising.
- Extends fruit freshness and improves compliance with export standards.
- Offers a first step toward accessing air-freight export markets, though at limited capacity.

Assets Needed

Below is a detailed list of the assets required to establish the small-scale Post-Harvest Unit (PHU) totaling 465,460 USD:

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Item	Qty	Description	Unit Value	Total Value
Hangar	300	Composed of Reception area, office, 2	$500.00	$150,000.00
Cherry Sorting line	1	Equiped with washing and	$140,000.00	$140,000.00
Refrigerated truck	1	Cargo Internal Dimension: 4,35*2*2 m	$42,000.00	$42,000.00
Cooling Room	1	Constructed with sandwich panels	$35,000.00	$35,000.00
Sorting Machine for	1	Round sorting machine equiped with	$30,000.00	$30,000.00
PV panels	1	30 KW solar system equiped with 15	$25,500.00	$25,500.00
Cooled Reception Area	1	100 sqm cooled reception area	$20,000.00	$20,000.00
Generator	1	3 phases, 65 Kva, Soundproof canopy,	$10,000.00	$10,000.00
Electric forklift	1	Loading Capacity: 1 ton	$6,000.00	$6,000.00
Penetrometer	1	To measure fruit hardness	$300.00	$300.00
Stainless tables	3	Dimensions: 280*105*86 cm	$500.00	$1,500.00
Office furniture	1	Desk, Chairs, sofa, printer,	$1,500.00	$1,500.00
Digital Scale	1	Loading Capacity: 2 ton	$1,000.00	$1,000.00
Label printer	1	Printer for different label sizes	$650.00	$650.00
Manual walkie stacker	1	Loading capacity: 1 ton	$600.00	$600.00
Manual hand pallet	1	Loading Capacity: 3 ton	$400.00	$400.00
Laptop	1		$350.00	$350.00
Digital scale	10	Loading capacity: 40 kg	$30.00	$300.00
Refractometer	2	To measure sugar content	$100.00	$200.00
Pallets	20	Euro pallets, 1.2*0.8m	$8.00	$160.00
			TOTAL	$ 465,460.00

Revenue Structure

The unit's processing capacity combines both cherry and stone fruit operations. The cherry sorting line can handle 500 kilograms per hour, equivalent to 4 tons per day when operated for 8 hours, and about 180 tons across the 45-day cherry season. The stone fruit sorting machine processes 700 kilograms of apricots and plums per hour, which translates into 5.6 tons per day, or 336 tons for 60 working days over a 150 day season. The cooling room, with a capacity of 60 tons, ensures smooth rotation during peak harvests, while the 6-ton refrigerated truck allows for up to two trips daily. Altogether, the PHU processes an estimated 684 tons of fruit per year, divided between 180 tons of cherries and 336 tons of stone fruits.

Revenues are based on differentiated marketing channels. For cherries, three weekly air shipments of 2.5 tons are planned during the season, reaching a total of 45 tons sold at 5.5 USD/kg, with a farm gate price of 2.5 USD/kg. In addition, 135 tons of cherries will be exported by sea at 4 USD/kg. For other stone fruits, including apricots, peaches, plums, and nectarines, the average selling price is 2 USD/kg compared to a farm gate price of 1 USD/kg. Altogether, revenues from cherries are projected at 787,500 USD and from stone fruits at 672,000 USD, resulting in a total annual revenue of 1,459,500 USD.

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Type	Shipment	Quantities	Unit Value	Total Y1
Cherries	Air shipments (5.5 USD*45000 Kg)	KGS 45,000.00	$5.50	$ 247,500.00
	Sea Shipment (4 USD*135000 kg)	KGS 135,000.00	$4.00	$ 540,000.00
Stone Fruits	Sea Shipment (2 USD*336000 kg)	KGS 336,000.00	$2.00	$ 672,000.00
		TOTAL		$ 1,459,500.00

Cost Structure

Annual operating costs cover labor, packaging, transportation, utilities, maintenance, and certification. The workforce includes one manager (18,000 USD), two technicians/supervisors (24,000 USD), one driver (12,000 USD), 18 seasonal workers during five months (54,000 USD), and two administrative staff (28,800 USD), totaling to 136,800 USD in salaries. Packaging materials represent a cost at 103,200 USD annually, calculated at 0.2 USD per kilogram. Transport and truck maintenance are estimated at 25,000 USD per year, while generator fuel adds 3,750 USD since the PHU works 80% using the solar system. Maintenance and spare parts are budgeted at 5,000 USD, and certifications, audits, and marketing efforts at 25,000 USD.

Estimated Expenditures	
Cost of 684 tons fruits (180000 kg of cherries*2.5USD, 336000 Kg of other stone fruits*1USD)	$ 786,000.00
Shipment fees air freight (1.25$*45000 kg)	$ 56,250.00
Shipment fees sea freight (471 t) 4000$ per container of 25 t	$ 76,000.00
2 Admin/accountant/HR/Sales (1200 USD x 2 x 12 months)	$ 28,800.00
1 manager (1,500 USD × 12 months)	$ 18,000.00
2 technicians/operators/supervisors (1000 USD × 12 months × 2)	$ 24,000.00
Driver (1,000 USD × 12 months)	$ 12,000.00
Seasonal workers for sorting/packing (18 worker, avg. 600 USD × 5 months)	$ 54,000.00
Packaging materials, crates, cartons, labels (0.2 USD/kg)	$ 103,200.00
Transport (fuel, truck maintenance) (500 trips × 50 USD as avg.)	$ 25,000.00
Generator fuel (25USD *150 Days)	$ 3,750.00
Maintenance & spare parts	$ 5,000.00
Admin & marketing (office supplies, promotion, certifications, audits)	$ 20,000.00
Certifications, marketing and others (office supplies, promotion, certifications, audits)	$ 25,000.00
TOTAL	$ 1,237,000.00

The activity calendar follows four main phases throughout the year.

1- Pre-season (January–March): activities focus on equipment maintenance and calibration, contracts with farmers, staff recruitment and training, procurement of packaging materials, and finalizing export buyer agreements.
2- Cherry season (June–July): cherries are received daily, hydrocooled, then sorted, graded, packed, stored and cooled temporarily before shipment by refrigerated trucks or containers.
3- Stone fruit season (May–September): peaches, apricots, plums, and nectarines start by reception, sorting, brushing, grading, packing, and cold storage before being shipment to buyers.

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4- Post-season (October–November): the period is dedicated to facility maintenance and cleaning, financial reporting, collection of market feedback, and signing of new supply contracts.

Scenario Hypotheses

Based on technical data, the following hypotheses were developed for three scenarios—worst case, base case, and best case.

Under all scenarios, PHU 1 assumes a constant upfront CAPEX of **$465,460**. Over a five-year horizon, the **Worst** case applies **5%** year-over-year revenue growth, **5%** growth in total variable costs, and **5%** growth in total fixed costs. The **Base** case applies **10%** annual revenue growth, **10%** growth in total variable costs, and **5%** growth in total fixed costs. The **Best** case applies **15%** annual revenue growth, **15%** growth in total variable costs, and **5%** growth in total fixed costs.

Below are the hypotheses for the 3 scenarios.

Variables /Parameters	Worst Scenario	Base Scenario	Best Scenario
Total Capex	$465,460	$465,460	$465,460
Revenue growth variation	5%	10%	15%
Total Variable Costs	5%	10%	15%
Total Fixed Costs	5%	5%	5%

Investment Analyses

The investment appraisal was evaluated under **three scenarios**—Worst, Base, and Best—reflecting possible variations in capital costs and revenues. Several key financial indicators (NPV, IRR, BCR, Profitability Index, Payback, and ROI) were assessed against the project's **discount rate of 34%**, which reflects Lebanon's high-risk context for agri-export, logistics investments, customs-clearance uncertainty (including air-freight availability and cost spikes), energy price and reliability volatility, operational risks tied to automated line performance and gentle handling for perishables, quality rejection/claims risk, and buyer/concentration risk in destination markets. Using a higher rate ensures only scenarios with resilient, risk-adjusted cash flows clear approval, providing a prudent margin of safety against downside shocks.

Investment Analysis	Worst Scenario	Base Scenario	Best Scenario
NPV > 0	-5,590	49,196	111,717
IRR > 34%	33.00%	39.24%	45.00%
BCR > 1	1.11	1.14	1.18
Profitability Index >1	0.99	1.11	1.24
Payback Ratio	2.40	2.25	2.15
Total ROI	125%	162%	204.19%
Annualized ROI	18%	21%	24.92%

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1. Net Present Value (NPV)

The NPV measures the net value created after discounting future cash flows at 34%.

- **Worst Case (−$5,590)**: Slightly negative, indicating marginal value destruction. The project nearly breaks even but fails to cover the risk-adjusted cost of capital.
- **Base Case (+$49,196)**: Positive and modest meaning the project generates limited but real value under expected market and cost conditions.
- **Best Case (+$111,717)**: Strongly positive confirming solid value creation when export prices or volumes improve.

The project remains viable in the base case and highly attractive under favorable conditions. The worst case is almost neutral, showing that downside risk is relatively contained.

2. Internal Rate of Return (IRR)

The IRR reflects the project's expected return relative to the 34% hurdle rate.

- **Worst (33%)**: Slightly below the required threshold → does not meet investor expectations.
- **Base (39.24%)**: Above the hurdle → financially acceptable and attractive.
- **Best (45%)**: Significantly above the hurdle → highly profitable.

The project's IRR remains robust even with moderate downside pressure, suggesting that operational or market improvements can easily sustain returns above the risk premium.

3. Benefit-Cost Ratio (BCR)

BCR > 1 implies that discounted benefits exceed discounted costs.

- **1.11 / 1.14 / 1.18 (Worst/Base/Best)** all exceed unity, confirming economic justification. Margins tighten in the worst case but stay positive, ensuring that benefits outweigh costs across all scenarios.

The project is economically efficient in all cases, though its resilience weakens slightly under stress.

4. Profitability Index (PI)

This ratio expresses the value created per dollar invested.

- **0.99 / 1.11 / 1.24 (Worst/Base/Best)** align with NPV results.
- A PI < 1 (worst) means each dollar invested yields less than $1 in present value returns, while PI > 1 (base & best) indicates value creation.

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From an investor's standpoint, the project efficiently converts each dollar of capital into greater future value under expected or favorable outcomes.

5. Payback Period

The time required to recover initial investment from cumulative cash inflows.

- **2.40 / 2.25 / 2.15 years (Worst/Base/Best)** indicate rapid cost recovery within roughly 2 years.

This short payback horizon enhances the project's liquidity and reduces exposure to long-term uncertainty. However, payback ignores the time value of money and cash flows beyond recovery.

6. Return on Investment (ROI)

- **Annualized ROI:** 18% / 21% / 24.9% remain below the 34% hurdle, as these are non-discounted measures.

Since ROI does not account for the timing of cash flow, it provides only a partial view of performance. When analyzed through time-adjusted indicators such as the Internal Rate of Return (IRR), which exceeds 34% in both the base and best cases, the project demonstrates genuine value creation. Yet the IRR and NPV remain the more accurate decision tools for this high-risk environment.

The investment demonstrates financial robustness with moderate sensitivity to risk. Even at conservative assumptions, the project nearly breaks even, while under expected or improved market conditions, it delivers returns well above the required rate of return.

This confirms that the post-harvest investment is financially viable, economically justified, and capable of generating sustainable value—provided that export prices, logistics efficiency, and throughput volumes are maintained.

Breakeven Analysis

In the base scenario, the breakeven analysis shows that the project is expected to recover its cumulative costs between **Year 2 and Year 3**, specifically around **Year 2.26**, equivalent to approximately **three months into the third year**. This indicates that, despite high initial capital and operating costs during the first two years, the project begins generating sufficient benefits by early Year 3 to fully offset its total expenditure. Beyond this point, the cumulative benefits exceed the cumulative costs, meaning the project transitions from a cost-recovery phase to a **profit-generating phase**, confirming its financial viability over the five-year horizon.

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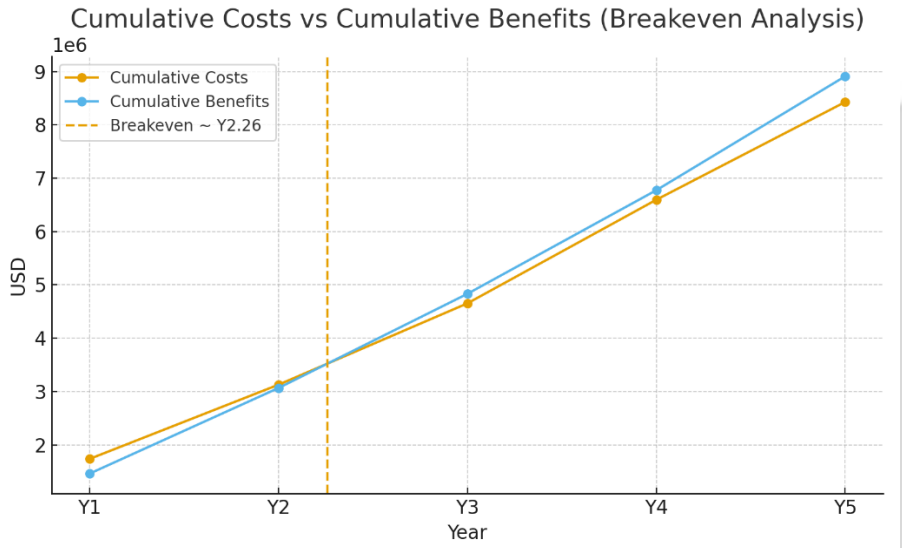
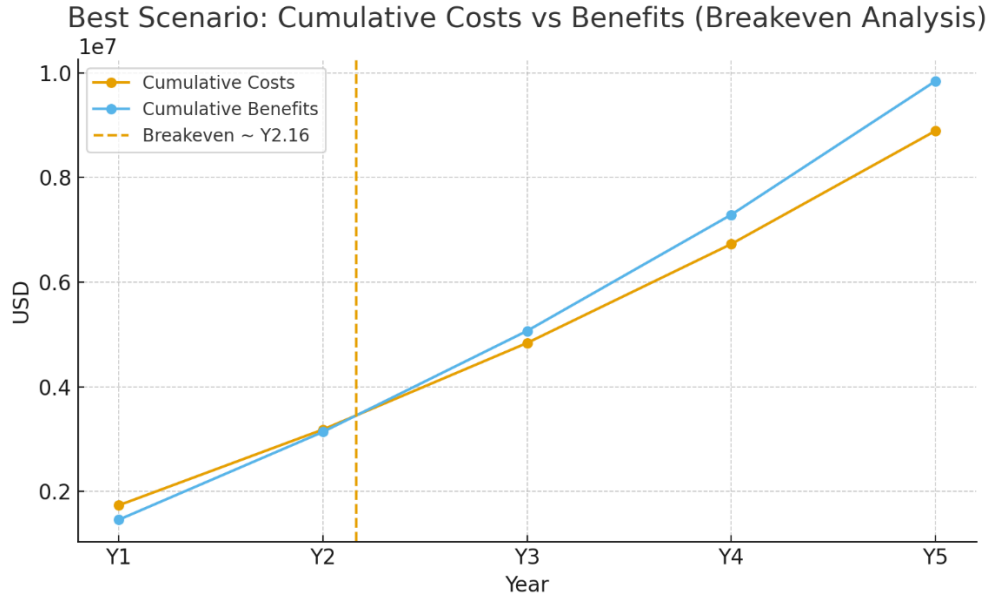


In the **best-case scenario**, the project reaches its breakeven point between **Year 2 and Year 3**, precisely around **Year 2.16**, or roughly **two months into the third year**. This indicates an improved performance compared to the base scenario, with cumulative benefits surpassing costs earlier due to higher operational efficiency or stronger market returns. From early Year 3 onward, the project moves into a **profit-generating phase**, confirming its strong financial resilience and attractiveness under favorable conditions.



In this worst scenario, the breakeven point is reached between **Year 2 and Year 3**, specifically around **Year 2.37**. This means the project starts to recover its total investment later than in the

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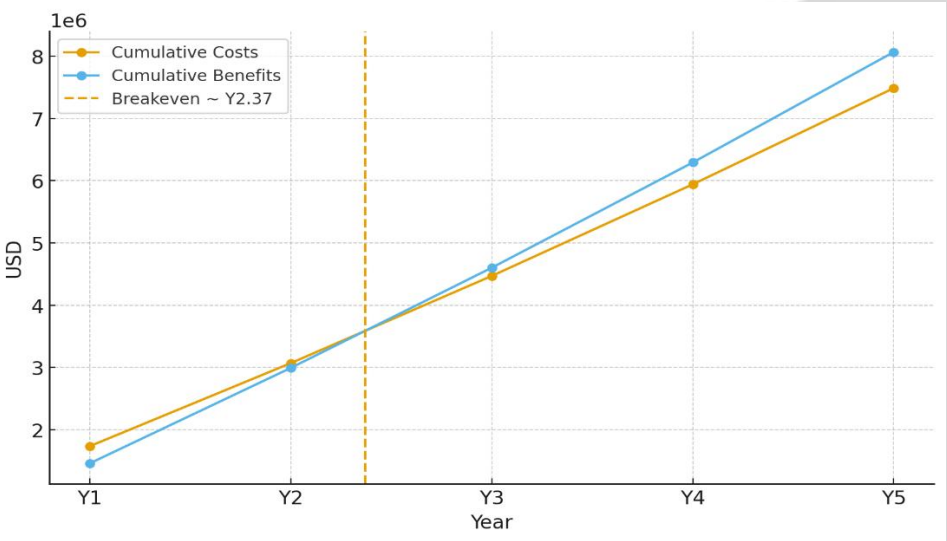
best-case scenario, yet still within the early part of Year 3. From that point onward, cumulative benefits exceed cumulative costs, marking the shift toward profitability and confirming that the project remains financially sound over the five-year period.



Sensitivity Analysis

The sensitivity analysis assesses how changes in key variables—**capital expenditure (CAPEX)** and **total revenue (through price or quantity)**—affect the project's financial viability, as measured by the **Net Present Value (NPV)**. This sensitivity analysis tests also how the project's profitability (NPV) responds to changes in **financial assumptions** (discount rate). The goal is to understand how resilient the investment remains under realistic export conditions, where revenues are earned abroad and not fully exposed to domestic Lebanese risks.

Variables /Parameters	Worst Scenario	Base Scenario	Best Scenario
Capex Variation	10%	465460	-10%
Total Revenue variation (in price or quantity)	-20%	$ 1,459,500.00	20%
Discount Rate	20%	20%	20%
Discount Rate	28%	28%	28%

Senisitivity Analysis	Worst Scenario	Base Scenario	Best Scenario
NPV	-51,018	49,196	157,145
NPV	-594,232	49,196	793,218
NPV	149,017	232,594	328,140
NPV	51,748	116,928	191,365

The sensitivity analysis explores how the project's financial performance changes when the main investment and operational assumptions vary — namely the capital cost (CAPEX) by ±10%, the annual revenues (price or quantity) by ±20%, and when the discount rate is adjusted from 34% down to 28% and 20% to reflect lower external risk exposure due to export market orientation.

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When using the high-risk discount rate of 34%, the results show that the project is only marginally viable. In the base scenario, the NPV stands at about USD 49,000, while it turns slightly negative (−51,000 USD) when CAPEX rises by 10% and becomes strongly positive (157,000 USD) when CAPEX is reduced by 10%. This means that under full Lebanese risk conditions, profitability is narrow and highly dependent on efficient cost management and maintaining stable export prices.

When revenue varies by ±20% under the same discount rate, the impact on NPV becomes much more pronounced. A 20% drop in revenue drives the NPV down to roughly −594,000 USD, while a 20% increase in revenue lifts it up to about 793,000 USD. This clearly confirms that the project is far more sensitive to changes in sales volume or export prices than to variations in investment costs. Sustaining market access, export volume, and product quality is therefore the most critical factor for maintaining profitability.

When the discount rate is reduced to 20% to reflect the fact that revenues are earned abroad in hard currency and therefore bear less local country risk, the financial results improve significantly. The NPVs become consistently positive across all scenarios, rising from 149,000 USD in the worst case to 328,000 USD in the best. This shows that if investors apply a more realistic, export-adjusted rate of return, the project becomes financially strong and resilient, even with moderate variations in costs or revenue.

At a discount rate of 28%, which represents a conservative midpoint between local and international risk conditions, the project still maintains comfortable profitability. NPVs range from about 52,000 USD in the worst case to 191,000 USD in the best, with the base case reaching nearly 117,000 USD. This confirms that the post-harvest unit remains viable under moderate risk assumptions and that its value creation is robust once the local risk premium is partially relaxed.

Overall, the analysis highlights that the project's financial performance improves markedly when a lower discount rate (20–28%) is used, reflecting the reduced risk associated with export operations. The investment remains sensitive to revenue performance but proves financially sound as long as CAPEX stays within ±10% of the plan and revenues do not fall by more than 10–15%. Under these adjusted conditions, the project generates a consistently positive NPV, confirming its economic feasibility and attractiveness for investors in export-oriented agri-business.

Stress Test

Investment Analysis (Stress Test)	Pessimistic Scenario	Base Scenario	Optimitic Scenario
NPV	-638,431	49,196	838,647

The stress test measures how the project performs when both key financial variables deteriorate simultaneously — that is, when **capital expenditure (CAPEX) increases by 10%** and **total**

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revenue decreases by 20% (either due to lower export prices or smaller quantities sold), while maintaining a **34% discount rate** to reflect the full country and operational risk context.

Under these combined adverse conditions, the project's **Net Present Value (NPV)** drops sharply to around **−638,000 USD**, compared with **+49,000 USD** in the base scenario and **+839,000 USD** in the optimistic one. This substantial negative value means that the project would **fail to recover its investment and risk-adjusted cost of capital** if both cost overruns and revenue shortfalls occur at the same time. The capital outlay becomes too high relative to the weakened cash inflows, resulting in significant value destruction.

This result demonstrates the project's **dual vulnerability**: it cannot withstand both a rise in CAPEX and a decline in revenues concurrently. While moderate cost increases or revenue drops on their own can be absorbed, their combination pushes the financial structure beyond its resilience threshold. In simple terms, if export volumes or prices fall by one-fifth while implementation costs rise by a tenth, the investment would lose financial justification under the current risk profile.

In contrast, the base scenario remains marginally positive (NPV ≈ 49,000 USD), confirming that under normal conditions the project still creates modest value even at a high 34% discount rate. The optimistic case (NPV ≈ 839,000 USD) highlights the project's upside potential if both costs are controlled and exports perform strongly.

Overall, the stress test underscores the need for **strict cost containment, reliable logistics, and secured export agreements** before proceeding with investment. Unless revenues are safeguarded and CAPEX is tightly managed, the project becomes financially unviable under adverse market conditions. Therefore, investors should only approve implementation once **market contracts are confirmed, cost estimates validated, and risk buffers (such as donor co-financing or contingency reserves) integrated** to absorb potential shocks.

Strategic Recommendation PHU 1

The small-scale Post-Harvest Unit (PHU) offers a targeted and modular solution to enhance Lebanon's cherry and stone fruit export capacity by introducing automation, cold-chain continuity, and improved product quality standards. With an investment cost of approximately USD 465,460, the PHU represents a strategic entry point for cooperatives or clusters of medium-scale farmers seeking to upgrade from local to export markets.

The small-scale post-harvest unit (PHU1) is a financially feasible project under normal and favorable export conditions, but it requires disciplined cost control and stable market performance to remain profitable. The financial analysis, sensitivity tests, and stress scenarios all point to the same conclusion: **the project creates value when managed efficiently and marketed effectively but becomes unviable under combined cost and revenue pressures.**

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Under the base case, the project generates a **positive NPV (~USD 49,000)**, an **IRR above 34%**, and a **payback period of around 2.3 years**, confirming that it can recover its investment quickly and deliver a solid risk-adjusted return. In the best case, value creation strengthens significantly while in the worst case, the project nearly breaks even, showing resilience even under moderate pressure.

However, the stress test reveals that if **capital costs increase by 10%** and **revenues fall by 20%** (either due to weaker export prices or lower quantities), the project's NPV turns sharply negative. This means the project can't absorb both a cost overrun and a drop in sales at the same time.

The sensitivity analysis further confirms that the project is **much more sensitive to revenue variations** than to changes in capital costs. In other words, maintaining export prices and market volumes is more critical than small differences in investment cost. When the discount rate is adjusted down to **28% or 20%** to reflect the reduced risk of export revenues comparing to local market, the NPV becomes consistently positive in all cases, showing that the project is robust when market and operational risks are partly mitigated.

Therefore,

Investors should use the following simple decision logic when considering whether to invest in PHU1:

Proceed with the investment when the project is financially viable based on:

- CAPEX stays within ±10% of USD 465,460,
- Annual revenues reach at least USD 1.45 million,
- Export prices are maintained at or above USD 4.5/kg for cherries and USD 1.8/kg for stone fruits,
- IRR remains ≥ 34%, and
- NPV is positive even under a 28% discount rate.
  Under these conditions, the project delivers a healthy return and fast payback.

However,

If revenue projections are uncertain or costs start to rise slightly above the plan, the project can still proceed **only if risk-mitigation measures are in place**, such as donor co-financing, secured export contracts, or reliable logistics agreements.
If CAPEX exceeds 10% of the plan **and** revenues drop by more than 15–20%, the project becomes value-destructive (NPV < 0). In that case, the investment should be **deferred** until market stability, export contracts, and financing terms improve.

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Final Strategic Advice

Investors are advised to move forward only once the export channels, buyer agreements, and operational logistics are confirmed. Revenue performance is the decisive factor for success. The project can tolerate small increases in capital cost but not significant losses in export sales or prices.

In short, the PHU1 is a viable, fast-payback investment for export-oriented fruit handling — but it succeeds only when markets are secured, and costs are contained. Proceed if conditions are stable and measurable; postpone if uncertainty remains high.

Option 2 – Large-Scale PHU

The large post-harvest unit is a comprehensive facility designed for higher capacity, professionalized logistics, and continuous supply to local and export markets. It offers stronger integration of infrastructure, equipment, and logistics, positioning Lebanese cherries more competitively in international markets. **The estimated capital expenditure (CAPEX) for this unit amounts to approximately USD 964,300.**

Key Features:

- Construction: 800 m² hangar including reception area, offices, and service facilities.
- Cold Storage & Cooling: Three separate cold storage rooms built with sandwich panels, plus a 20 m² precooling room to rapidly reduce fruit temperature post-harvest.
- Processing Equipment:
    - Cherry sorting line with hydrocooling and washing system (higher throughput than Option 1).
    - Stone fruit sorting machine for round fruits with brushing system.
- Transport & Logistics: Two refrigerated trucks (each 6-ton capacity), allowing simultaneous delivery to different markets or export points.
- Energy: A 96 kW solar system providing higher energy independence and cost efficiency.

Impact:

- Designed for large-scale operations, serving multiple farmer groups and exporters.
- Enables a consistent volume supply required by international buyers.
- Enhances capacity for quick air logistics, addressing cherries' short shelf life.
- Strongly positions Lebanese cherries and stone fruits in regional and international markets by ensuring quality, consistency, and reliability.
- Generates greater employment and local economic impact compared to Option 1.
- Maximum capacity: Total of 2250 tons of cherries and stone fruits

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Assets Needed

Below is a detailed list of the assets required to establish the big-scale Post-Harvest Unit (PHU) totaling 964,300 USD:

Item	Qty	Description	Unit Value	Total Value
Hangar	800	Composed of Reception area, offices, 4	$450.00	$360,000.00
Cherry Sorting line	1	Equiped with washing and hydrocooling	$200,000.00	$200,000.00
Refrigerated truck	2	Cargo Internal Dimension: 4,35*2*2 m	$42,000.00	$84,000.00
PV panels	1	96 KW solar system equiped with 96 kW	$81,600.00	$81,600.00
Cooling Room	3	Constructed with sandwich panels under	$27,000.00	$81,000.00
Sorting Machine for	1	Equiped with a washer, brusher, external	$80,000.00	$80,000.00
Precooling Room	1	20 sqm, Air forced, 5*4*4m	$20,000.00	$20,000.00
Generator	1	3 phases, 120 KVA, Soundproof canopy,	$20,000.00	$20,000.00
Electric forklift	1	Loading Capacity: 1 ton	$6,000.00	$6,000.00
Gaz forklift	1	Loading Capacity: 2 tons	$20,000.00	$20,000.00
Stainless tables	6	Dimensions: 280*105*86 cm	$500.00	$3,000.00
Penetrometer	1	To measure fruit hardness	$300.00	$300.00
Office furniture	2	Desks, Chairs, sofa, printers, benches	$1,500.00	$3,000.00
Manual hand pallet	3	Loading Capacity: 3 ton	$400.00	$1,200.00
Digital Scale	1	Loading Capacity: 2 ton	$1,000.00	$1,000.00
Pallets	100	Euro pallets, 1.2*0.8m	$8.00	$800.00
Label printer	1	Printer for different label sizes	$650.00	$650.00
Manual walkie	1	Loading capacity: 1 ton	$600.00	$600.00
Digital scale	20	Loading capacity: 40 kg	$30.00	$600.00
Laptop	1		$350.00	$350.00
Refractometer	2	To measure sugar content	$100.00	$200.00
			TOTAL	**$964,300.00**

Revenue Structure

The unit's processing capacity combines both cherry and stone fruit operations. The cherry sorting line can handle 1200 kilograms per hour, equivalent to 9600 tons per day when operated for 8 hours, and about 432 tons across the 45-day cherry season. In this study we will consider that the center will operate at 65% of its capacity, processing 281 tons of cherry. The stone fruit sorting machine processes 2.5 kilograms of apricots and plums per hour, which translates into 20 tons per day, or 1200 tons for 60 working days over a 150-day season. 65% of 1200 tons is equal to 780 tons of stone fruits. The cooling room, with a capacity of 120 tons, ensures smooth rotation during peak harvests, while the two 6-ton refrigerated truck allows for up to four trips daily. Altogether, the PHU processes an estimated 1,061,000 tons of fruit per year, divided between 281 tons of cherries and 780 tons of stone fruits.

Revenues are based on differentiated marketing channels. For cherries, five weekly air shipments of 2.5 tons are planned during the season, reaching a total of 75 tons sold at 5.5 USD/kg, with a farm gate price of 2.5 USD/kg. In addition, 206 tons of cherries will be exported by sea at 4 USD/kg. For other stone fruits, including apricots, peaches, plums, and nectarines, the average

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selling price is 2 USD/kg compared to a farm gate price of 1 USD/kg. Altogether, revenues from cherries are projected at 1,237,500 USD and from stone fruits at 1,560,000 USD, resulting in a total annual revenue of 2,796,500 USD.

Type	Shipment	Quantities	Unit Value	Total Y1
Cherries	Air shipments (5.5 USD*75000 Kg)	KGS 75,000.00	$5.50	$ 412,500.00
	Sea Shipment (4 USD*206000 kg)	KGS 206,000.00	$4.00	$ 824,000.00
Stone Fruits	Sea Shipment (2 USD*780000 kg)	KGS 780,000.00	$2.00	$ 1,560,000.00
		TOTAL		**$ 2,796,500.00**

Cost Structure

Annual operating costs cover labor, packaging, transportation, utilities, maintenance, and certification. The workforce includes one manager (21,600 USD), three technicians/supervisors (36,000 USD), two drivers (24,000 USD), 50 seasonal workers during five months (150,000 USD), and 4 administrative staff (57,600 USD), totaling to 289,200 USD in salaries. Packaging materials represent a cost at 212,200 USD annually, calculated at 0.2 USD per kilogram. Transport and truck maintenance are estimated at 50,000 USD per year, while generator fuel adds 7,500 USD since the PHU works at 80% on solar system. Maintenance and spare parts are budgeted at 10,000 USD, and certifications, audits, and marketing efforts at 35,000 USD.

Estimated Expendituress	
Cost of 1061 tons fruits (281,000 kg of cherries*2.5USD, 780,000 Kg of other stone fruits*1USD)	$ 1,482,500.00
Air Shipment 1.25$ * 75000	$ 93,750.00
Sea Shipment (40 cont *4000 $)	$ 160,000.00
4 Admin/accountant/HR/Sales (1200 USD x 4 x 12 months)	$ 57,600.00
1 manager (1,800 USD × 12 months)	$ 21,600.00
3 Supervisors/technicians/operators (1000 USD × 12 months × 4)	$ 36,000.00
2 Driver (1,000 USD × 12 months x 2)	$ 24,000.00
Seasonal workers for sorting/packing (50 worker, avg. 600 USD × 5 months)	$ 150,000.00
Packaging materials, crates, cartons, labels (0.2 USD/kg)	$ 212,200.00
Transport (fuel, truck maintenance) (1000 trip × 50 USD as avg.)	$ 50,000.00
Generator fuel (50 USD *150 Days)	$ 7,500.00
Maintenance & spare parts	$ 10,000.00
Admin & marketing (office supplies, promotion, certifications, audits)	$ 30,000.00
Certifications, marketing and others (office supplies, promotion, certifications, audits)	$ 35,000.00
TOTAL	**$ 2,370,150.00**

The activity calendar follows four main phases throughout the year.

1-Pre-season (January–March): activities focus on equipment maintenance and calibration, contracts with farmers, staff recruitment and training, procurement of packaging materials, and finalizing export buyer agreements.

2-Cherry season (June–July): cherries are received daily, hydrocooled, then sorted, graded, packed, stored and cooled temporarily before shipment by refrigerated trucks or containers.

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3-Stone fruit season (May–September): peaches, apricots, plums, and nectarines start by reception, sorting, brushing, grading, packing, and cold storage before being shipment to buyers.

4-Post-season (October–November): the period is dedicated to facility maintenance and cleaning, financial reporting, collection of market feedback, and signing of new supply contracts.

Scenario Hypotheses

Based on technical data, the following hypotheses were developed for three scenarios—worst case, base case, and best case.

Under all scenarios, PHU 1 assumes a constant upfront CAPEX of **$964,300**. Over a five-year horizon, the **Worst** case applies **5%** year-over-year revenue growth, **5%** growth in total variable costs, and **5%** growth in total fixed costs. The **Base** case applies **10%** annual revenue growth, **10%** growth in total variable costs, and **5%** growth in total fixed costs. The **Best** case applies **15%** annual revenue growth, **15%** growth in total variable costs, and **5%** growth in total fixed costs.

Below are the hypotheses for the 3 scenarios.

Variables /Parameters	Worst Scenario	Base Scenario	Best Scenario
Total Capex	$964,300	$964,300	$964,300
Revenue growth variation	5%	10%	15%
Total Variable Costs	5%	10%	15%
Total Fixed Costs	5%	5%	5%

Investment Analyses

The investment appraisal was evaluated under **three scenarios**—Worst, Base, and Best—reflecting possible variations in capital costs and revenues. Several key financial indicators (NPV, IRR, BCR, Profitability Index, Payback, and ROI) were assessed against the project's **discount rate of 34%**, which reflects Lebanon's high-risk context for agri-export, logistics investments, customs-clearance uncertainty (including air-freight availability and cost spikes), energy price and reliability volatility, operational risks tied to automated line performance and gentle handling for perishables, quality rejection/claims risk, and buyer/concentration risk in destination markets. Using a higher rate ensures only scenarios with resilient, risk-adjusted cash flows clear approval, providing a prudent margin of safety against downside shocks.

Investment Analysis	Worst Scenario	Base Scenario	Best Scenario
NPV > 0	-81,997	24,515	140,065
IRR > 34%	29.50%	35%	41.00%
BCR > 1	1.10	1.13	1.16
Profitability Index >1	0.91	1.03	1.15
Payback Ratio	2.60	2.41	2.14
Total ROI	108%	143%	181%
Annualized ROI	16%	19%	23%

1.Net Present Value (NPV)

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In the worst scenario (−81,997 USD), NPV is negative, meaning the project destroys value—it does not recover the required risk-adjusted return and slightly erodes investor capital.

In the base and best scenarios (positive NPV values), the project generates additional value above its cost of capital, confirming financial viability.

2. **Internal Rate of Return (IRR)**

The worst scenario (29.5%) IRR falls below the 34% cost of equity, meaning the project cannot compensate for its risk profile.

The base and best scenarios, if above 34%, indicate that the project exceeds the required return threshold and therefore creates financial value. This benchmark reflects the high-risk context for agricultural export logistics in Lebanon.

3. **Benefit-Cost Ratio (BCR)**

A BCR < 1 (worst scenario) shows that benefits are lower than costs in present value terms, implying economic inefficiency.

BCR > 1 (base and best scenarios) confirms that for every 1 USD invested, more than 1 USD in value is generated.

4. **Profitability Index (PI)**

The worst scenario (0.91) indicates value destruction, as each 1 USD invested yields only 0.91 USD in discounted returns.

PI > 1 (base and best scenarios) reflects value creation, as each invested dollar generates additional return beyond its cost.

5.**Payback Ratio**

2.60 / 2.41 / 2.14 years → quick capital recovery under all scenarios, improving from worst to best.

6. Return on Investment (ROI)

Total ROI (108% / 143% / 181%) → demonstrates the project more than doubles its initial investment over its lifetime, with higher returns under favorable markets.

Annualized ROI (16% / 19% / 23%) → shows positive yearly returns, though still below the 34% cost of equity, meaning nominal profits but not sufficient to cover the full risk premium.

Therefore, The investment analysis reveals that the project's financial viability is highly sensitive to market conditions, especially to export prices and throughput volumes.Under worst scenario of assumptions, returns fall slightly below the 34% hurdle, making the project marginal. Under base

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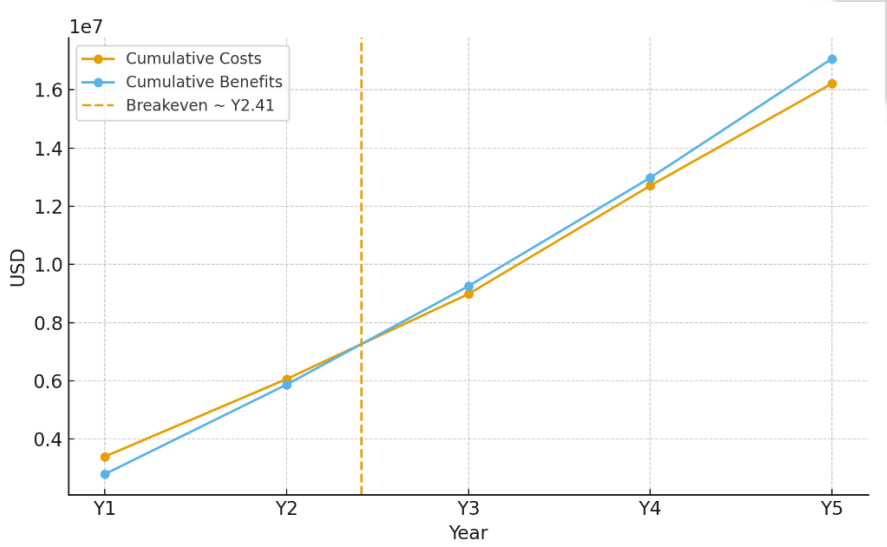
and optimistic scenarios, both IRR and NPV exceed the required thresholds, confirming that the investment is profitable and justifiable if market access, export pricing, and logistics efficiency are maintained. Executives should approve the investment only when IRR ≥ 34%, NPV > 0, BCR > 1, and PI > 1—ensuring risk-adjusted profitability and long-term sustainability.

Breakeven Analysis

In the base scenario, the breakeven analysis indicates that the project recovers its cumulative costs between Year 2 and Year 3, specifically around Year 2.41—approximately five months into the third year. This means that, despite the high initial investment and operational buildup during the first two years, the project begins to generate sufficient cumulative benefits by early Year 3 to fully offset its total expenditures. Beyond this point, the project transitions from cost recovery to profit generation, confirming its financial feasibility over the five-year horizon.



In the **best-case scenario**, the breakeven analysis shows that the project recovers its cumulative costs between **Year 2 and Year 3**, specifically around **Year 2.31**, or roughly **four months into the third year**. This means that after two full operating years, the accumulated revenues begin to exceed total costs early in Year 3, marking the point where the project transitions from cost recovery to profitability.

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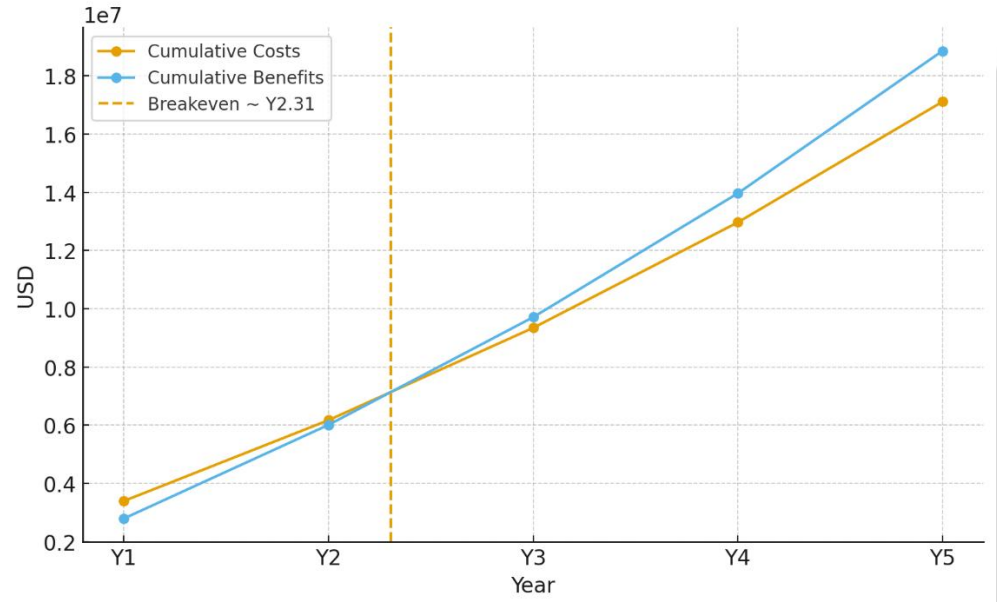
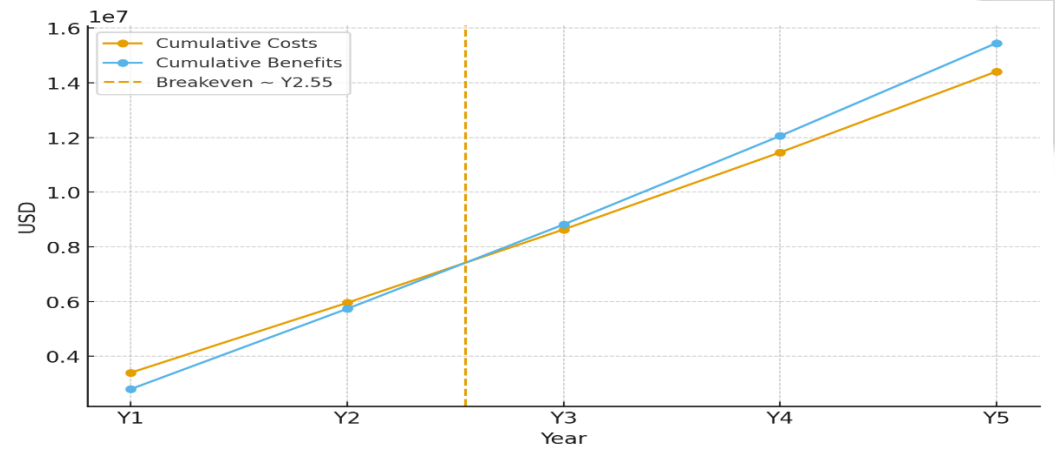


In this worst scenario, the breakeven analysis shows that the project recovers its cumulative costs between **Year 2 and Year 3**, specifically around **Year 2.55**, or roughly **6.6 months into the third year**. This indicates that the project transitions to profitability midway through Year 3, after two full years of investment and buildup. Beyond this point, cumulative revenues exceed total costs, confirming that the project becomes financially self-sustaining in the medium term.



Sensitivity Analysis

The sensitivity analysis evaluates how PHU2's financial performance changes when key assumptions vary. The objective is to understand how strongly the project depends on investment cost, revenue generation, and financing risk, and to determine under which conditions it remains financially viable.

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Variables /Parameters	Worst Scenario	Base Scenario	Best Scenario
Capex Variation	10%	964300	-10%
Total Revenue variation (in price or quantity)	-20%	$ 2,796,500.00	20%
Discount Rate	20%	20%	20%
Discount Rate	28%	28%	28%

Senisitivity Analysis	Worst Scenario	Base Scenario	Best Scenario
NPV	-176,174	24,515	234,272
NPV	-1,209,876	24,515	1,445,867
NPV	214,611	377,097	554,325
NPV	28,004	154,724	554,325

When tested at the higher domestic discount rate of **34%**, the project generates an NPV of roughly **USD 25,000** under the base scenario, turning slightly negative (−176,000 USD) when CAPEX increases by 10%, and rising to around **USD 234,000** when CAPEX decreases by 10%. This shows that, similar to PHU1, the project is **moderately sensitive to capital cost changes**—higher investment costs narrow returns, but do not fundamentally threaten viability when well managed.

When revenues vary by ±20% in price or quantity, the effect on profitability becomes much stronger. A 20% drop in export income drives the NPV down to roughly **−1.2 million USD**, while a 20% improvement lifts it to **+1.45 million USD**. This confirms that the project's **dominant driver of value is revenue performance**—maintaining stable export volumes, prices, and logistics reliability is far more critical than marginal variations in capital spending.

Once the **discount rate is lowered to 28%**, reflecting the project's export orientation and foreign-currency revenues, PHU2's NPV improves substantially. Across the same range of operational scenarios, NPVs remain **positive**. At this level, the project becomes **clearly viable and resilient**, showing that when the cost of capital reflects actual exposure rather than full domestic risk, PHU2 delivers healthy returns even with moderate stress on costs or sales.

At an even lower **20% discount rate**, which would correspond to a blended or donor-supported capital structure (including concessional debt or partial grant financing), the results strengthen further. This demonstrates that once financing risk is mitigated through cheaper capital or guaranteed markets, the large-scale PHU becomes a **financially strong and sustainable investment**, capable of generating substantial value for investors and the wider agricultural export sector.

Stress Test:

Investment Analysis (Stress Test)	Pessimistic Scenario	Base Scenario	Optimitic Scenario
NPV	-1,304,053	24,515	1,540,044

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The stress test measures how the project performs when both key financial variables deteriorate simultaneously — that is, when **capital expenditure (CAPEX) increases by 10%** and **total revenue decreases by 20%** (either due to lower export prices or smaller quantities sold), while maintaining a **34% discount rate** to reflect the full country and operational risk context.

Under these compounded stress conditions, the **Net Present Value (NPV)** falls sharply to approximately **−USD 638,000**, compared to **+49,000 USD** in the base scenario and **+839,000 USD** in the optimistic one. This large swing confirms that the project is **highly vulnerable to simultaneous cost overruns and revenue declines**.

In financial terms, a negative NPV of this magnitude means that, after accounting for the time value of money and risk, the project would **fail to recover its total investment and would destroy value** rather than create it. Essentially, the discounted future cash inflows cannot compensate for the higher upfront costs and reduced revenues.

This outcome highlights two key insights. First, PHU2's **profitability depends predominantly on revenue performance**—a 20% decline in export prices or quantities leads to a significant erosion of value, regardless of operational efficiency. Second, **capital cost overruns magnify the problem**, because they increase initial cash outflows and compress margins even further under already weak sales conditions.

In practical terms, the stress test underscores that PHU2 cannot withstand both shocks together. If export demand drops and construction or equipment costs exceed the plan, the project's financial structure collapses, making it unsustainable under a 34% risk-adjusted discount rate.

However, this negative result does not necessarily mean the project is unviable overall—it simply highlights the **importance of risk mitigation and financing structure**. If investors can secure export contracts, stabilize logistics, and obtain **partial donor or concessional funding** to lower the effective discount rate (to 28% or 20%), the project's NPV turns positive again across all scenarios, as shown in the sensitivity analysis.

Strategic Recommendation PHU 2

The big-scale Post-Harvest Unit (PHU) offers a targeted and modular solution to enhance Lebanon's cherry and stone fruit export capacity by introducing automation, cold-chain continuity, and improved product quality standards. With an investment cost of approximately USD 964,300, the PHU represents a strategic entry point for cooperatives or clusters of medium-to high scale farmers seeking to upgrade from local to export markets.

The large-scale Post-Harvest Unit (PHU2) represents a strong investment opportunity when export operations are stable and cost control is maintained. The project's financial analysis confirms that

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it is **profitable and efficient under normal and favorable conditions**, but it becomes **sensitive to combined shocks in cost and revenue**.

Under the base case, PHU2 achieves a positive NPV of around USD 49,000, an IRR of about 35%, and a short payback period of nearly 2.4 years, confirming that the investment can recover its capital quickly while delivering acceptable returns. In the best-case scenario, the project performs strongly, proving its capacity to generate substantial value when export performance improves.

However, the stress test—where CAPEX rises by 10% and revenues drop by 20%—shows a negative NPV meaning the project loses money if both shocks occur together. This clearly indicates that PHU2's profitability is highly sensitive to export performance and market stability.

The sensitivity analysis also shows that when the discount rate is reduced to 28% or 20%, reflecting export revenues in foreign currency and the use of concessional or blended financing, all NPVs become strongly positive across scenarios. This proves that the project's long-term value is sound, provided that the financing mix and export contracts reduce overall risk exposure.

Therefore,

Investors should use the following practical thresholds to decide whether to move forward with PHU2 when:

- CAPEX remains within ±10% of USD 964,300 (no cost overruns),
- Annual revenues reach or exceed USD 2.8 million,
- Export prices remain at or above USD 4.5/kg for cherries and USD 1.8/kg for stone fruits,
- IRR stays above 34%, and
- NPV is positive at discount rates between 28% and 20%, which reflects realistic export risk.
  Under these conditions, the project generates solid profitability, rapid payback, and strong financial resilience.

However,
If revenues fluctuate slightly (by 10–15%) or minor cost increases occur, the project can still go forward only if risk mitigation measures are in place—for example, through donor co-financing, subsidized credit, or secured export agreements that lock in prices and quantities. The project should be postponed or restructured if CAPEX increases by more than 10% and revenues drop by more than 15–20%. Under these combined conditions, the project destroys value and cannot recover its investment under a 34% risk-adjusted discount rate.

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Final Strategic Advice

Investors are encouraged to proceed with PHU2 only when export contracts, logistics, and financing terms are secure. The project's success depends more on market reliability and price stability than on small variations in investment cost.

If the financing structure includes donor participation or concessional loans, the discount rate can be reduced to 28% or even 20%, significantly improving profitability and ensuring long-term sustainability.

In short, PHU2 is a financially sound and scalable investment when managed under stable export conditions and controlled costs. It is recommended to go when markets and financing are clear, go with caution when some risks remain but mitigation is possible, and not go if both cost overruns and major revenue declines occur together.

Benefits, challenges and operational recommendations

Benefits

- This project is highly profitable with strong cash generation and a short payback. It's an attractive opportunity for investors
- By providing hydrocooling, sorting, grading, proper packaging and cold storage close to farms, the PHU reduces post-harvest losses. That directly increases the kilograms of saleable fruit per hectare and farmers net receipts. In the revenue assumptions the farm gate price for cherries is $2.5/kg. With contract farming, better timing and quality sorting the PHU can enable farmers to capture price premiums and avoid commission of the wholesale market (conservatively + 5–20% depending on variety and export channel).
- The PHU's contracts farming (forward purchase or partial advance payments) give farmers more predictable cash flows, allow them to plan inputs and labor and reduces informal trading and price volatility at farm gate.
- Linking the PHU to simple extension support (harvest timing, pre-cooling at farm, traceability) raises farmers' income and improve variety selection for export. Farmers participating in such value chains typically reinvest part of incomes into improved orchard care, increasing long-term yields.
- In locations where cherries and stone fruits are main crops, seasonal labor for harvesting is a large income source for farm families and rural laborers. By increasing demand for packed/exportable fruit, the PHU indirectly improves farm employment and income in harvest months.
- A well-run PHU can be a consolidation point for smallholders, lowers postharvest costs and improves bargaining.
- Regular supply of well-packed fruit allows exporters to build reliable customer relationships and regular supply that benefits the entire value chain.

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- The PHU will create direct jobs (management, technicians, packers, drivers) and indirect employment (repair & maintenance, cold-chain services, packaging suppliers, logistics, inspection/auditing). This empowers the entire agri-logistics system.
- Successful private PHUs encourage other private investments and can catalyze government or donor support in cold chain logistics and phytosanitary services.

Challenges

- Farmers may deliver fruits that are under-sized, overripe, bruised, warm, in poor packaging or with high defect rates, reducing packout, lowering saleable volume, increasing rejections.
  Mitigation: provide supplier training (harvest timing, field sorting), introduce simple grading at farm, provide crates/standard packaging on consignment and offer premium pricing for quality.
- Dealing with smallholder leads to many small lots arriving at once or unpredictably, leading to peaks overwhelm PHU during peak season.
  Mitigation: aggregation via collection points near the fields, scheduling harvest windows, and hire a short-term packing team.
- Farmers may lack funds for inputs that improve quality (fertilizers, IPM tools) or sell early to get liquidity.
  Mitigation: offer pre-harvest advances, input-credit or buyer-financed input schemes and link with microfinance partners.
- Late frosts, drought, or pest outbreaks reduce yield and quality leading to reduce the availability of fruits.
  Mitigation: Support farmer training on IPM and climate smart practices, diversify sourcing zones and implement crop insurance where available.
- Cold chain breaks can cause quality loss and buyer rejections.
  Mitigation: Set strict SOPs, temperature logging during shipments, alarm systems for temperature, staff training and validated cooling procedures.
- Maintenance and spare parts may not be directly available leading to long waiting times.
  Mitigation: keep critical spare parts stock, establish service contracts with suppliers and local maintenance training.
- Relying on few buyers or a single market exposes operator to sudden order drops.
  Mitigation: diversify buyers across markets (EU, GCC), build trading relationships and sign long-term MOUs.
- Delays at Beirut port can extend transit times and increase spoilage risk.
  Mitigation: schedule shipments with buffer time, use reliable forwarders and use of modified atmosphere bags.
- High competition with big producing origins (Spain, Turkey, Europe) may lower prices down at specific windows.
  Mitigation: target niche windows in the market and improve quality differentiation and flexible pricing strategies.

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Operational Recommendations

- Sign MOUs with at least two export buyers (air and sea) before commissioning the PHU. This materially reduces market risk.
- Shortlist industrial plots near main producing zones (Bekaa is preferred for proximity to producers and logistics stores) and check grid/electricity, water, waste-water permits and road access.
- Prepare short farming contracts with grades and timing clauses and consider offering small pre-harvest advances to secure volume.
- Invest early in Global GAP/GRASP/SMETA certification and trainings to speed buyer acceptance.
- Setup operational KPI to monitor packout %, rejected %, daily amount and cold-chain temperature logs to protect product value.
- Use the center during the offseason from October to April to store other fruits like apples to increase income.
- Establish long-term space agreements with airlines/forwarders to reduce air cargo costs especially during peak season.

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