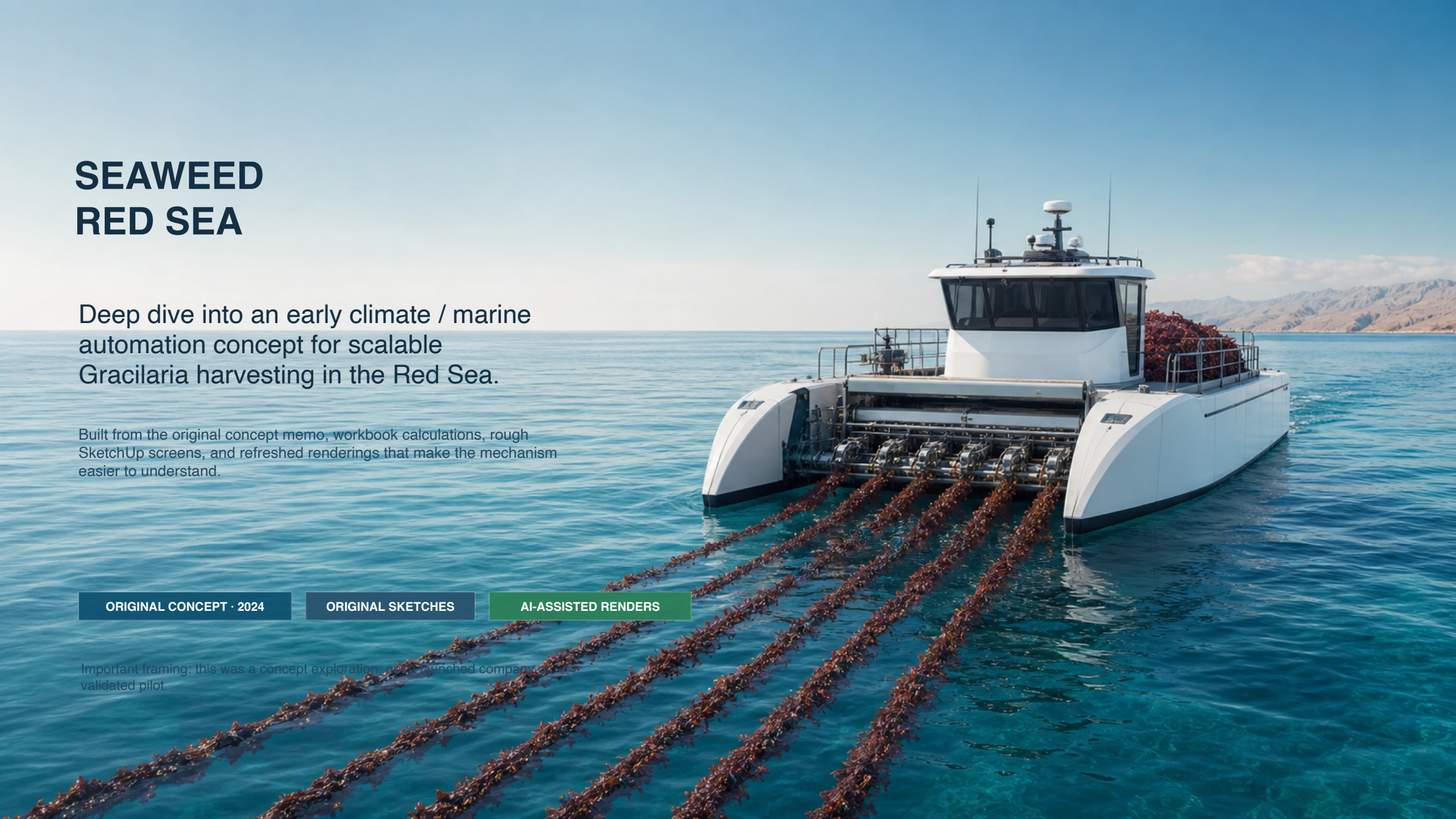
SEAWEED RED SEA

Deep dive into an early climate / marine automation concept for scalable Gracilaria harvesting in the Red Sea.

Built from the original concept memo, workbook calculations, rough SketchUp screens, and refreshed renderings that make the mechanism easier to understand.

ORIGINAL CONCEPT · 2024 | ORIGINAL SKETCHES | AI-ASSISTED RENDERS

Important framing: this was a concept exploration, not a launched company or validated pilot.



Executive summary

What the project was, what the core insight was, and why it still reads as a serious systems concept.

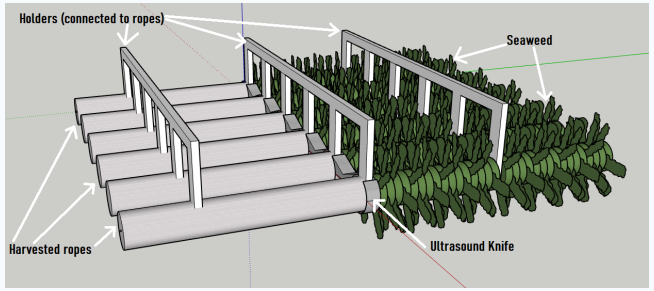
What it was

- An early concept for automated Gracilaria farming and harvesting adapted to Red Sea conditions.
- The project combined farm layout, harvesting machinery, onboard handling, transport, and shore processing.
- The strongest part was not a finished prototype; it was the operating logic.

Core insight

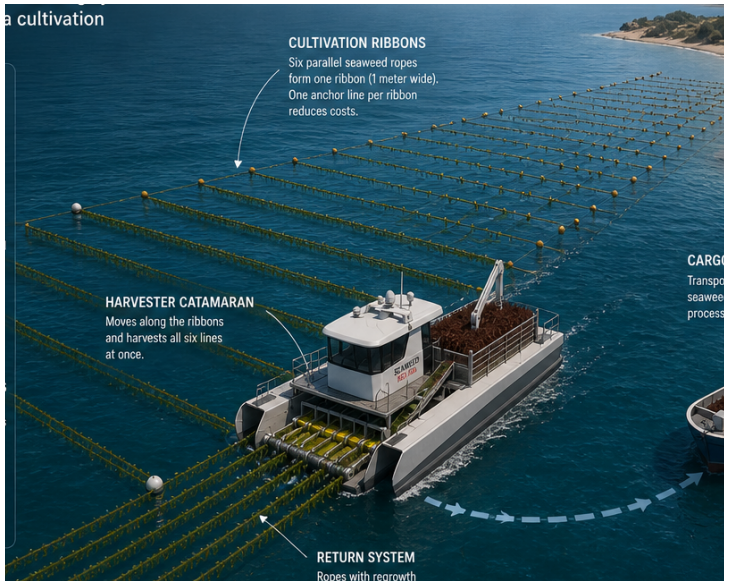
Harvesting one rope at a time is too slow. Turning six ropes into one handled “ribbon” creates something a machine can ingest, cut, and return in one pass.

ORIGINAL CONCEPT SKETCH



What makes it credible

- There is a real mechanism hypothesis, not only a branding story.
- There is a farm-density hypothesis, not only a single machine drawing.
- There is a rough workbook tying layout to yield, labor, boats, and payback.



Short founder read

REFRESHED SYSTEM RENDER

This concept is interesting because it shows the same pattern seen later in your hardware and storage work: spot a broken physical system, then redesign the whole flow around it.

Sources used throughout this deck: uploaded concept memo, uploaded workbook, uploaded nutrition paper, uploaded original images, and refreshed AI-assisted renders based on those materials.

Why a Red Sea version needed a different system

The memo starts from a believable constraint: the dominant Asian methods are not optimized for expensive labor or automation.

Long-line method

- Simple and proven.
- Works well in shallow or anchored settings.
- But rope-by-rope harvesting creates too much manual handling.
- Anchors, buoys, and line management become expensive when scaled offshore.

What the memo implies

Great biology does not automatically produce a great operating system.

Floating raft method

- Better surface exposure and nutrient access.
- Higher density can be achieved.
- But square-net style handling is harder to automate and less elegant for continuous harvesting.
- Water-quality control and repeated machine access become awkward.

What the memo implies

Density without a machine-friendly geometry is not enough.

The hybrid answer

Take the continuous rope logic of long-lines and the density ambition of rafts — then bundle six ropes into one aligned harvesting unit.

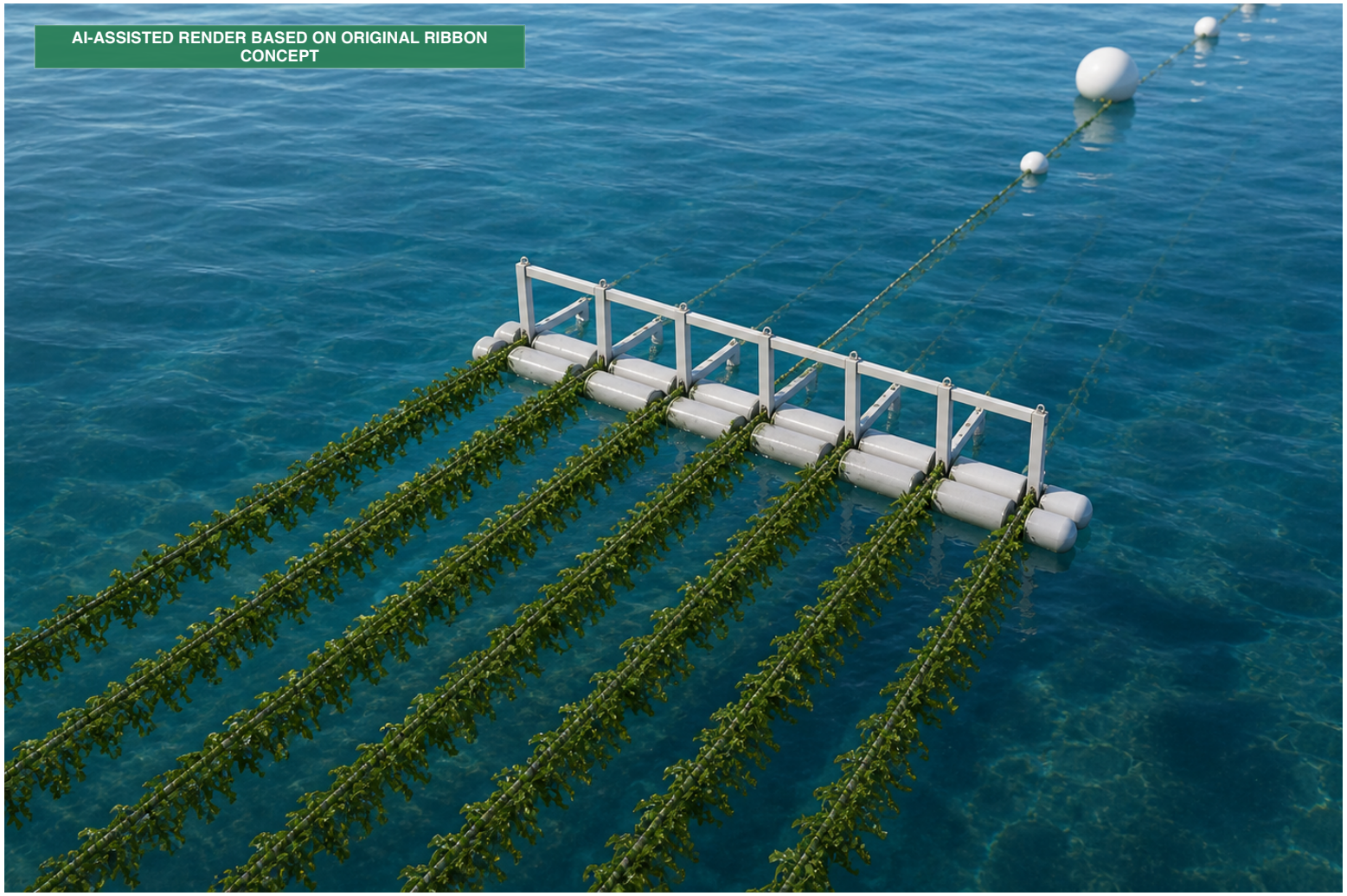
- One anchor line per ribbon rather than one per loose rope.
- Six parallel ropes spaced at 20 cm.
- A machine sees one predictable inlet instead of tangled individual lines.
- Harvesting can happen continuously while regrowth lines return to water.

This is the leap from “seaweed farm” to “processable manufacturing lane.”

The language and framing here are derived from the uploaded concept memo; the wording is tightened for clarity and investor / website readability.

Cultivation ribbon: the key structural idea

The ribbon converts loose biological growth into a repeatable, machine-readable lane.



Original ribbon parameters from the workbook: 6 ropes per ribbon, 1,000 m rope length, 3 ribbons per hectare.

How the ribbon works

- Six ropes are held in fixed parallel spacing instead of drifting independently.
- The memo targets 20 cm between ropes, giving an overall width of about 1 meter.
- A top holding frame keeps the intake geometry stable for the harvester.
- One ribbon behaves like a single harvest unit even though biologically it contains six growth lines.

Why this matters operationally

- Fewer anchoring elements per productive meter of biomass.
- Less line entanglement during harvesting.
- Cleaner machine intake and a better chance of repeatable throughput.

Why the ribbon idea matters beyond aesthetics

It changes the density equation, the anchoring equation, and the machine interface at the same time.

ropes per ribbon	spacing between ropes	nominal ribbon width	ribbons per hectare	productive rope meters / ha
6	20 cm	~1.0 m	3	18,000 m

1. Higher harvesting density

A machine gets six biologically separate lines in one aligned intake instead of traveling for six disconnected passes.

In concept terms: more harvested biomass per meter of vessel travel.

2. Lower infrastructure overhead

By anchoring a ribbon rather than treating each rope as a totally independent handling object, the memo tries to reduce support complexity per productive line.

This is the CAPEX logic behind “one anchor line per ribbon.”

3. Better machine inlet geometry

The holders do not only suspend seaweed — they create a controlled entry pattern for cutting, conveyor capture, and rope return.

That is what transforms farming hardware into process hardware.

This slide expands the memo’s intuition: the ribbon is simultaneously a farm-layout innovation and a machine-interface innovation.

What the original visual thinking looked like

The drawings were rough, but they already described the right sequence: align → cut → separate → return.

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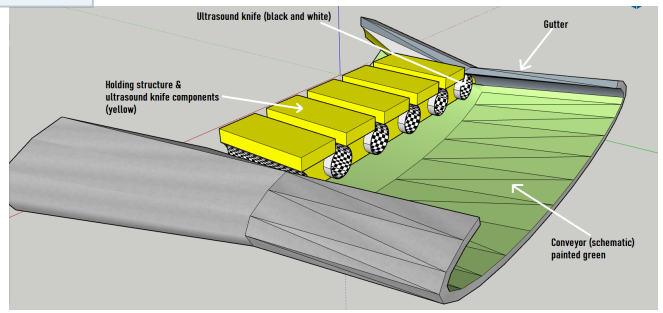
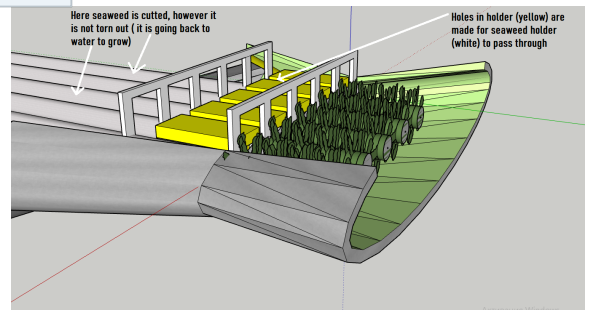


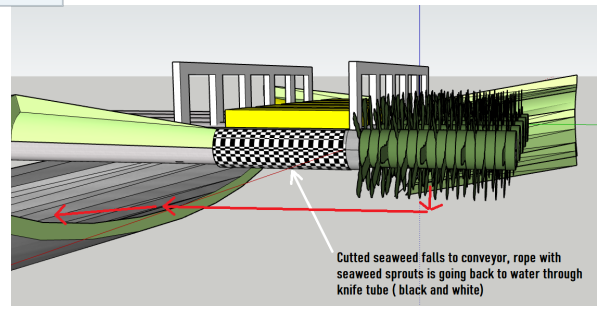
Knife module + conveyor relationship

ORIGINAL CONCEPT SKETCH



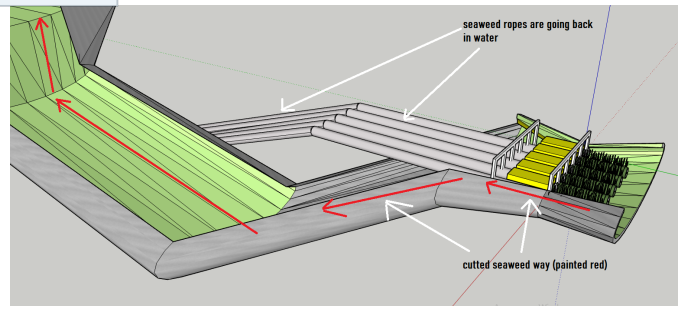
Holder pass-through + intact regrowth zone

ORIGINAL CONCEPT SKETCH



Opened scheme showing return path

ORIGINAL CONCEPT SKETCH



Conveyor separation and rope routing

These screenshots are useful precisely because they are raw: they show the concept existed as a mechanical workflow, not as a polished after-the-fact narrative.

Ultrasonic cutter principle: what the mechanism was trying to achieve

Here the goal is not to prove a finished design, but to explain the engineering logic behind the proposed cutting approach.

Conceptual explanation

- Each rope enters a semi-circular cutting zone rather than a full closed ring.
- The open zone allows the holder / structural support to pass through without being severed.
- The blade path is meant to shear the outer mature biomass while preserving the rope core and some regrowth material.
- A conveyor positioned immediately below catches what is cut before it falls back into the sea.

Why “ultrasonic” was interesting

In theory, high-frequency cutting could reduce snagging, drag, and tearing in wet fibrous biomass versus a crude mechanical chop.

Important honesty: the concept did not yet validate power draw, corrosion, fouling resistance, or whether ultrasonic blades would beat rotary or shear-based alternatives offshore.

This explanation is intentionally phrased as a mechanism hypothesis. It makes the project sound stronger because it is precise without pretending the design was already field-proven.

Material flow: harvest the biomass, keep the line alive

The most distinctive part of the concept is the split between collected biomass and returning regrowth ropes.

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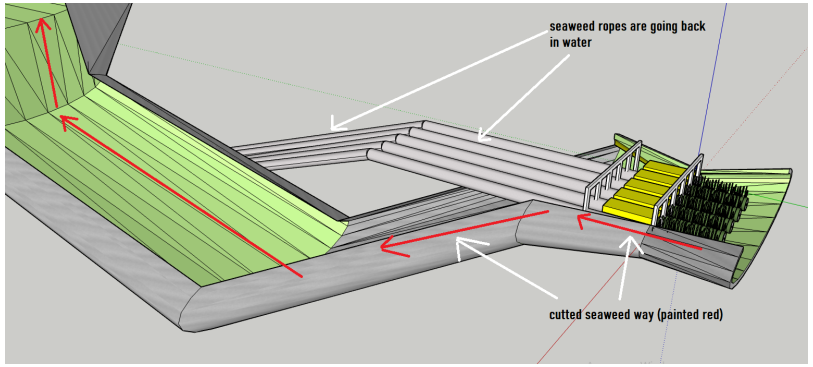


Why this matters

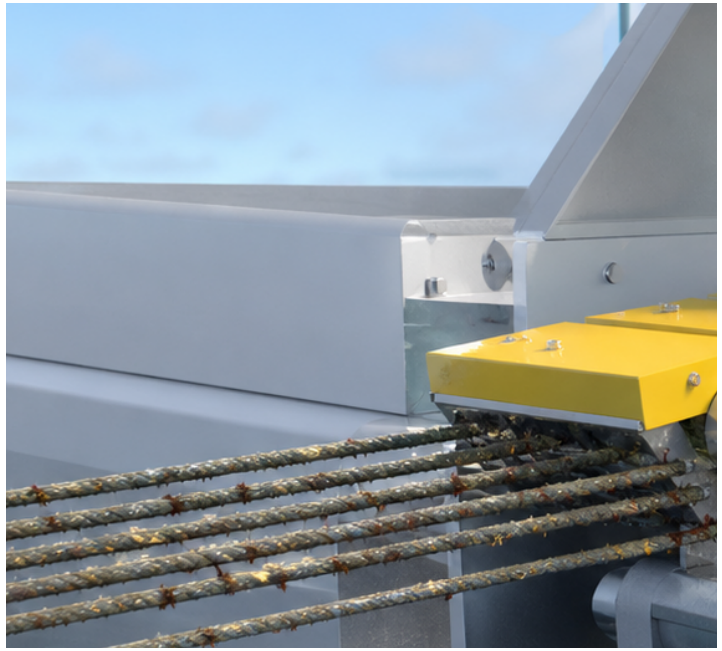
The project is not proposing to rip the entire line out of the water each time. It is trying to create a partial-harvest loop.

Four-step process

1. Aligned ropes enter the machine.
2. Mature seaweed on the outside is cut away.
3. Cut biomass falls onto a conveyor for onboard handling.
4. The cleaned rope and remaining growth continue through a protected return path.

Operational consequence

If this worked in practice, you would be preserving productive infrastructure instead of rebuilding each crop cycle from scratch.



REFRESHED CLOSE-UP

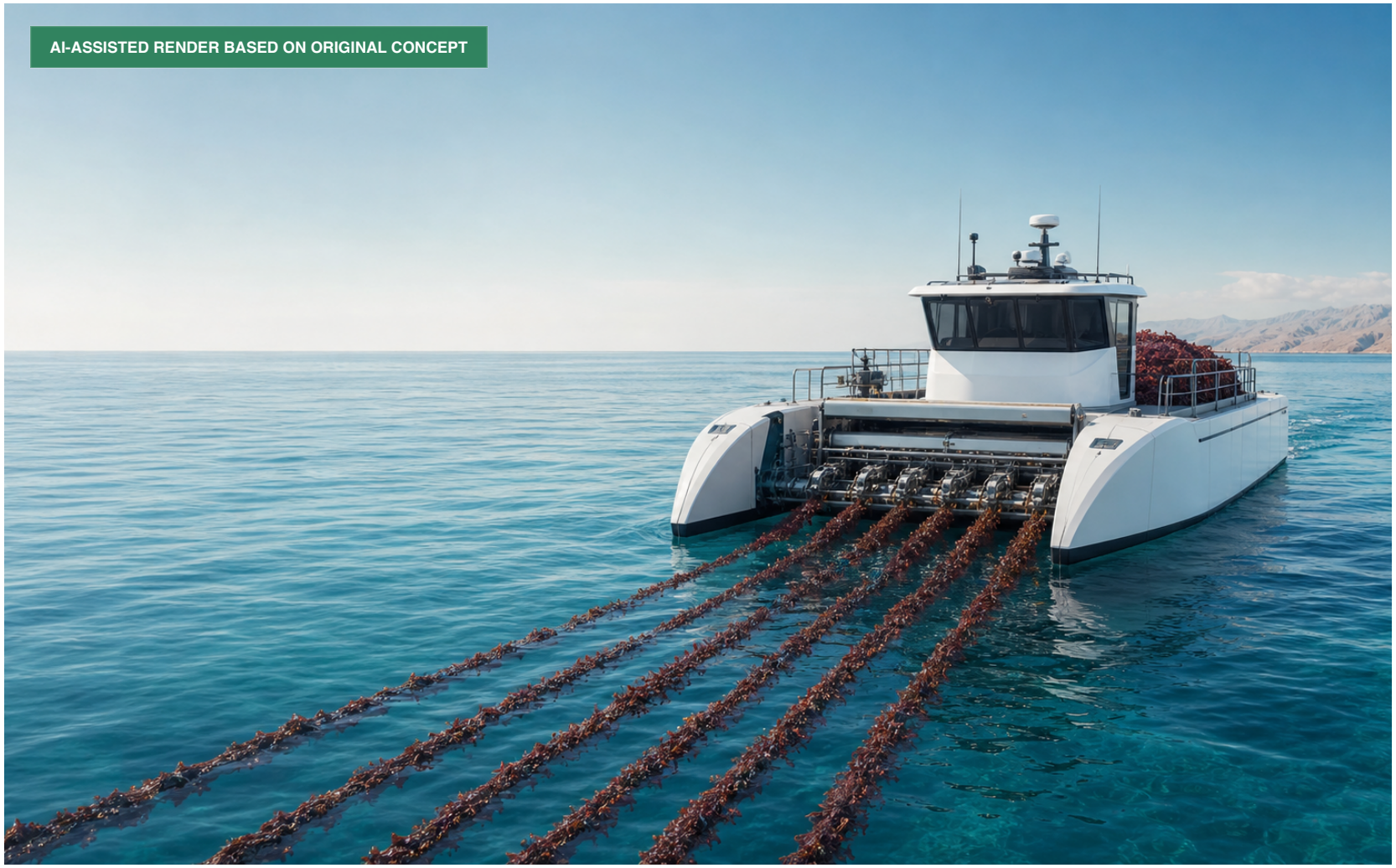
What the refreshed image adds

It makes the separation logic legible: rope in, biomass out, rope back to water. That legibility is important for a website or deck.

This partial-harvest loop is arguably the most important thing to explain if you want viewers to understand why the project is more than “a boat with blades.”

Why a catamaran harvester makes sense

The vessel choice is part of the concept: wide intake, stable deck, room for storage, and cleaner line handling.



Why catamaran

- A wide front opening can ingest multiple ribbons in parallel.
- The twin-hull layout creates useful deck volume in the middle for conveyors and storage.
- A broader stance should help stability during harvesting and onboard transfer.
- The vessel doubles as the first processing stage: cut, capture, and stage biomass before cargo pickup.

Design note

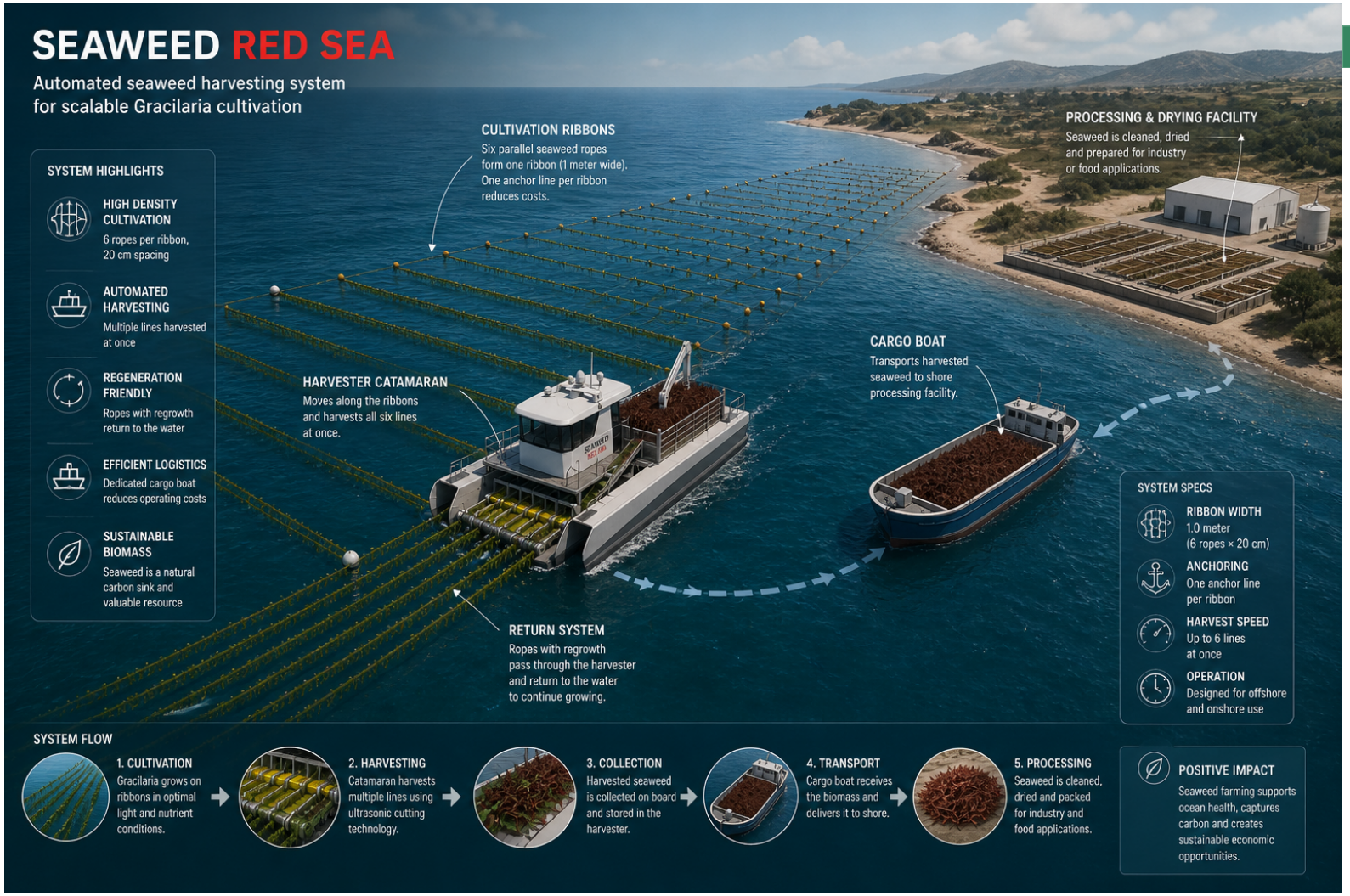
The boat is not just transport. In this concept it is the process platform.

The memo also proposed a separate cargo boat so the harvester could keep working instead of losing time on every shore run.

System map: farm layout, harvesting pass, cargo transfer, shore facility

The concept becomes much stronger when shown as an end-to-end operating system rather than a single mechanism.

AI-ASSISTED SYSTEM MAP



Operating model: what happens after cutting

A good founder concept thinks about the queue after the machine, not only the machine itself.

Three-stage logistics loop

1 Harvester catamaran

Cuts seaweed, captures biomass, keeps the farm lanes moving.

2 Cargo boat shuttle

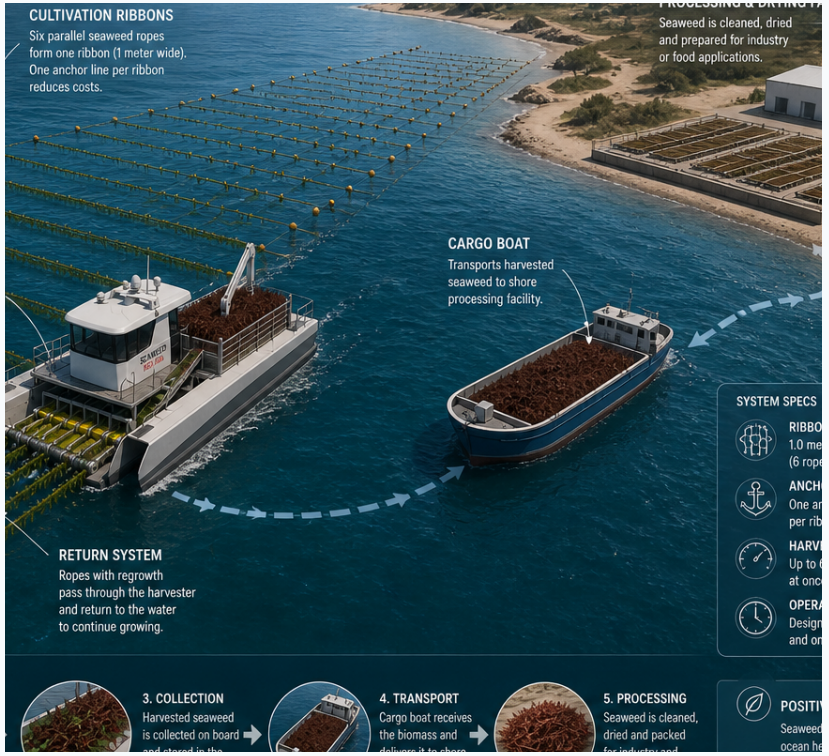
Receives harvested biomass and transports it to shore so the harvester does not stop.

3 Shore facility

Washes, dries, presses, stores, or otherwise prepares biomass for sale or further processing.

Why this is good thinking

The memo correctly recognized that harvesting downtime is often a logistics problem, not only a machine-speed problem.



SYSTEM VIEW

Original memo questions that still mattered

- Would Red Sea nutrient levels support comparable growth to Asian sites?
- Would the biomass need sun drying, industrial drying, or a hybrid?
- How much washing is required before sale or processing?
- Can the required power, water, and shore infrastructure be built economically on a bare coastal site?

This list does not weaken the project. It proves you understood where the unknowns were.

The open questions on the right are reformulated from the memo's own research backlog.

Workbook math: production, throughput, and farm geometry

Keep the key workbook outputs, but make the logic visible from rope → ribbon → hectare → 100 ha site.

0.6 kg FW / m rope	16.5% dry yield	6 ropes × 1,000 m / ribbon	3 ribbons / ha	10% losses	2 harvester boats @ 0.5 m/s

Per ribbon / harvest	Per hectare / harvest	Per hectare / year	100 ha / year
3,600 kg FW 594 kg DW	10.8 t FW 1.782 t DW	131.4 t FW 21.681 t DW	1,951 t DW after losses

Ribbon logic

0.6 kg/m × 6 ropes × 1,000 m = 3,600 kg FW per ribbon

3,600 kg FW × 16.5% dry yield = 594 kg DW per ribbon

Scale-up logic

594 kg DW × 3 ribbons / ha = 1.782 t DW per hectare per harvest

1.782 t × (365 / 30-day cycle) × 100 ha × (1 − 10% losses) ≈ 1,951 t DW / year

Harvesting throughput implied by the workbook

2 harvester boats assumed for a 100 ha site

900 m/h realistic line intake after operating efficiency

≈0.3 ha/h practical harvesting throughput

Why the cultivation ribbon matters

Without multi-line intake, the same annual output would require more boats or a longer harvest window.

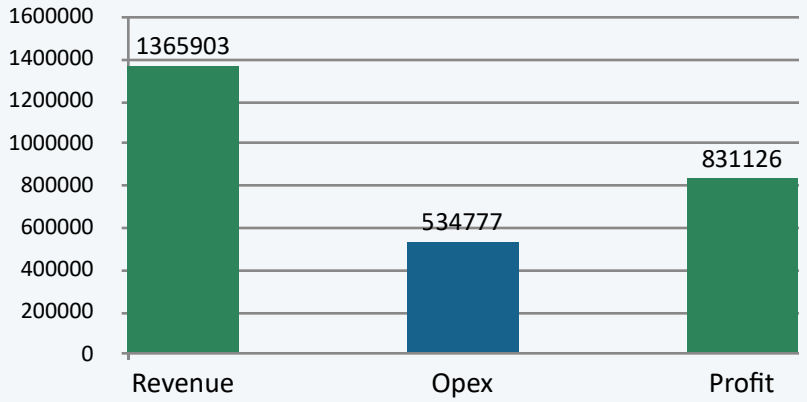
The ribbon is the throughput lever for the whole system, not just a farming geometry detail.

Data shown here are transcribed from the uploaded workbook's saved values, not independently validated in the field.

Workbook math: rough economics, margin, and payback

Keep the metrics, but frame them as concept-stage economics tied to growth, harvesting throughput, and shore processing assumptions.

annual revenue	annual opex	annual profit	margin	payback
$1.366M	$0.535M	$0.831M	64.3%	19.7 mo



Other useful outputs

CAPEX to open site + facility: $1.363M
Average monthly revenue: $113.8k
Average monthly opex: $44.6k
DW production cost: $0.25 / kg
Break-even output: 63.7 t DW / year

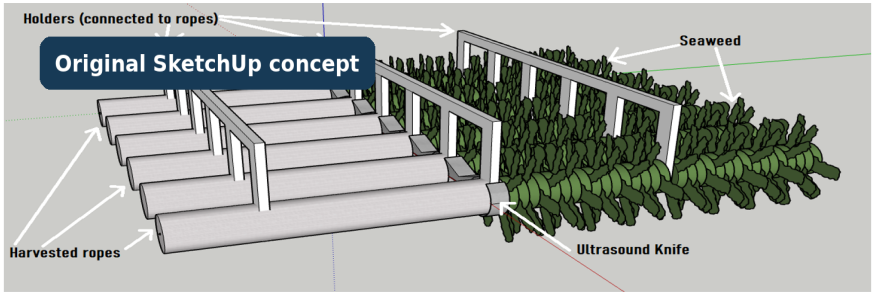
How to read the economics

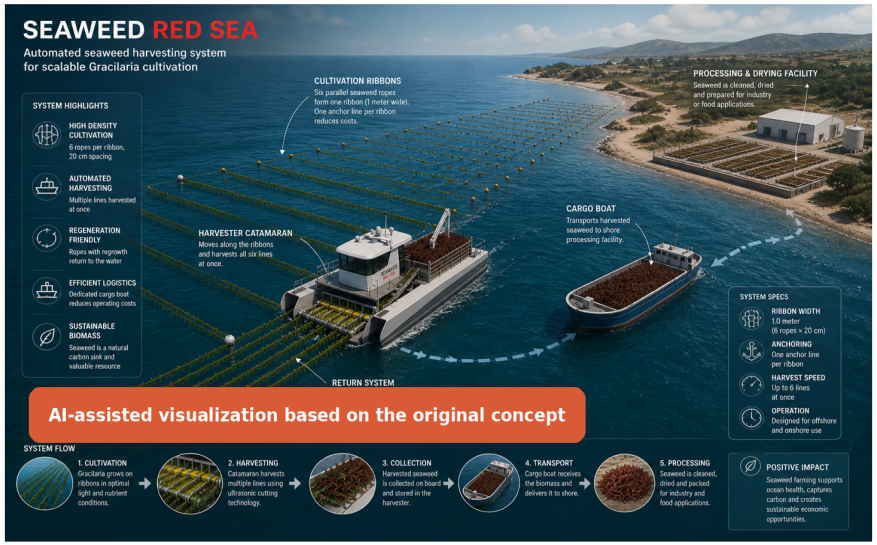
These figures show structured thinking, not a proven business model.
They are highly sensitive to growth rate, harvesting speed, and drying / washing assumptions.
The strongest signal is that the machine idea was already being linked to site CAPEX, operating cost, and payback.

The smart way to talk about this slide: the workbook does not prove the business, but it proves you were already translating a mechanism into revenue, burn, margin, and payback.

Why this concept still matters

An early climate-infrastructure concept that already showed system-level product thinking.





1 · Workflow, not gadget

The strongest idea was the full harvesting flow: dense cultivation ribbons, partial cutting, biomass collection, and regrowth lines returning to water in one pass.

2 · Systems and economics awareness

The project already connected farm geometry, boat count, throughput, facility load, and payback logic. Mechanism, operations, and cost structure were being designed together.

3 · Strong portfolio framing

Present it as an early climate-infrastructure concept: ambitious, system-level, and honest about stage. It shows how you think about physical automation.

What this project shows

From mechanism to operating system

Physical systems thinking

Designing real-world solutions at the intersection of biology, engineering, and infrastructure.

Mechanism → Workflow → Operating System

A harvesting machine is only one part. The full value comes from cultivation geometry, logistics, and the surrounding workflow.

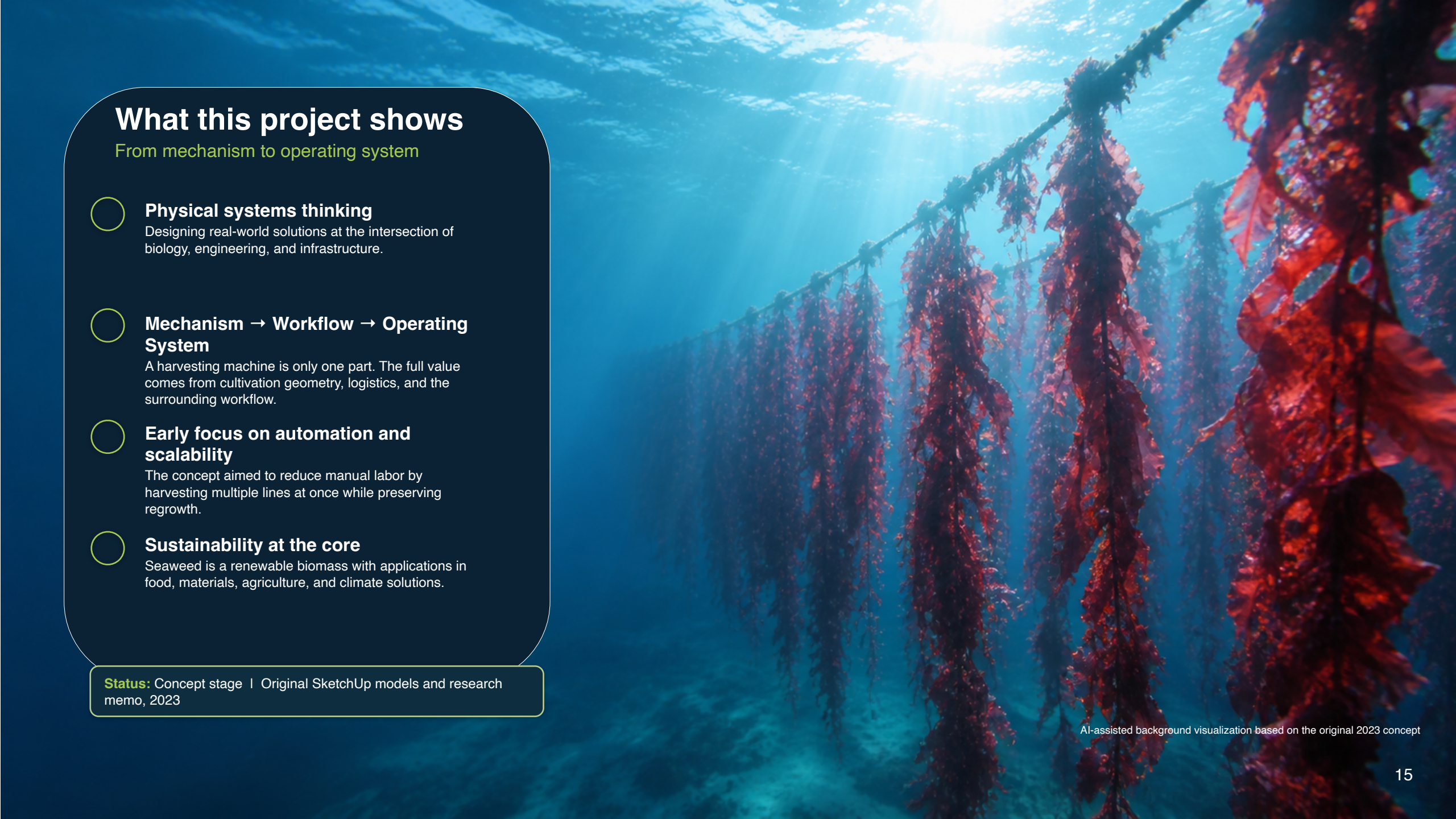
Early focus on automation and scalability

The concept aimed to reduce manual labor by harvesting multiple lines at once while preserving regrowth.

Sustainability at the core

Seaweed is a renewable biomass with applications in food, materials, agriculture, and climate solutions.

Status: Concept stage | Original SketchUp models and research memo, 2023



AI-assisted background visualization based on the original 2023 concept

Thank you

for your attention

SEAWEED RED SEA · Concept Deck

Original concept 2023 · Deck reconstructed in 2026