Reed Value Chains

A report produced by
the BalticReed project group

Interreg
Co-funded by
the European Union
Central Baltic Programme

BalticReed

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Photo: Eeva Tähtikarhu

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Background & Overview

1

Photo:Maija Salmiovaara

1.1

Background to BalticReed project

The **BalticReed project** — funded by the EU Interreg Central Baltic Programme — tackled the challenge of eutrophication in the Baltic Sea by harvesting dense reed beds along the coastlines of Finland, Åland and Sweden.

Reed beds accumulate substantial loads of phosphorus and nitrogen from coastal ecosystems. By removing the biomass, the project aims to help restore coastal habitats, improve water quality, and re-open shores for biodiversity and recreation.

At the same time, BalticReed aimed to build economically viable reed-based value chains: harvesting the biomass, developing new products, and involving entrepreneurs, municipalities and environmental authorities in creating sustainable business models.

The project period was May 2023 to April 2026 and covered pilot activities in coastal areas across the participating countries.

IN SHORT:

the project blended ecosystem restoration with circular economy innovation — harvesting coastal reeds not just for habitat improvement but for turning a previously under-utilized raw material into sustainable business opportunities.

1.2

2023–2026
BalticReed

Interreg
Co-funded by the European Union
Central Baltic Programme
BalticReed

GOAL

To remove nutrients from eutrophicated coastal areas of the Baltic Sea by harvesting reed beds and promoting an ecologically sustainable reed value chain in order to bring new reed products to the market.

BIOCOMPOSITE

ARTIFICIAL TURF GRIT

BUILDING MATERIAL

14
product development

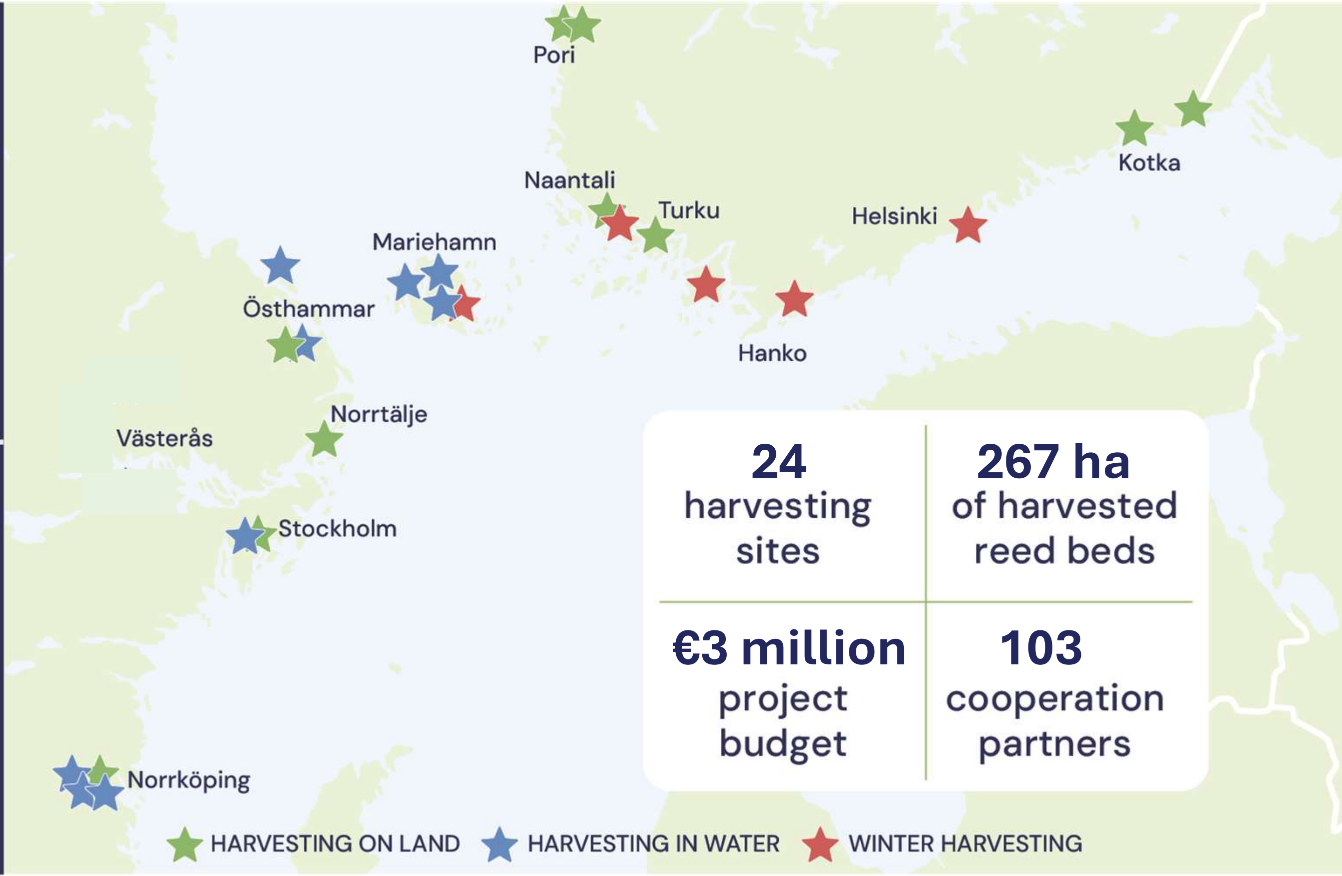
GARDEN PRODUCTS

DRINKING STRAWS

FEED

DISPOSABLE CONTAINERS

BIOGAS



24 harvesting sites

267 ha of harvested reed beds

€3 million project budget

103 cooperation partners

1.3

About this report

This report has been developed within the EU Interreg Central Baltic project BalticReed, which aims to unlock the potential of reed as a sustainable resource for the Baltic Sea region. It presents a value-chain analysis mapping of current reed-based production in Finland, Åland, and Sweden, identifying key bottlenecks as well as opportunities for innovation and growth.

By examining existing operating conditions, market structures, and practical challenges, the report highlights concrete development needs and solutions to strengthen reed-based value chains — from harvest to product. It is designed for entrepreneurs, policymakers, researchers, and regional actors interested in advancing bio-based materials, circular economy, and coastal restoration in the Central Baltic area or elsewhere.

The value-chain findings and recommendations in this report are derived from project pilot results, stakeholder consultations, interviews, workshops, event discussions, and complementary research conducted by the project consortium. They represent the project's collective interpretation and may not fully capture all regional variations or future developments.

Parallelly, four other project reports have been produced. Together the reports form a comprehensive framework for reed harvesting and utilization:

- Ecological guidelines for sustainable reed harvesting
- Guide to Reed Harvesting – Permits, Notifications and Assessments
- Monitoring of coastal bays following reed harvesting
- Riktlinjer för planering av vasslogistik (Swe, Fi)

The project is being funded by the EU's INTERREG Central Baltic programme, which finances cross-border cooperation projects to improve the state of coastal and marine environment.

Executive Summary

BalticReed, an EU Interreg Central Baltic programme project, demonstrates how harvesting common reed (*Phragmites australis*) can simultaneously deliver Baltic Sea nutrient reduction, biodiversity gains, and new circular-economy business opportunities across Finland, Åland and Sweden. Despite covering ~260,000 ha of coastline, less than 1% of reed is used today, even though each hectare stores significant amounts of phosphorus and nitrogen that can be removed through harvesting.

The project shows strong potential for reed to serve as a new regional biomaterial at a time when EU demand for sustainable raw materials is rising sharply and supply gaps are expected. Market opportunities include construction materials, soil products, animal feed and bedding, bioenergy, packaging, peat replacements, biocomposites, and future nature-credit mechanisms linked to nutrient removal and ecosystem services.

However, value chains are fragmented and face structural barriers and bottlenecks – unpredictable procurement, slow permitting, scattered harvesting areas, limited machinery, high logistics costs and low market awareness.

The value chain report maps these bottlenecks and proposes a clear development roadmap, including harmonized tendering and permitting, regional reed databases, multi-year contracts, shared equipment models, sustainable harvesting guidelines, and targeted funding to bridge initial cost gaps until economies of scale and market competitiveness is achieved.

Through pilots and product development with companies and municipalities, the project has demonstrated proof of concept and proof of value for multiple applications, with several showing strong technical and commercial promise.

For funders and policymakers, BalticReed highlights a scalable nature-based solution that aligns with EU climate, circularity and biodiversity goals. For entrepreneurs, it offers a growing market with early-mover advantage and a pathway toward competitive, high-value bio-based products. Together, these efforts can establish reed as a credible regional resource while supporting long-term Baltic Sea restoration and coastal resilience.

1.5

Common reed – *Phragmites australis*

Reed **grows naturally** almost everywhere in the world, including the coastlines of the Baltic Sea, as well as in the lakes of the Nordic countries.

Reed is a **self-sufficient** plant, which grows without nurturing, chemicals nor watering.

Reed **binds carbon** [1] in the summer, both in the stem and root system.

At the same time, reedbeds also act as filters and may uptake excess nutrients before they enter the Baltic Sea [2]. Reedbeds also prevents erosion, and function as important habitats for **local biodiversity** [2]. However, as reedbeds overgrow, water ways are blocked and nesting areas for birds, fish and insects are threatened.

Reed is often cut either for **ecological purposes** – such as coastal management, habitat restoration, or nutrient removal – or on **an ad hoc basis** to meet **practical or aesthetic needs**, rather than within a **coordinated ecological or commercial** management framework.

1.6

Historic use of common reed

Thatching & roofing – One of the most widespread uses; reed roofs are water-repellent, insulating and can last 30–50 years.

Mats, screens & fencing – Woven reeds used for windbreaks, privacy screens, floor mats and wall coverings.

Basketry & crafts – Baskets, ropes and simple tools made from bundled or woven reeds.

Building infill & insulation – Reed mixed with clay or mud in traditional walls.

Animal uses – Bedding, rough fodder, shelter material for livestock.

Fuel – Burned directly or bundled as a local biofuel before modern energy systems.

Musical instruments – Reed pipes, flutes and reed organ (the word “reed” in music comes from this plant).

Water & land management – Shoreline stabilization, erosion control and drainage support in wetlands and canals.

Household items – Writing tools, arrows, fishing tools.

WHY THIS MATTERS TODAY

These historic uses show that reed is:

- **Structurally strong and moisture-resistant**
- **Well suited for low-tech, low-energy processing**
- **Proven in construction, agriculture and daily life**

Modern reed-based products (biocomposites, insulation boards, packaging, pellets) build directly on this long tradition—now combined with **industrial processing, sustainability standards and circular-economy markets**.

1.7

Reed is a versatile material with many possible applications.

Here is a comprehensive list:

Soil & Environment
- Soil cover
- Mulch /Cover material
- Compost feedstock
- Erosion control
- Constructed wetlands
- Stormwater filtration

Agriculture & Animal Use
- Fodder
- Animal bedding pellets
- Livestock shelter material
- Silage component
- Insect habitat

Fiber, Craft & Textile
- Basketry
- Mats
- Woven panels
- Rope/twine
- Handicrafts

Cultural, Recreational & Aesthetic
- Landscaping
- Musical reeds/pipes
- Artistic installations
- Natural playground surfacing
- Artificial football turf

Building Materials
- Thatching
- Reed mats
- Insulation panels
- Acoustic panels
- Wall boards
- Clay–reed composites

Packaging & Consumer Products
- Straws
- Single-use tableware
- Food packaging
- Flowerpots
- Biocomposites
- Paper pulp
- Molded fiber items

Industrial Materials
- Pulp
- Nanocellulose
- Lignin fraction
- Adsorbents
- Composite reinforcement
- 3D-printing biomaterial

Water & Shoreline Management
- Shoreline stabilization
- Wave buffering
- Filtering & Nutrient removal
- Wetland carbon sequestration

Energy & Fuels
- Biogas
- Biofuel
- Bioethanol
- Biochar
- Pellets/briquettes

Different applications are in different stages of maturity. Some are already in commercial use while others are being researched.

Market

2

Photo: Anna Andersson

2.1

Demand for biomass in EU is expected to increase…

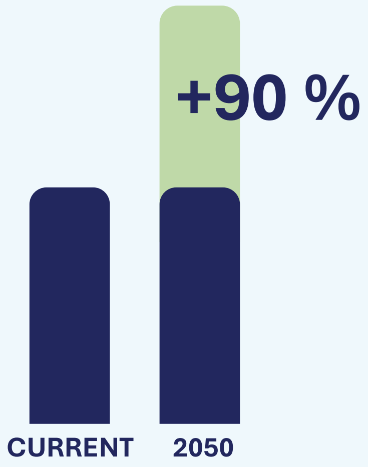
BIOMASS DEMAND IN THE EU

- EU biomass demand is projected to increase by 90% compared to today. The reasons behind are:
  - **Overconsumption** and processing of resources increase GHG emissions [3]
  - **Regulatory pressure:** Corporate reporting and EU demand to shift from fossil materials to biomass [4, 5]
  - **Consumer expectations**, consumers are increasingly demanding sustainable solutions [6, 7]

BIOMASS SUPPLY IN THE EU

- Current supply—forestry, agriculture, and recycled waste—may fall 40–100 % short of demand by 2050 [8]
- Total biomass supply in the EU is ~1 billion tdm, ~70% from agriculture (food, residues, grazed biomass).
- There is a pressing need for new bio-based raw material sources to meet future demand. [9]

…and unharvested potential is left in the sea.



<1 % of reed is utilized

Reed grows in Finland and Sweden on an estimated area of 260 000 ha [2]

2.2

Opportunities for reed across industries:

Construction: **12,7 % CAGR**	**Global sustainable construction materials market** (from $381Bn in 2023 to $1,263Bn by 2033 [10]). Building/construction accounts for 37% of global energy & process-related CO_2 emissions. [11]
Single-Use plastics: **5,1 % CAGR**	**Global disposable tableware market** (from $14Bn in 2023 to $22Bn by 2032 [12]). EU ban on single-use plastics by 2030 drives demand for alternatives like reed straws with superior water-repellant qualities. [13]
Biogas Production: **4,5 % CAGR**	**European biogas market** (from $24.6Bn in 2022 to $35Bn by 2030 [14]) Finland aims to quadruple biogas production to 4 TWh by 2030. [15] Reed can supplement biomasses from agriculture and food industry side streams.
Bioplastics & composites: **18,3 % CAGR**	**European bioplastics market** (from $5.82Bn in 2023 to $19.07Bn in 2030 [16]). Reed is a novel material for biocomposites. While replacing plastics, mechanical properties in composites can also be improved and developed for specific applications.
Moving away from Peat	**> 2,5 million m^3 of peat is utilized annually for non-energy purposes in Sweden and Finland** [17,18], and there is a growing pressure to find alternatives. Reed offers a sustainable alternative for energy, horticulture, animal bedding, and landscaping.

CGAR = compound annual growth rate

Selected Product-Specific Market Opportunities

ANIMAL FEED & FODDER

Demand for local fodder alternatives high on protein and fiber, low on sugar. No need for watering or fertilizing and doesn´t compete for agricultural land. Promising early market traction.

CONSTRUCTION MATERIALS

Insulation boards, thatching, bio-composites, panels; reed offers good thermal properties and a natural, low-carbon profile.

BIOMASS & ENERGY

Pellets, briquettes, or biogas feedstock as a renewable alternative to wood-based fuels.

BIOBASED PACKAGING

Biodegradable fibers for molded packaging, replacing plastics in select applications.

HORTICULTURE & SOIL PRODUCTS

Mulch, soil improvers, and peat substitutes in gardening and professional horticulture.

TEXTILES & DESIGN MATERIALS

Fibers for craft products, interior design elements, and natural fiber composites.

CARBON-SMART MATERIALS

Products marketed for low climate impact, especially where reed replaces more carbon-intensive inputs.

NATURE CREDIT MARKET

Valorizing reed as part of nutrient-removal systems (eutrophication mitigation), in the future potentially linked to carbon credits, biodiversity credits, nature credits or ecosystem-service payments.

Value Chain Mapping

3

Photo:Ilkka Vuorinen

3.1

Reed Value Chain

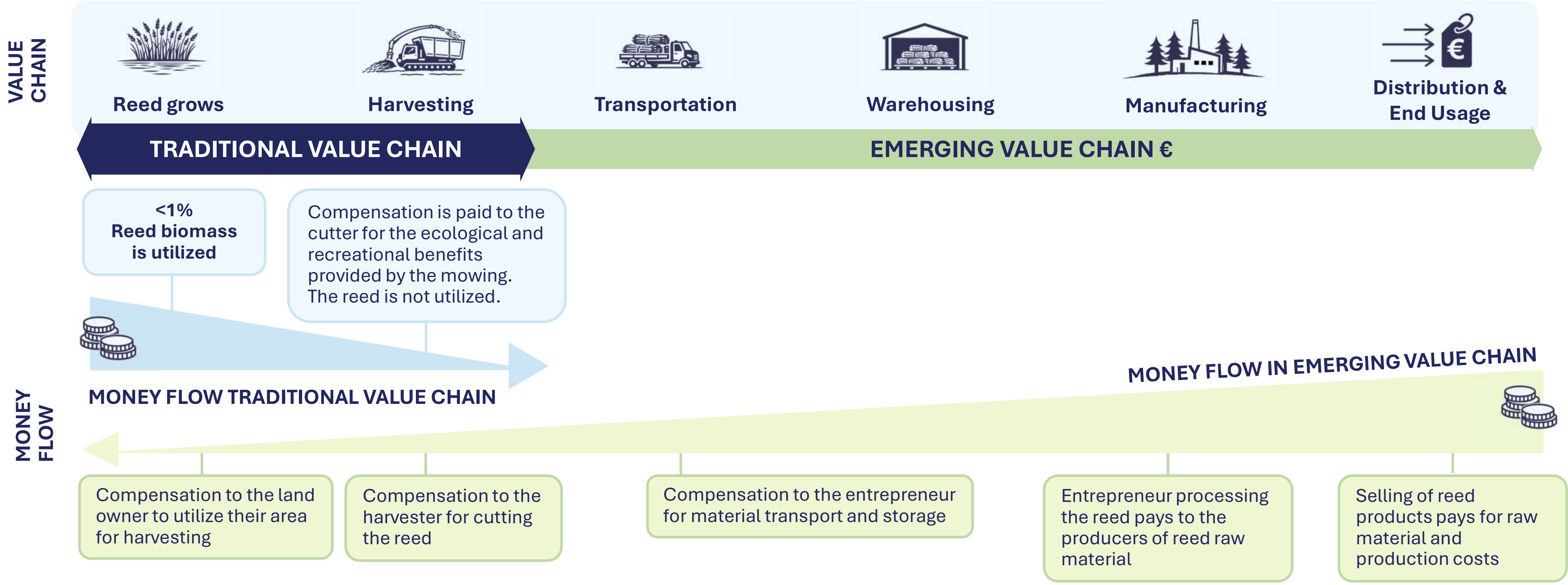
Current reed-based value chains are characterized by many small sized players and limited integration between them.

VALUE CHAIN	**Reed grows**	**Harvesting**	**Transportation**	**Warehousing**	**Manufacturing**	**Distribution & End Usage**
KEY PLAYER	**Land and water area owners;** **Public:** Municipalities, governmental orgs. **Private**: Private person or co-operative **Non-governmental orgs.**	**Harvester**	**Harvester** **Logistics partner**	**Harvester** **Warehouse operator** **Soil companies**	**Companies / Entrepreneurs / SMEs**	**Retailer** **End-user / Consumer, e.g. gardener**
TYPICAL MOTIVE	Improved biodiversity & water quality Nutrient removal Recreational value Lower carbon and methane emissions	Local source of livelihood Equipment synergies	Local source of livelihood Logistics synergies	Economies of scale / synergies Ensuring the quality of the raw material	New sustainable, local & alternative raw material Increased brand value	Sustainability High quality product

TRADITIONAL VALUE CHAIN — **EMERGING VALUE CHAIN**

Reed Value Chain Money Flow

To utilize reed as a raw material, new money flows are needed to cover the costs & profitability requirements in the full chain.



VALUE CHAIN

Reed grows

Harvesting

Transportation

Warehousing

Manufacturing

Distribution & End Usage

TRADITIONAL VALUE CHAIN

EMERGING VALUE CHAIN €

<1% Reed biomass is utilized

Compensation is paid to the cutter for the ecological and recreational benefits provided by the mowing. The reed is not utilized.

MONEY FLOW TRADITIONAL VALUE CHAIN

MONEY FLOW IN EMERGING VALUE CHAIN

MONEY FLOW

Compensation to the land owner to utilize their area for harvesting

Compensation to the harvester for cutting the reed

Compensation to the entrepreneur for material transport and storage

Entrepreneur processing the reed pays to the producers of reed raw material

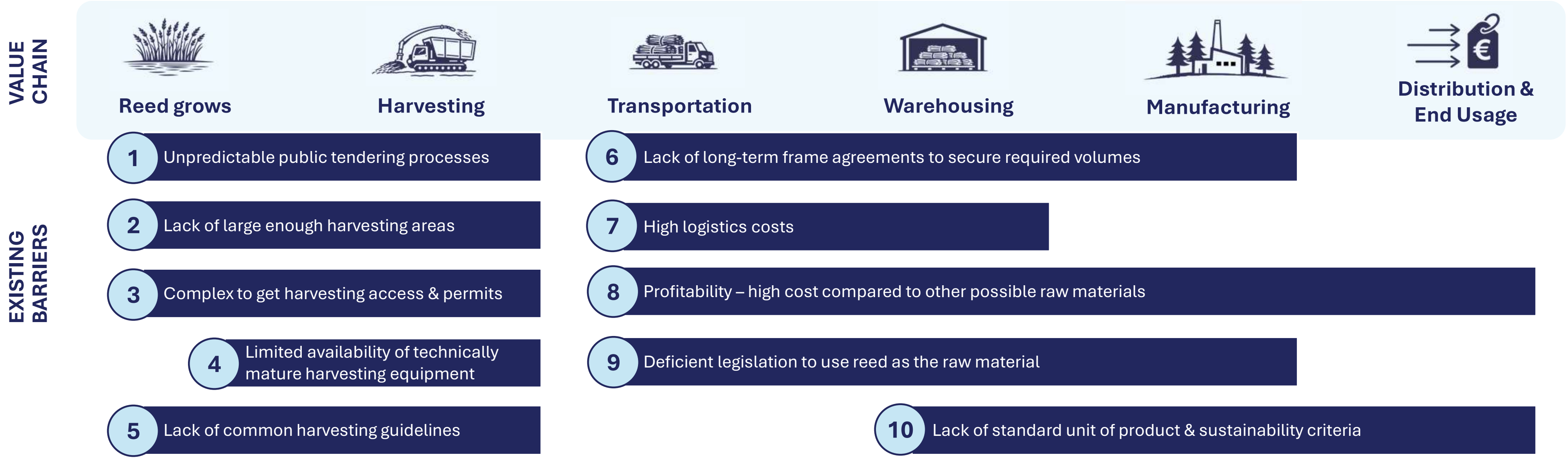
Selling of reed products pays for raw material and production costs

3.3

Barriers & Bottlenecks

There are a number of systematic barriers in scaling the reed-based value chains- and related businesses.

Key systematic barriers in scaling the reed-based value chains, challenges and bottlenecks that need to be considered in different parts of the value chain.



1 Unpredictable public tendering processes

2 Lack of large enough harvesting areas

3 Complex to get harvesting access & permits

4 Limited availability of technically mature harvesting equipment

5 Lack of common harvesting guidelines

6 Lack of long-term frame agreements to secure required volumes

7 High logistics costs

8 Profitability – high cost compared to other possible raw materials

9 Deficient legislation to use reed as the raw material

10 Lack of standard unit of product & sustainability criteria

See explanations of numbers 1-10 on following slides

3.4

Barriers, Bottlenecks & Solutions

A set of key requirements and solutions have been identified.

Key requirements and possible solutions to scale **(1/4)**

Barrier	Description	Key requirements for the scalable value chain	Possible solutions (long list)
Unpredictable public tendering processes ①	• There is no uniform way for public tenders • The scope of the bid is typically poorly defined (e.g. no info about reed density, dispatching areas, topography, rocks), so pricing is done based on the worst-case scenario • Calls for tender come on very short notice (e.g. only 1-2 moths prior to the harvest) and are one-time only (no long-term contracts)	• **Longer time reserved for planning & preparation of the offer** (incl. site visits) to estimate required resourcing and pricing properly • More detailed information about the harvesting area and the key requirements to be stated in the tender • **Long term contracts (up to 5 years) to increase harvesters' willingness to invest and enable increased efficiency** due to e.g. getting familiar with the area	**1A.** Train the public buyers for the best practices for tendering reed harvesting, start from the most influential actors first
Lack of large enough harvesting areas ②	• Harvesting areas are typically small and scattered • Information about potential harvesting areas is scattered; there is no full view on the possible harvesting areas at hand	• **Large enough harvesting areas** (min ~5 ha) • **Better visibility** to possible reed beds, logistics infrastructure and underlying nature values • **Increased coordination** among key stakeholders & joint information channels • **Possibility to combine different areas** (both nature protection areas and private areas) at proximity to be harvested at the same time	**2A.** Build updated common database for reed, e.g. register with information about the reed beds, underlying nature values, logistics infrastructure etc. **2B.** Develop platform for getting consent from private land & water owners for harvesting (duplicate, see 3C) or utilize existing digital platforms e.g. Maapörssi in Finland

Barriers, Bottlenecks & Solutions

A set of key requirements and solutions have been identified.

Key requirements and possible solutions to scale **(2/4)**

Barrier	Description	Key requirements for the scalable value chain	Possible solutions (long list)
Complex to get harvesting permits 3	• Permits/permissions from several actors are needed; water- and property owners, Authorities/County Administration Board and possible other actors if considering nature preservation areas (Natura-2000) • Tracking down the owners is very hard, even with the access to full public databases (e.g. ELY) • Getting required permits can take long time, require several steps that are not clearly stated and can be expensive • Permits are usually for one year or season at a time; additional years and/or changes requires new permit process.	• **Clear guidelines on what permits are required for which area** and how those should be applied • **Smoother and more efficient process** to get the required harvesting permits • **Scattered and small water area owners should be merged and organized to larger areas** (i.e. areas would be represented by one person and thus make contacting and gathering of permits more efficient)	**3A.** Create guidelines, develop new template and share information about the permit process and appropriate harvesting standards **3B.** Develop process for reed harvesting permits, enable easy way to make changes and renew the permit. Enable longer term permits over several years/seasons. **3C.** Reform permit process, for example by creating a registry where property- and water owners can give consent for harvesting for longer time periods
Limited availability of technically mature harvesting equipment 4	• Some existing equipment isn't designed to harvest on large scale with high efficiency • Separate equipment is needed for land vs water harvesting; and not all equipment is suitable for harvesting in shallow areas • Equipment is expensive and requires capital to be invested in	• **Investments and innovation in machine development** • **Required financing for the new equipment**	**4A.** Funding or new partnerships to develop and buy/build new equipment **4B.** Investments in new machinery and scaling up production. New financing options, possibility to rent/lease the required equipment.
Lack of common harvesting guidelines 5	• Not all the harvesting is equally good, e.g. over harvesting, summer vs. winter harvest, above or below the sea level, harming of the bottom sediments, consideration of bird & fish habitats • Currently, there isn't enough collected information / commonly agreed guidelines on how harvesting should be conducted responsibly	• **Clear guidelines for sustainable harvesting**, which would both guide harvesters in their operations as well as make the permit process more efficient (see #3) and enable better transparency & trust for the raw material buyer (see #10)	**5A.** Create industry wide sustainable harvesting guidelines and implement a code of conduct in standardized contracts, which would state e.g. when to harvest, what type of reed and area to harvest, and ensuring mosaic reedbed for biodiversity, etc.

Barriers, Bottlenecks & Solutions

A set of key requirements and solutions have been identified.

Key requirements and possible solutions to scale **(3/4)**

Barrier	Description	Key requirements for the scalable value chain	Possible solutions (long list)
Lack of long-term frame agreements to secure required volumes 6	• Current harvesting volumes aren't enough for launching new products towards large industries; even though the knowledge and facilities are ready • Harvesters don't have certainty over the upcoming demand for the raw material	• Clear commercial business case for using reed • Long term contract between property-owners, harvesters, logistics partners and manufacturer (and its partners) **would ensure longevity and volumes for all parties** • **Longer term visibility to reed demand would encourage investment**, as well as enable even larger transportation distances for machinery, which is especially important in cases where separate machinery is needed for different types of reed beds	**6A.** Agree several year contracts with a predefined harvesting plan to ensure continuity **6B.** Specify future requirements and start piloting on a smaller scale **6C**. Form collectives/associations or other collaborative bodies between harvesters to secure required volumes **6D.** Combine volumes from several sources by utilizing digital platforms, e.g. Maapörssi, or KiertoaSuomesta
High logistics costs 7	• Reed is a very airy raw material, especially when transported uncut • Due to high volumes, it is costly to transport reed long distances (approx. maximum distance 100-150 km) • Roads and intermediate warehousing is not available at all locations	• **Well planned logistics**; Trucks should transport something to- and from the harvesting area • **Large enough volumes**; minimum requirement is to have full truck, i.e. ~75 m^3 of reed at once • **Due to reed shrinking in size** (200 m^3 of reed → 100 m^3 cut reed) it is best to process it as far as possible close to the harvesting site (e.g. cutting, storage clamp, composting)	**7A.** One-time investment / funding for the establishment of proper infrastructure to optimal reed areas (pick-up spots, roads and loading areas), as well as facilities for processing the reed, such as composting facilities close to harvesting areas **7B.** Increase the size of the harvesting areas, see #2

Barriers, Bottlenecks & Solutions

A set of key requirements and solutions have been identified.

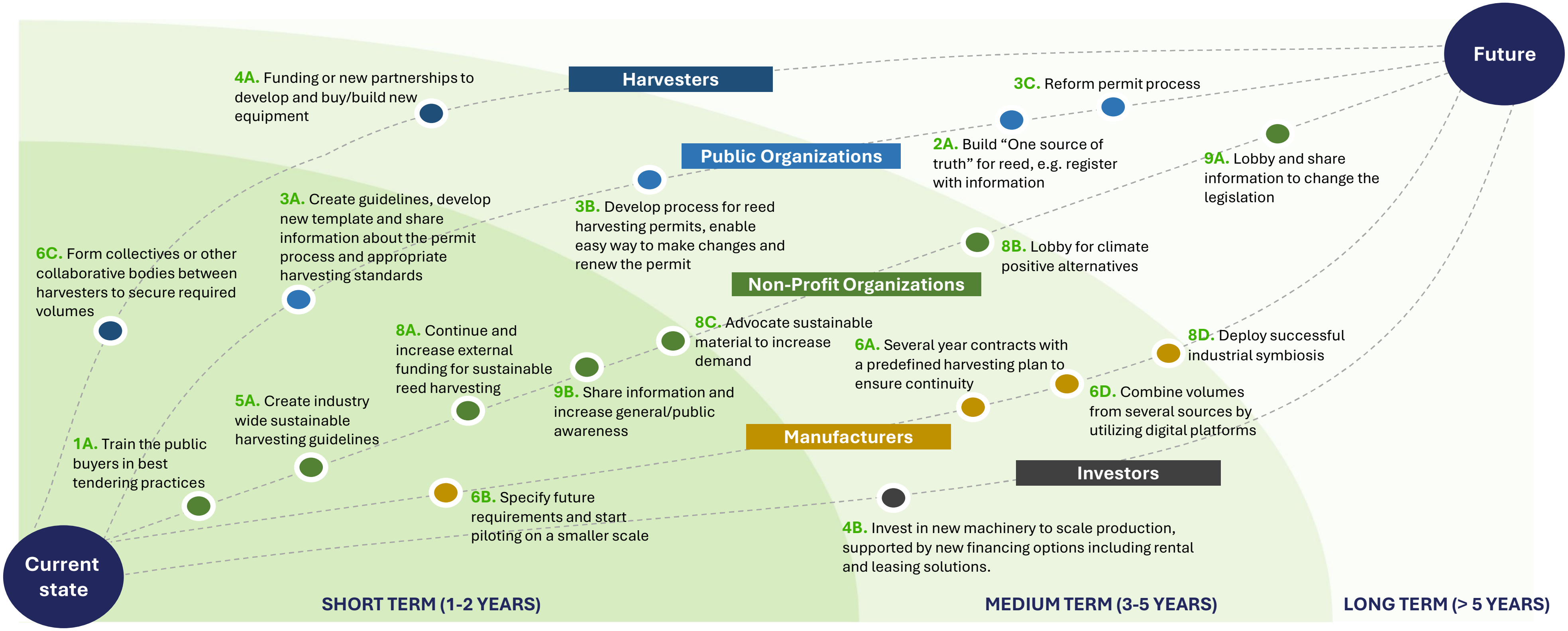
Key requirements and possible solutions to scale **(4/4)**

Barrier	Description	Key requirements for the scalable value chain	Possible solutions (long list)
Profitability – high cost compared to other possible raw materials 8	- Certain applications target a price sensitive market (e.g. soil, biogas, plastic) where sustainability currently doesn't provide premium price on a larger scale - Many competing raw materials are easily available and ready to be used with less processing needed in existing production systems - Lack of existing infrastructure for reed	- Harvesting and transportation need to be made more efficient (both by increasing volumes and enabling longer harvesting contracts) to enable competitive prices - Functioning overlapping value chains need to be created to maximize synergy value of the reed (e.g. over seasons biogas in summer, building material in winter)	**8A.** Continue and increase external funding for sustainable reed harvesting (e.g. through blended finance) **8B.** Lobby for climate positive alternatives for materials (tax, restrictions, environmental impact) 8C. Advocate sustainable material to increase demand (focus on industry and retail) **8D.** Deploy successful industrial symbiosis, e.g. residue from other productions streams **8E.** Form collective/association (See 6B)
Deficient legislation to use reed as the raw material 9	- Lack of definition of reed leads to it legislatively defined as waste, limiting it's use and requiring special permit for waste handling - Low or no willingness to pay for waste – some actors might expect gate fee from taking the reed - Updating legislation is tricky and time consuming	- Reeds need to be defined as raw material in legislation (instead of waste) - There should be clear guidelines for public entities on how they can further distribute the harvested reed for further usage	**9A.** Lobby and share information to change the legislation (in conjunction to other circular raw materials) **9B.** Share information and increase general/public awareness about the benefits of using reed as raw material
Lack of standards for reed unit, quality & sustainability 10	- There exists no unified measurement for unit or quality of the product, making selling & buying reed more complex (e.g. bundle/shredded/long, dryness, thickness, nutrient content) - There are no standards on the sustainability impact (nutrient removal, carbon, biodiversity), making usage of the claims in the end-product risky	- Unified measurement for unit of product as well as product quality characteristics should be defined - If sustainability claims will be used in selling the end-product, the sustainability and the origin should be possible to be audited / confirmed	**10A.** Propose and implement a set of standardized unit of product and quality criteria (e.g. industry best practice) **10B.** Look for existing certification bodies where reed could be included OR standardize "Sustainable reed harvesting" practices (see 5A)

3.5

Barriers, Bottlenecks & Solutions

Different actors are needed to build the future of sustainable and viable reed-based value chains



Current state

Future

Harvesters

Public Organizations

Non-Profit Organizations

Manufacturers

Investors

4A. Funding or new partnerships to develop and buy/build new equipment

6C. Form collectives or other collaborative bodies between harvesters to secure required volumes

3A. Create guidelines, develop new template and share information about the permit process and appropriate harvesting standards

3B. Develop process for reed harvesting permits, enable easy way to make changes and renew the permit

2A. Build "One source of truth" for reed, e.g. register with information

3C. Reform permit process

9A. Lobby and share information to change the legislation

8B. Lobby for climate positive alternatives

1A. Train the public buyers in best tendering practices

5A. Create industry wide sustainable harvesting guidelines

8A. Continue and increase external funding for sustainable reed harvesting

9B. Share information and increase general/public awareness

8C. Advocate sustainable material to increase demand

6A. Several year contracts with a predefined harvesting plan to ensure continuity

8D. Deploy successful industrial symbiosis

6D. Combine volumes from several sources by utilizing digital platforms

6B. Specify future requirements and start piloting on a smaller scale

4B. Invest in new machinery to scale production, supported by new financing options including rental and leasing solutions.

SHORT TERM (1-2 YEARS)

MEDIUM TERM (3-5 YEARS)

LONG TERM (> 5 YEARS)

Bridging the Gap to Price Competitiveness

Cost of harvesting, and consequently market pricing, is a key bottleneck.
For reed to become a commercially competitive material in the short-to mid term, various shifts need to take place.

CURRENT COST OF REED MATERIAL
The current cost of reed material may initially be higher than alternative materials. Commercial use is emerging but in early stages, so harvesting and processing is still expensive. While cost is only one factor in product success (see WILLINGNESS TO PAY), narrowing significant price gaps with competing materials improves market acceptance and competitiveness.

EXTERNAL FUNDING
For reed to become cost-competitive with alternative materials, the current cost gap must be bridged. External funding—through investors, grants, subsidies, or project support—is essential to scale operations and achieve efficiencies. Over time, this need decreases as products become self-sustaining and sales cover production costs.

ECONOMIES OF SCALE
Increasing volumes enable better planning, more efficient harvesting machines, improved techniques, and streamlined logistics. As operations scale and processes become faster and more coordinated, unit costs decrease. In short, economies of scale mean each tonne becomes cheaper to harvest and handle as production grows.

WILLINGNESS TO PAY
By clearly communicating the benefits of reed-based products—quality, performance, design, and environmental value—market awareness and willingness to pay will grow. In some segments, customers may even accept a premium when the added value of reed is effectively demonstrated and understood.

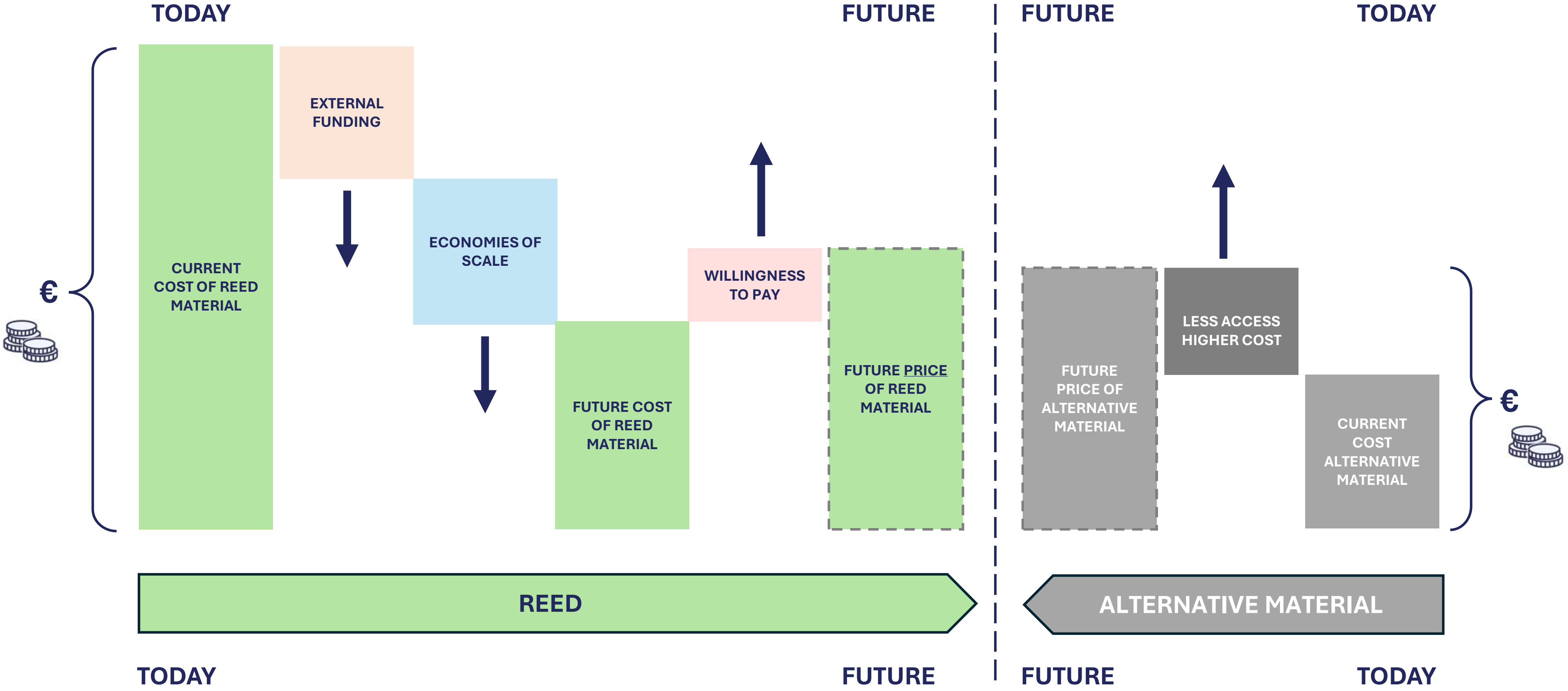
ALTERNATIVE MATERIAL
Current Cost: Many less sustainable biomaterials are still cheap partly due to historic market incentives.
Less Access, Higher Cost & Future Price:
However, as regulations tighten, awareness grows, and resources become scarcer, prices will rise—boosting the competitiveness of sustainable alternatives like reed.

Examples of alternative material: peat, roughage, plastic- and paper products, tiles, etc..

See illustration
on next page →

3.7

Bridging the Gap – An Infograph



3.8

Summary: Value Chain, Barriers & Solutions

Disconnected stakeholders in value chain
Fragmented stakeholders with misaligned incentives, low awareness and weak coordination across the reed value chain.
Solution: Connect stakeholders and align incentives by clearly demonstrating the ecological and economic value of reed biomass.

Unpredictable tendering & short planning windows
Public procurement varies regionally, deadlines are short, and tenders lack key data (density, terrain, access).
Solution: Standardize tendering, provide better site info, and enable multi-year contracts.

Scattered, small, and poorly mapped reed areas
Potential harvesting sites are fragmented and hard to identify.
Solution: Create a comprehensive database for reed beds, logistics access and nature values; combine adjacent areas.

Slow and complex permitting processes
Multiple authorities, unclear steps, long waiting times, and expensive permits.
Solution: Develop clear guidelines, harmonize processes, enable long-term consent registries.

Limited availability of suitable harvesting equipment
Current machinery is not optimized for large-scale or shallow areas; high capital costs.
Solution: Co-invest in specialized machines, create equipment pools, enable leasing models.

Lack of consistent harvesting guidelines
Practices vary widely, risking biodiversity harm and inefficiency.
Solution: Establish industry-wide sustainable harvesting standards and codes of conduct.

Inconsistent biomass supply and limited long-term demand
Volumes vary yearly; few long-term buyers; fragmented harvesters.
Solution: Secure multi-year frame agreements, build harvester collectives, establish regional supply hubs.

High logistics costs and weak infrastructure
Uncut reed is low-density and expensive to transport; limited access roads and processing sites.
Solution: Invest in local pre-processing (cutting, baling, compacting), improve access points, optimize routing.

Limited processing capacity for reed-based products
Few facilities exist; adaptation to reed requires investment.
Solution: Support modular processing plants; partner with existing straw/hemp/wood processors.

Weak market awareness and competition from low-cost materials
Buyers lack familiarity; competing materials often cheaper.
Solution: Provide pilots and performance data. Communicate product advantages and sustainability benefits; target niche/high-value markets. With investments, efficiency gains and scale up production cost can come down in time – resulting in more competitive market pricing.

No unified standards for quality, units or sustainability claims
Difficult to trade reed without agreed product specs or verified environmental impact.
Solution: Define format and quality metrics, create certification schemes, enable auditing of origin and impacts.

Nature credit market
Valorizing reed as part of nutrient-removal systems (eutrophication mitigation), in the future potentially linked to **carbon credits, biodiversity credits, nature credits** or ecosystem-service payments.

Product Development

4

- An Outline of Products Developed Through Collaboration Between stakeholders, and the BalticReed Project
- The BalticReed project group has been a catalyst for product development, directly or indirectly, together with various collaborators (entrepreneurs, commercial companies, local and regional authorities, etc.).

Photo: Sonja Jaari

4.1

Selected Product-Specific Market Opportunities

REED BEDS:

- Grows naturally
- Self-sufficient
- Binds nutrients & carbon
- Generally unwanted

CHARACTERISTICS:

- Local
- High-quality
- Durable
- Free from toxins
- Renewable

SUSTAINABLE HARVESTING CAN:

- Remove excess nutrients, such as phosphorus*
- Improve water quality & flow
- Restore the coastal environment
- Promote biodiversity

10 kg/ha of phosphorus ☀

2 kg/ha of phosphorus ❄

One hectare of summer reed contains 5–10 kg of phosphorus and 50–100 kg of nitrogen. Winter reed contains less as nutrients withdraw to the root system. [2, 20]

4.2

List of Products and Value Chains explored in the BalticReed project:

Soil

Cover material in garden

Playground safety material

Animal bedding

Compost litter, toilet litter

Fodder

Biogas

Pellets

Drinking straws

Disposable tableware

Biocomposites

Mushroom substrate

Roofs & Building materials

Biochar

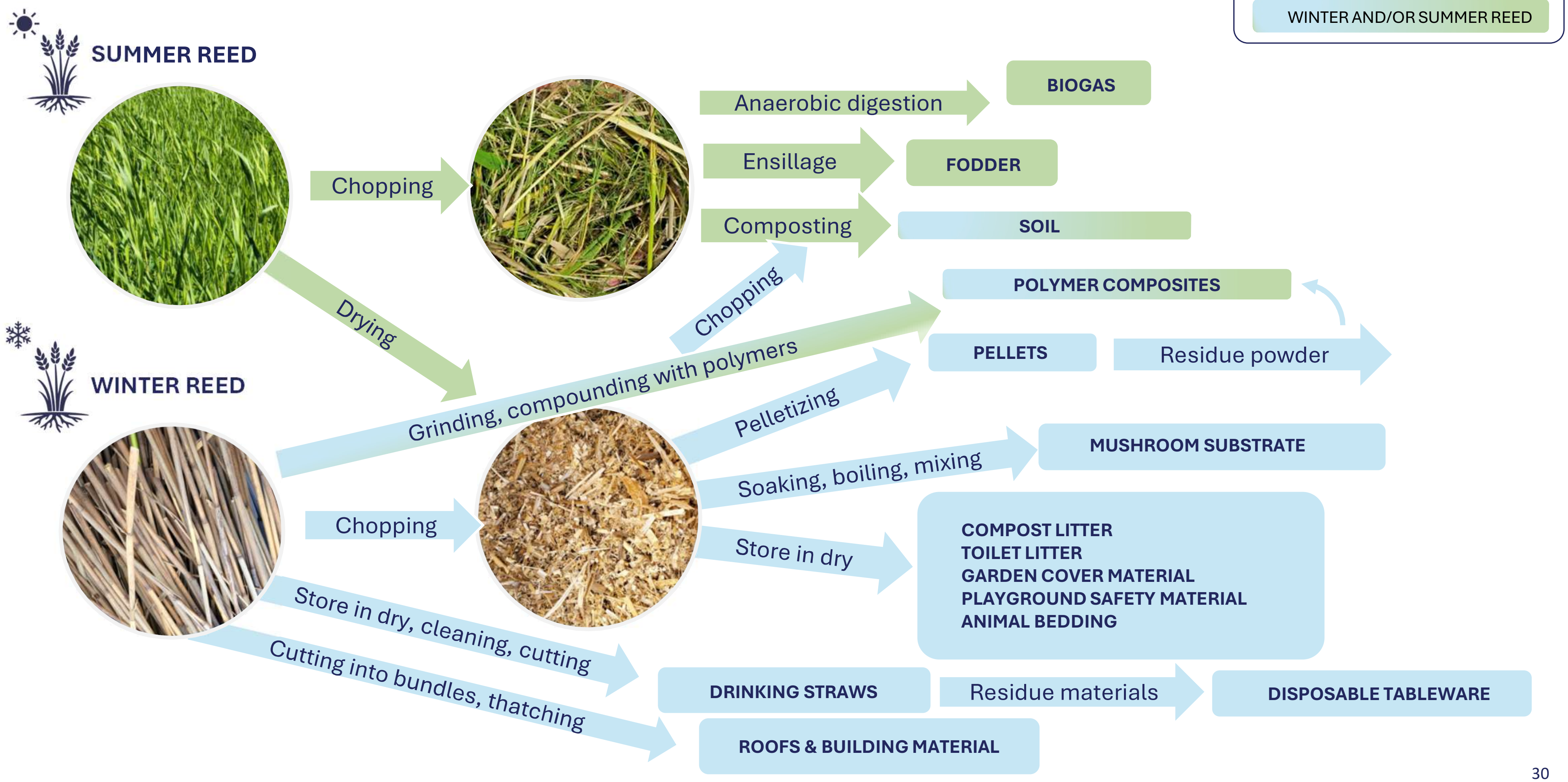
Extent of engagement in different applications has varied depending on requirements for respective application, ex:

- **LABORATORY ASSESSMENTS**
    - chemical composition
    - material properties
- **PRODUCTION PILOTS**
    - Harvesting
    - Transporting
    - Processing
    - Packaging
- **FOCUS GROUPS AND WORKSHOPS**
    - Researchers
    - Industry experts
    - Commercial companies
    - Regulatory authorities

4.3

Product Development & Processing

REED USED
🟩 SUMMER REED
🟦 WINTER REED
WINTER AND/OR SUMMER REED



SUMMER REED

Chopping

Anaerobic digestion → **BIOGAS**

Ensillage → **FODDER**

Composting → **SOIL**

Drying

WINTER REED

Chopping

Chopping

Grinding, compounding with polymers → **POLYMER COMPOSITES**

Pelletizing → **PELLETS**

Residue powder

Soaking, boiling, mixing → **MUSHROOM SUBSTRATE**

Store in dry →

COMPOST LITTER
TOILET LITTER
GARDEN COVER MATERIAL
PLAYGROUND SAFETY MATERIAL
ANIMAL BEDDING

Store in dry, cleaning, cutting → **DRINKING STRAWS**

Residue materials → **DISPOSABLE TABLEWARE**

Cutting into bundles, thatching → **ROOFS & BUILDING MATERIAL**

4.4

Product Development & Processing

REED USED
SUMMER REED
WINTER REED
WINTER AND/OR SUMMER REED

(LOW) DEGREE OF PROCESSING (HIGH)

COVER MATERIAL IN GARDEN [21]
+ easy production & storage
+ no further processing
+ prevents unwanted species growth in gardening
- variation in efficiency
- requires regular reapplication

PLAYGROUND SAFETY MATERIAL [21]
+ easy production & storage
+ no further processing
+ natural material
+ good results in Head Injury Criterion (HIC) test
- requires periodic replenishment
- transport-inefficient (bulky, density)

ANIMAL BEDDING
+ easy production & storage
+ no further processing
+ variation in material interesting for horses
- transport-inefficient (bulky, density)

ROOFS & BUILDING MATERIAL
+ renewable and bio-based
+ long service life with carbon storage
+ good insulation and moisture regulation
+ strong cultural heritage and premium aesthetics
– labour-intensive installation
– limited availability of skilled installers
– mainly suited for niche or high-end markets

SOIL
+ replaces peat and other carbon-intensive inputs
+ simple processing, low technical barriers
– low margins
– variable nutrient content
– requires blending for consistent quality

DRINKING STRAWS
+ bio-based, plastic-free
+ water-repellent and rigid
+ compliant with EU plastic bans
+ strong sustainability narrative
– higher cost than plastic or paper
– variable size and quality
– limited volume potential (niche market)

FODDER [22, 23]
+ low sugar, high protein and fibre
+ extends the feeding season with low sugar intake
+ low heavy-metal uptake
+ no land-use competition; reduces import dependence
– short harvesting time window
– requires adaptation by animals
– must be blended for a balanced diet

COMPOSTE LITTER, TOILET LITTER
+ easy production & storage
+ can replace peat and forestry products
+ local value chains possible
- low margin industry

BIOGAS
+ maximizes nutrient removal
+ complements agricultural and food-industry side streams
+ suitable for anaerobic digestion with basic pre-treatment
– lower methane yield than some substrates
– requires pre-treatment to improve digestibility
– seasonal biomass availability

PELLETS [24]
+ from chopped or long winter reed
+ efficient in transport
+ multipurpose: animal bedding, burning, raw material for other uses
- separate production equipment needed

SINGLE USE PRODUCTS
+ bio-based, plastic-free
+ EU-compliant for single-use restrictions
+ strong sustainability and consumer appeal
+ food-contact suitable (with proper processing)
– higher cost than plastic or paper
– requires industrial molding infrastructure
– limited compostability (binder-dependent)
– price-sensitive, competitive market

POLYMER COMPOSITES [25]
+ less plastic use
+ lower carbon footprint than pure plastic
+ technical properties can be enhanced
+ summer reed can be used if dried
- recyclability and circularity under research
- higher price than conventional plastics
- complex regulations

MUSHROOM SUBSTRATE [26]
+ biological performance higher than with hemp shives in pilot study (productivity and growing speed)
+ positive results despite problems with homogeneity
+ good potential if correct optimization is achieved
- need for homogenous size after chopping
- need to be stored so no mold grows

4.5

Product Life Cycle

PRODUCT LIFE CYCLE*

The Product Life Cycle model (PLC) describes six stages: product development, introduction, growth, maturity, decline, and potential extension. Each phase has distinct characteristics in terms of sales, profitability, competition, and marketing strategy. Understanding these stages helps businesses anticipate market shifts, allocate resources effectively, and identify opportunities for innovation, renewal, and long-term profitability throughout the product's lifespan.

Typically, sales and profits start low, rise rapidly during growth, peak at maturity, and decline as market saturation increases.

The BalticReed project group´s purpose has been to support the development of reed-based products, together with commercial companies and other stakeholders. Depending on which phase the product is in, the project group´s role has been adapted to offer the relevant support.

**PLC is a generic model, used to map out, analyze and plan around. The different variables can differ significantly (duration of phases, sales/profit, market conditions, etc.) for different products and industries.* [27, 28]

PRODUCT DEVELOPMENT

The product development phase marks the start of creating reed-based products. Activities include idea generation, material testing, research, and prototyping to explore suitable uses for common reed biomass. This phase focuses on understanding material characteristics and ensuring that product performance meets design- and market expectations before launch.

INTRODUCTION

The introduction phase begins when products made from common reed biomass are launched on the market. Sales start modestly as awareness grows, while investments focus on harvesting systems, processing equipment, logistics, and marketing. Efforts aim to establish reliable supply chains, demonstrate product quality, and build customer confidence in reed-based, sustainable alternatives.

GROWTH

The growth phase begins as demand for reed-based products increases and markets expand. Production capacity and harvesting operations are scaled up, supported by investments in machinery, logistics, and quality assurance. Companies focus on improving efficiency, building partnerships, and strengthening distribution, while growing awareness of the environmental and economic benefits of reed-based materials.

MATURITY

The maturity phase is reached when reed-based products are well established in the market and demand stabilizes. Production processes, harvesting, and logistics are optimized for cost efficiency and consistent quality. Competition increases, driving differentiation through branding, innovation, and sustainability performance, while companies seek to maintain market share and maximize profitability.

DECLINE

The decline phase occurs when demand for reed-based products decreases due to market saturation, new technologies, or changing consumer preferences. Production may be reduced or diversified into new applications. Companies focus on cost control, product adaptation, or transitioning resources toward innovation and product extension to sustain business value and relevance.

PRODUCT EXTENSION

The product extension phase aims to revitalize reed-based products after market decline. Strategies may include improving material properties, developing new applications, or targeting emerging markets. By innovating design, processing, or marketing, companies can extend the product's life cycle, attract new customers, and reinforce the value of sustainable reed-based solutions.

PROOF OF CONCEPT & PROOF OF VALUE

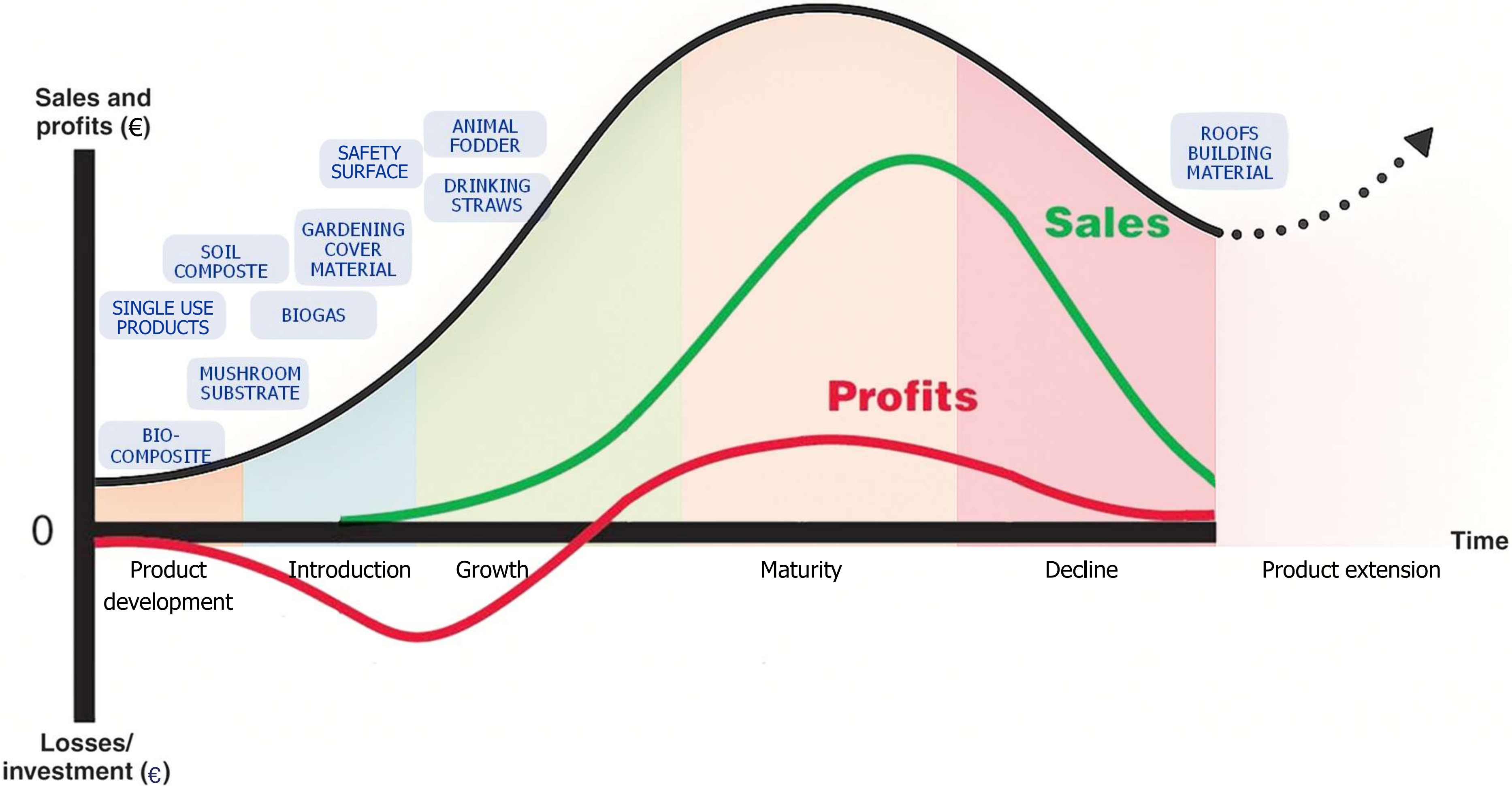
To successfully develop reed-based value chains, key stakeholders must be engaged—ranging from researchers and landowners to municipalities, companies, and investors. The BalticReed project group has approached this with two parallel methods:

1) Practical – Proof of Concept: Pilots involving harvesting, transport, and material testing demonstrate feasibility, build trust, and connect stakeholders along the value chain. These shared activities foster ownership and serve as replicable case studies.

2) Theoretical – Proof of Value: Market analyses, business cases, and communication of reed-based opportunities demonstrate commercial potential. By clarifying costs, benefits, demand, and competitive advantages, stakeholders gain confidence in the economic viability of reed value chains—ensuring that environmental goals align with long-term market success.

4.6

Product life cycle – selected products



Business Model, Sales, Costs and Margins

5

- When planning, launching or running a business, it´s beneficial to consider central aspects;
- Who is the buyer? What will it take to deliver my product to them? What costs will I have? How can I price it – this in turn dictates how much revenue I can get and what profit will there be in the end

Photo: Anna Andersson

5.1

Key Parts of Product Costing and Pricing

It's crucial to build a realistic costing- and pricing model to ensures competitiveness and profitability.

RAW MATERIAL & HARVESTING

- Harvesting operations (labor, fuel, machinery, maintenance)
- Transport from site to storage or processing facility
- Site preparation, access, and environmental permits
- Storage and drying (facilities, handling, losses)

PROCESSING & PRODUCTION

- Machinery and equipment (purchase, depreciation, maintenance)
- Energy use (electricity, fuel, heat)
- Processing steps (cutting, shredding, compressing, pelletizing, etc.)
- Consumables and inputs (binders, additives, packaging)
- Production and quality control
- Waste management and by-product handling

OVERHEAD & ADMIN

- Facility rent, insurance, and compliance costs
- R&D and product innovation
- Management, accounting, HR, and IT systems
- Certifications, licensing, and audits

DISTRIBUTION & LOGISTICS

- Transportation to distributors or retailers
- Warehousing and inventory management
- Export/customs fees
- Handling and potential losses in transit

MARKETING & SALES

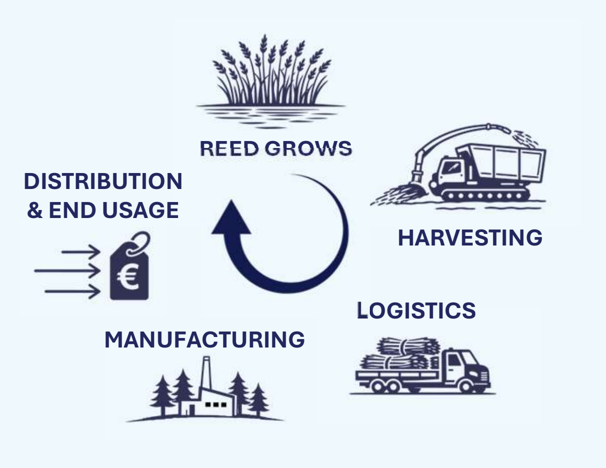
- Market research, branding, and communications
- Advertising, digital marketing, and trade fairs
- Packaging design and labeling
- Sales commissions, customer service, and retail margins

PRICING STRATEGY

- **Cost-based pricing:** setting price by adding a markup on total cost
- **Market-based pricing:** aligning with comparable natural materials (e.g. straw, hemp, wood fiber)
- **Value-based pricing:** incorporating ecological and local sourcing benefits
- **Tiered pricing:** adjusting by volume, product grade, or customer segment

FINANCIAL INDICATORS

- Break-even analysis (minimum sales volume for profitability)
- Contribution margin (price – variable cost)
- Return on investment (ROI) and payback period
- Sensitivity analysis for changes in yield, cost, or pricing



MARGINS & PROFITABILITY

Ensuring **adequate margins** to cover all costs and yield **sustainable profit**.

- **Gross margin:** difference between sales price and direct production cost
- **Operating margin:** profit after overhead and marketing costs
- **Target margin:** typically set based on industry benchmarks and investor expectations
- **Profit buffer:** accounting for fluctuations in raw material availability, energy prices, demand, etc.
  Factoring in clear and realistic margins safeguards the business against volatility and ensures long-term financial resilience.

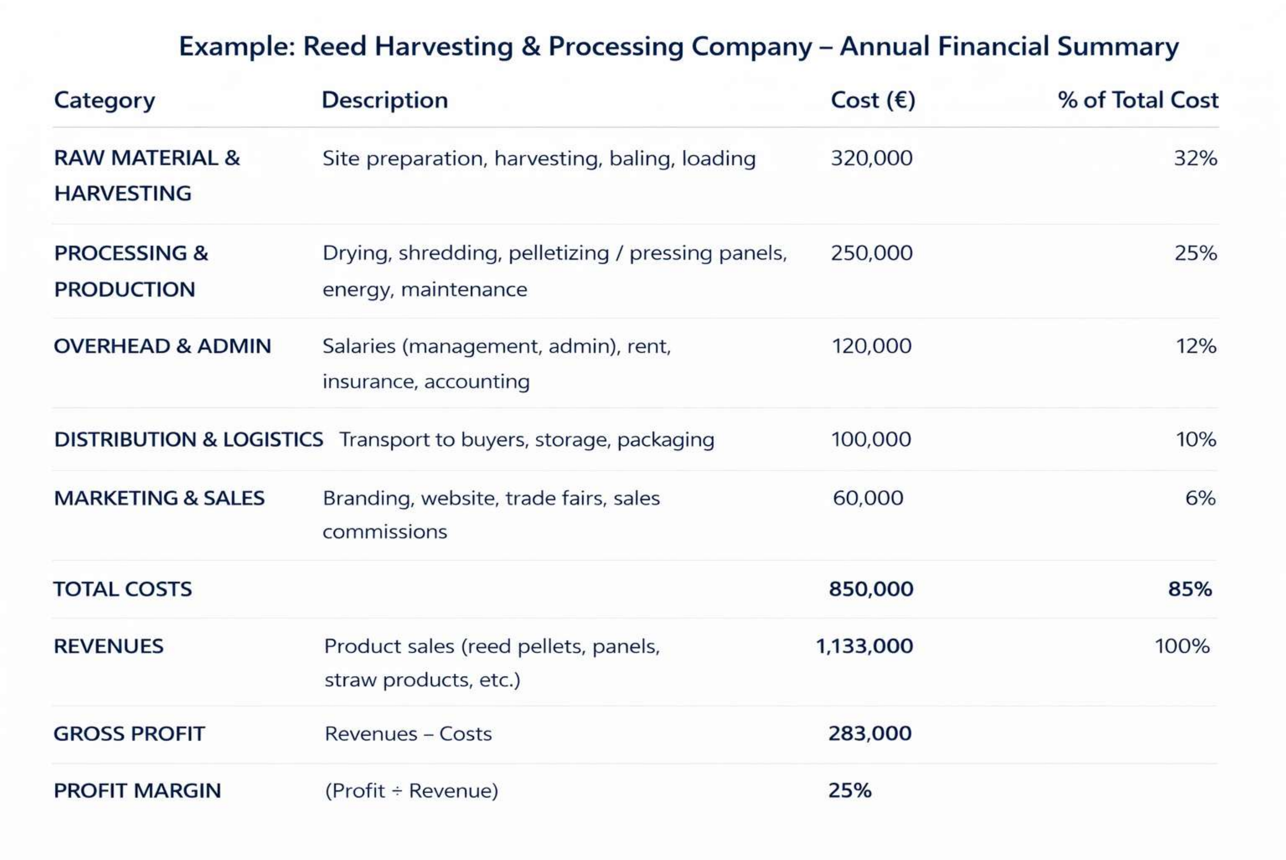
EXTERNAL & SUSTAINABILITY FACTORS

- Carbon footprint and environmental co-benefits
- Access to green subsidies or circular-economy funding
- Compliance with building codes, product standards, or eco-labels
- Seasonal availability and long-term resource management

5.2

Revenues, Cost & Profit

Hypothetical example of what revenue, cost and profits sheet could look like.
Numbers are fictional and only for illustration.



Example: Reed Harvesting & Processing Company – Annual Financial Summary

Category	Description	Cost (€)	% of Total Cost
RAW MATERIAL & HARVESTING	Site preparation, harvesting, baling, loading	320,000	32%
PROCESSING & PRODUCTION	Drying, shredding, pelletizing / pressing panels, energy, maintenance	250,000	25%
OVERHEAD & ADMIN	Salaries (management, admin), rent, insurance, accounting	120,000	12%
DISTRIBUTION & LOGISTICS	Transport to buyers, storage, packaging	100,000	10%
MARKETING & SALES	Branding, website, trade fairs, sales commissions	60,000	6%
TOTAL COSTS		**850,000**	**85%**
REVENUES	Product sales (reed pellets, panels, straw products, etc.)	**1,133,000**	100%
GROSS PROFIT	Revenues – Costs	**283,000**	
PROFIT MARGIN	(Profit ÷ Revenue)	**25%**	

Funding Sources

6

Overview of public and private funding and investment options for reed-based projects and businesses—showing who provides funding, what they support (restoration, research, or commercial scaling), and which pathways are best suited at different stages of development.

Photo: Eeva Tähtikarhu

6

Funding Sources

Examples of possible sources of funding & financing (non-exhaustive list) that could be channeled to reed-based value chains.

	Private			Public	
Description	Private donors and foundations allocating funds in form of grants or awards to projects aligning with their aims, either in form of direct environmental impact or research.		Private investments, for example, venture capital, angel investors and catalysts, either in form of equity or loans.	The governments allocating funds to entities, such as registered associations, water area cooperatives, municipalities or companies, for public benefit projects.	
	Environmental project funding/grants	**Research funding**	**Business financing**	**Environmental project funding**	**Business financing**
Examples	• Baltic Sea Conservation Foundation • Ålandsbanken – Östersjöprojektet • Nordic Environment Finance Corporation (NEFCO) • Postkodstiftelsen (SE) • BalticSea2020	• The Association of Finnish Foundations (list) • Östersjöstiftelsen • Kone Foundation • Maj and Tor Nessling foundation • Lantmännen research foundation • Formas (SE)	• Nordic Environment Finance Corporation (NEFCO) • First Fellow Partners • Milkywire • Nordic Investment Bank • Catalysts / hubs e.g. A'Pelago • Angel investors / family offices • Impact VCs (bioeconomy, circular economy)	• EU programs e.g. Horizon, LIFE and Interreg • Helmi habitats programs (FI) • LOVA / LONA grants (SE) • Baltic Sea Action Plan Fund • Vaikuta Vesiin (FI)	• NEFCO • ELY financing for rural businessess • Leader (FI, SE) • Business Finland • European Comission Innovation funds
Driver	Environmental impact ether in terms of biodiversity, nutrient removal or benefiting water quality Resource efficiency	Primarily supports academic and applied research, including doctoral and postdoctoral work	The funder expects return on investment as well as return on impact	Environmental impact ether in terms of biodiversity, nutrient removal or benefiting water quality Resource efficiency	Supporting (local) businesses, mainly in rural areas, with intent to increase activities in a sustainable manner
Actor	Environmental organizations, public bodies and other institutions or companies	Researchers or research institutes	Investments are mainly targeted at SMEs and startups	Environmental organizations, public bodies and other institutions	Investments are mainly targeted at SMEs and startups
Applicability	**Medium -** Limited to project scope and lifespan	**Medium -** Limited to research only	Low for early-stage restoration-only projects; higher for scalable bioeconomy business models	**High -** Highly applicable, focus on restoration	**High -** Highly applicable, focus on business cases

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7

Photo: Maria Gustavsson

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Photo: Pasi Jakkula

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