Workshop

Developing novel blue biorefineries from aquatic resources

Organised by CEVA

Advancing Zero-Waste Multi-Product Biorefineries Through Innovative Technologies

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Coordinator of IMPRESS

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Co-funded by the European Union

What is a Biorefinery?

What is a Biorefinery?

- ✔ A facility that integrates biomass conversion processes and equipment to produce **fuels**, **power**, and **chemicals** from biomass.

- ✔ Analogous to today's petroleum refineries

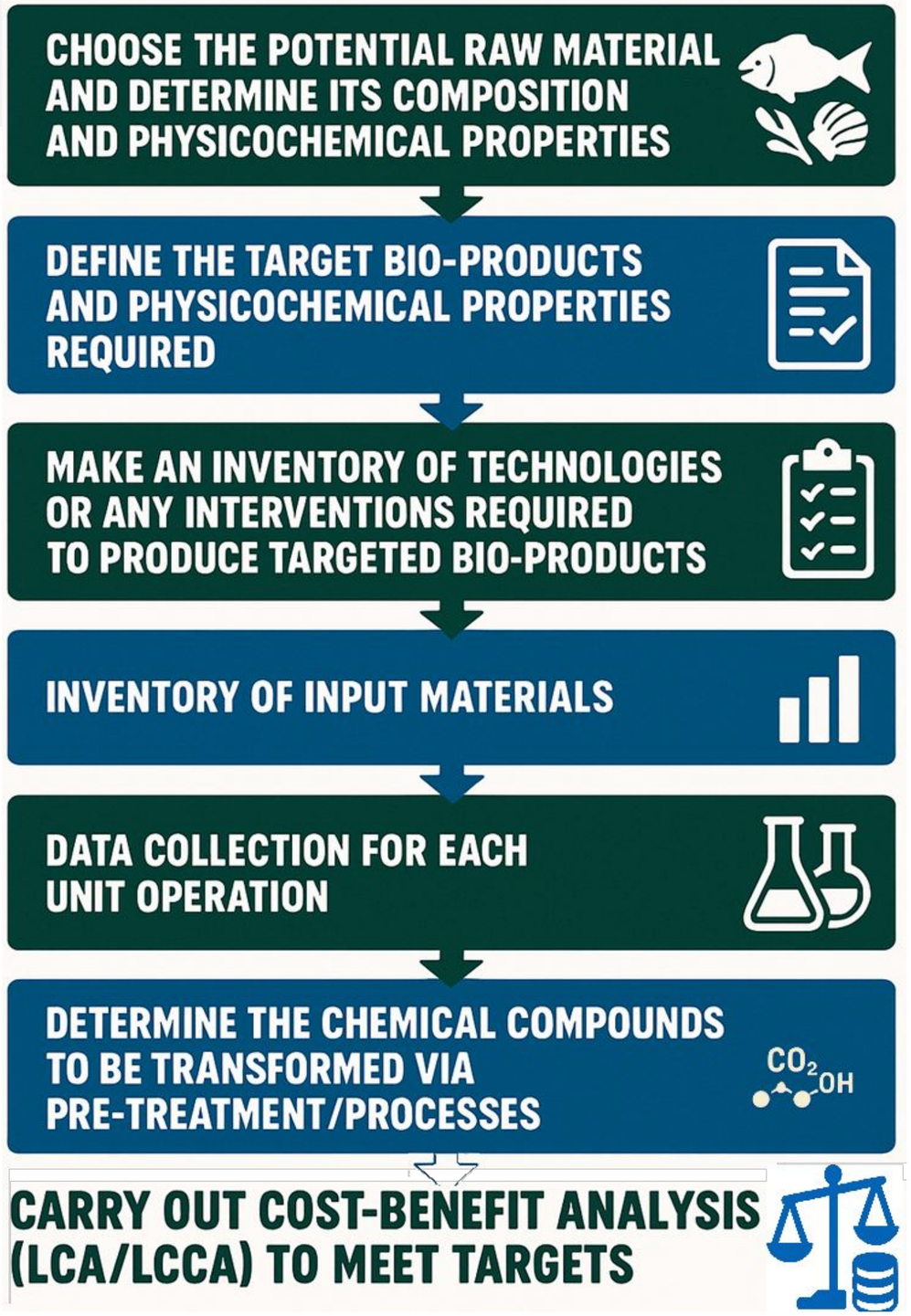
- ✔ The sustainable processing of biomass into a spectrum of bio-based products (**Food, Feed, Ingredients, Chemicals**) and bioenergy (**Fuel, Power, Heat**).

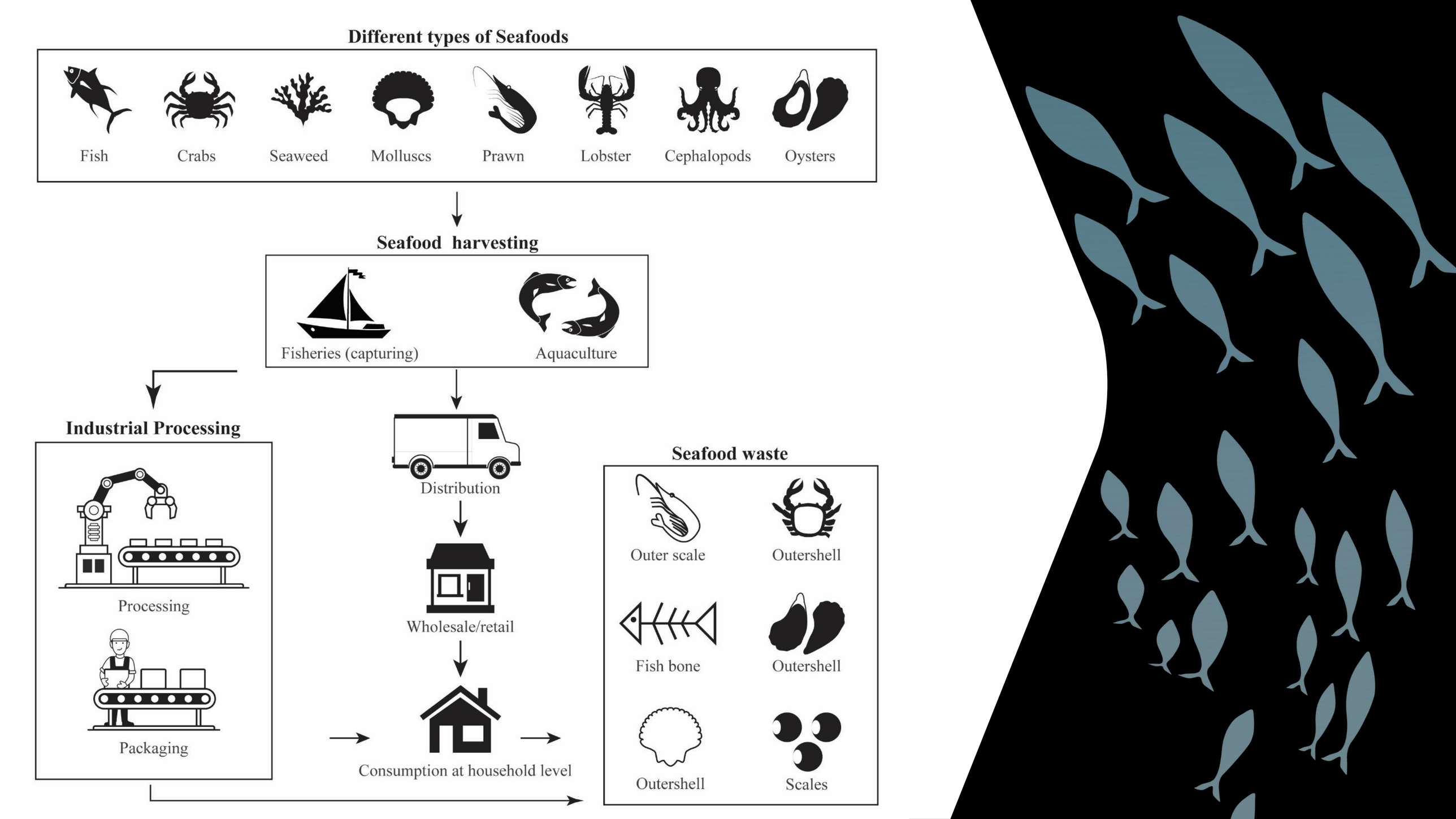
Key drivers

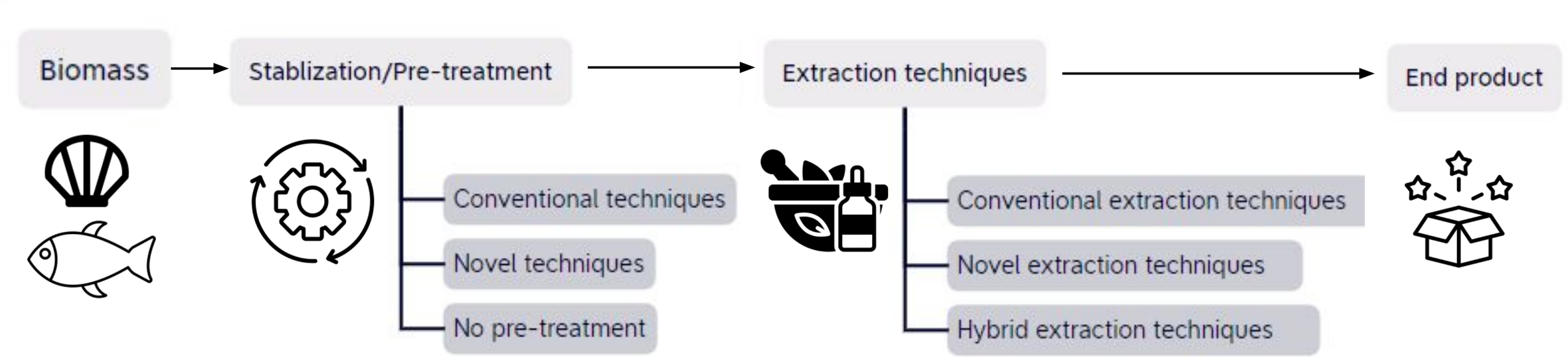
- ✔ Complying with net-zero targets
- ✔ Reducing greenhouse gas emissions
- ✔ Sustainable Developmental Goals
- ✔ Transitioning economies to an environment, economic, and socially sustainable

Establishing a seafood biorefinery

1. Choose the potential raw material and determine its composition and physicochemical properties.
2. Define the target bio-products and physicochemical properties required
3. Make an inventory of technologies or any interventions required to produce targeted bio-products.
4. Inventory of input materials
5. Data collection for each unit operation
6. Determine the chemical compounds to be transformed via pre-treatment/processes
7. Carry out cost-benefit analysis (LCA/LCCA) to meet targets.



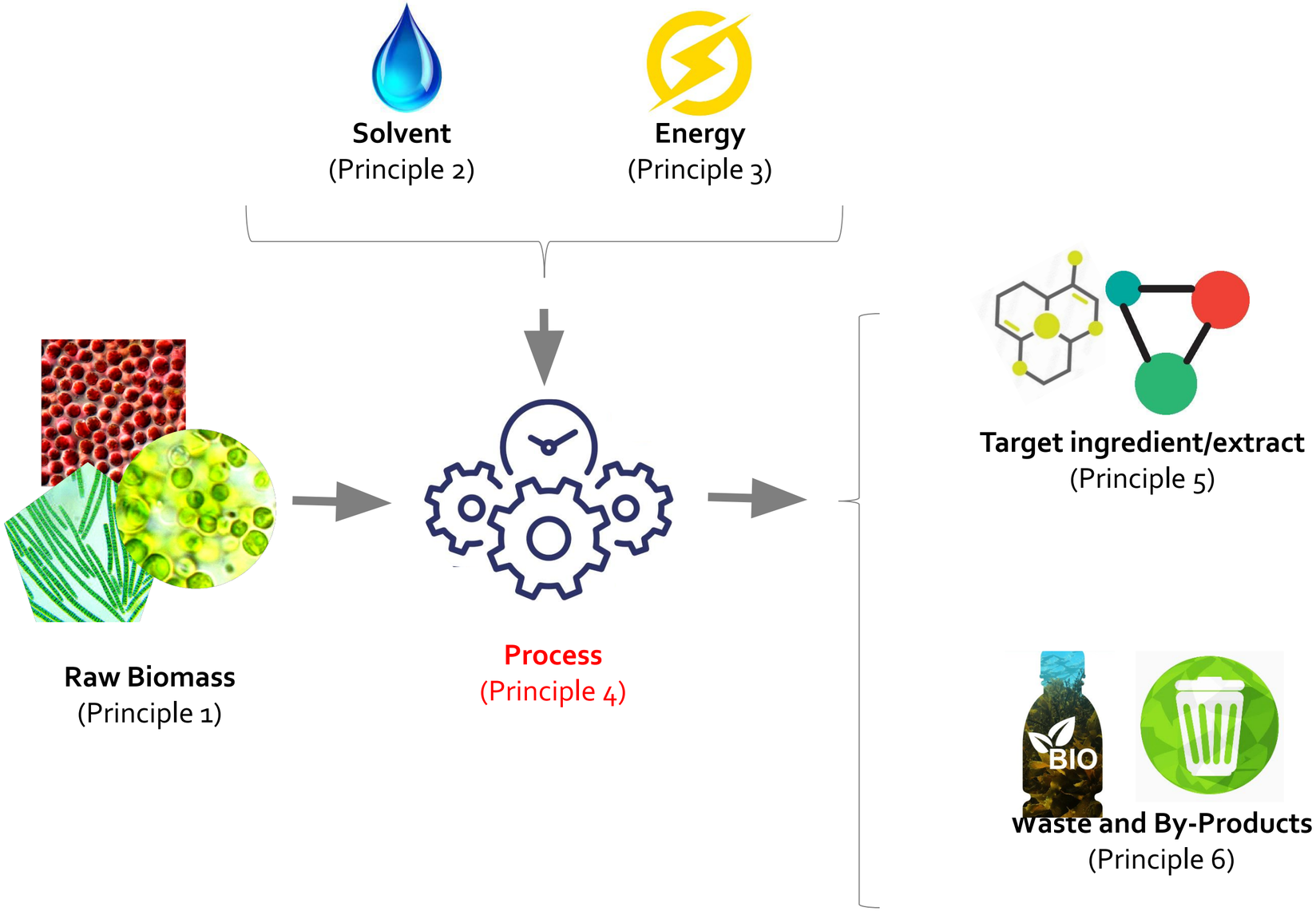

Different types of Seafoods
Fish
Crabs
Seaweed
Molluscs
Prawn
Lobster
Cephalopods
Oysters
Seafood harvesting
Fisheries (capturing)
Aquaculture
Industrial Processing
Processing
Packaging
Distribution
Wholesale/retail
Consumption at household level
Seafood waste
Outer scale
Outershell
Fish bone
Outershell
Outershell
Scales



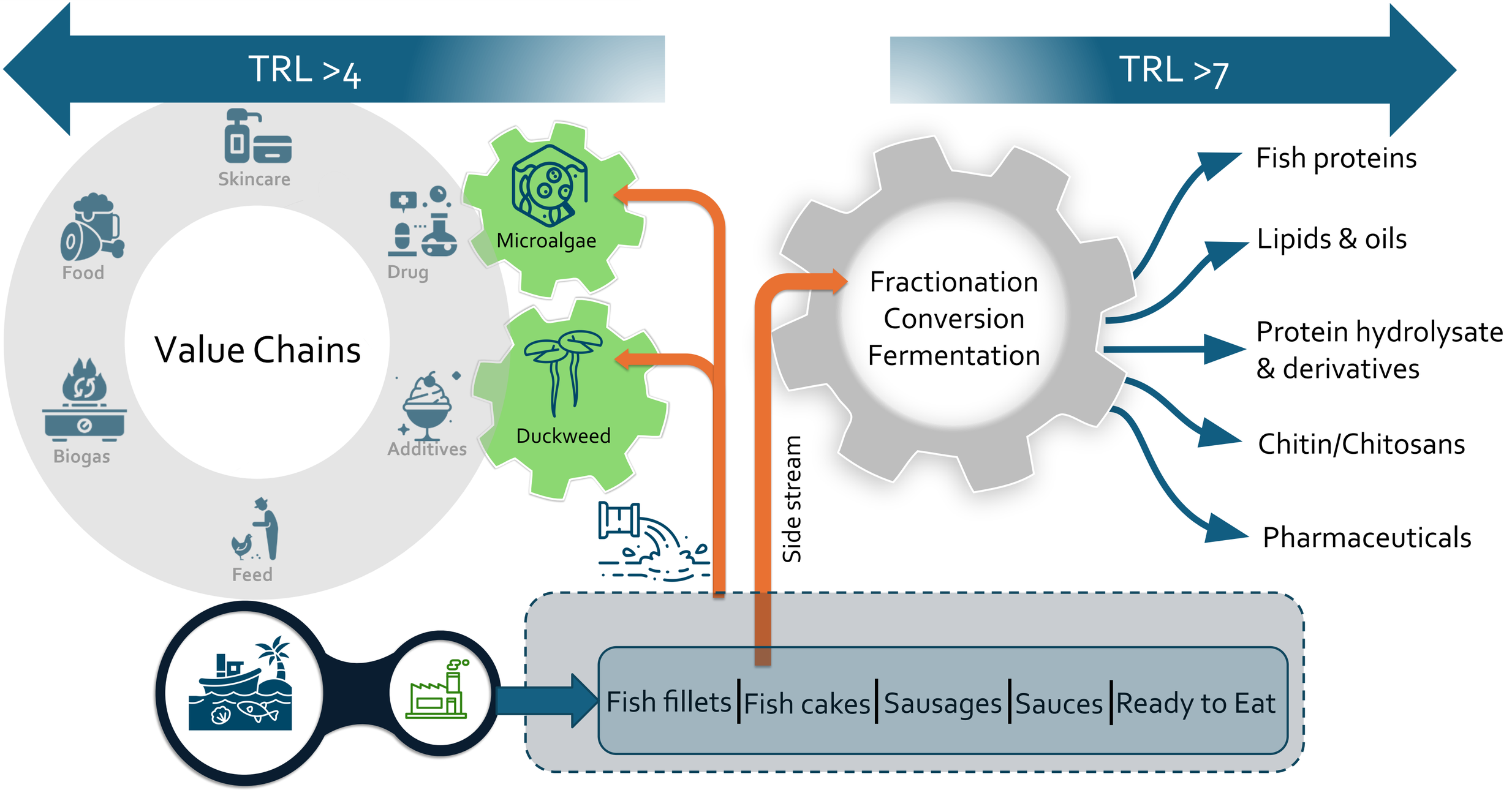
Processing of biomass for valorisation

Principles of clean processing technologies

Reduce negative environmental impact of products and processes



Seafood Biorefinery

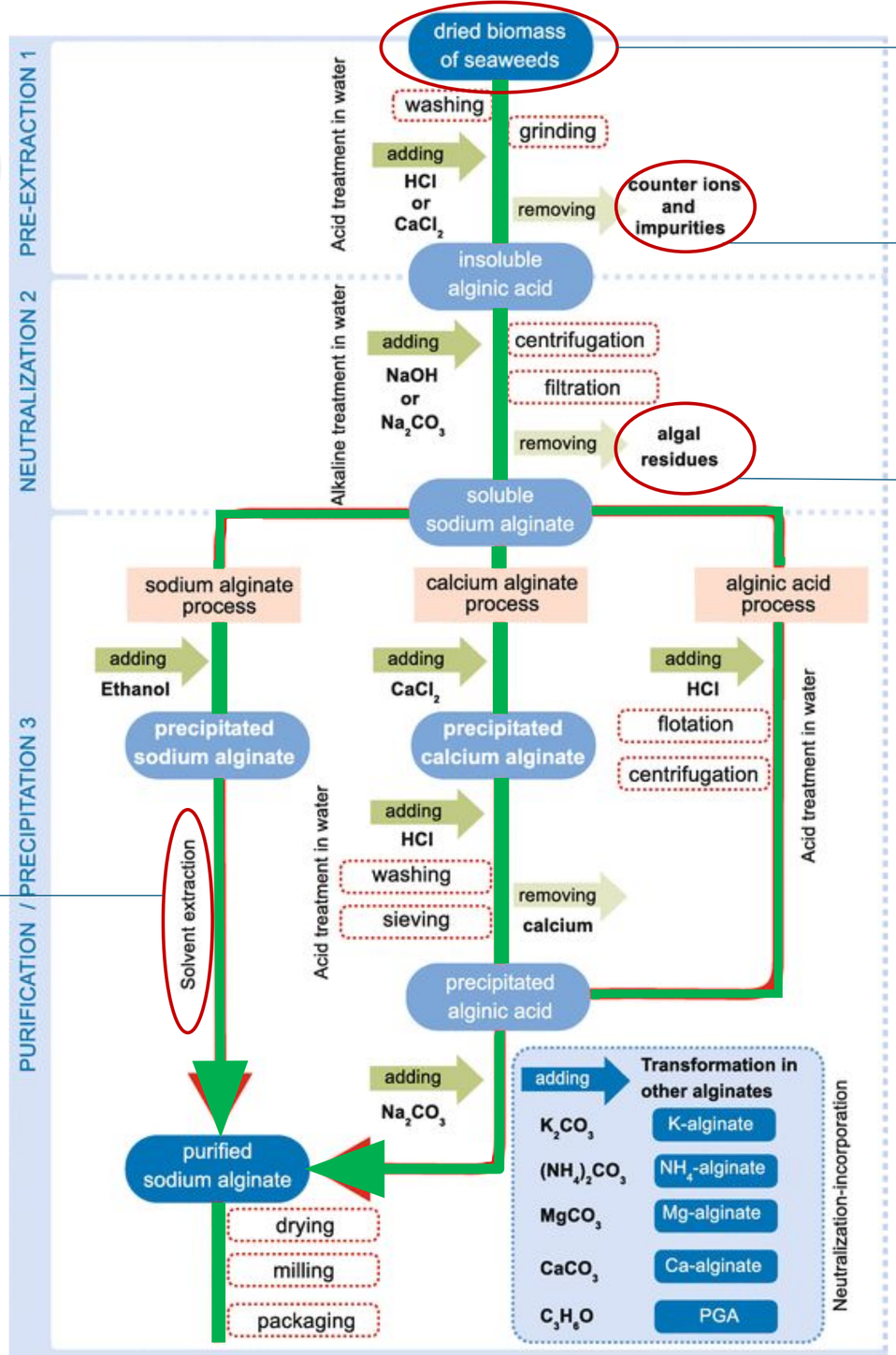


Value Addition

Approach

- Greening the process
- Zero waste approach
- Utilising every fraction

✔ Solvent replacement
✔ Membrane technology



✔ Energy efficient drying techniques
✔ Stabilising fresh biomass
✔ Utilising fresh biomass

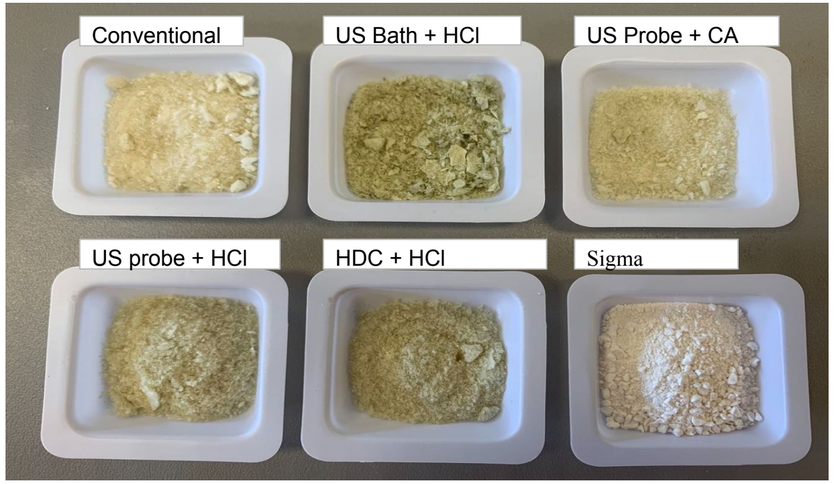
✔ Laminarin (Value chain 1)
✔ Amino acids (flavour enhancers) (Value chain 2)
✔ Phlorotannins (Value chain 3)

✔ Proteins (Value chain 4)
✔ Algal fibre (Value chain 5)

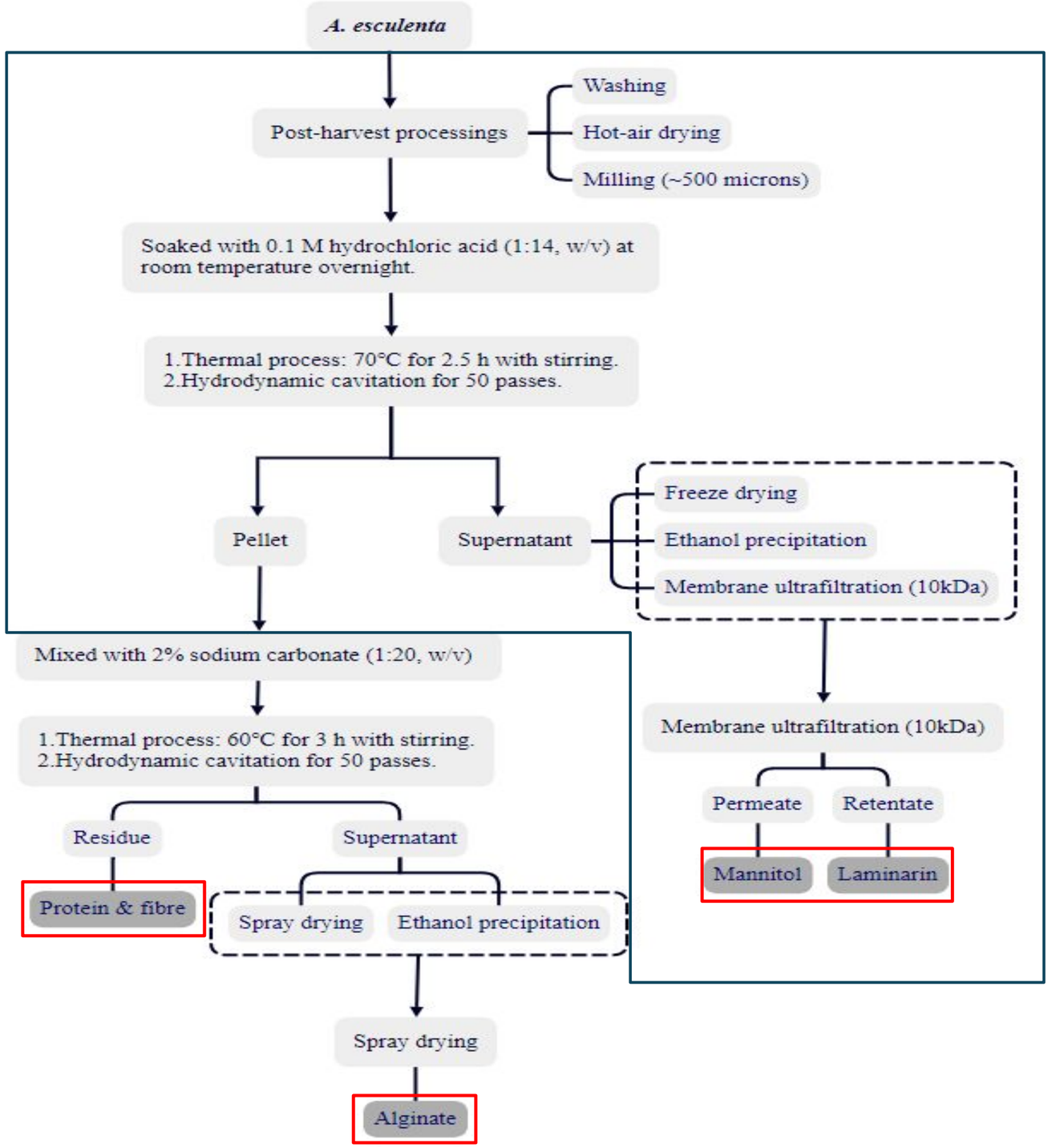
Tiwari & Troy (2015), Seaweed Sustainability – Food and Non Food Applications, Elsevier

Seaweed biorefinery

1st stage process



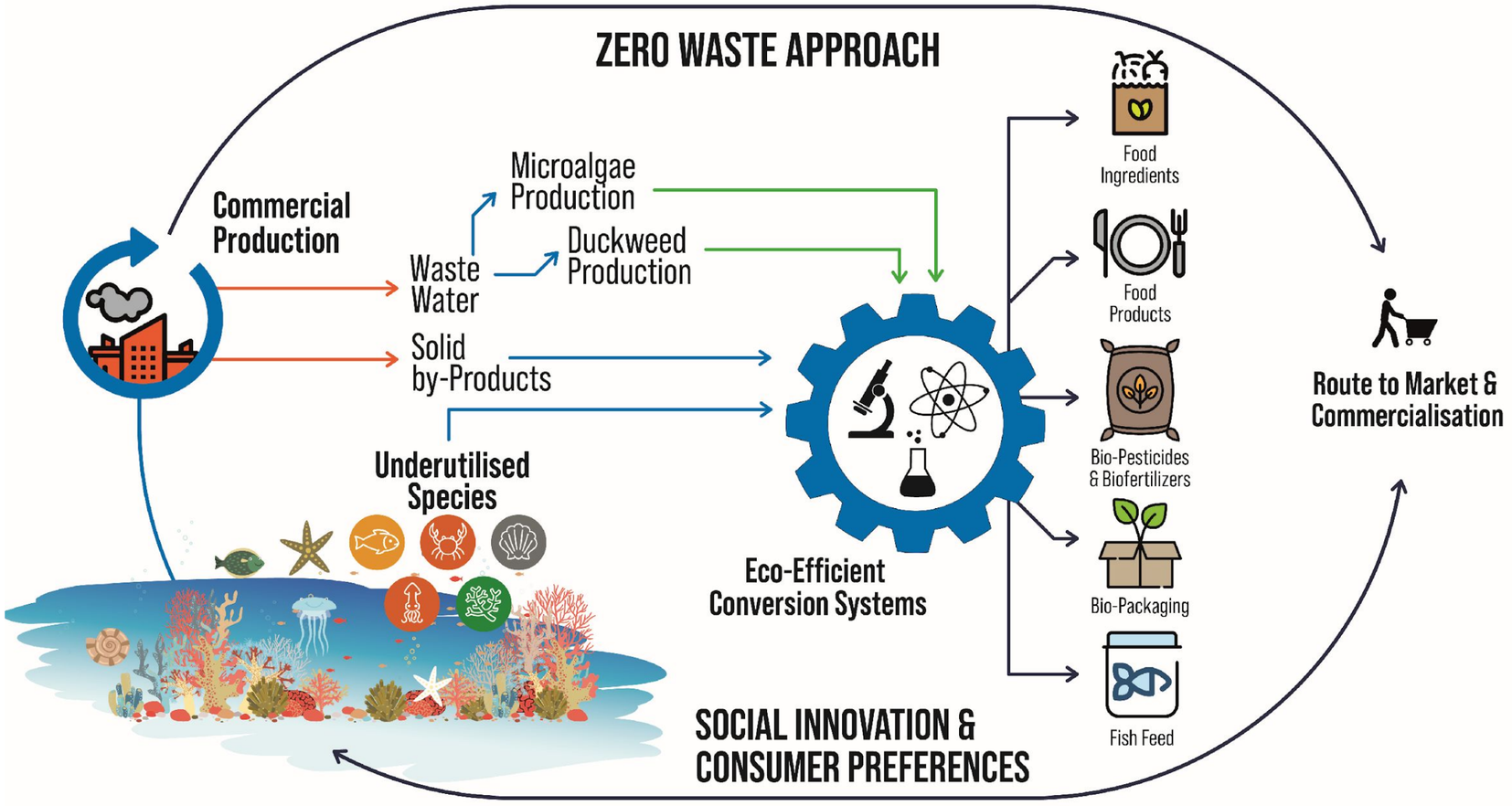
2nd stage process



Extraction efficiency

Extracts	Treatment	Purity (%)	Molecular weight (kDa)	Energy consumption (kWh)	Recovery rate(%)
Laminarin	Con-FD	47.23±1.97a			
	HDC-FD	46.40±0.59a			
	Con-EtOH	43.67±0.98a			
	HDC-EtOH	54.90±0.28a			
	Con-Membrane	80.36±6.90b	5.14±0.01a	10.75±0.57a	54.98±4.75a
	HDC-Membrane	86.57±3.72b	5.13±0.05a	1.83±0.12b	55.55±3.10a
	Sigma		5.24±0.01a		
Mannitol	Con-Membrane	37.77±3.41a			54.53±1.58a
	HDC-Membrane	40.49±2.78a			75.90±4.49b
Sodium alginate	Con-Con-FD	33.36±4.94a			
	Con-HDC-FD	58.01±7.18a,b			
	HDC-HDC-FD	34.06±10.67a			
	HDC-Con-FD	35.37±11.94a			
	Con-Con-EtOH	68.6±13.34b,c	215.75±2.51a	20.46±1.69a	64.84±3.71a
	Con-HDC-EtOH	78.29±9.64b,c	173.43±3.25b,c	13.71±0.93b	56.85±4.88a
	HDC-HDC-EtOH	88.98±4.70c	169.64±2.77c	5.08±0.37c	65.13±5.14a
	HDC-Con-EtOH	67.18±0.78b,c	188.98±5.62b,d	13.75±1.24b	62.34±2.97a
	Sigma		190.80±1.18d		
Protein	Alaria powder	4.94±0.31a			
	Con-Con	13.13±0.11b			
	Con-HDC	12.90±0.19b			
	HDC-HDC	17.19±1.33c			
	HDC-Con	10.73±0.66b			

EU Blue Circular Bioeconomy



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MIR National Marine Fisheries Research Institute

ANGAZ

neoalgae

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SINT

UCC University College Cork, Ireland, Coláiste na hOllscoile Corcaigh

ESHKOL INNOVATION HUMAN CAPITAL

clúster alimentario de galicia

Xcomex Rok założenia 1987

CIRCULAR_IMTA_DEMO

An Roinn Talmhaíochta,
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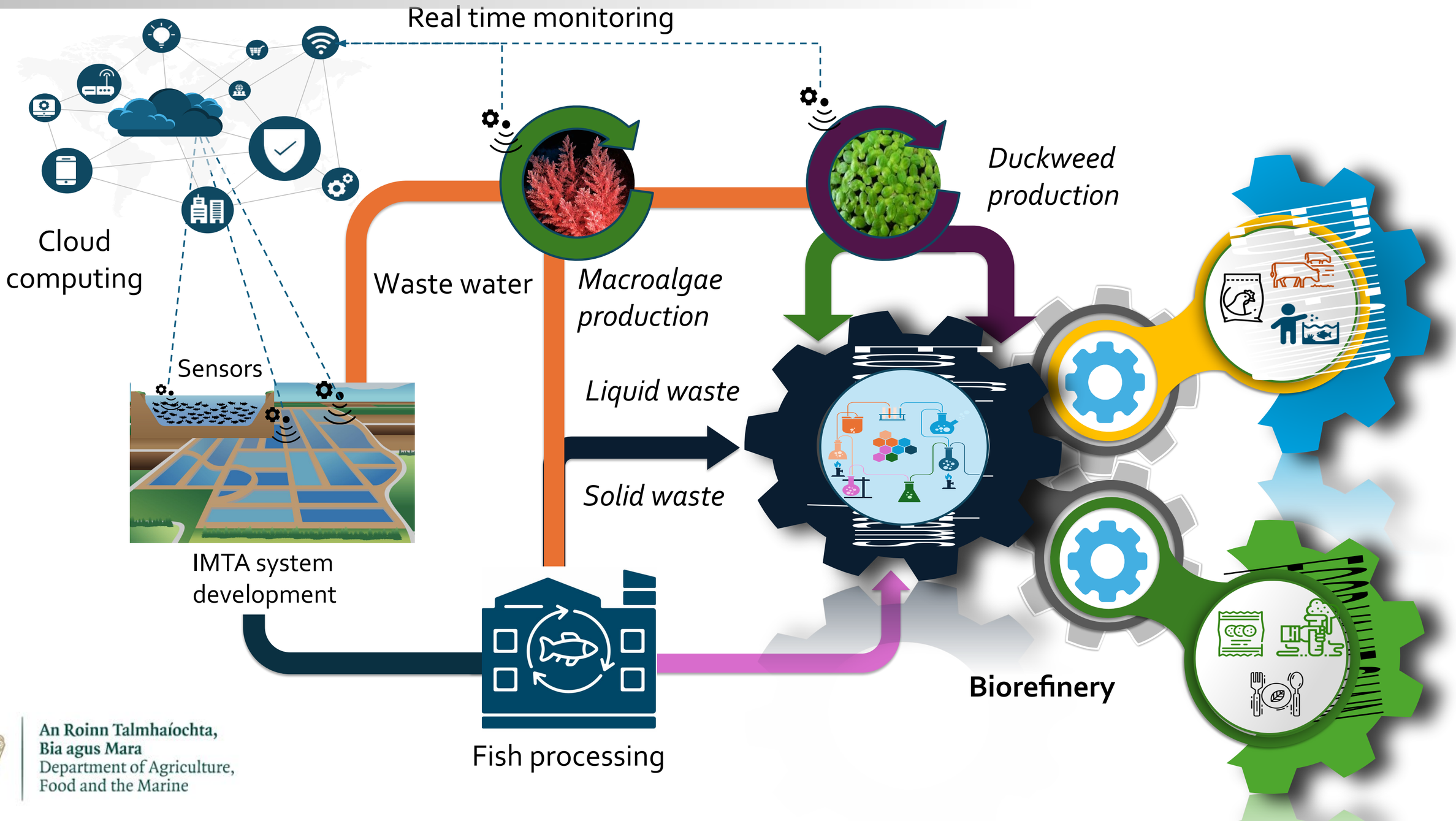

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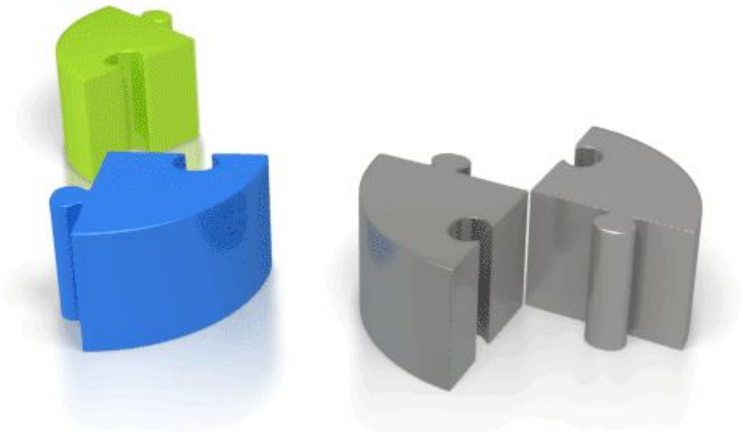
Department of Agriculture, Food and the Marine

Conclusions

✔Complete valorisation of marine biomass is challenging though achievable
✔Transformation and translational approach is the key
✔Technologies are available but requires innovative translation
✔Adoption of circular economy/Bio-refinery is the key



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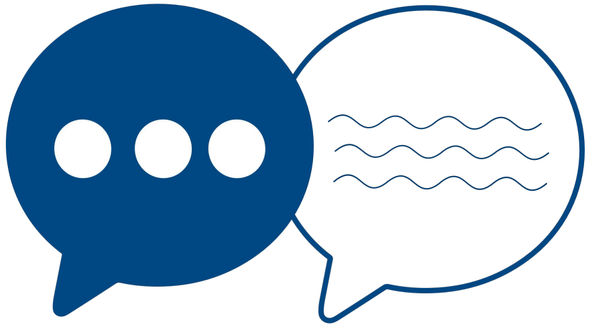
Questions



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