Sustainable cultivation of seaweed for the food, feed and health market - is it possible to cultivate seaweed without scientific support and research ?

Olavur Gregersen, Ocean Rainforest Ltd.

Mussels/clams and Algae growing opportunities in the Baltic Sea,
Tallinn, Estland, Nov. 24, 2016

Main goals for Ocean Rainforest

- Vision:
  - Leading supplier of sustainable macroalgae biomass in open ocean environments.
- Mission:
  - The most reliable provider of high quality seaweed cultivated in Europe and North America.

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Key issues for commercial seaweed cultivation

- Scalability
- Survivability
- Sustainability
- Predictability
- Profitability

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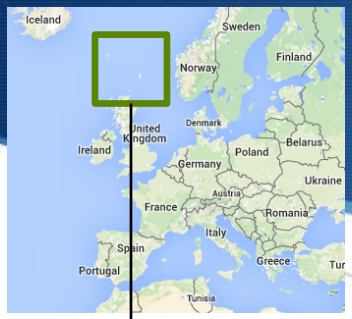
Our cultivation site

62°18'19.0"N 6°54'29.0"W



- Water depth: 50-70 meters
- Water temperature: 7-11 °C
- Salinity: approx. 35 ‰
- Current: 1-3 knots
- Max. significant wave height: 8 meters
- Max. wind speeds: 62 m/s

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6 MACRs with total 20.000 meters growth lines

- Seeded with *Saccharina latissima* & *Alaria esculenta*
- Exposed site
  - 2 x 5000 meters & 2 x 2500 meters
- Moderate exposed site
  - 1 x 2500 meters & 1 x 2000 meters
- One of the largest seaweed cultivation farm in Europe
- Probably largest exposed seaweed cultivation farm in the world

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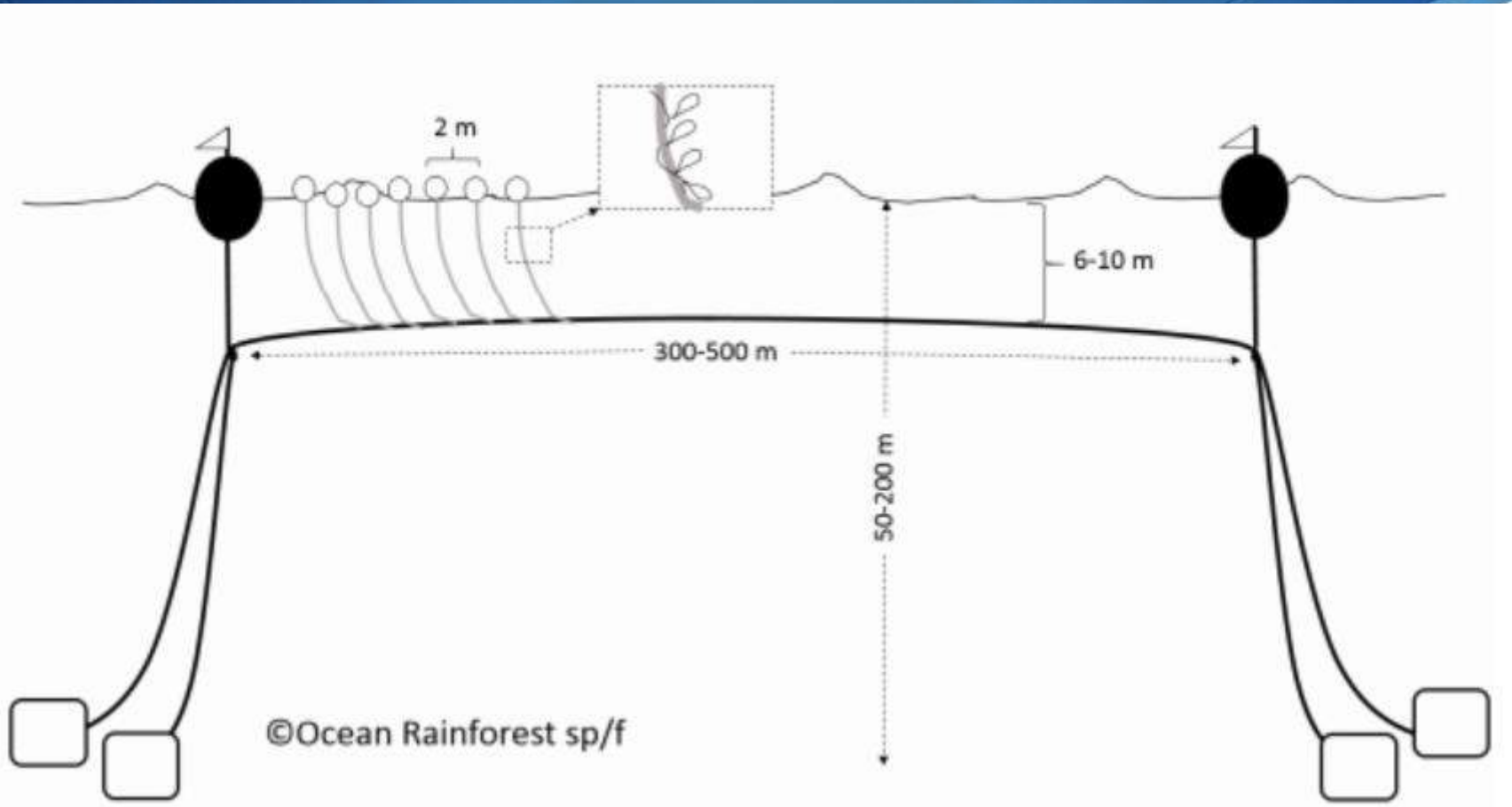
Macro Algae Cultivation Rig (MACR)



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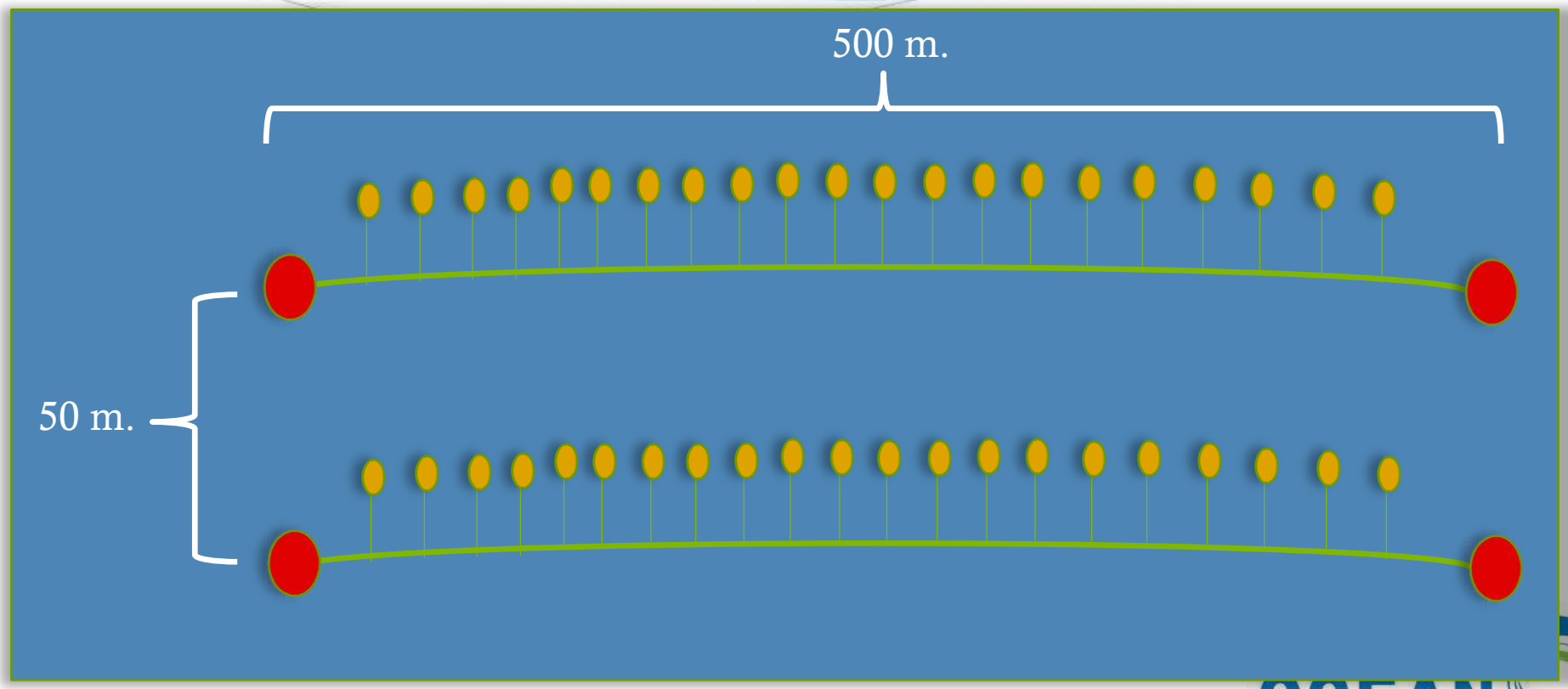
Spatial requiremets for MACR 500-10 m
25.000m^2 / 0.025km^2 / 2.5ha



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Laboratory

Deployment

Seeding

Harvest

Operational facilites

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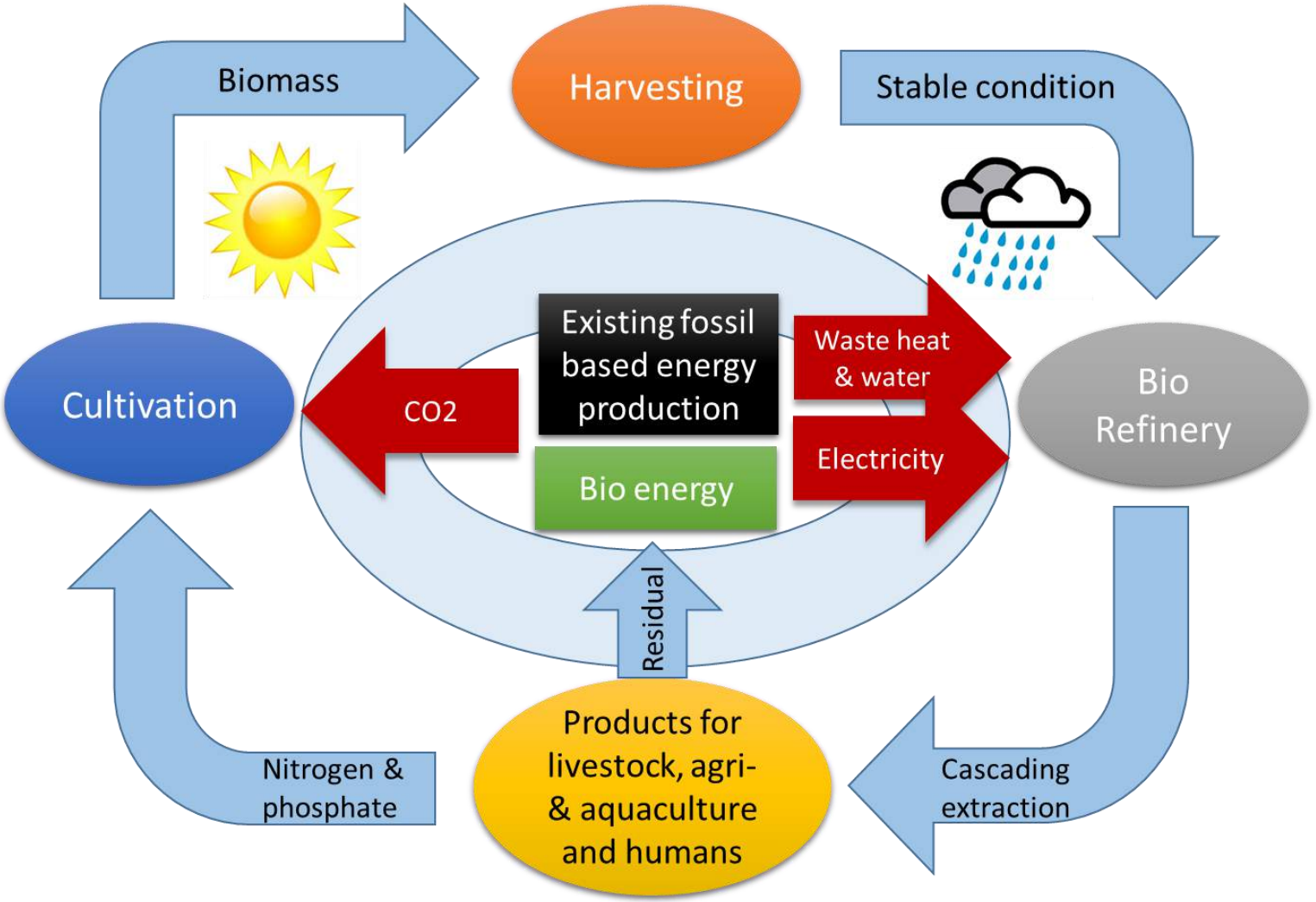
BlueGreenFuture - a sustainable & circular blue economy with zero waste and emission



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Impact of seaweed farming
Global value €6B– approx. 20M tonnes

- 1000 tonnes of farmed seaweed fresh weight (FW) will
- Remove
  - 5 tons nitrogen (N)
  - 0.3 tons phosphorus (P)
  - 200 tons CO_2 equivalents (CO_2 eq)
- Produce
  - 40 tons/ha/y (4000 tons/km2/y)
  - 4 FTE @ €40000
  - Average utilisation FW/DM 18%
  - Average price €12.000/tons

If the whole Europe's cultivated seaweed industry could **match that of Indonesia** (**6.5 million tonnes** in 2012):

- **1,3 million tonnes of CO_2** eq - proportional to emissions from 2.2 million households,
- Remove **33.000 tonnes of N** and **2.000 tonnes of P**
- Create **25.000 new jobs**
- Require 163.000 ha or 1600 km2. **(<3% of European coastline)**
- Value creation of **€10-15 Billion** (depending on cascading system)

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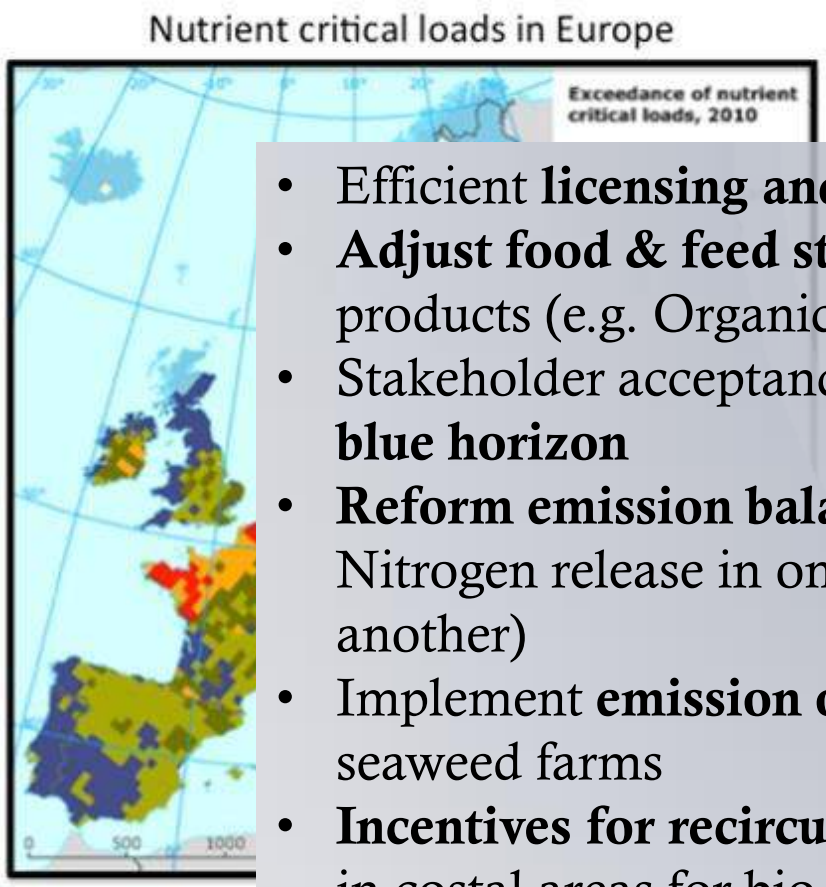
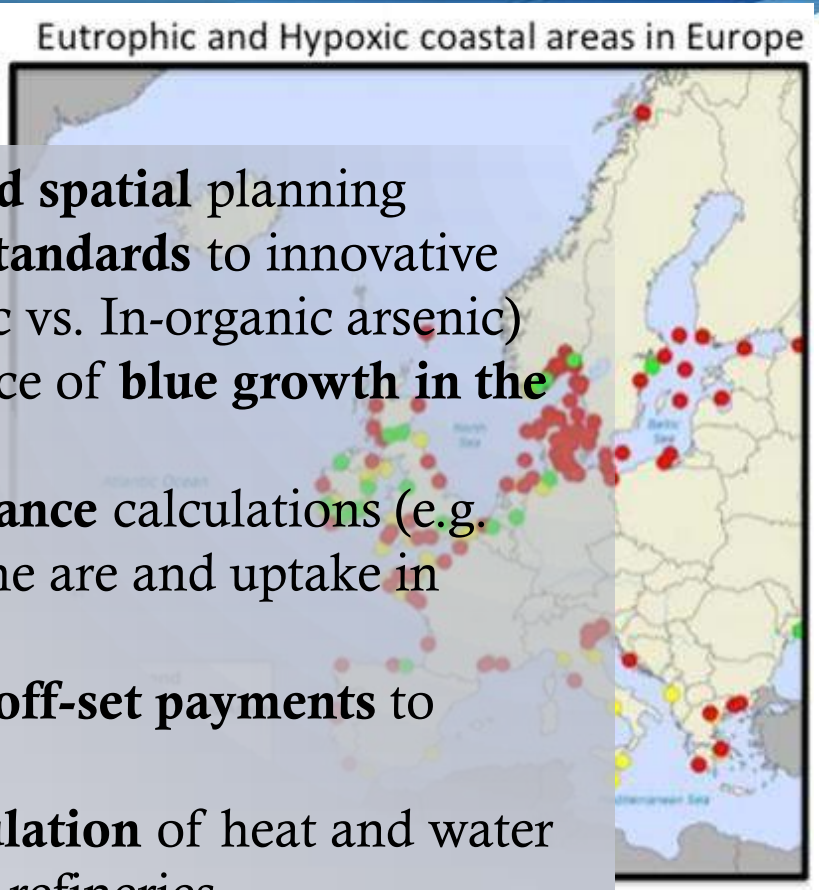
Q6 - What are the main non-technical barriers preventing the access to an extended market and the forecasts of costs and timing required to upgrade technology or develop products to an extended market?





Source: E

ri.org

- Efficient **licensing and spatial** planning
- **Adjust food & feed standards** to innovative products (e.g. Organic vs. In-organic arsenic)
- Stakeholder acceptance of **blue growth in the blue horizon**
- **Reform emission balance** calculations (e.g. Nitrogen release in one are and uptake in another)
- Implement **emission off-set payments** to seaweed farms
- **Incentives for recirculation** of heat and water in costal areas for bio-refineries
- **Branding of sustainable, organic and circular** commodities

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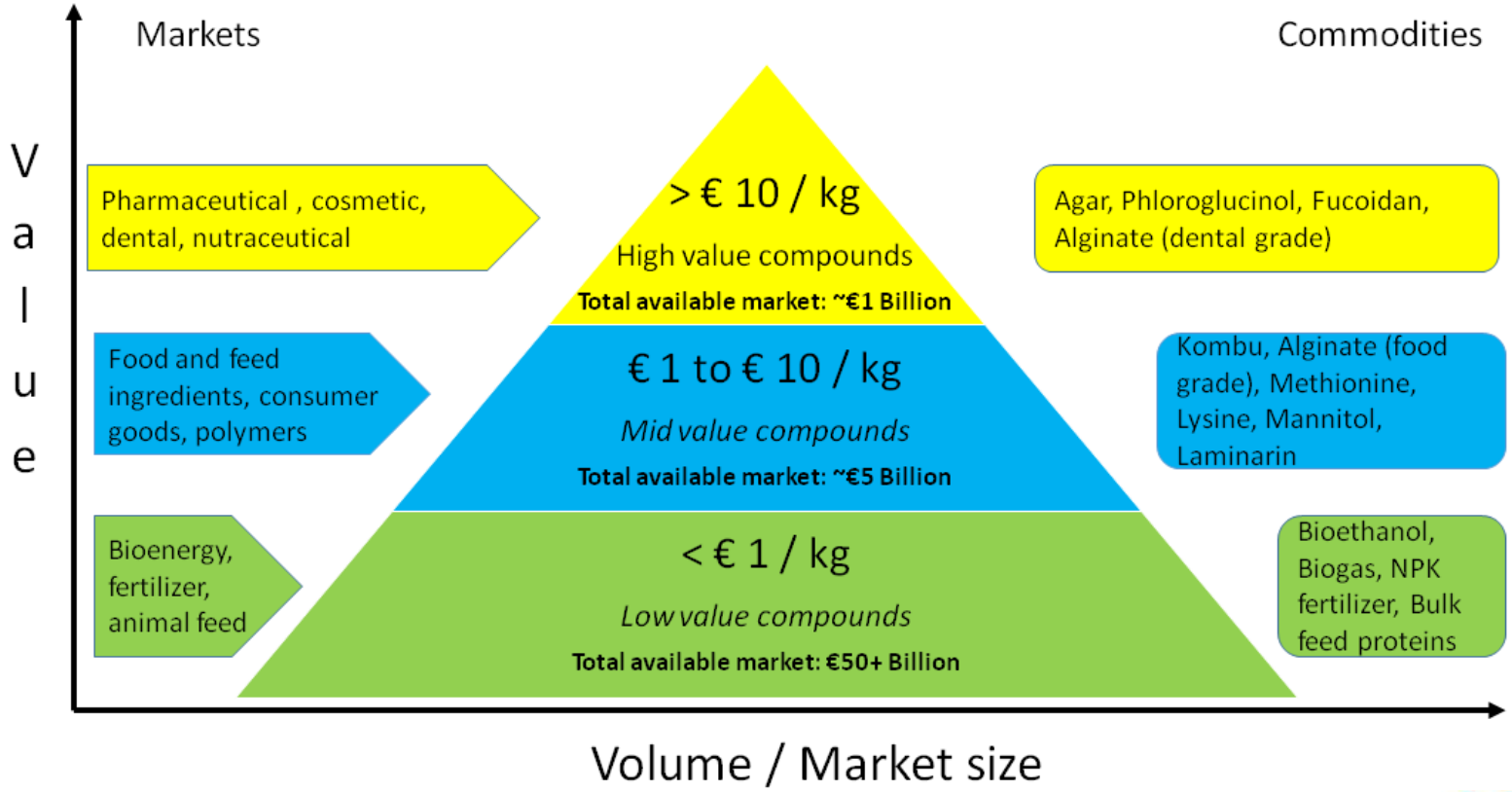
The market

Prices in dry weight for biomass supplied as fresh (wet)



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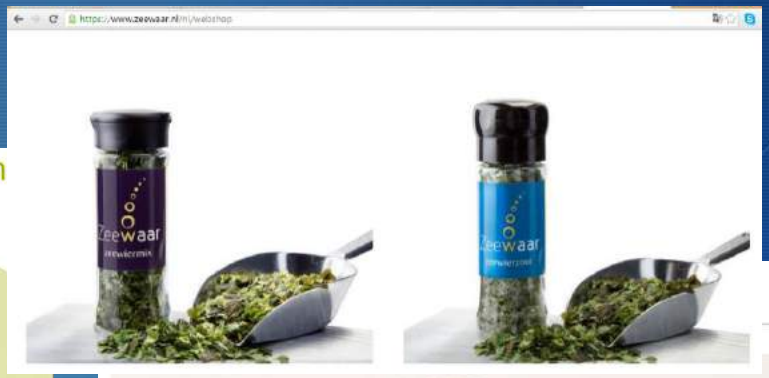
European products



set of 3 seaweed shaker tins for $17.50

oceanwell

A new dimension in algae-based cosmetics

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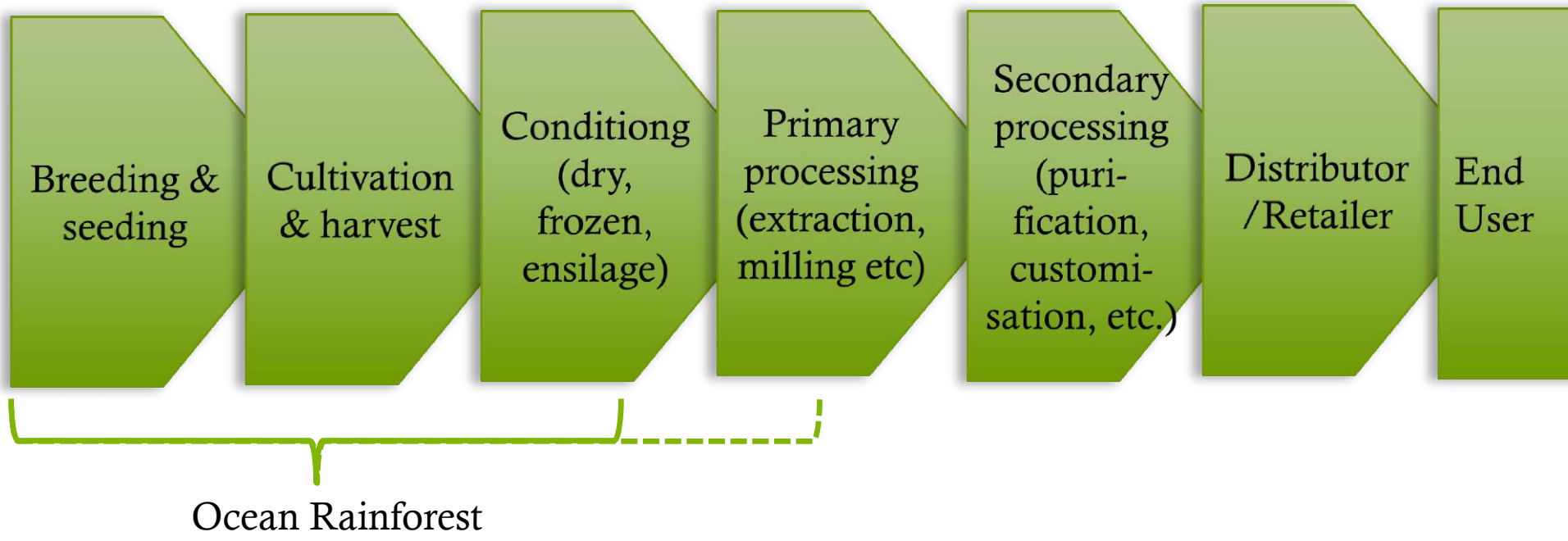
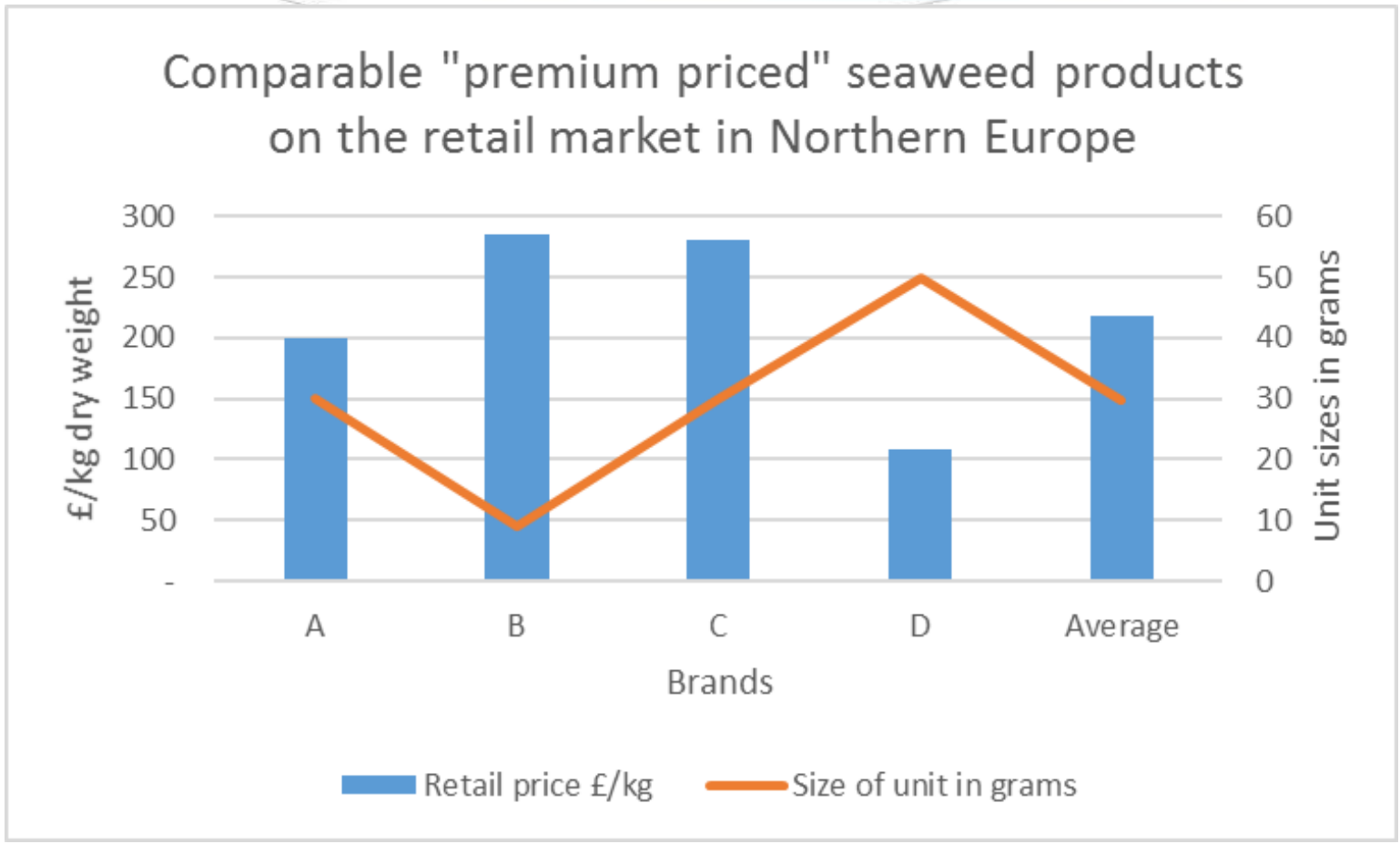
The supply/value chain

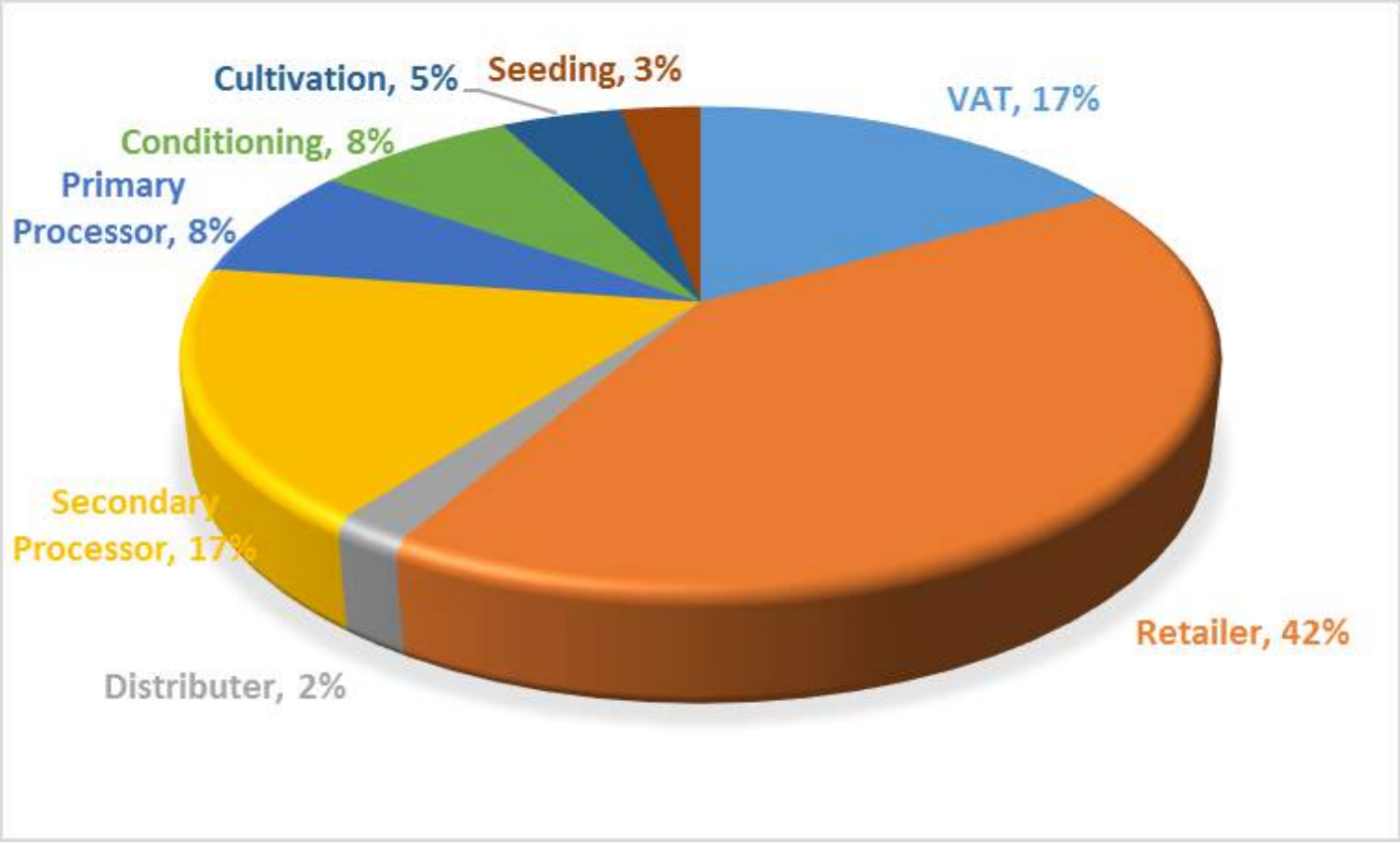


Premium priced food market segment in Europe



Added value split on the supply chain

(based on a premium priced product)



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Main market barriers

- Iodine & Cadmium content (expecially food market)
- Lack of differentiaiton between in-organic and organic arsenic
- Premature requests on certification programes
  - Costly for start-ups
- License framework and marine spatial planning
  - Delays commercial up-scaling for reliable supply

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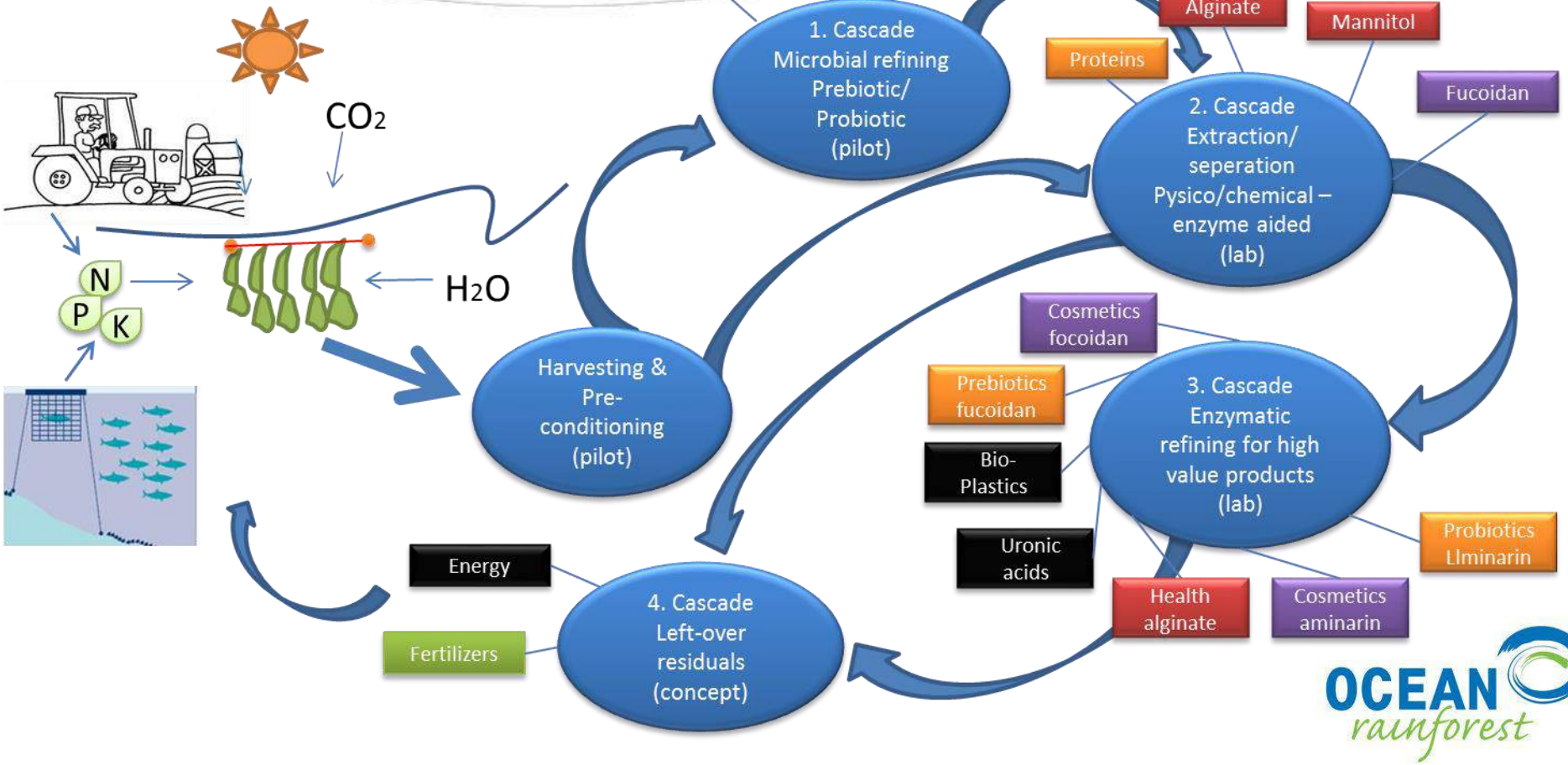
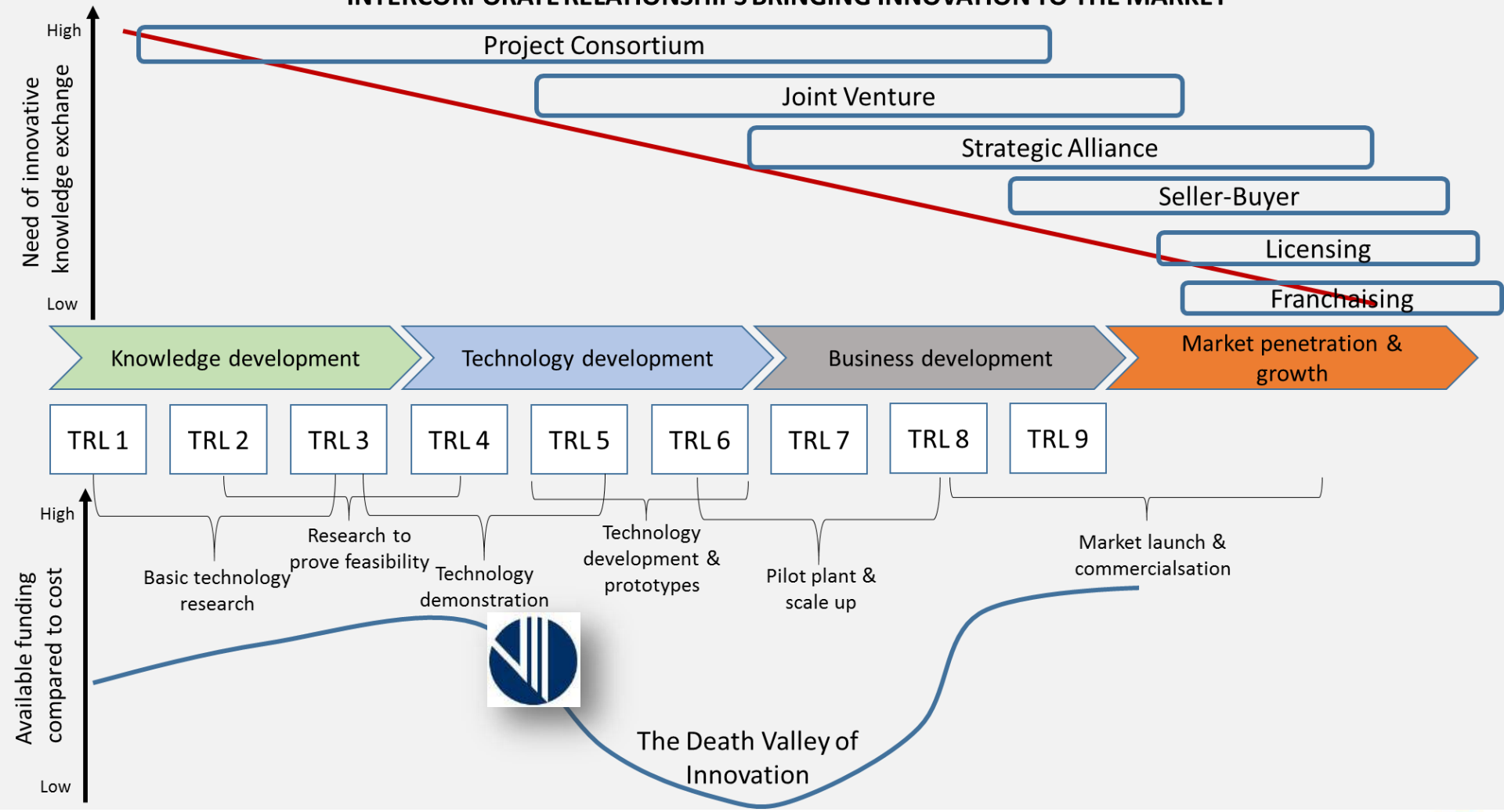
Cultivation scenarios with +yield & -cost in €/kg/DW

The bio refinery approach

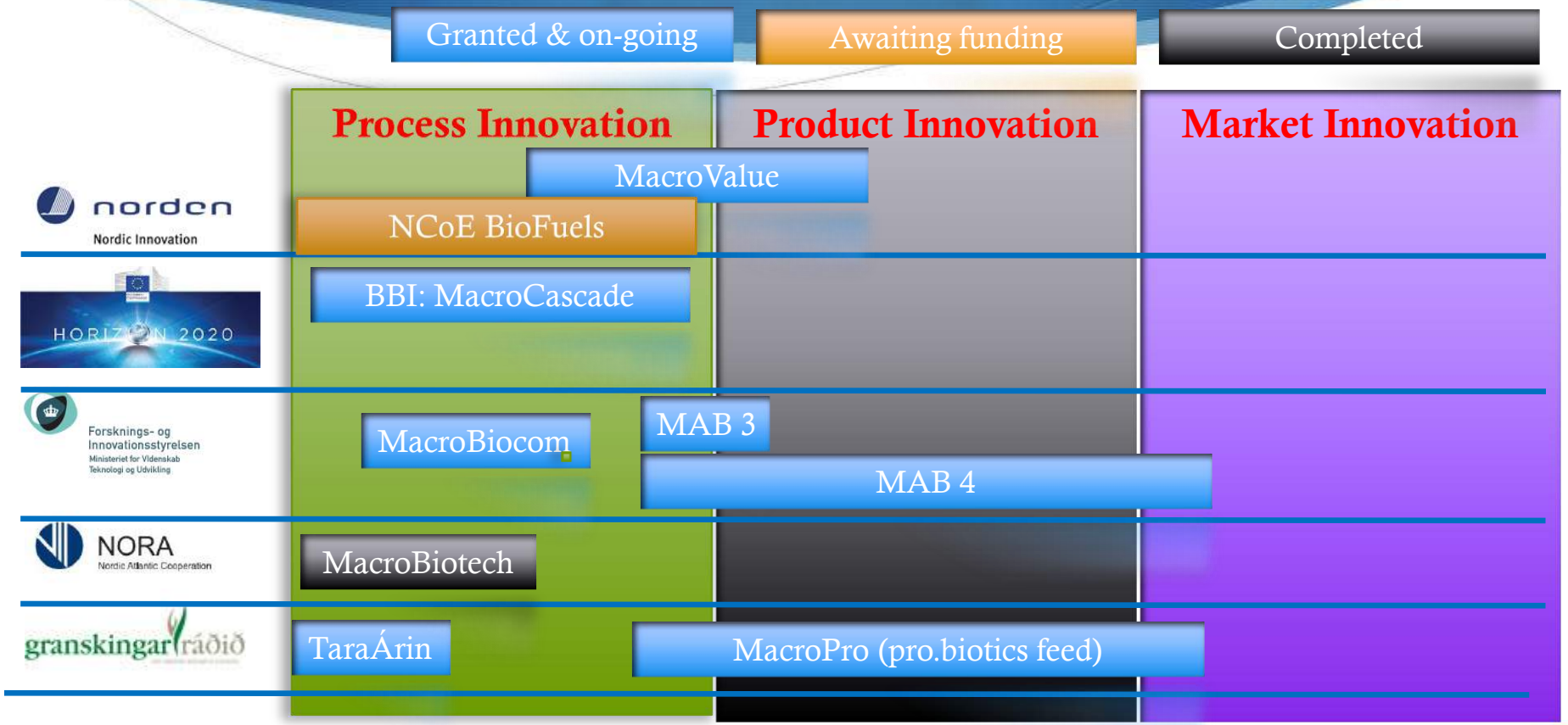


INTERCORPORATE RELATIONSHIPS BRINGING INNOVATION TO THE MARKET



R&D Project Portfolio

2013-2019; approx €0,5M/year



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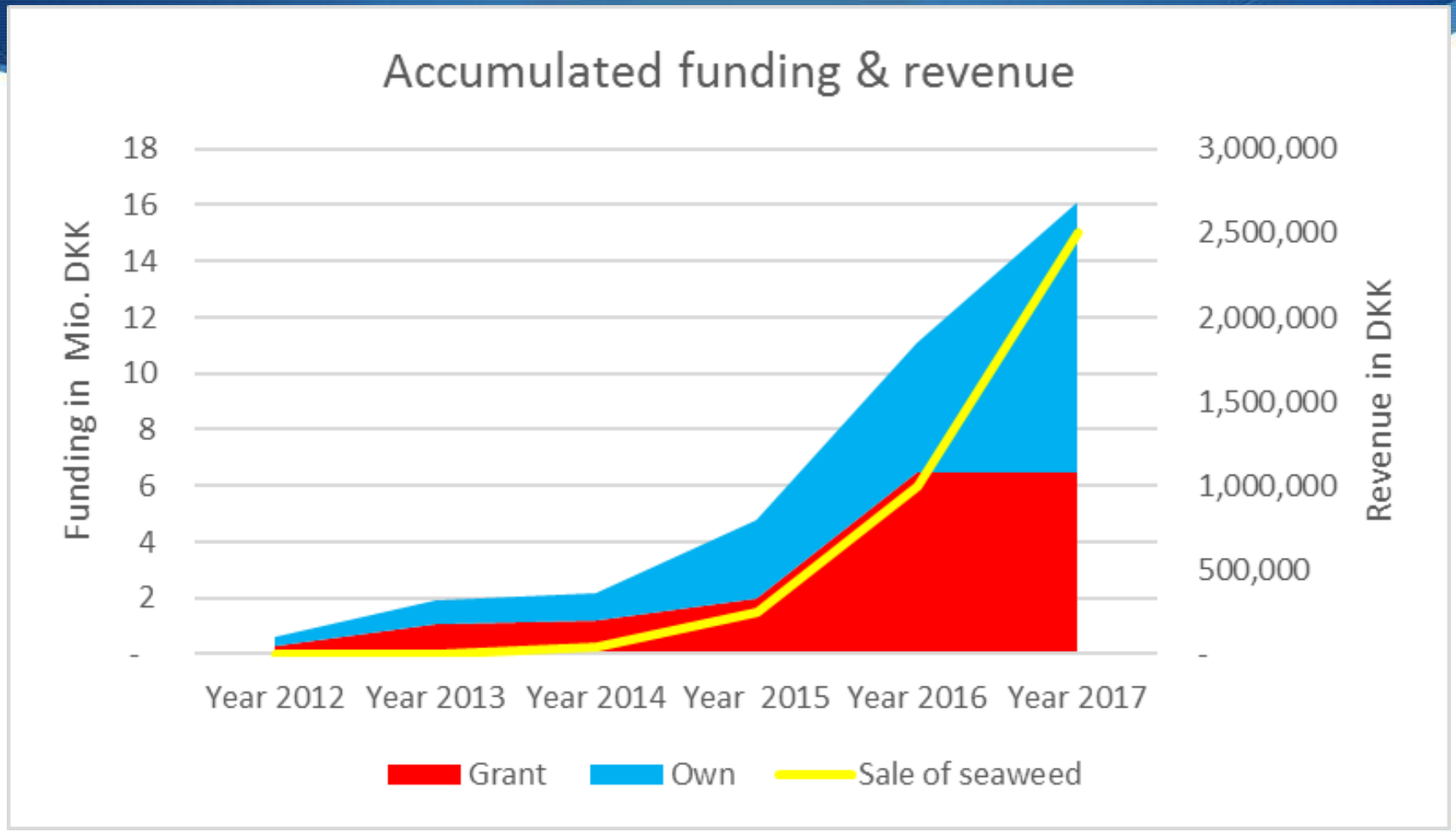
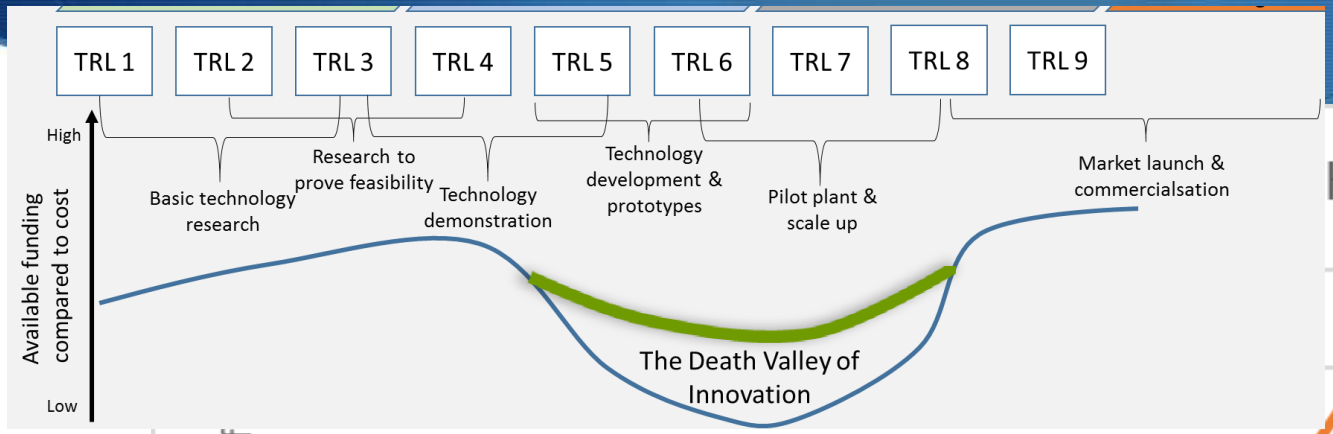
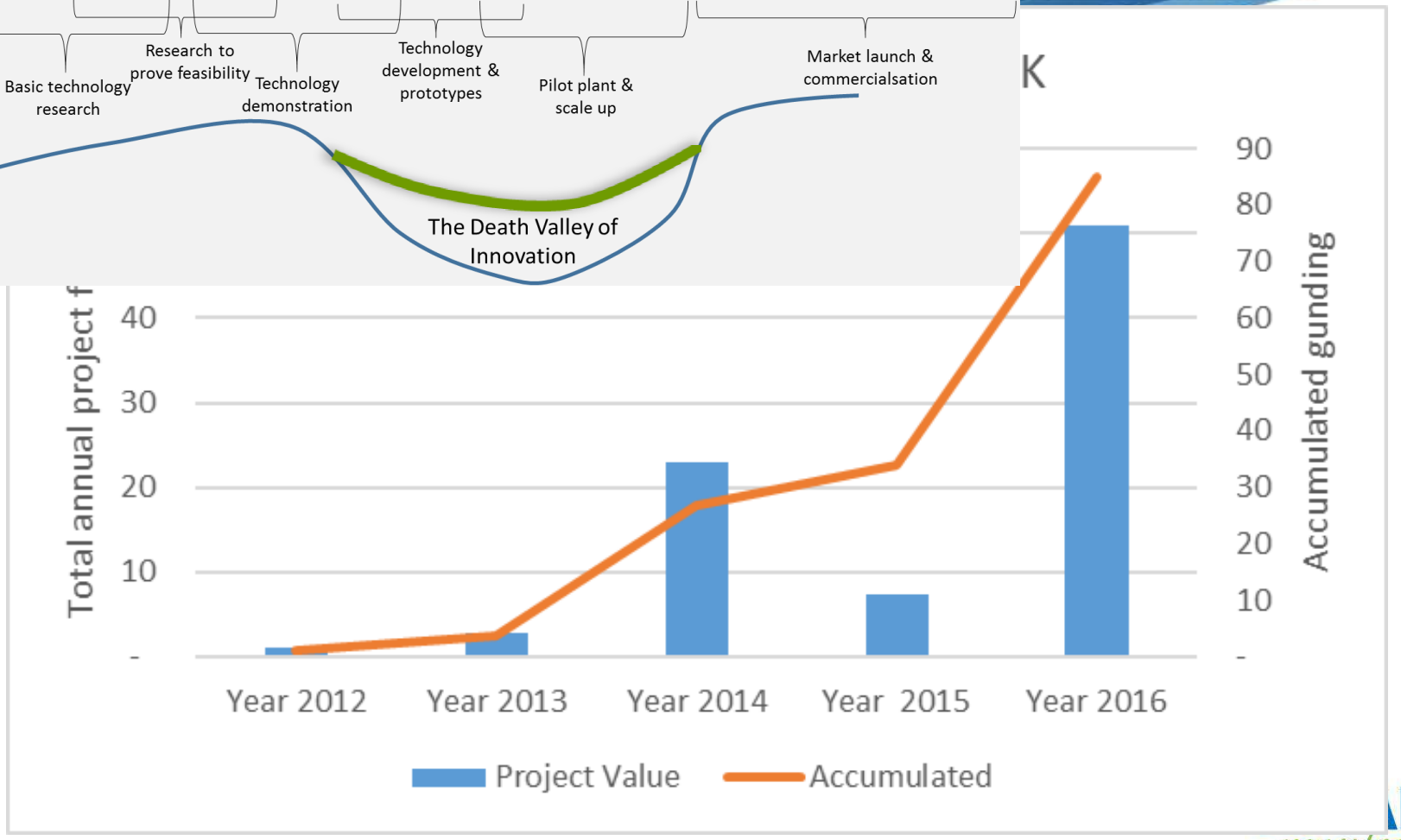
From Angel to Venture



Innovation value:
"Angel" capital factor 100 in 4 years!





Conclusion

- **The MACR system is scalable, survivable, predictable and sustainable**
- **Multiple partial harvest is suitable for both *S. latissima* and *A. esculenta* and contributes significantly to profitability**
- **Important to decide on strategic position in the value chain**
- **Market barriers have to be addressed**
- **Future business development is related to multi stream co-extraction**
- **An Angel investment can make the "Death Valley" process less painful**
  - **The NORA "angel" investment in terms of a grant of 120k Euro has sofar:**
  - **Generated additional 0.8 Mio. Euro in grants to Ocean Rainforest**
  - **Generated in total 0,7 Mio. Euro in shareholder funding (+ 1 Mio. Euro in 2017)**
  - **Enabled Ocean Rainforest to participate in seaweed projects with a total value of 12 mio. Euro.**

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Conclusion

- The MACR system is scalable, survivable, predictable and sustainable.
  - Future investments will make the production process profitable.
- The NORA grant has made the "Death Valley" process less painfull
- The NORA "angel" investment in terms of a grant of 0,9 mio DKK has sofar:
  - Generated additional 6 mio. DKK in grants to Ocean Rainforest
  - Generated in total 5 mio. DKK in shareholder funding (+ 5 mio DKK in 2017)
  - Enabled Ocean Rainforest to participate in seaweed projects with a total value of 90 mio. DKK.

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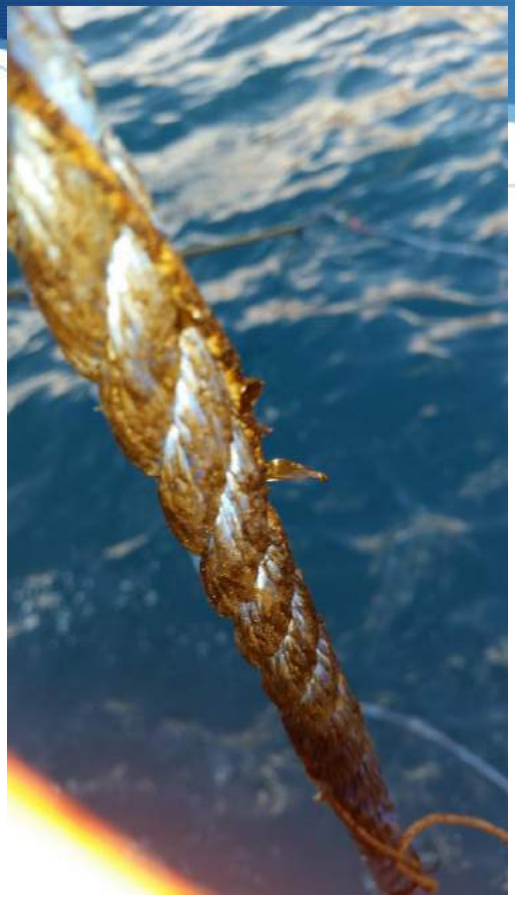
Seeking partners to grow in R&D and in the market



February 2015

20 May 2015

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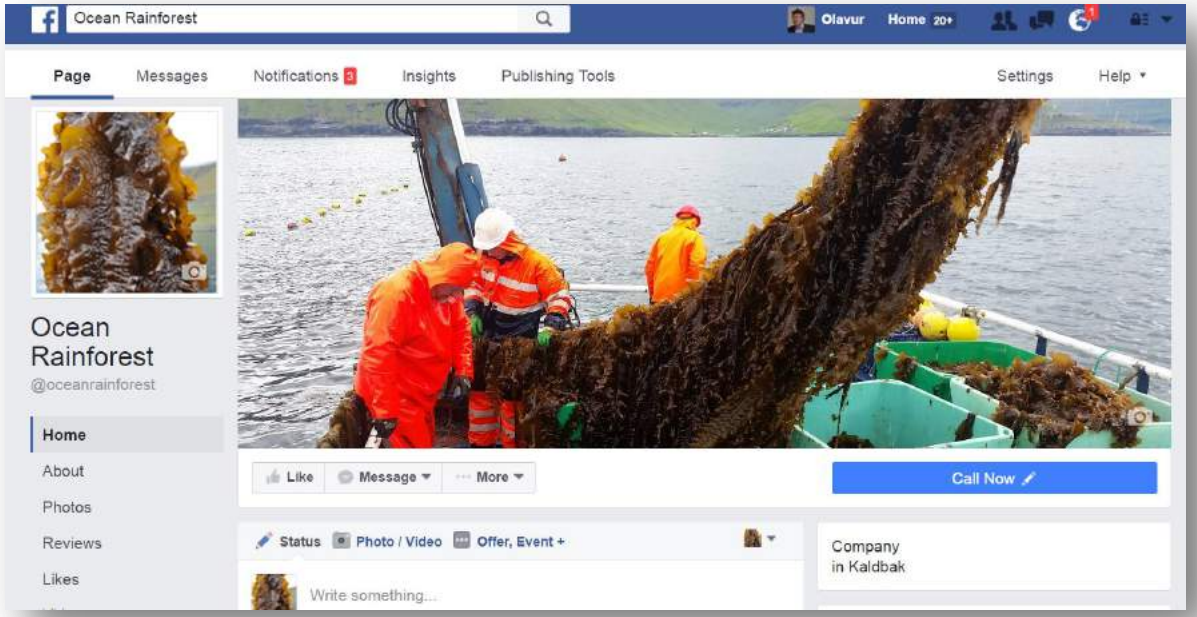
www.oceanrainforest.com

https://www.facebook.com/oceanrainforest/



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