



The Norwegian Biorefinery Platform SBP-N – so far

by Prof. Finn L. Aachmann – leader of the
Norwegian Seaweed Biorefinery Platform (SBP-N)



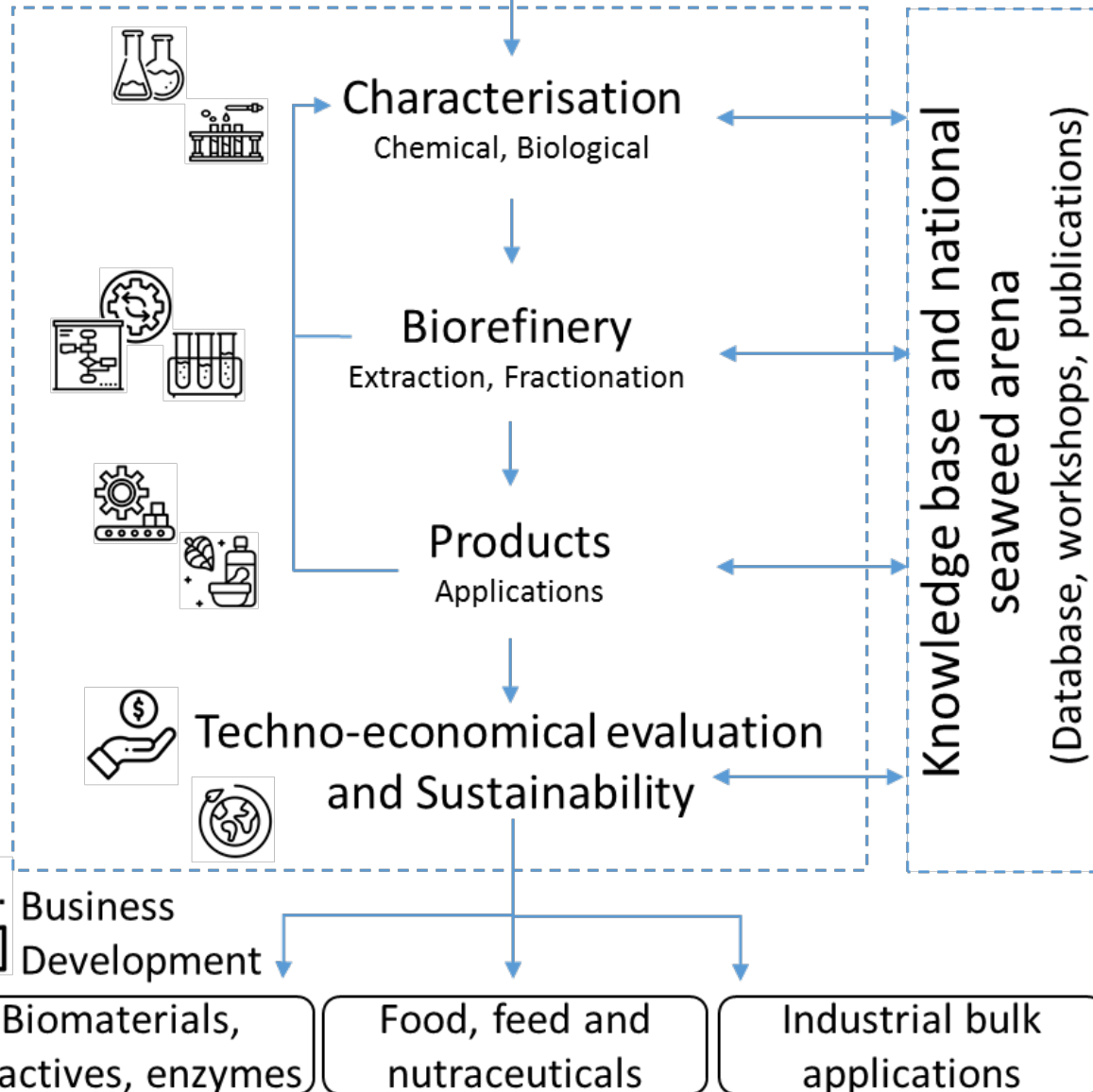
Norwegian University of
Science and Technology

Foto: Seaweed Solution AS

The Norwegian Biorefinery Platform SBP-N



Harvested seaweed  Cultivated biomass



The main goal of the platform will be to serve as a hub for research, knowledge, methodology and stakeholder networks.

- ✓ SBP-N will aid in the regulation of macroalgae cultivation and harvesting industries, and in the characterization of macroalgae-derived products.
- ✓ Research will focus on characterization of the biomass, development of technology enabling future economically and environmentally sustainable biorefinery processes, and establishment of high-value and bulk product pipelines.



WP 1 – Project management and education.



Education

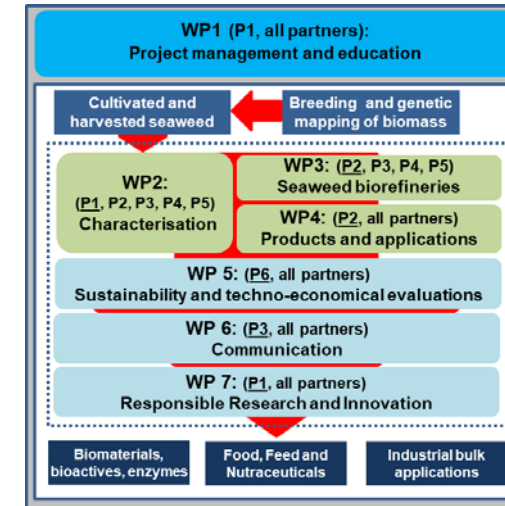
✓ 17 Master students graduated, 8 ongoing

1. Tore Kristoffer Wæhre: Mixed hydrogel system – How does fucoidan affect alginate gel formation and its effect on cells.
2. Tina Storrø: Cloning and characterisation of fucoidan modifying enzymes.
3. Shizhe Zhang : Characterisation of fucoxanthin from cultivated brown seaweeds *Saccharina latissima* and *Alaria esculenta*.
4. Agnes Beenfeldt Petersen : Structure and functional characterization of alginate modifying enzyme KgdF.
5. Ellen Martine Vestå: Effects of alginate and cellulose rich fraction on the bread matrix
6. Sunniva Bauck Dahl. Seaweed into the Toro matrix.
7. Wei Liu. Bioactive Components in seaweed
8. Aurora Cardoso. Characterization of Seaweed harvested in Greenland

✓ All PhD and Post Doc has started

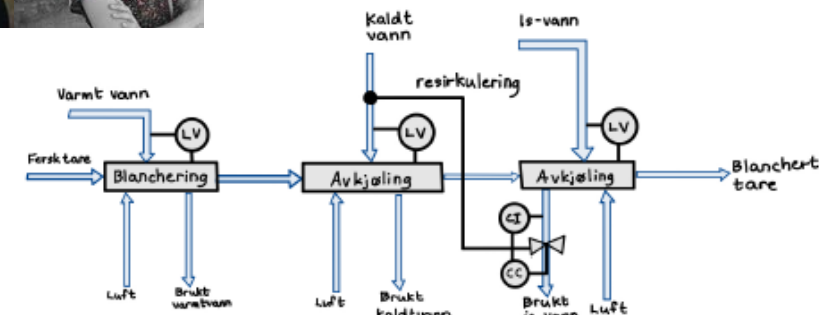


(Associated PhDs)



TKP4170 - Prosjektering av prosessanlegg (NTNU) (spring 2021)

- ✓ Blanchering av *Alaria esculenta* og *Saccharina latissimi* – in collaboration with SES
- ✓ Lønnsomhet i bioprosesseringsanlegg for kultivert tare
→ Interested education collaboration



WP 2 – Characterization



✓ National Sampling campaign

I: 8 sites, 12 SL and 3 AE (23.04-01.07 -2020)

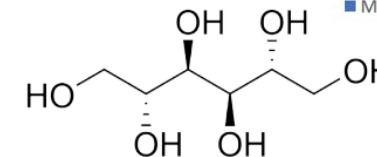
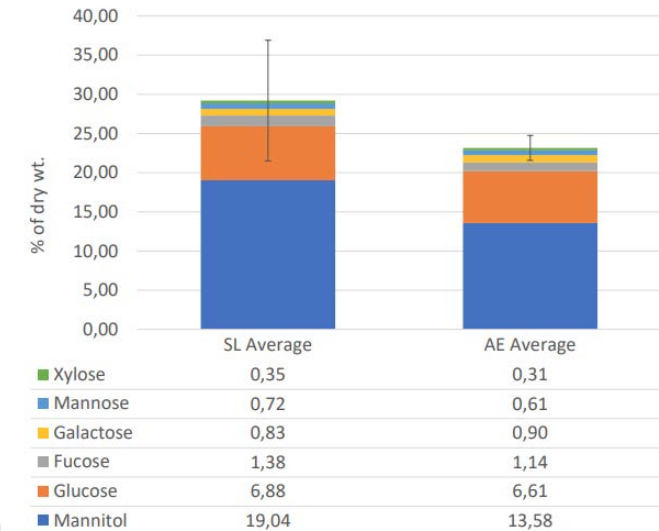
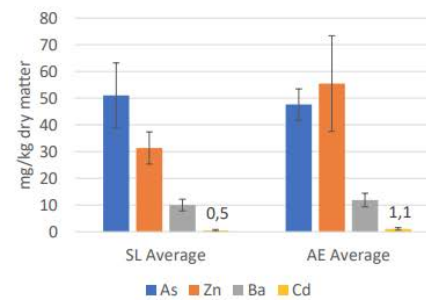
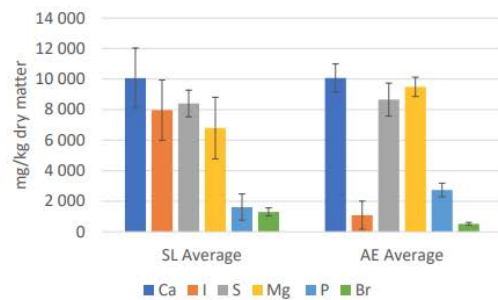
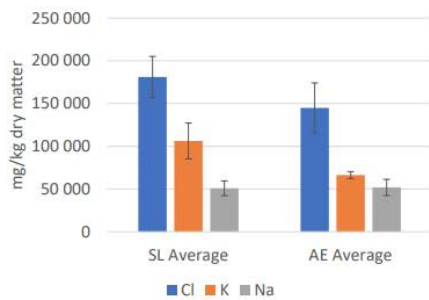
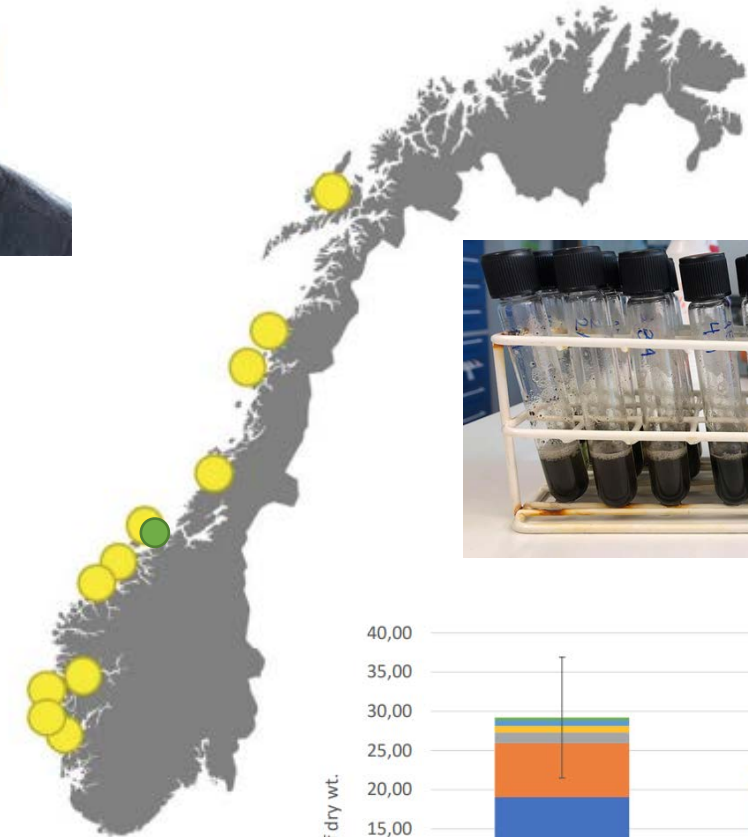
II: in collaboration with SES during harvest



✓ Analytical protocols (SOP) for seaweed

➤ Become available through publications (and website)

✓ Iodine, arsenic (organic/inorganic), cadmium

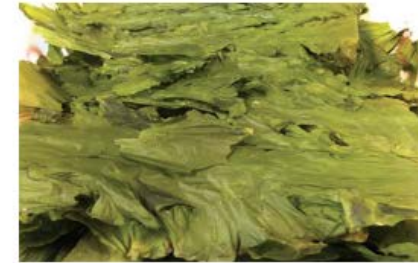


WP 3 – Seaweed biorefineries



Pre-processing of Seaweed

- Acid preservation
- Fermentation
- Drying and storage



Consolidated Biorefinery



Seaweed biomass



Fucoidan
Laminarin



Seaweed residues

Alginate



Cellulose

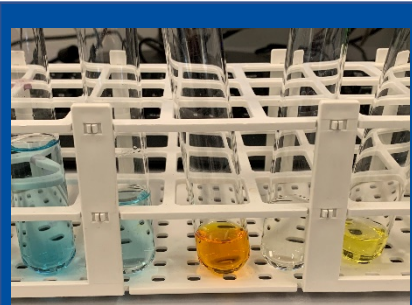


Solutions for Iodine Reduction



WP 4 – Products and application

✓ Fucoxantin - which biological activity?



Pigments

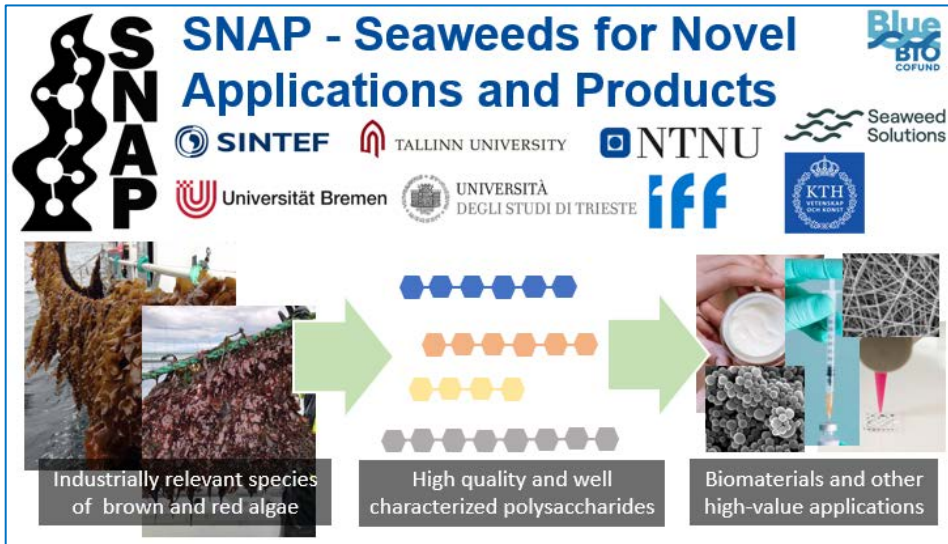
Biomaterials

Food

Food ingredients

Bioplastic

Biopolymers



What is relevant for you and Norway?

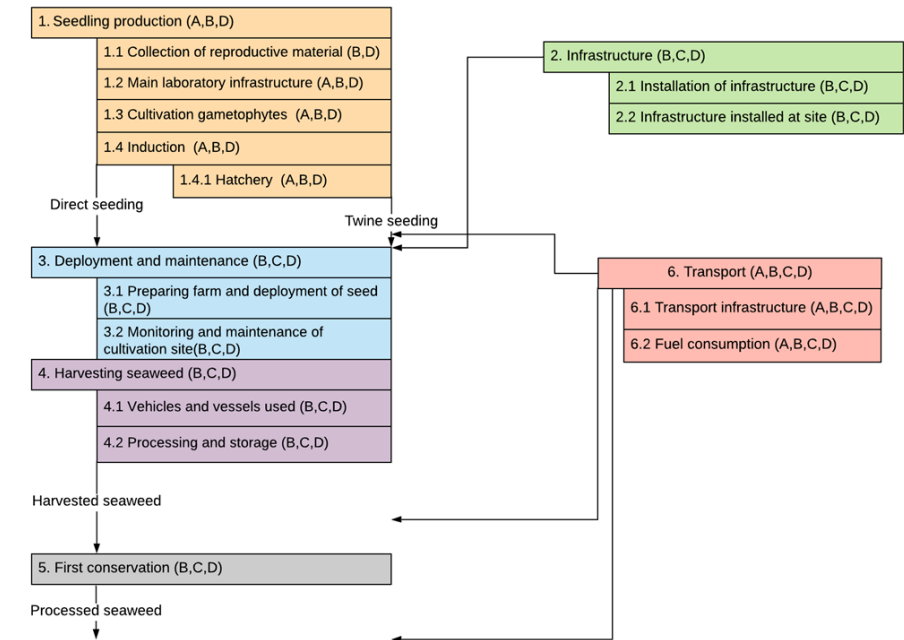
WP 5 – Sustainability and techno-economical evaluations



FROM PROMAC TO SBP-N

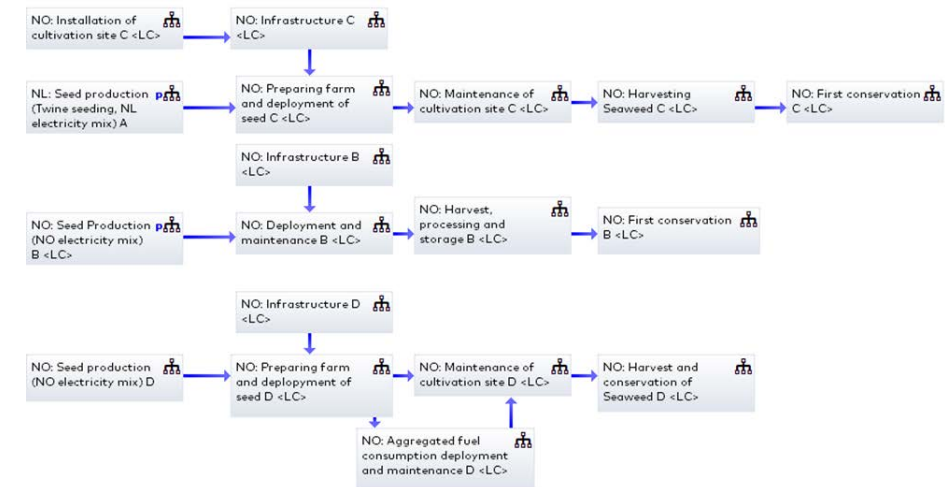


Data collection overview



✓ Value chain for alginates and fucoidans from *Saccharina latissima*.

- Data collection is ongoing, and quality checked
- Setting up the modelling methodology



WP6 - National seaweed Knowledge base



CRISTIN

Current Research Information System In Norway

70 post in CRISTIN total

✓ **2021: >19 presentation, 5 (17) publication**

✓ **Newsletters**

Workshops/conferences

✓ **Bioprosessering av tare – hvilket utstyr trengs?**

✓ **SIG Seaweed meeting**

☐ **Seaweed Applications - Opportunities and Challenges 2022**

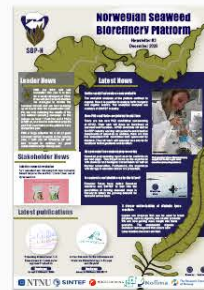
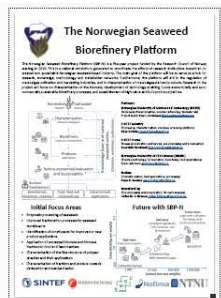
Websites

✓ **Homepage:** <https://www.sintef.no/projectweb/seaweedplatform/>

✓ **Linkedin:** <https://www.linkedin.com/groups/8988723/>

✓ **Facebook:** <https://www.facebook.com/Norsk-senter-for-tang-og-tareteknologi-132044173553700>

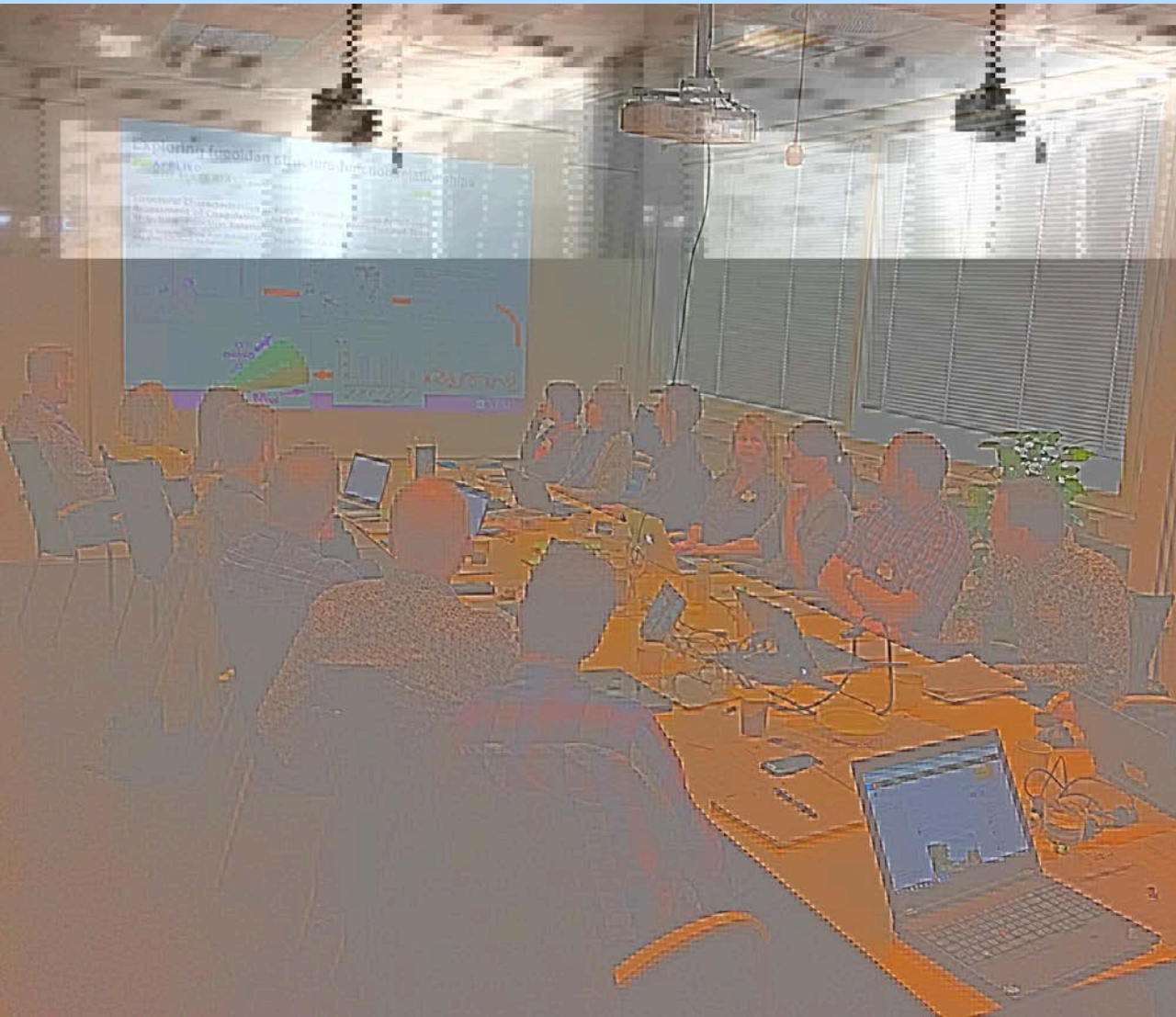
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- East Asia Marine Cooperation Platform
- Aquaculture Europe
- AquaNor
- Forskningstorget
- Thora Strom VGS
-



WP 7 – Responsible research and innovation



«RRI skal bidra til samfunnsgagnlig forskning gjennom diskusjoner innad i prosjektet og dialog med samfunnet utenfor.»



En ny norsk tareindustri – muligheter og hindringer



Image: EU RRI Tools project, rri-tools.eu.

Associated and Spin-off projects with SBP-N



2019

2024



FOODS?NORWAY aims to feed fish and farm animals using sustainable new ingredients

AlgiPharma

spermvital

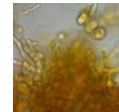
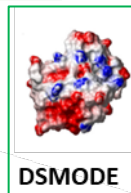
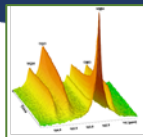


Still room for more

Associated Industry driven projects and innovations

Norwegian Seaweed Biorefinery Platform (SBP-N)

Associated National and International Research driven projects



SusKelpFood

Relevant Key infrastructure



Cultivation lab

- 24 27L flow-through tanks
- Light regime Control
- Spores or gametophyte cultures
- Seeding to ropes



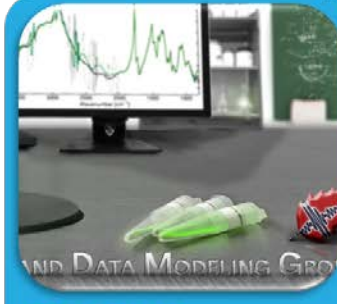
HighEFF lab

- Vacuum drying
- Freeze-drying
- Heat pump system
- Freezing technologies



Food lab

- Nofima/NTNU
- Small scale food production equipment
- Preparation kitchen
- Sensory analysis test room



FT-IR lab

- Nofima/NMBU
- Biospectroscopy and Data Modeling
- Infrared and Raman
- Chemometrics



Seaweed lab

- Reactor 120L steering and temperature control
- DSP processing equipment
- Filtersystems (lab to pilot scale)
- CNS Analysator



Biopolymer lab

- Fractions and isolation of products
- Freeze-drying
- Modification of carbohydrates
- Characterisation of chain, Mw distribution, sugar composition



Mass Spec

- Various GC-MS/LC-MS
- ICP-MS (I, Cd, As,...)
- Rapidfire (HTP MS)
- FT-ICR-MS (Ultra-HR)



Rheology lab

- Gels, gelling kinetics and viscosity
- Double emulsion
- Texture and rupture strength
- Particular size and distribution



Molgen lab

- DNA sequencing and bioinformatics
- Gene engineering
- Protein production, purification and characterisation



Bioactivity Lab

- Large library of human cell lines and microbial (pathogenic) strains
- High-throughput cytotoxicity and immunological assays
- Cell microencapsulation, 3D bioprinting, confocal microscopy, flow cytometry



BioRef lab

- Steam explosion pretreatment
- Enzymatic saccharification
- Fermentation for production of enzymes and single cell protein
- Microbial communities (biogas)



NMR lab

- Structure elucidation and molecular characterization
- Chemical fingerprint
- Diffusion, Dynamics and kinetics characterization

**Thank you for
your attention!**

SEAWEED INDUSTRY
**-A part of the solution for a
new bioeconomy in Norway**

Foto: Olav Øiehaug