

Variety creates wealth

- Marine biodiversity as a source of higher value-added products

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Content

Introduction: Variety

As-Is-Analysis: Environment and potential of MB

- Are the prerequisites satisfactory for a major step forward in MB?

How to tap MB's potential on regional and enterprise level ?

- diverse and balanced MB portfolio

- navigation by sight having the vision in mind (3-horizon-innovation)

- „cascade utilization“ and diversification of technologies, organisms and products → Ecosystem Service Approach

- with patience

Introduction: Variety creates wealth

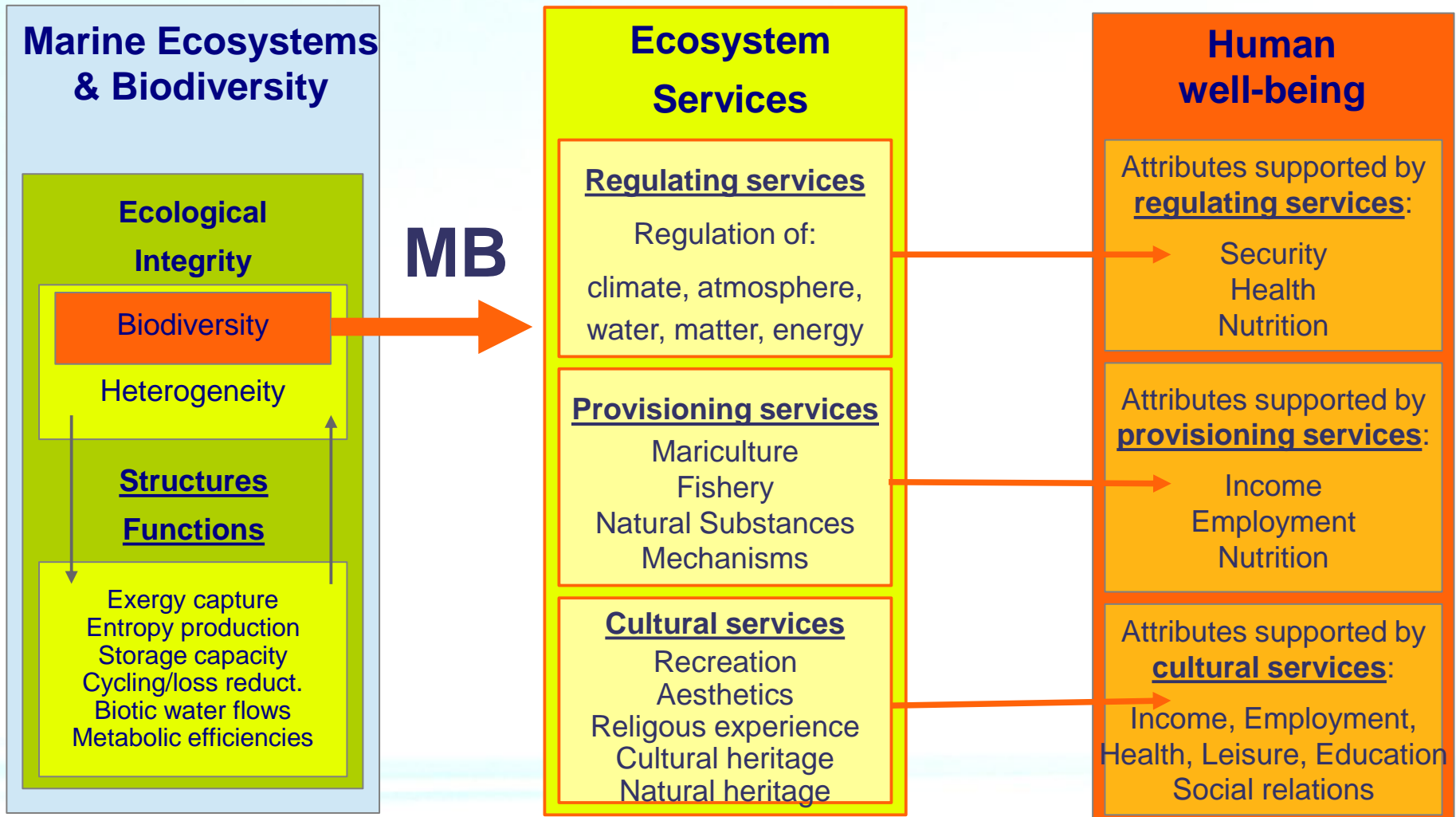
„Variety creates wealth“
(Chuang-Tse, 300 b.c.)

Introduction: Variety creates wealth

Concept (cybernetics, economy, ecology):

The more diverse a self-organisational system is
the more stable it is

Variety creates wealth

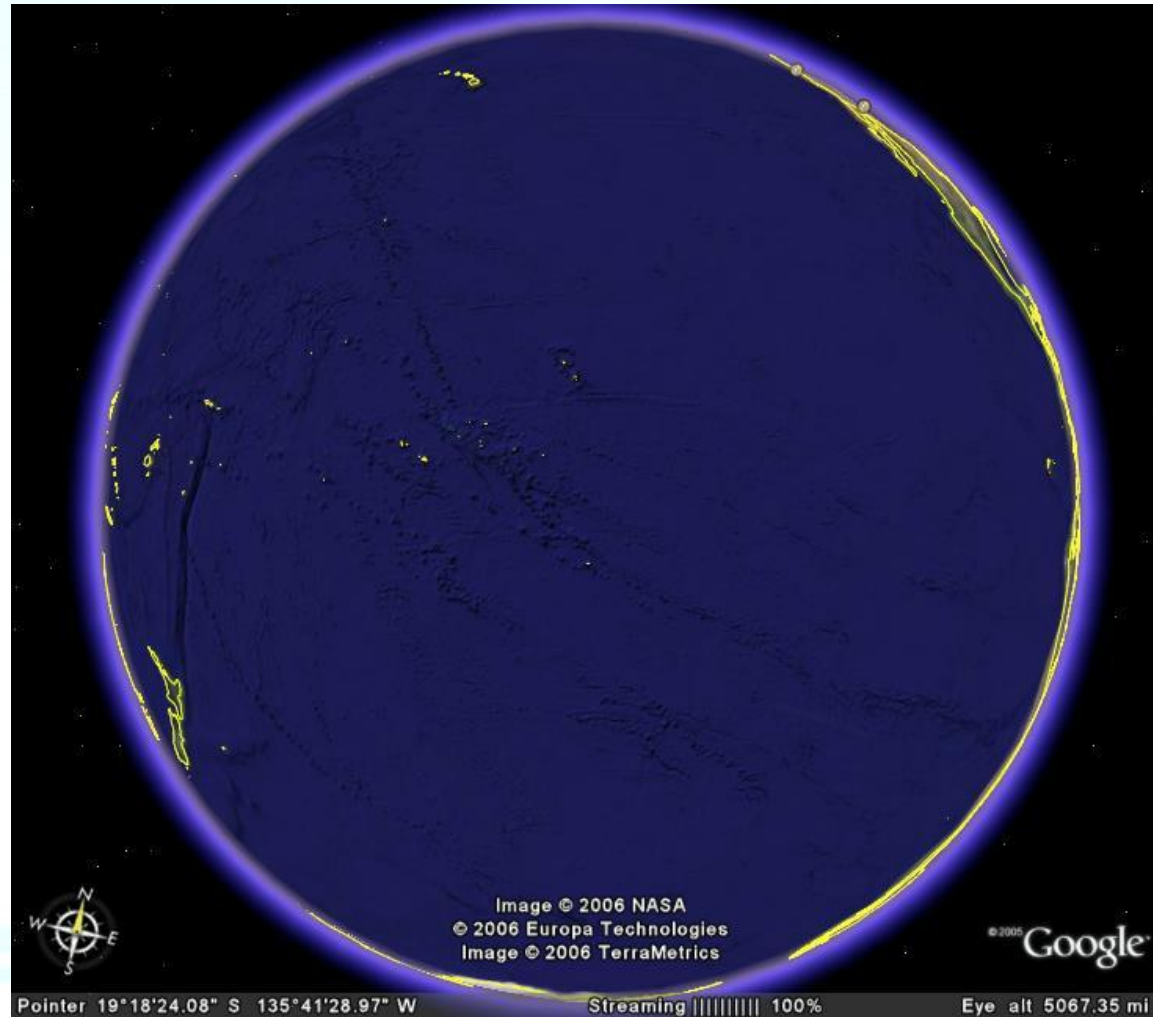


Modified after Kandziora *et al.*, 2013

Can Marine Biotechnology tap this potential of system, organism, molecule diversity?

→ **As-Is-Analysis**

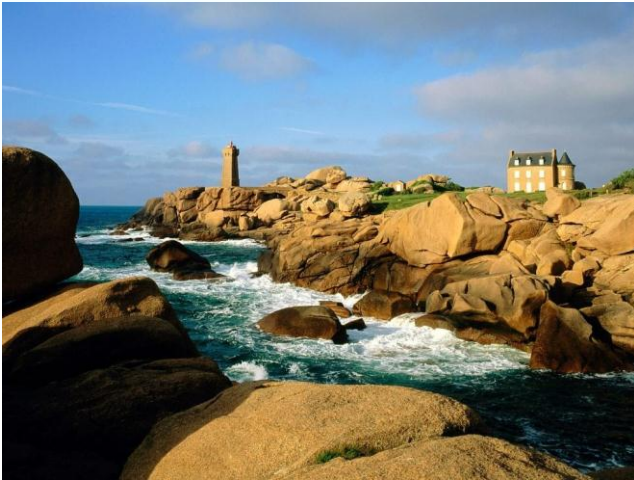
As-Is-Analysis: Geography



As-Is-Analysis: Geography

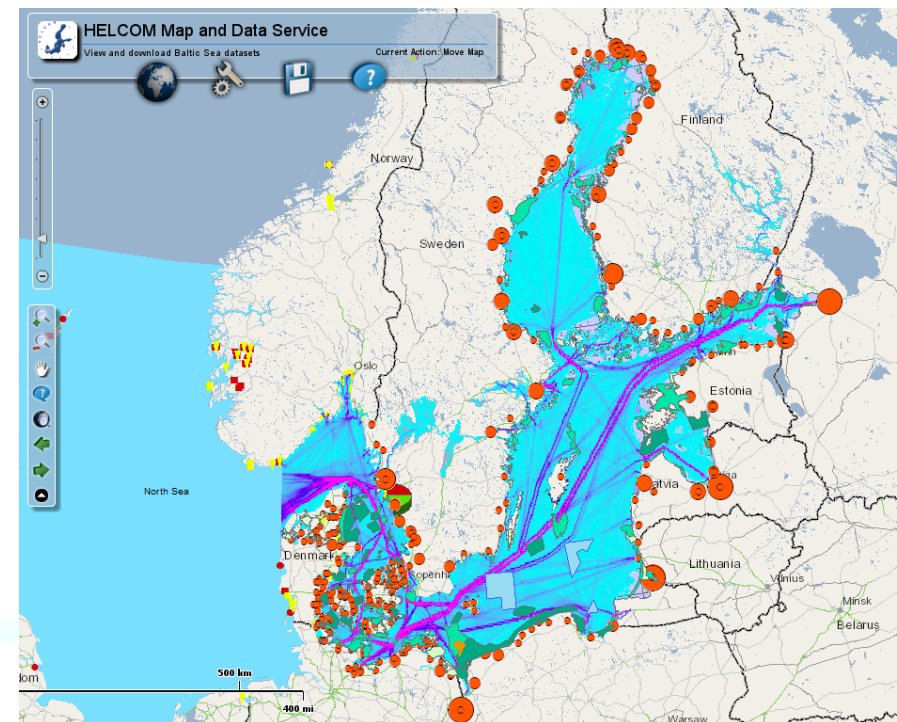


As-Is-Analysis: Geography



As-Is-Analysis: Geography / Ecology

- most dense coastal population
- strictly controlled anthropogenic impact
- strong competition for space
- water framework directive
- no ICZM standards



As-Is-Analysis: Politics

- democratic
- stable
- supporting mainstream (managed) economy

As-Is-Analysis: (Socio-)Economy

Technology & Knowledge oriented

NOT natural and human resource oriented

As-Is-Analysis: (Socio-)Economy

- stable
- weak growth
- managed economy
- no entrepreneurial economy

Situation: Economy

Managed Economy (Schumpeter I) \longleftrightarrow **Entrepreneurial Economy** (Schumpeter II)

Globalisation \longleftrightarrow Localisation

Continuity \longleftrightarrow Change

Stability \longleftrightarrow Turbulence

Specialisation \longleftrightarrow Diversification

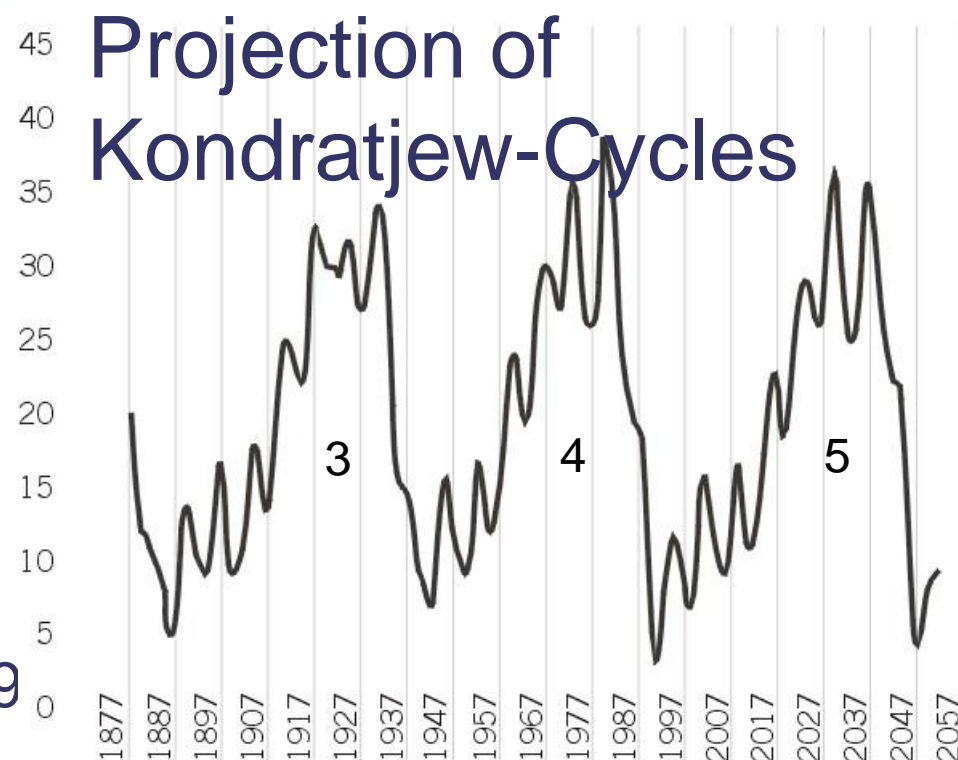
Conserving innovation \longleftrightarrow Disruptive innovation

Substitution of competition and cooperation \longleftrightarrow Complementarity of competition and cooperation

As-Is-Analysis: Economy - Big Cycles

Kondratjew-Cycles:

1. Steam Engine, cotton (1793-1847)
2. Railway, navy, steel (- 1893)
3. Electricity, Chemistry (- 1939)
4. Car, petroleum, electronic (- 1984)
5. Information, communication (- 2039)



As-Is-Analysis: Economy

Prediction of the next cycle

Biotechnology

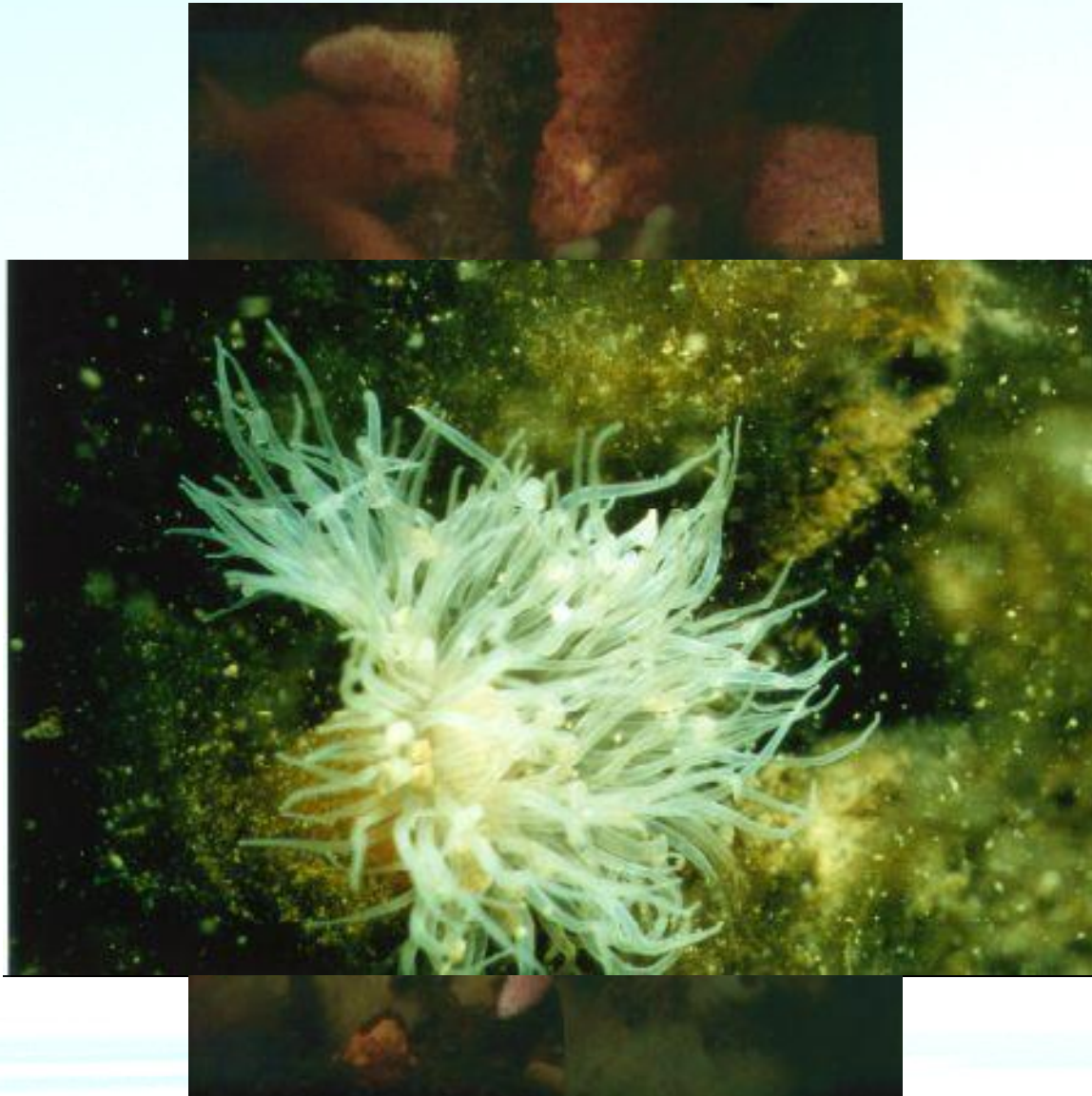
Nanotechnology

Regenerative energy

(psycho-social) Health and competence

(Nefiodow and others)

As-Is-Analysis: Biology



As-Is-Analysis: Marine Biotechnology

- predominantly **unexplored** oceanic regimes → expectation of a vast amount of new natural substances and functions
- highly developed **(bio-)chemical mechanisms** for defense and reproduction
- **Congruences** of mineral and trace element composition in human cell fluid and ocean
- **Biodiversity**: all 33 animal clades live in the sea, 15 on land
- The **future economic era** will be driven by biotechnology as the basic innovation created today

As-Is-Analysis: Result

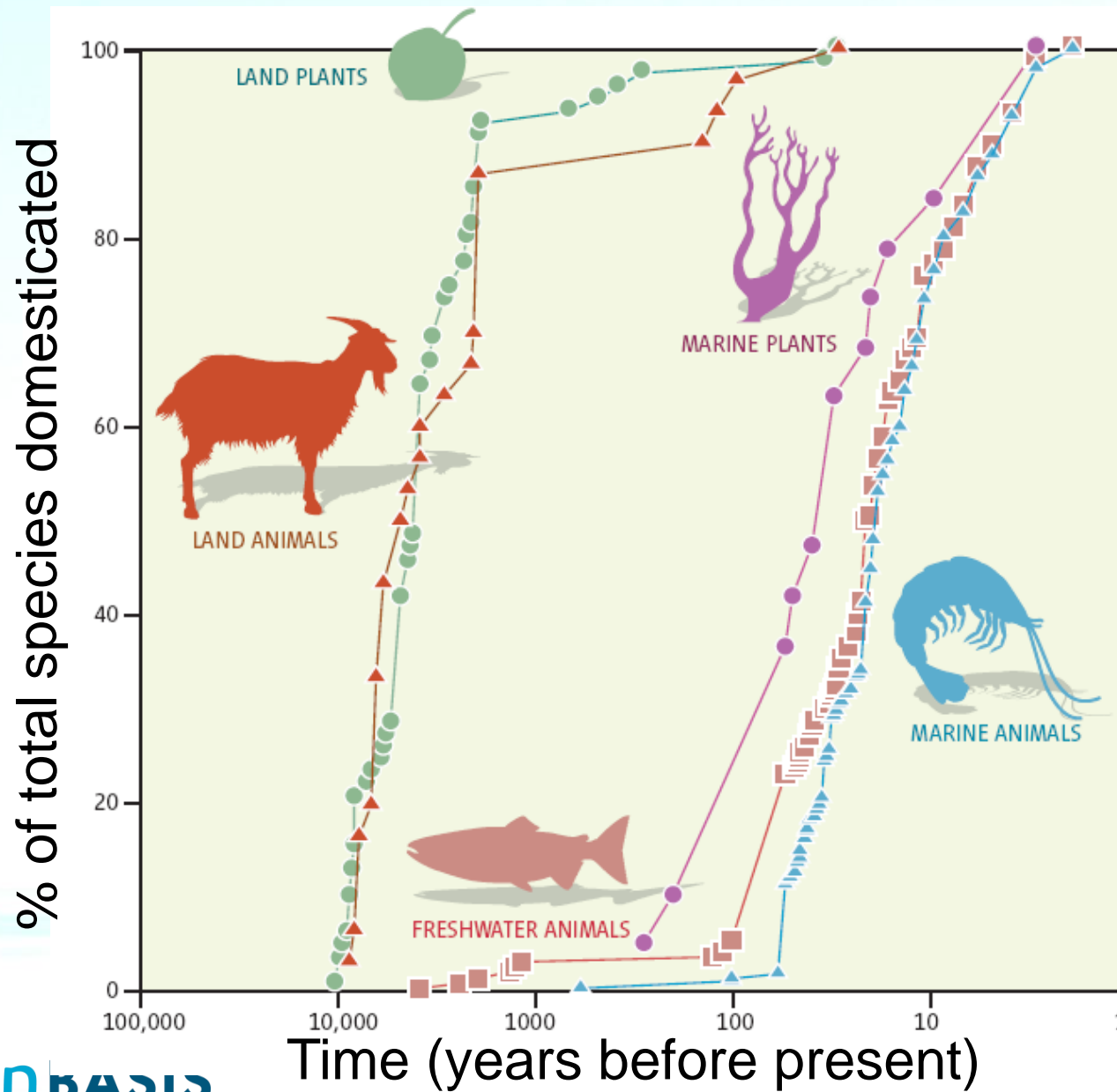
Perfect prerequisites for exploring the
marine biodiversity for
human well-being

?

But, to be more critical with the outcome of two and a half decade (?) of R&D in Marine Biotechnology:

Relating to methods of ocean management and exploitation humans are still gatherer and hunter, NOT blue engineers.

State of the Art



Duarte *et al.*, 2007

And:

Utilisation of marine resources is far away
being rational, intelligent or sustainable

Example:

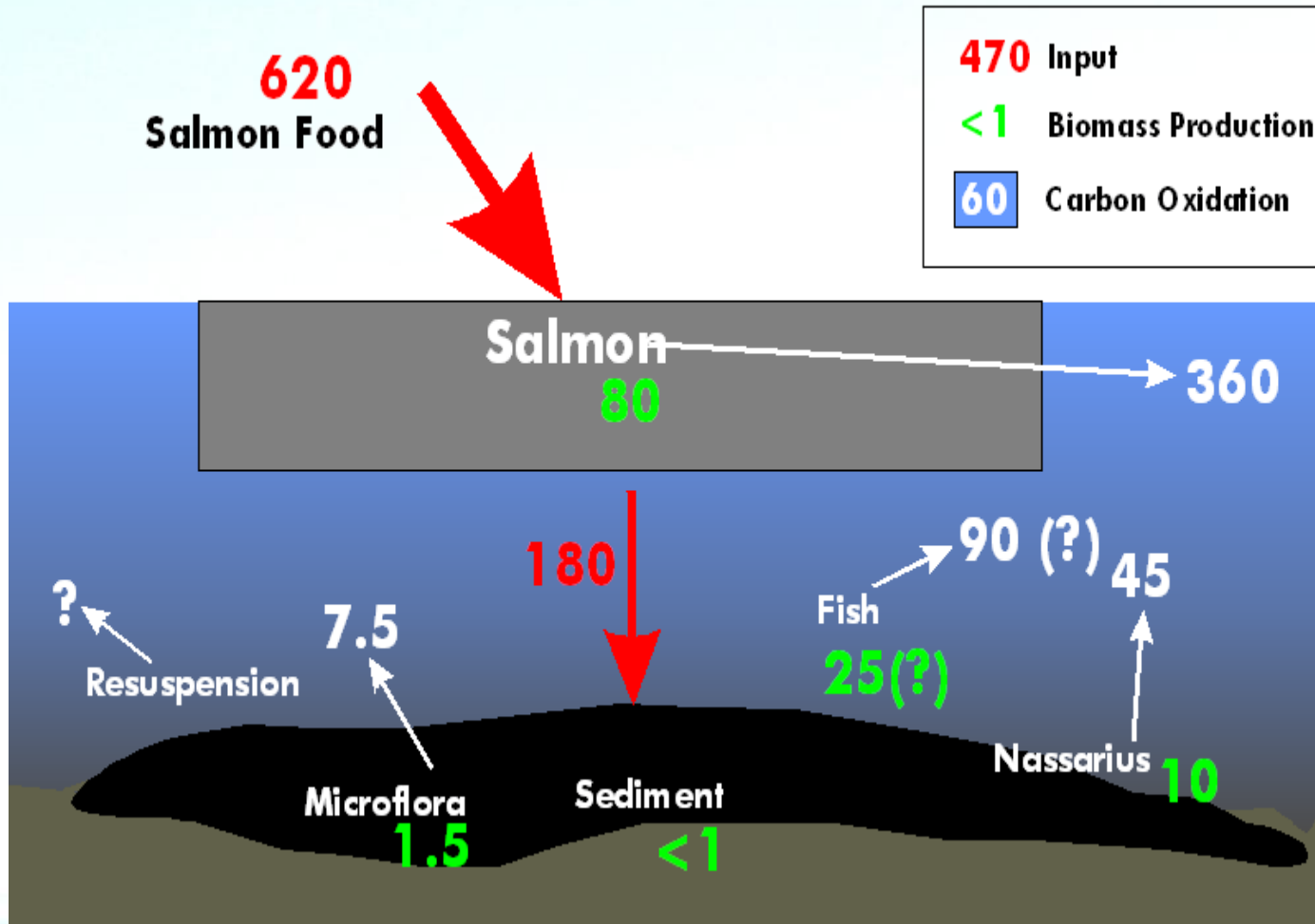
Extensive Salmon Farming (X. Region, Chile)







Carbon flow [t] in a salmon farm producing 2.000 t of salmon per year



Piker et al., 2002

Also Marine Biotechnology Facts

→ Marine Biotechnology market is marginal

Also Marine Biotechnology Facts

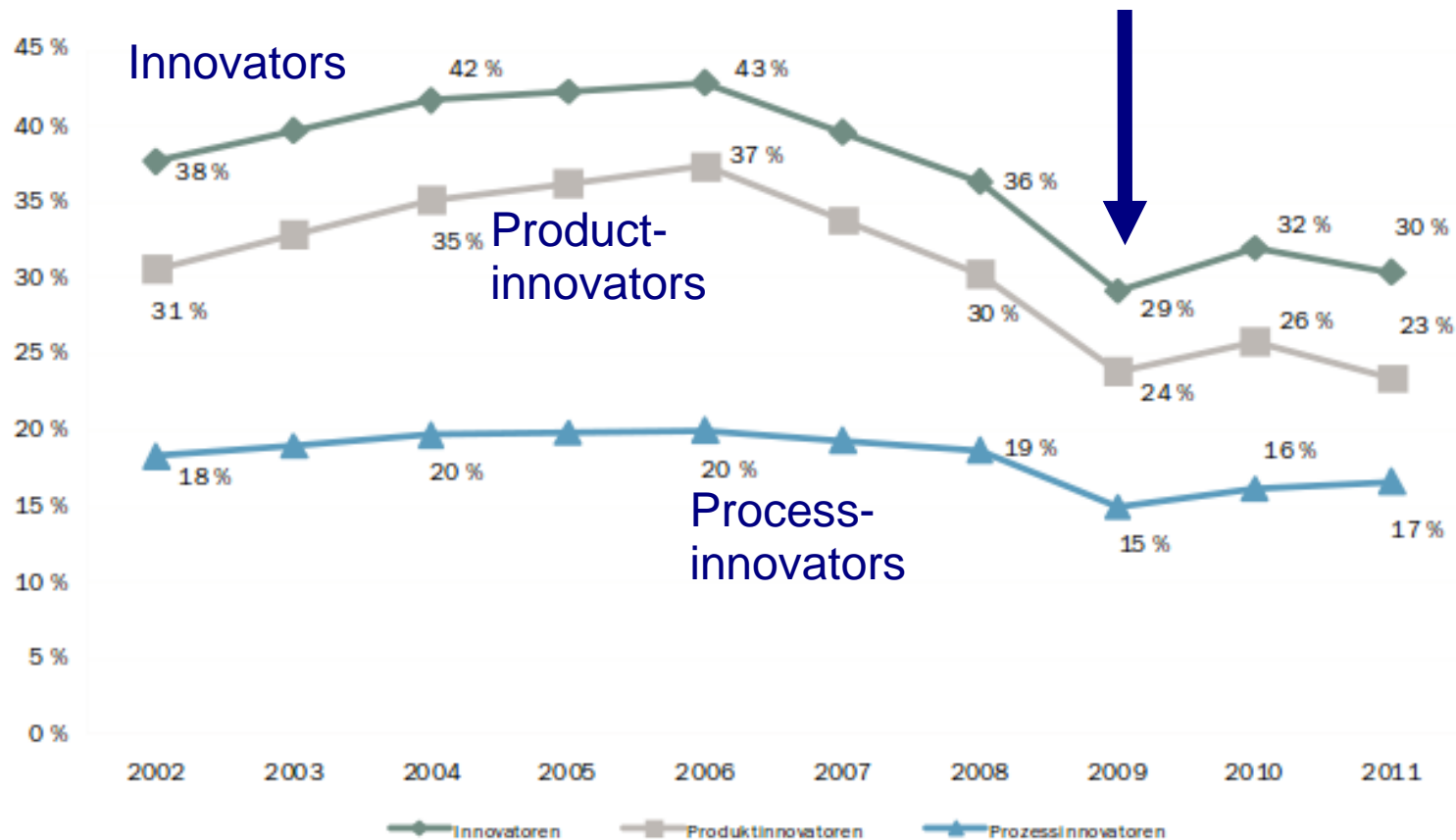
- Biotechnology industry is a major growth area in the global healthcare market,
- Global biotechnology market was worth over \$281.7 bn in 2011, with 7.7% growth
- Global **Marine** Biotechnology Market to reach \$4.1 bn by 2015 (report by Global Industry Analysts, Inc.)

Main obstacle: Money

- Capital urgently needed (report by Global Industry Analysts, Inc.)
- Only 140 Mio. Euro capital flow to Biotech firms in Germany (2011, Dr. Helge Braun, Federal Ministry of Research and Education)
- Innovation break by mitigation of risk

Innovation slump (Germany)

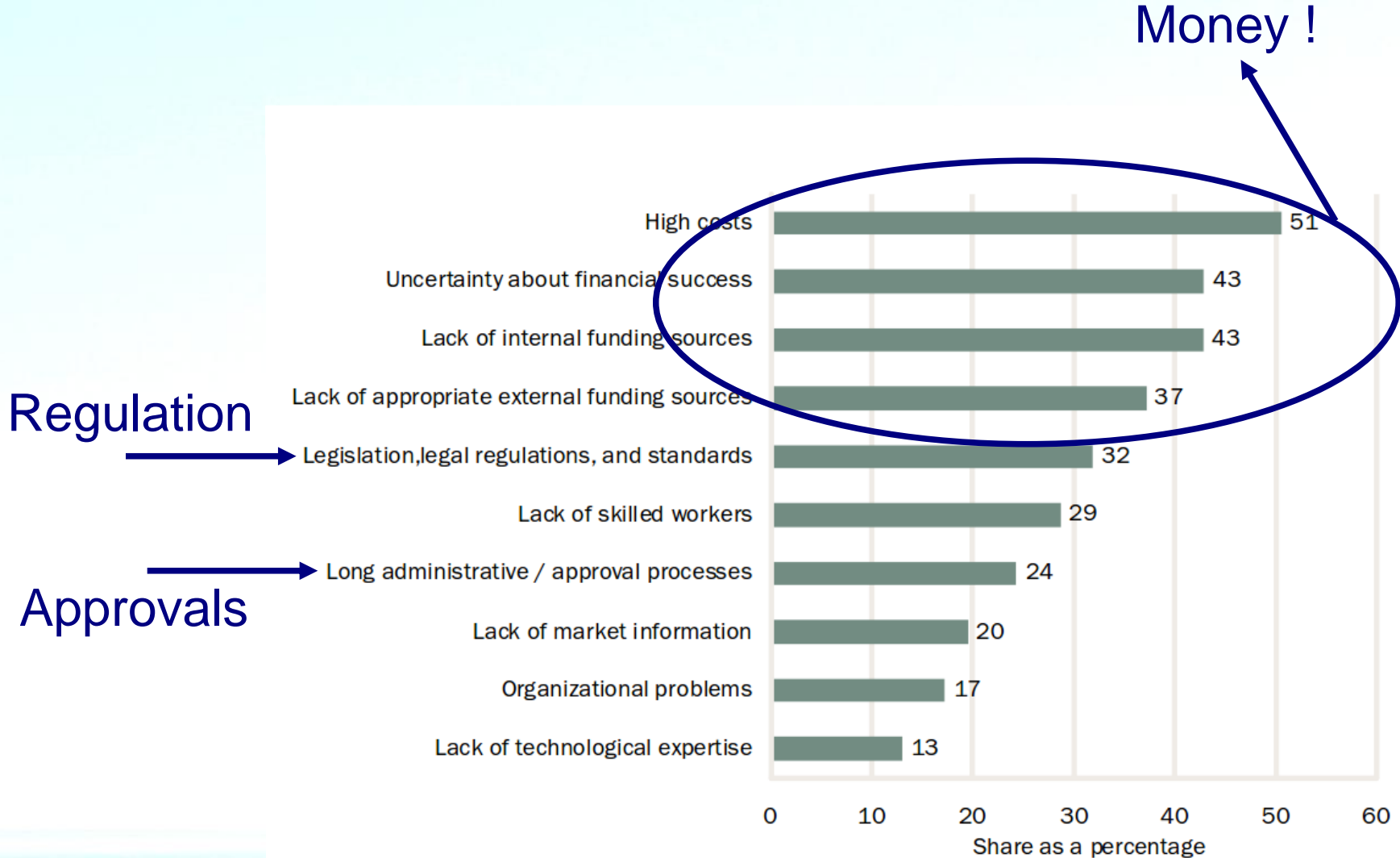
Development of Innovation Index over the last 10 Years



Anmerkung: Mit der Anzahl der Unternehmen hochgerechnete Werte

Quelle: KfW-Mittelstandspanel.

Factors hampering innovation in the SME sector (2008-2010)



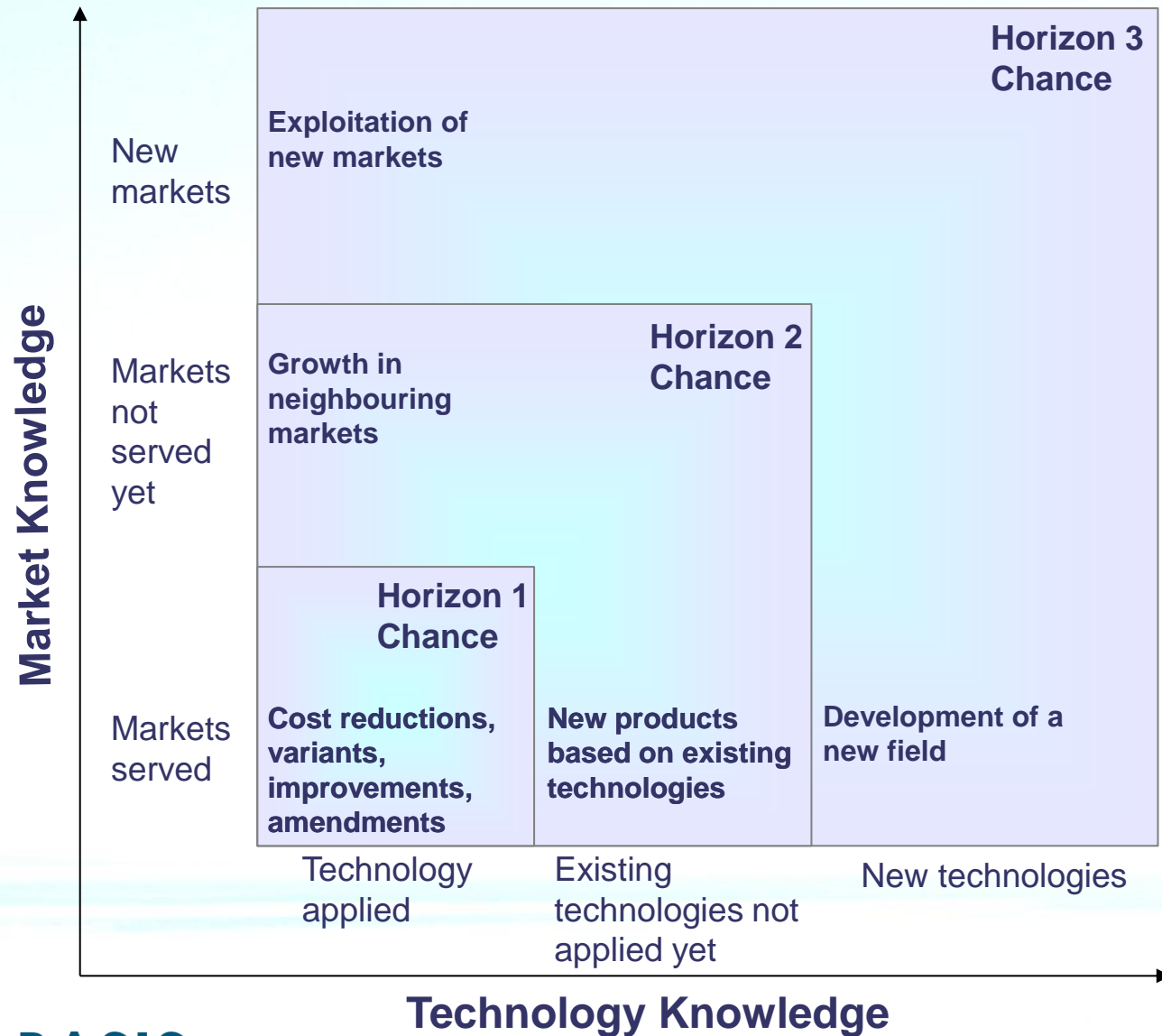
Note: only companies with innovation activities

Source: KfW SME Panel 2011

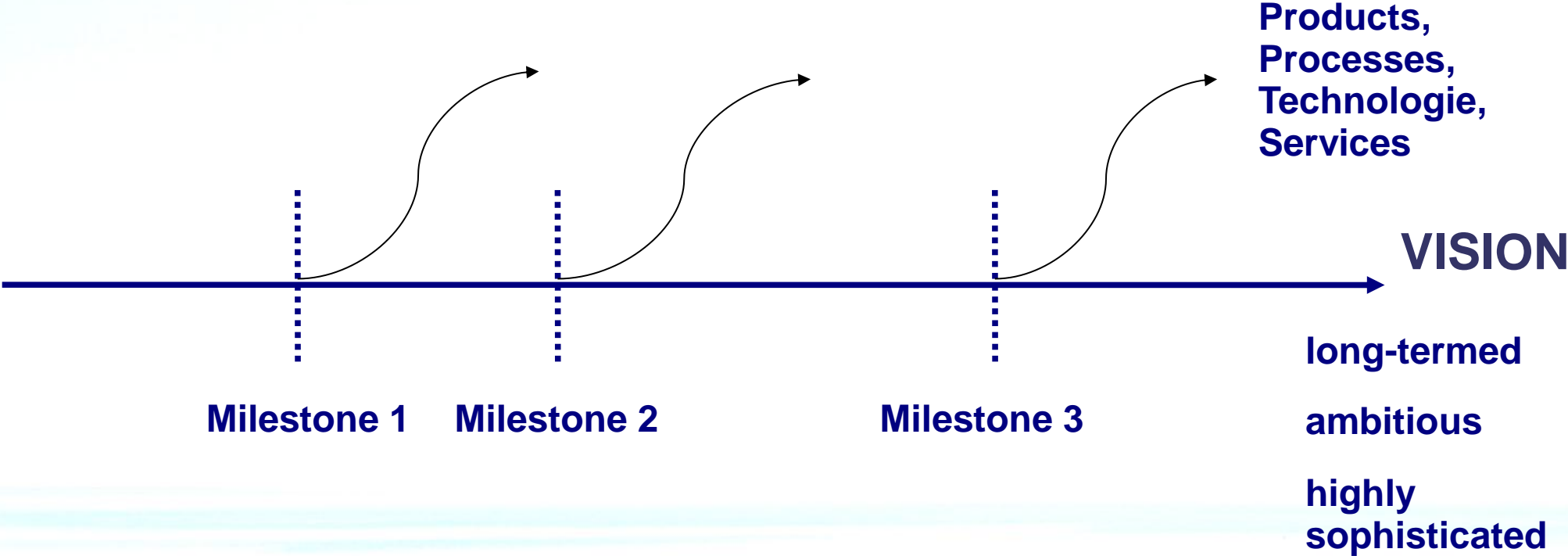
How to:

- better tap the full potential of Marine Biotechnology ?
- efficiently implement MB R&D efforts in society, in the market ?
- overcome the obstacles ?
- establish a diverse and balanced portfolio for enterprises and economics ?

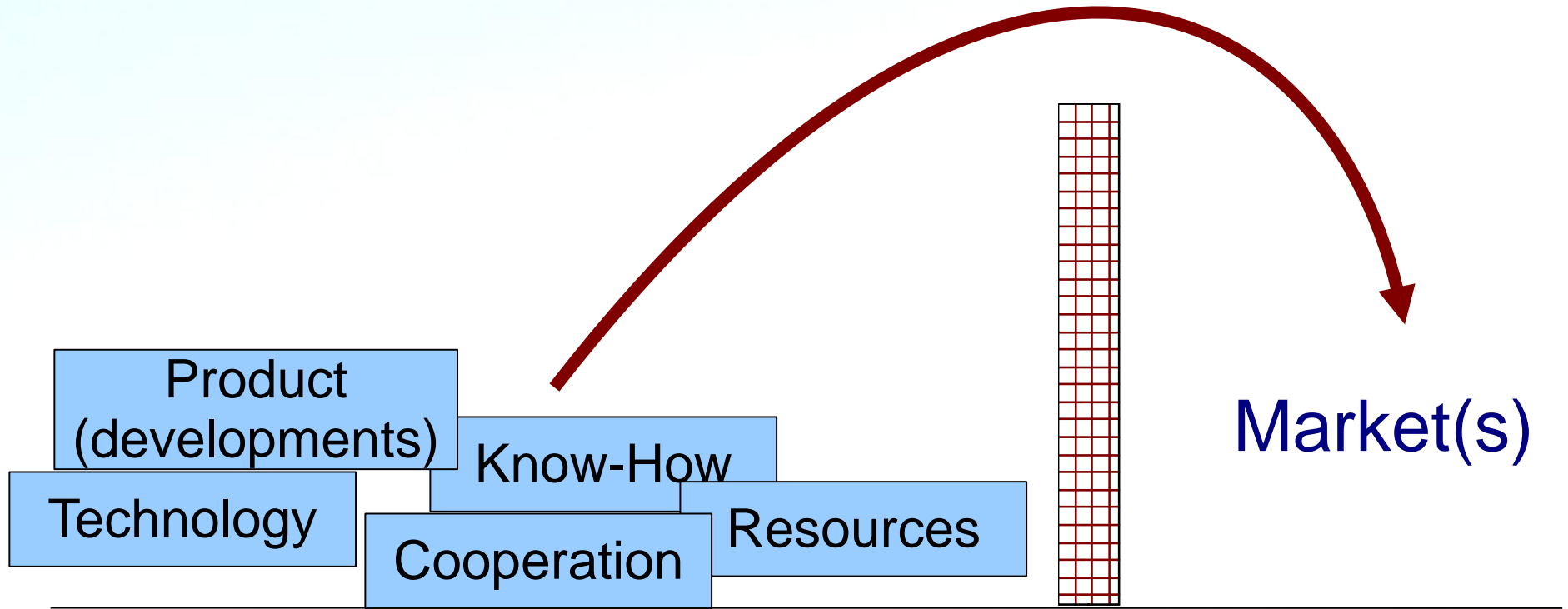
3-Horizon innovation management for ecological entities (enterprises, regions, EU)



Definition of vision and milestones in correspondence with characteristics of entities (enterprises, counties, states)



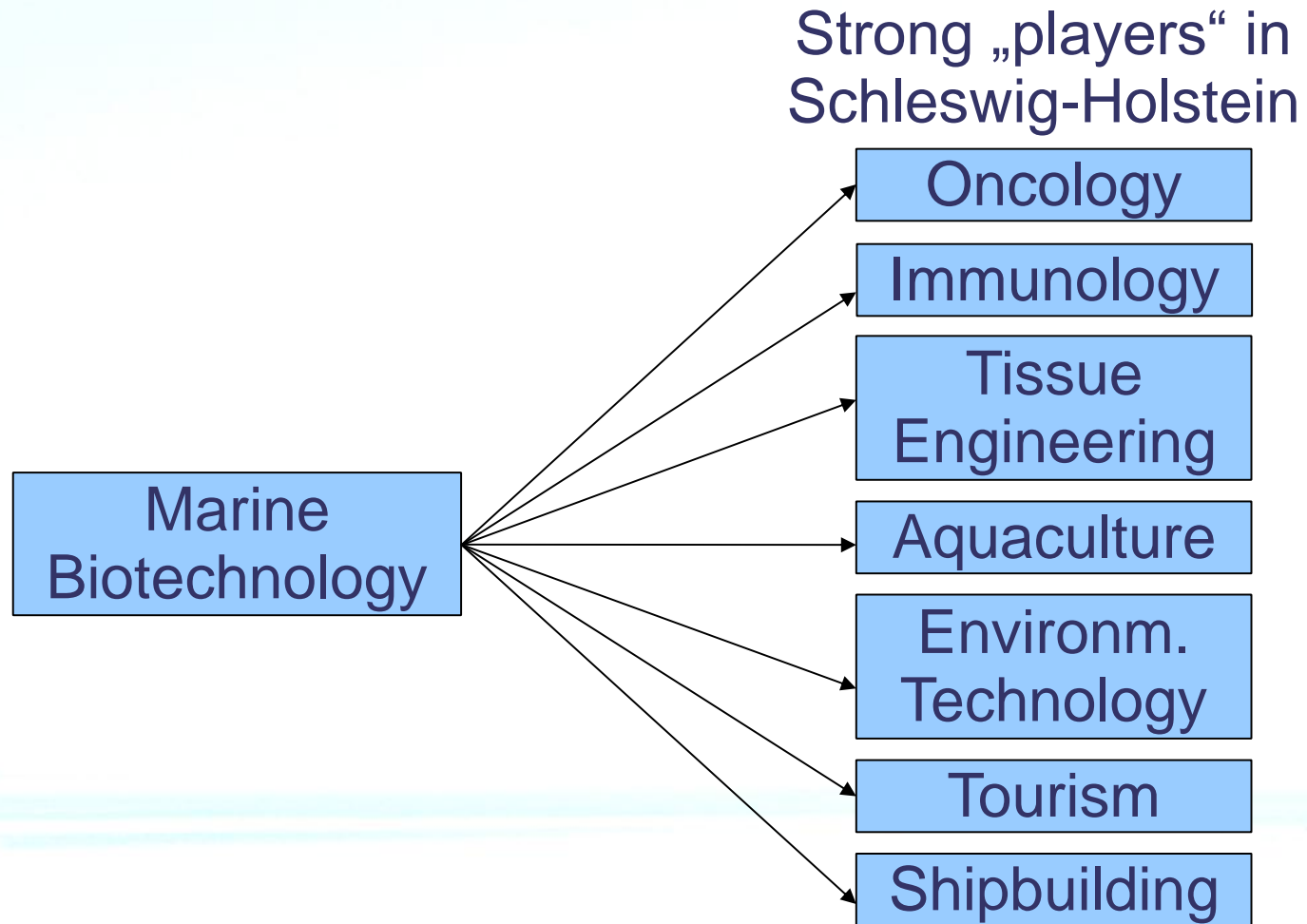
Market access factors „unsorted“



Masterplan Marine Biotechnology



Cross-link to successful „service“ sectors (Example Schleswig-Holstein)



A balanced portfolio of Marine Biotechnology for Europe and the regions using:

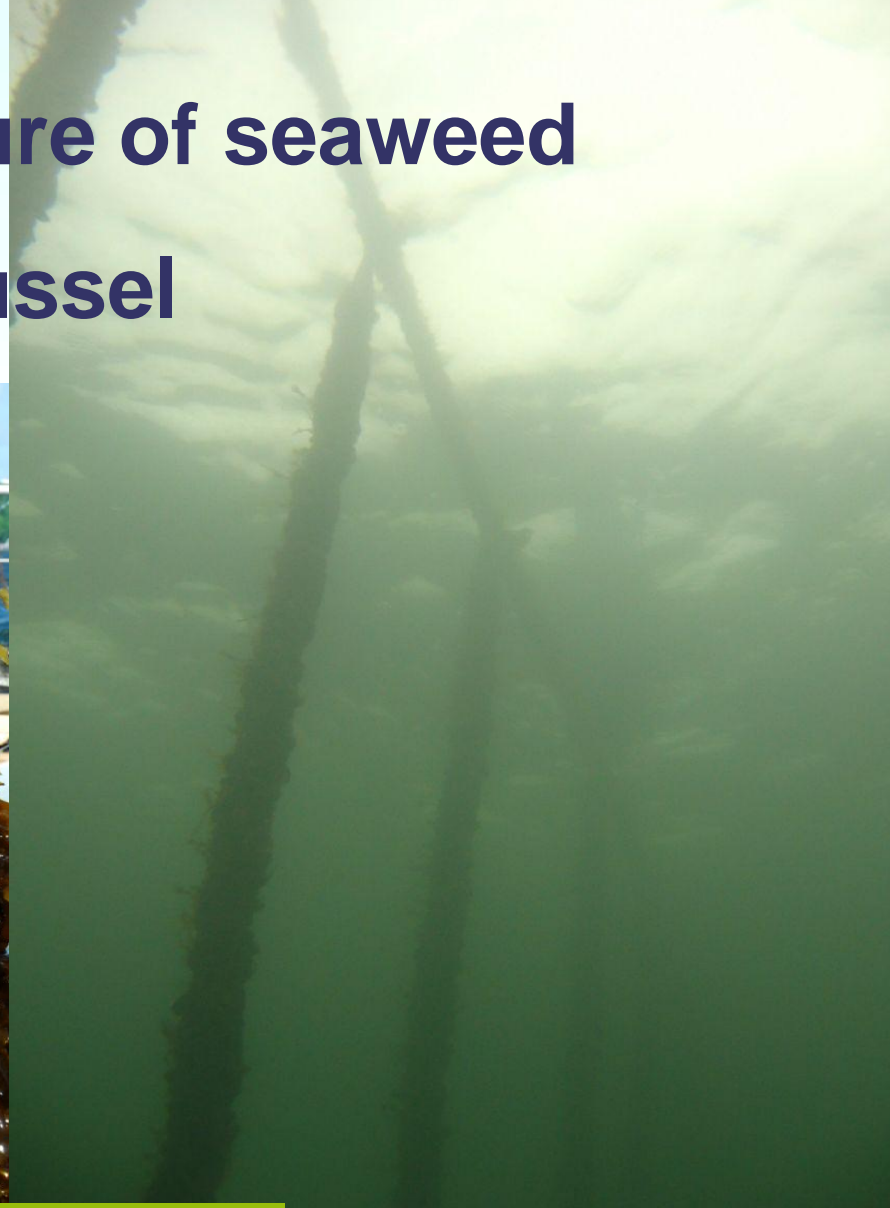
- Ecosystem service approach
- Entrepreneurial economy
- Cascade utilisation of marine living resources
- Life Cycle Assessments of exploitable marine living resource (including R&D efforts)
- focus on local or regional resources (it is not obligatory to perform million-Euro-expeditions in order to profit from ecosystem services)

→ **Concept: Sustainable Aquaculture (IMTA),
Diversification, Value Added Products**

Sustainable aquaculture of seaweed and blue mussel

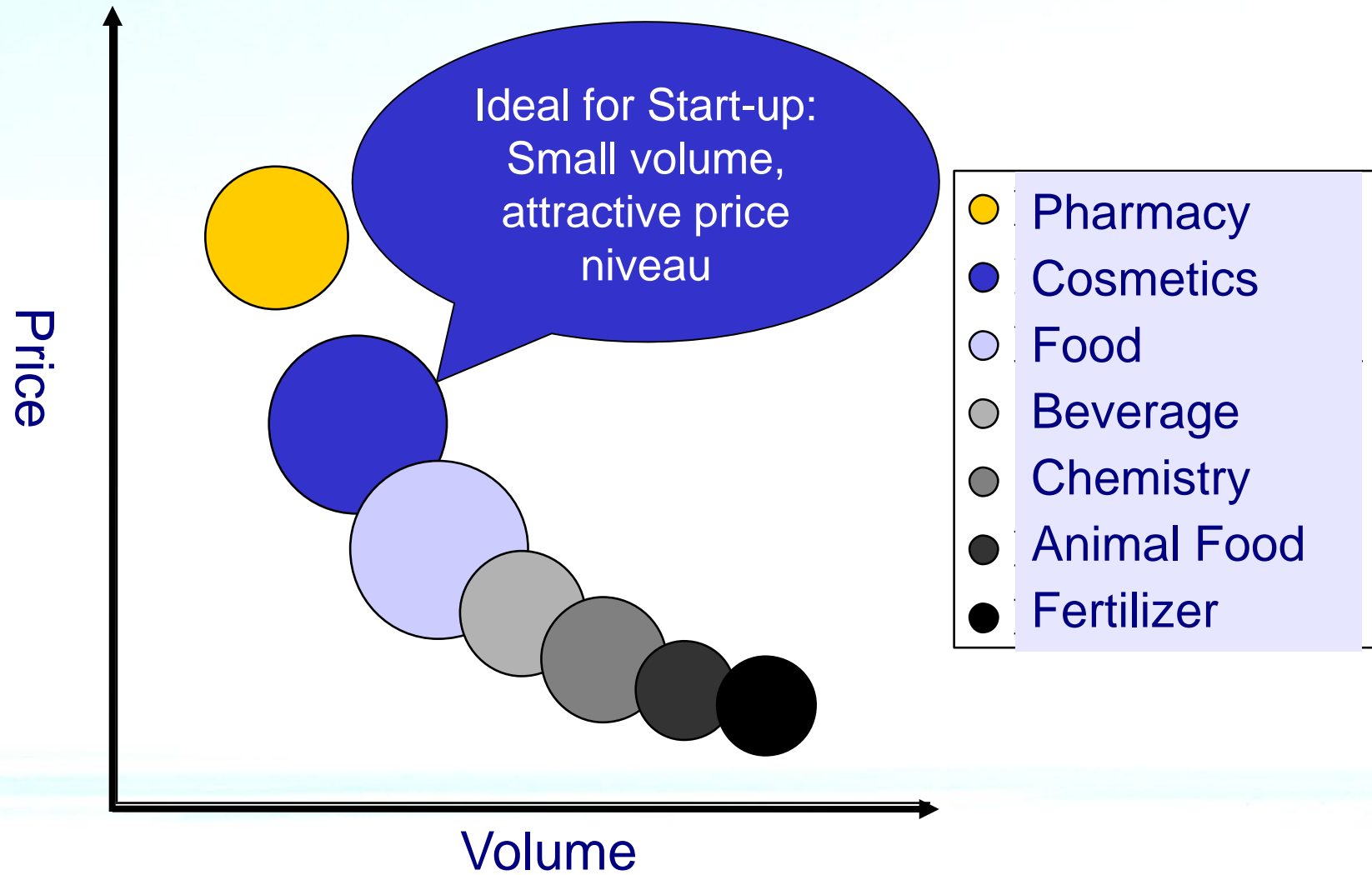


Saccharina latissima

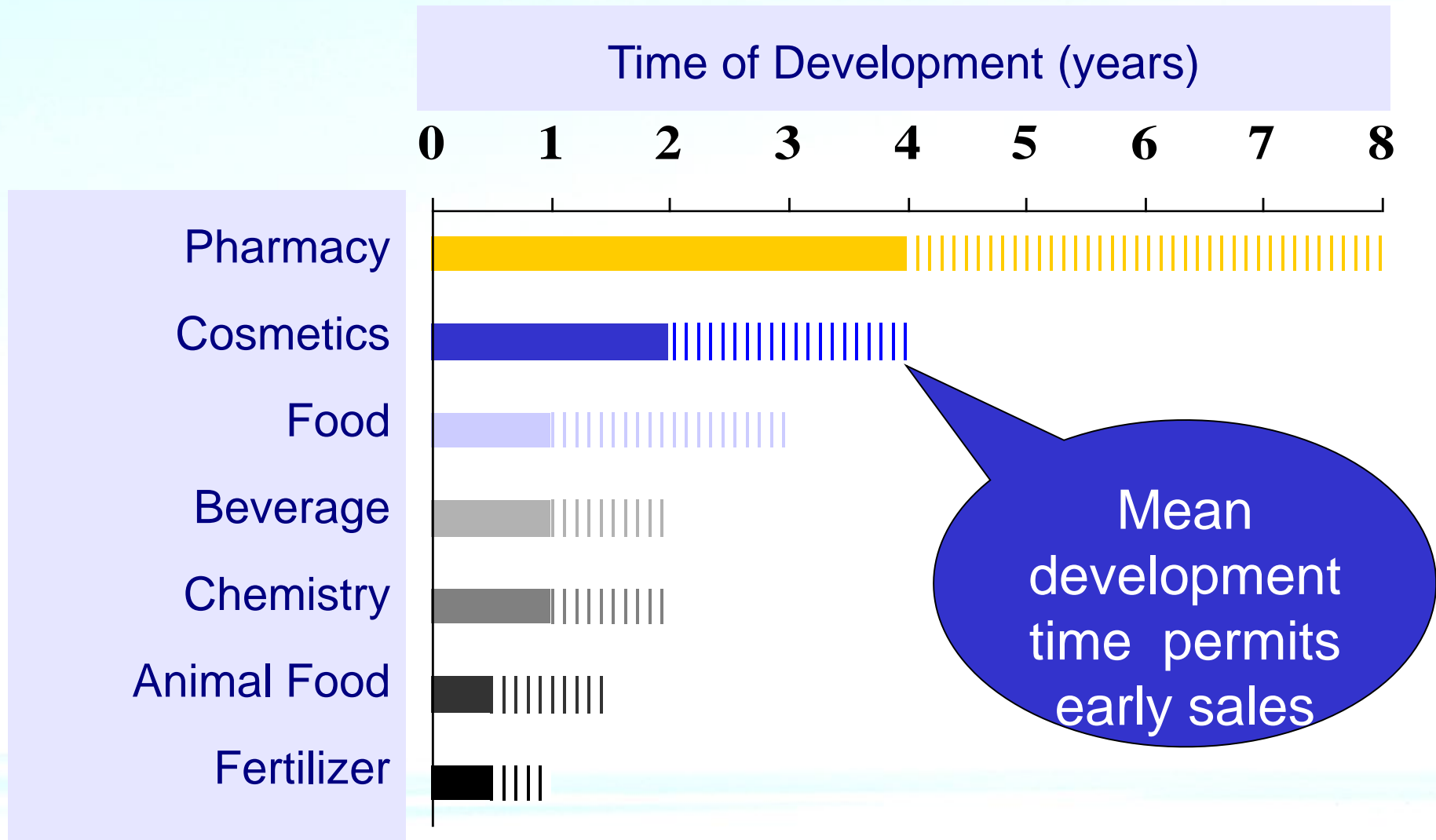


Mytilus edulis

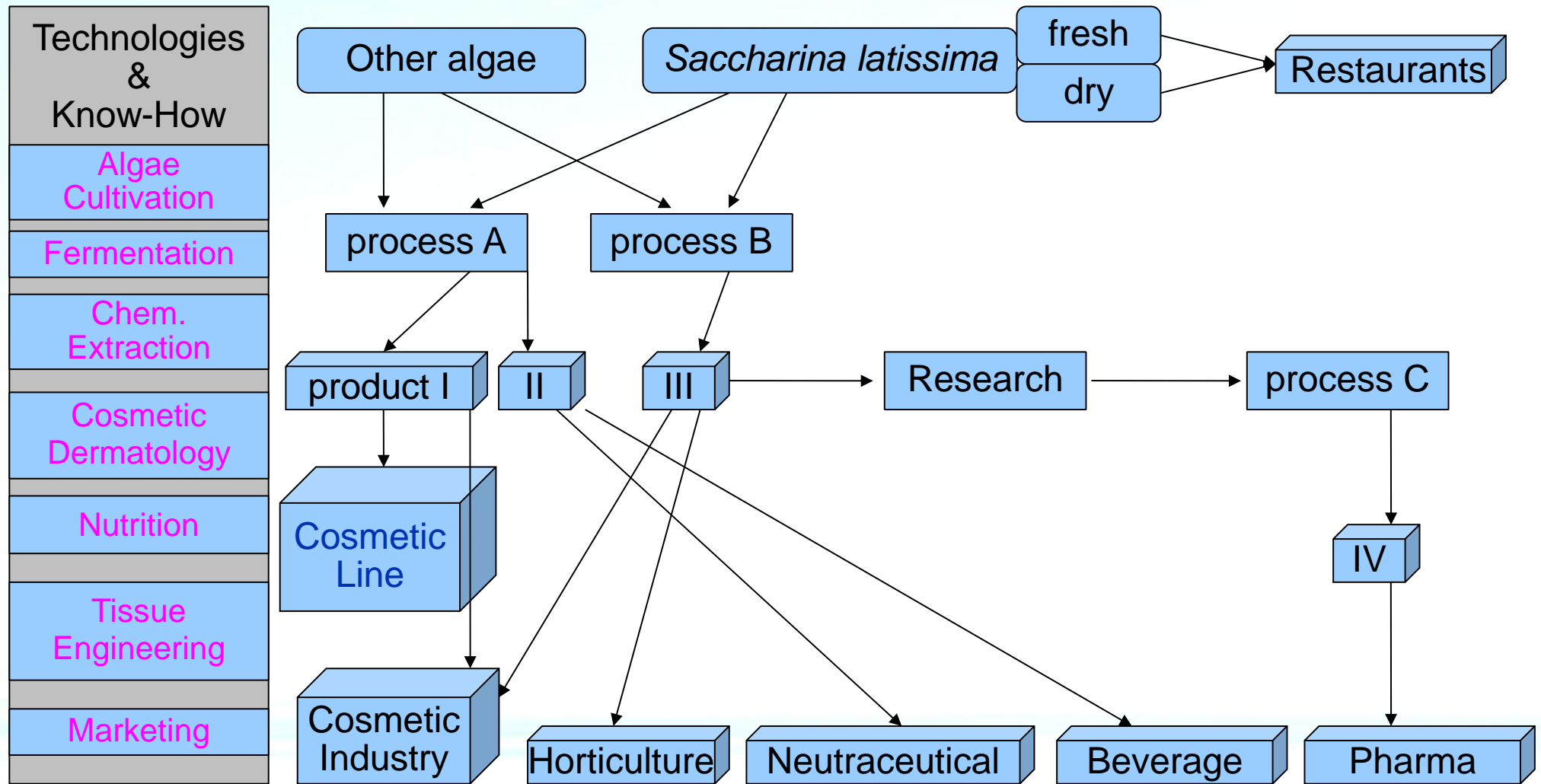
Markets for *S. latissima*



Relatively Quick Product Development



Product Diversification & Value Adding Scheme by CRM/oceanBASIS (*Saccharina latissima*)

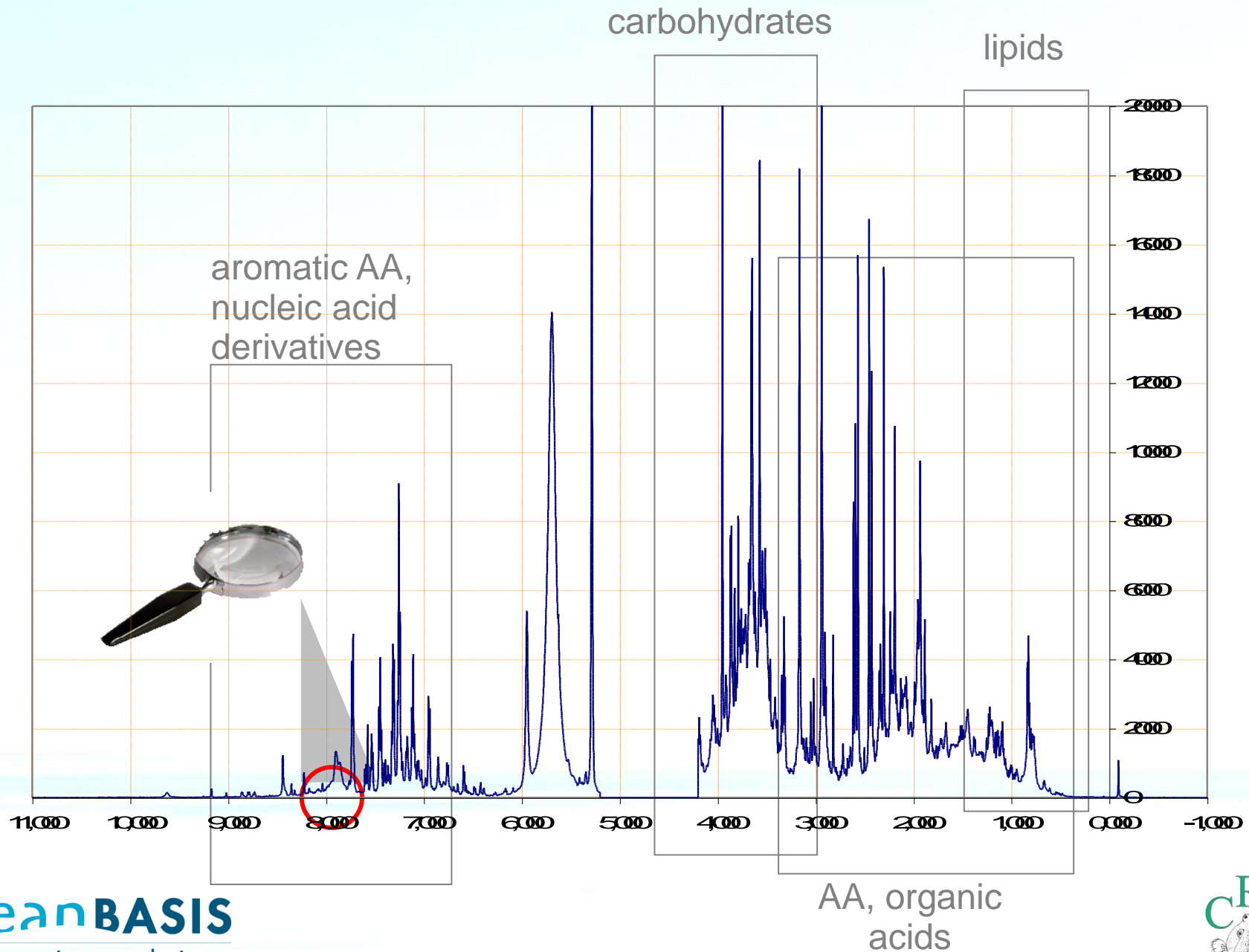


Algae-based active ingredients

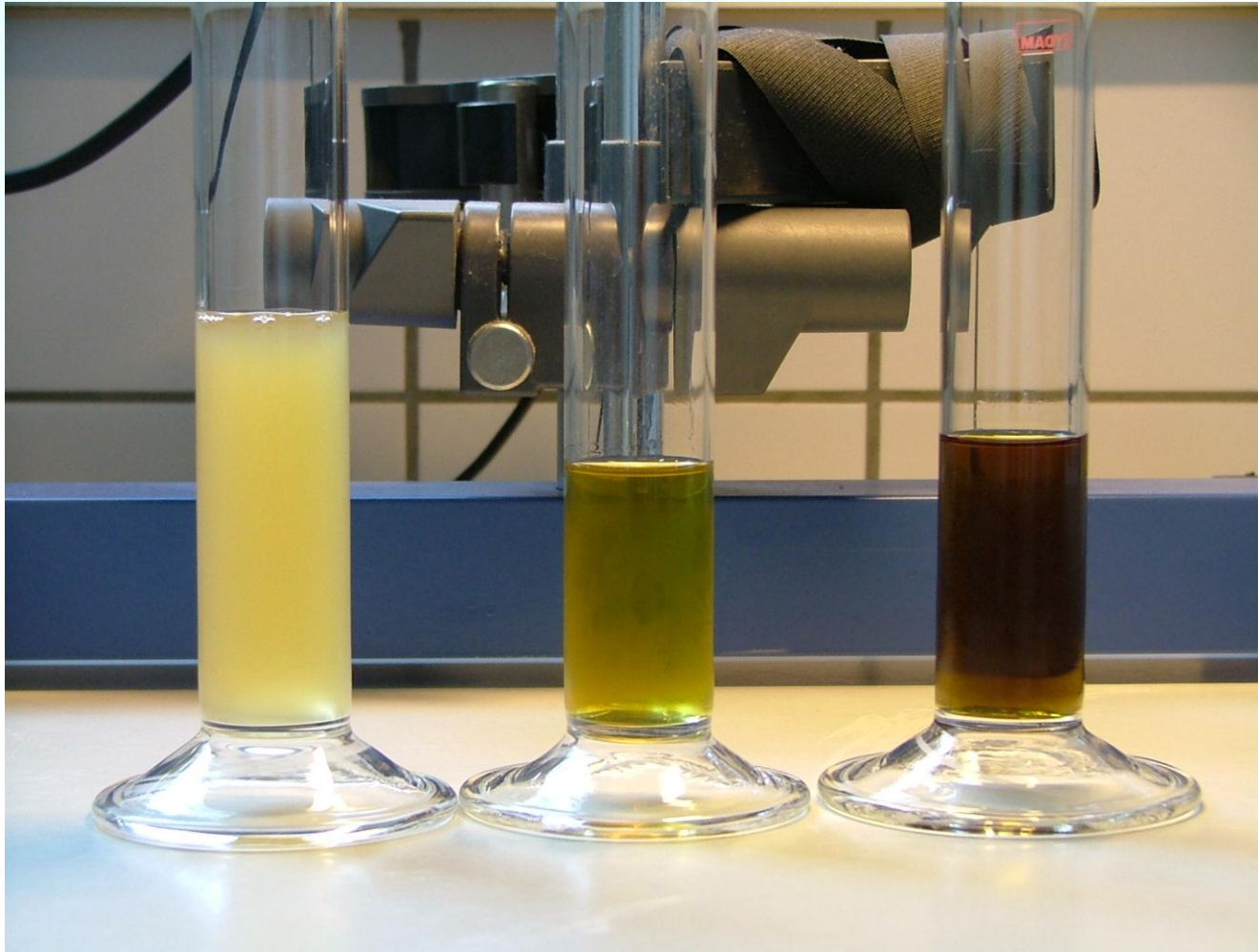
- minerals and dissolved salts: sodium, calcium, magnesium, potassium, chloride, sulphate
- trace elements: zinc, iodine, selenium, strontium
- special algae sugars (polysaccharides): alginate, fucoidan, laminaran
- polyphenols
- special amino acids
- vitamins
- antioxidants
- other secondary phytochemicals



Whole NMR-spectrum from *S. latissima*



Actives containing marine substances



Natural cosmetics

- marine and effective

- moisturizing

- protecting

- regenerating

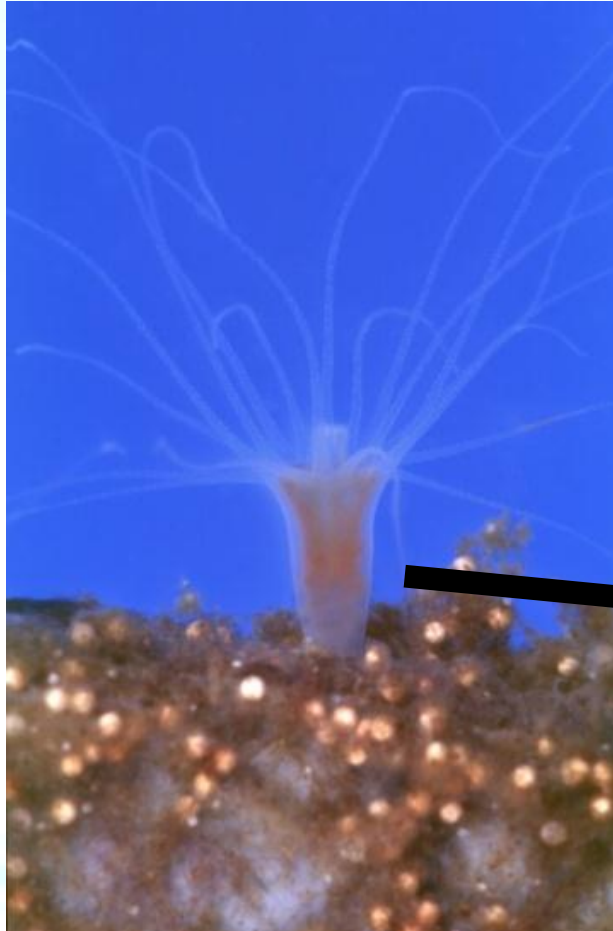
- revitalizing



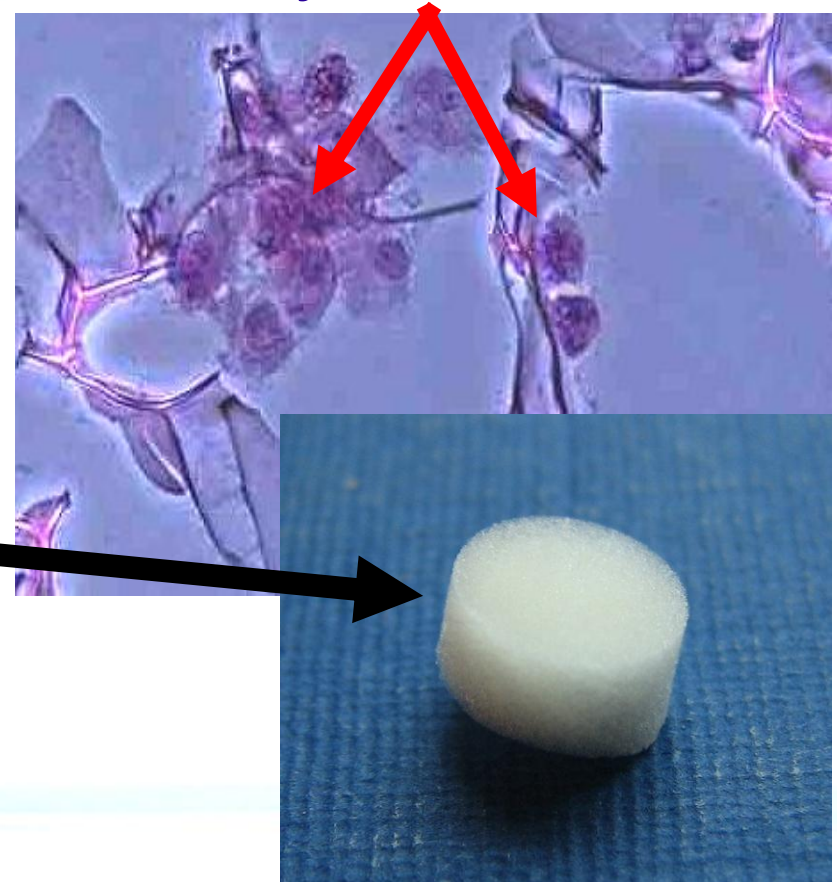
Other success factors for SMEs

- Keeping touch to modern research

Research on the use of marine collagen in cartilage repairing and wound healing techniques

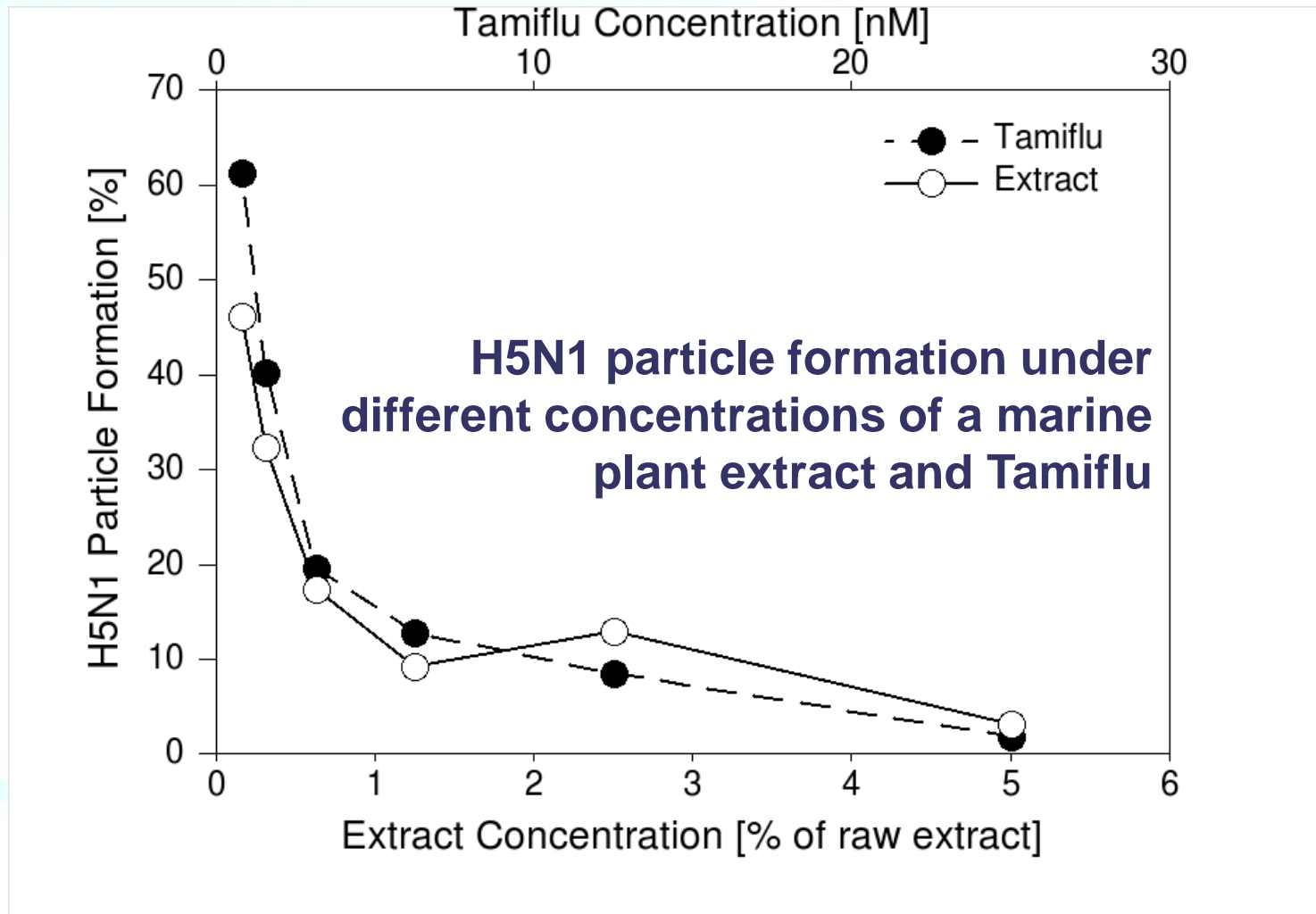


Chondrocytes in bioscaffold



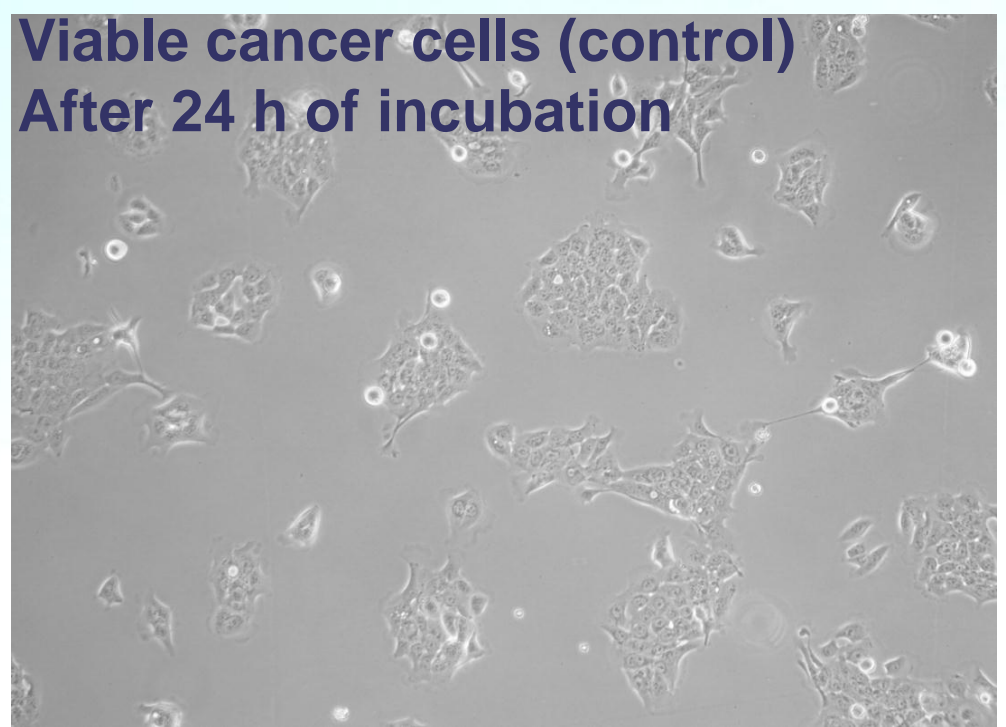
Fotos: Dr. Silke Erdmann

Anti-viral activities (H5N1, H1N1, HIV)

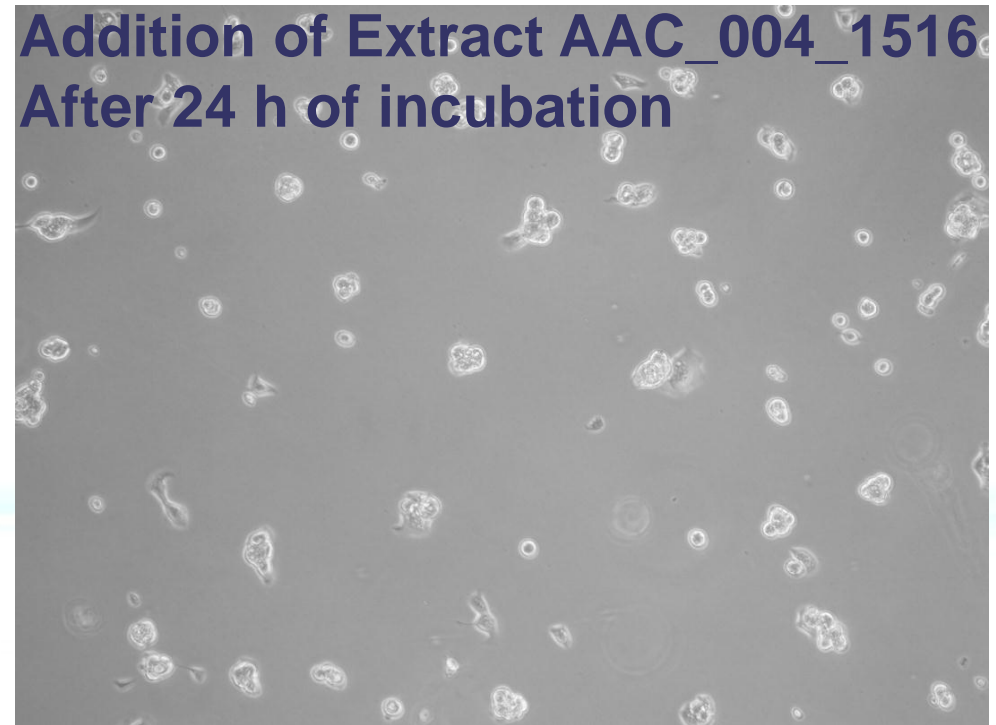


Anti-cancer activities (solid and haematologic) „AAC-Algae Against Cancer“

**Viable cancer cells (control)
After 24 h of incubation**



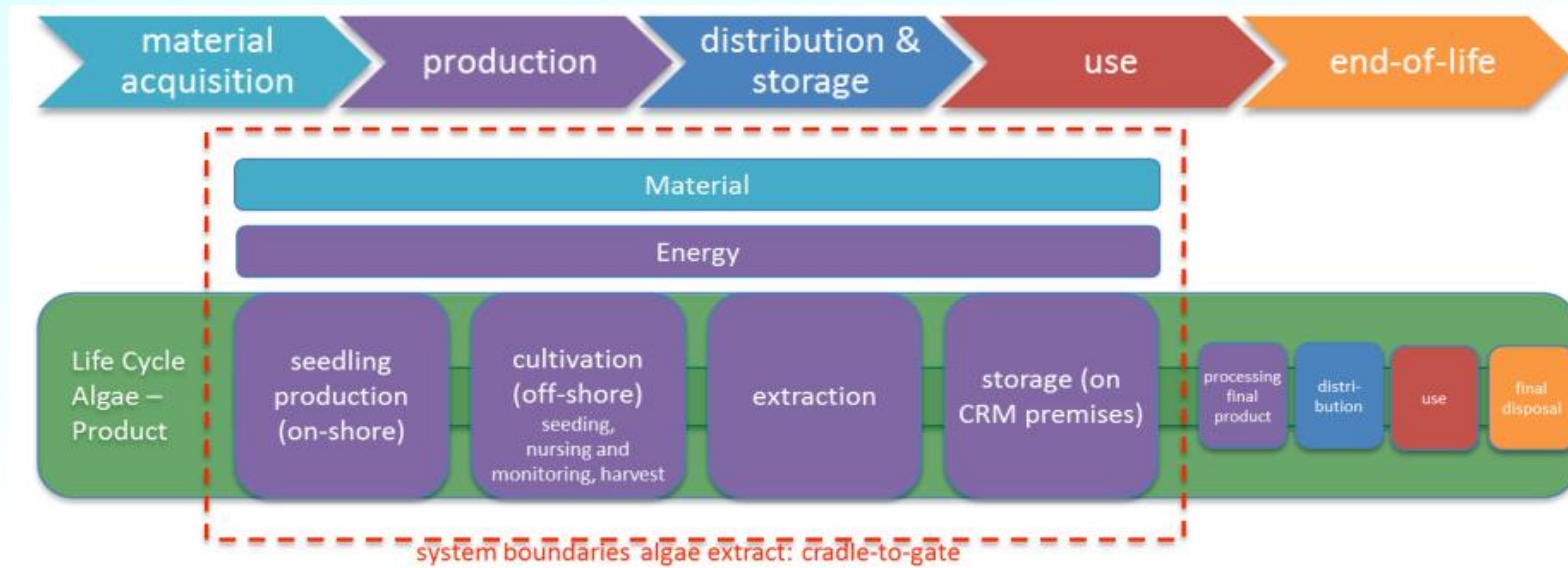
**Addition of Extract AAC_004_1516
After 24 h of incubation**



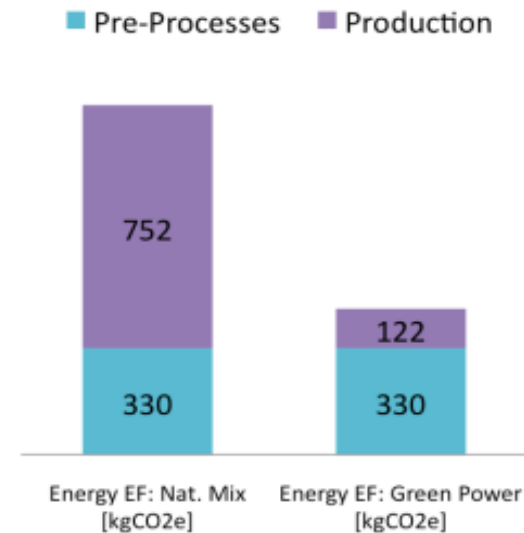
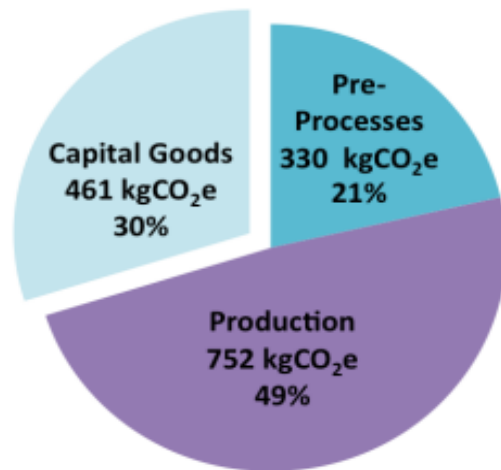
Other success factors for SMEs

- Keeping touch to modern research
- transparent sustainability

Carbon foot print



Simplified process map of algae extract production



Certified Sustainable Economics (CSE)

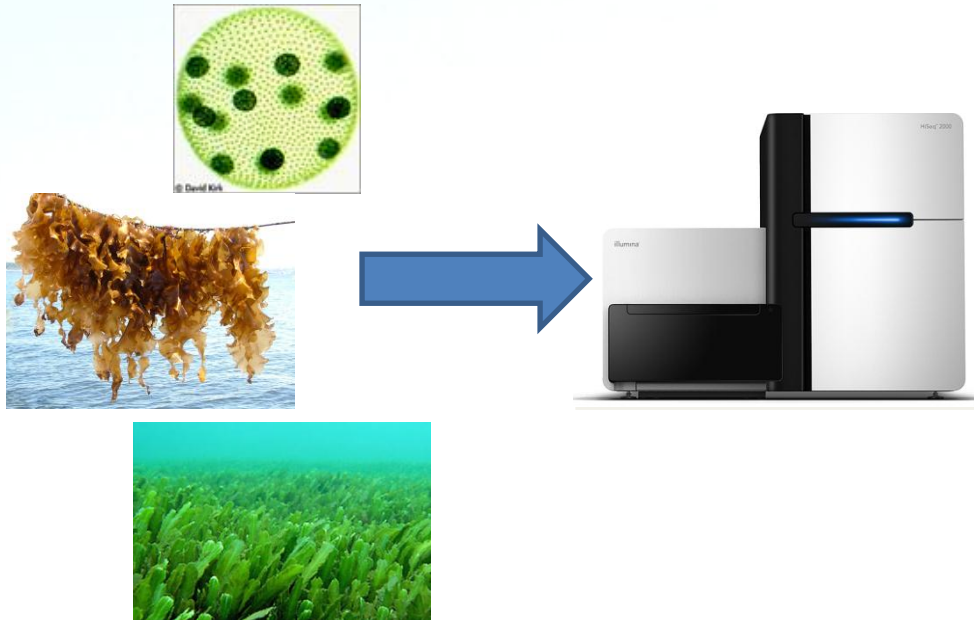


- **CSE: standard for certification of sustainable business management**

Other success factors for SMEs

- Keeping touch to modern research
- transparent sustainability
- supplement the innovation portfolio with new technologies

Gene-Sequencing De-novo ,Algaeomics' – Scheme



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.....

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Genomes

Transcriptomes

Proteomes

Biomarker

Mutations

Other success factors for SMEs

- Keeping touch to modern research
- transparent sustainability
- supplement the innovation portfolio with new technologies
- a good team



What MB SMEs can do for Europe

- new technologies
- new products
- employment
- research
- bottom up R&D (serving the societal demands and markets)

What Europe can do for MB SMEs

- Redirection of capital from financial to value-adding industries, especially innovators:
 - a) Establishment of an European Fund for Innovation feeded by systemic banks acting as monetary bond of SME's own contribution to R&D funded projects
 - b) higher financial transaction tax (0,2 % for stocks, 0,02 % for derivative activities)
- R&D programme for Marine Biotechnology (covering focus R&D issues energy; health: infection/cancer; IMTA/food; bio-materials/-polymers)
- facilitating access to clinical studies/approvals/market and helping to take regulation hurdles

Marine Biotechnology is a value adding instrument transforming biodiversity into wealth.

– Sustainable use is essential



Thank you for your attention!