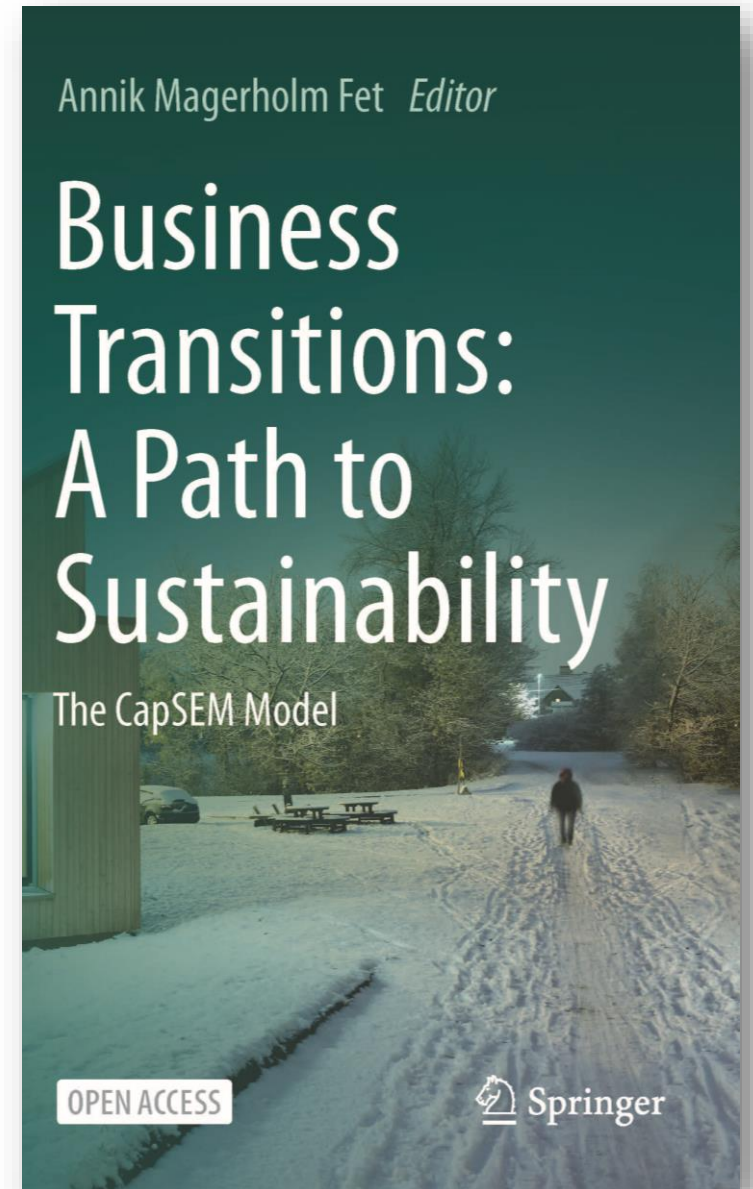
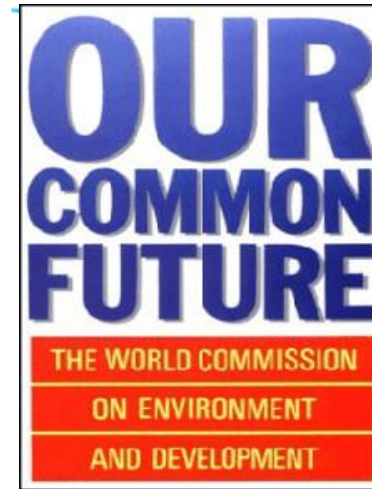
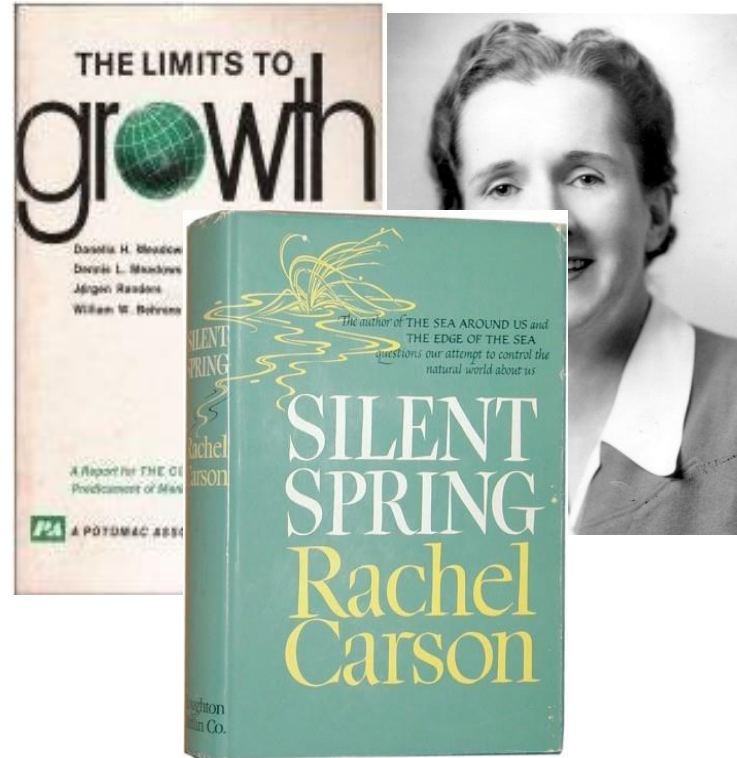


Business Transitions: A Path to Sustainability

Annik Magerholm Fet, Professor Emerita NTNU
Department of International Business



The history of «Sustainability»



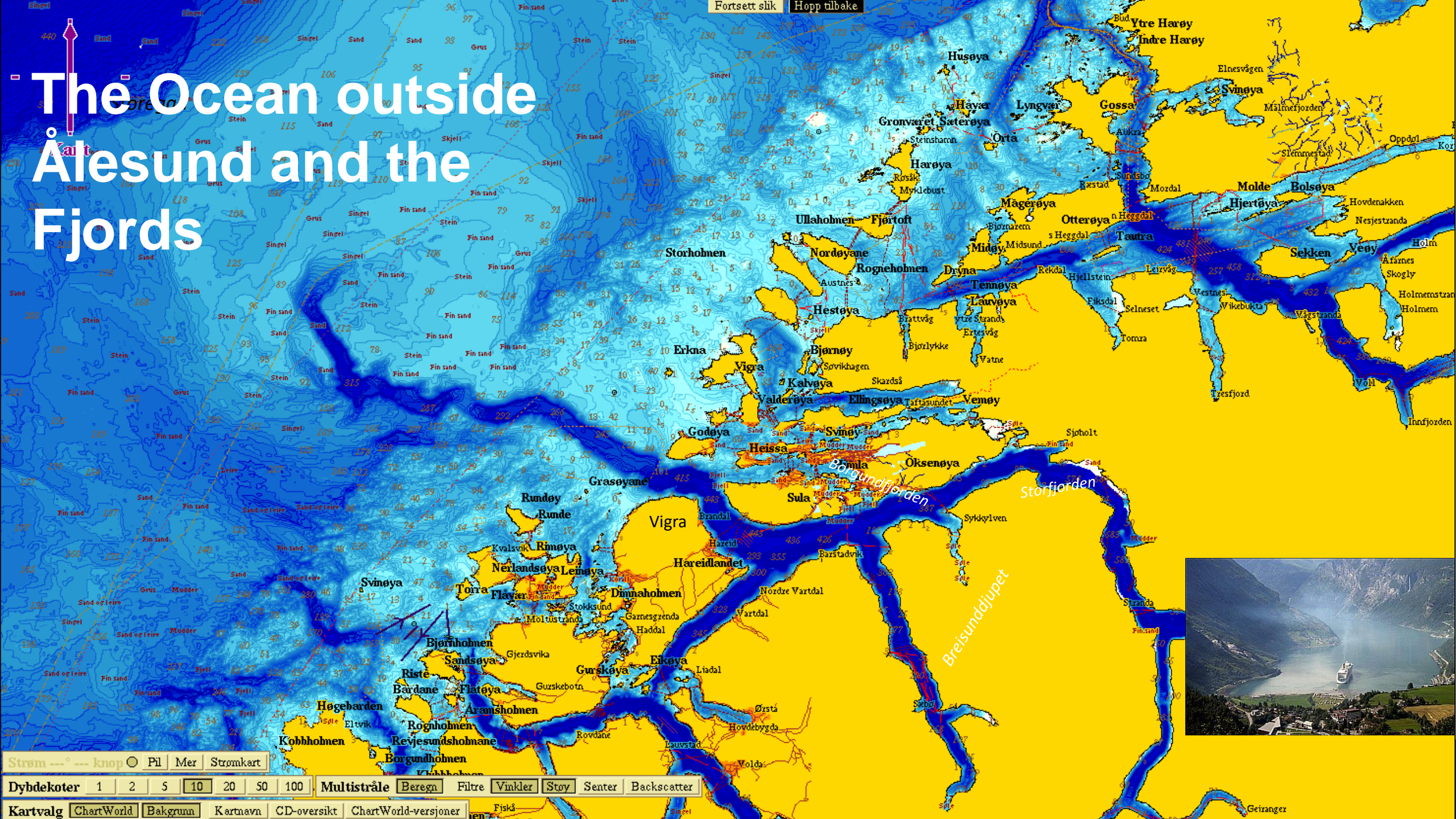
Epoch 1: 1850 - 1960: Industrial growth

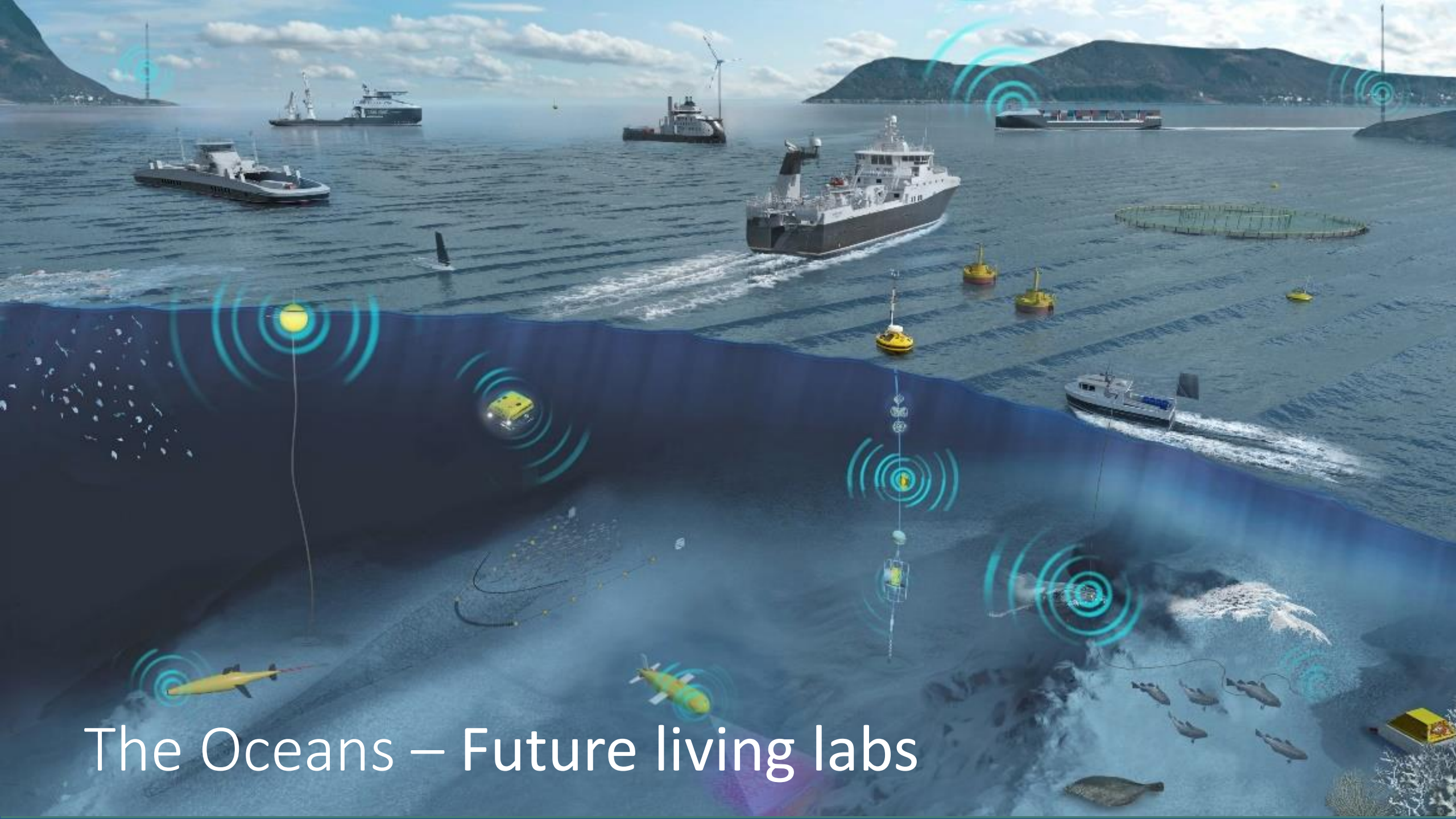
Epoch 2: 1960 - 1970: Environmental advocates

Epoch 3: 1970 – 2000: Regulation and new practices

Epoch 4: 2000 – : Business involvement

The Ocean outside Ålesund and the Fjords





The Oceans – Future living labs

A Clean and Healthy Ocean is of most importance for our future

This requires

- Research collaborations
- Collaborating with the public sector
- Collaboration with the industries





circular ocean

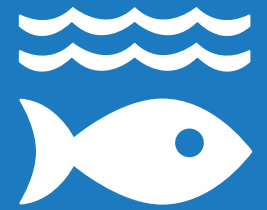
12 RESPONSIBLE
CONSUMPTION
AND PRODUCTION



9 INNOVASJON OG
INFRASTRUKTUR



14 LIFE BELOW
WATER



OPPORTUNITIES

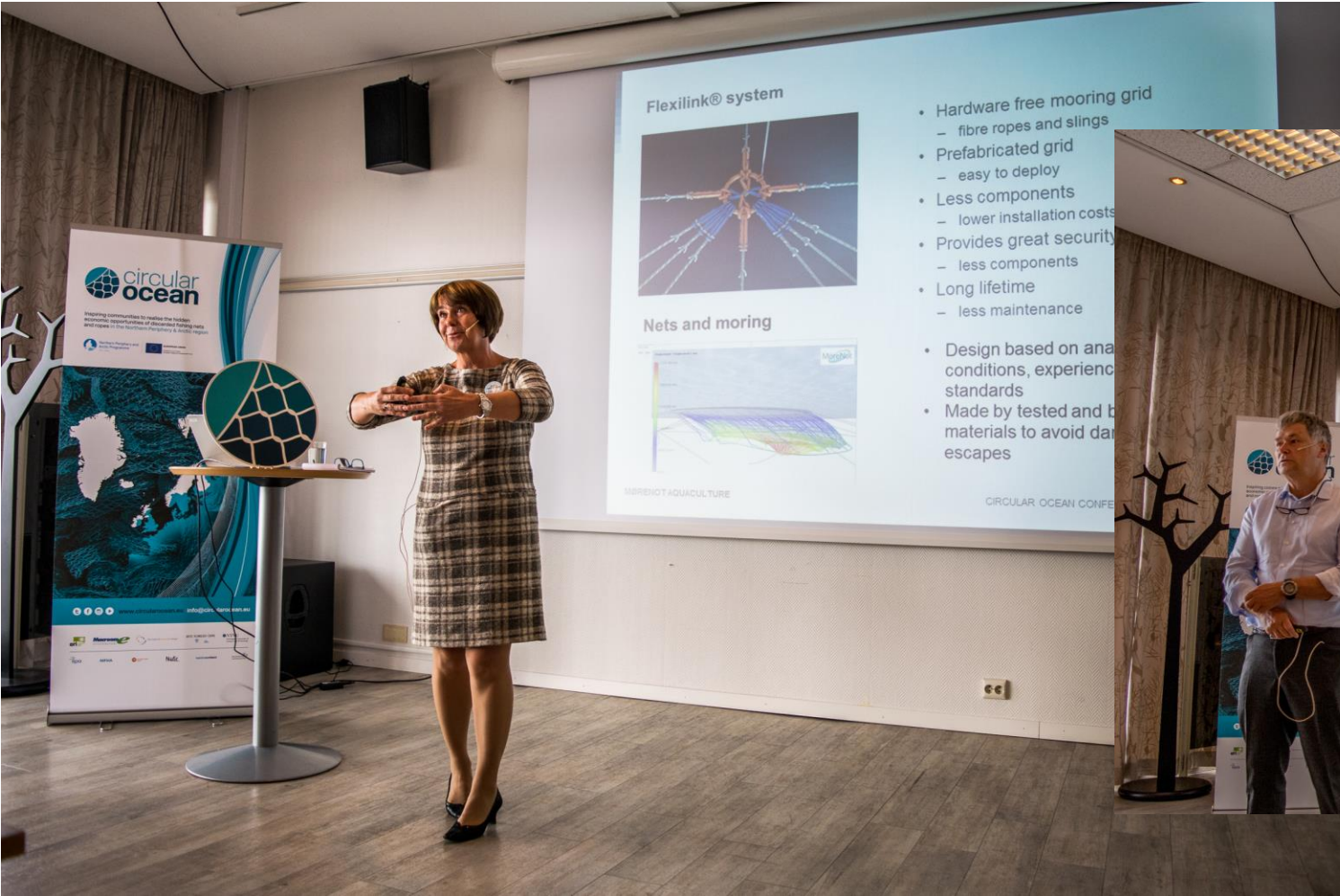
Applying information, knowledge and ideas gathered from across the region and beyond, the Circular Ocean Project will act as a catalyst to **empower communities** to develop **robust business opportunities** that are **environmentally sustainable** and enhance income generation in these regions.



2016 Ålesund



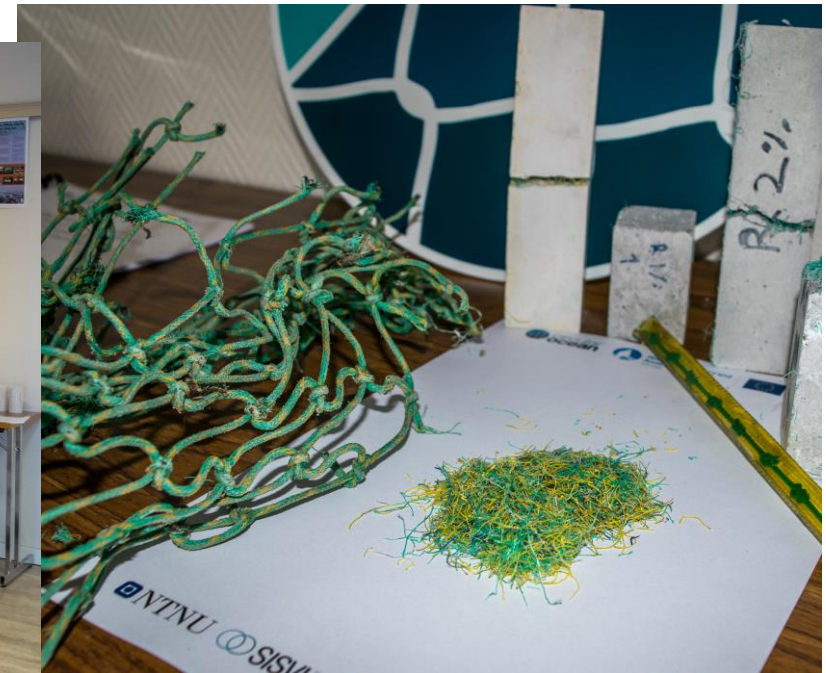
Session: Recycling of fishnets



Marte Lund Jakobsen, Director Mørenot Aquaculture ASB



Nils Roar Hareide – Director – Runde Miljøsentert



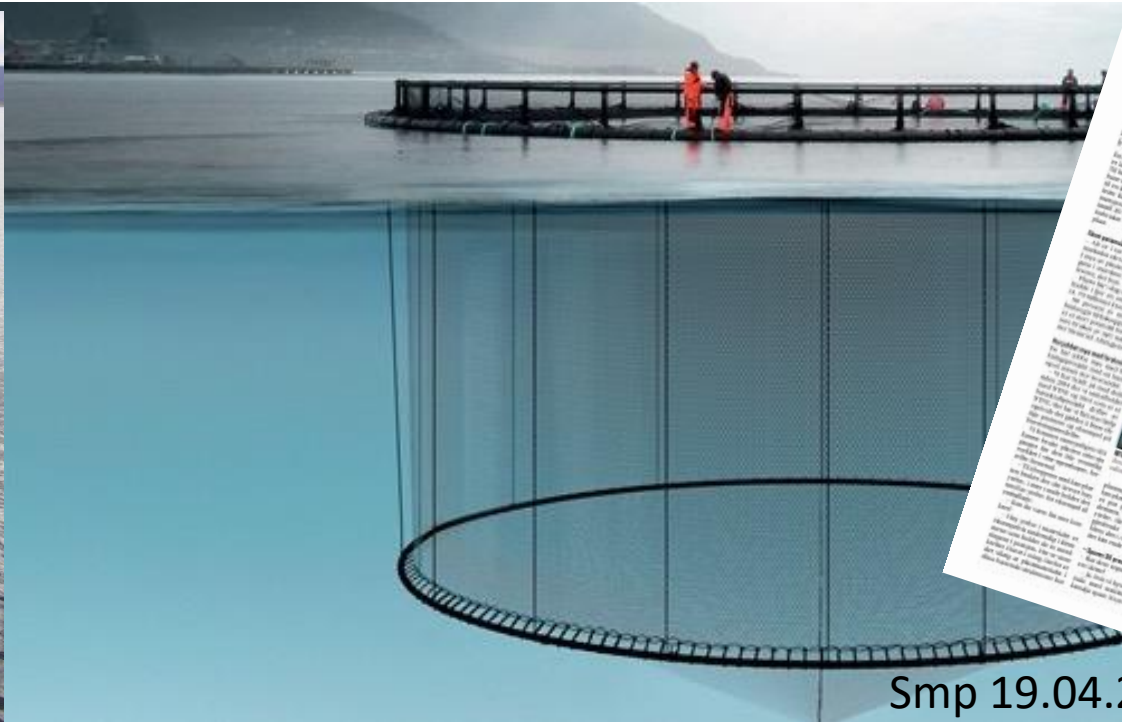
Session World Café – discussing methodologies to increase circularity





Connecting industry – Reusing material from aquaculture cages

- Brackets and walk-ways from Plasto
- Pipes from Helgeland Plast (AKVA group)
- Same material (HDPE)



Smp 19.04.2018

Examples of circularity projects at NTNU

Marine Pollution

- PlastOPol (IIR, IIF)
- SlepeROV (IIR)

Circular Economy and Business Models

- BH4S (IIF)

Circular value chains for plastics

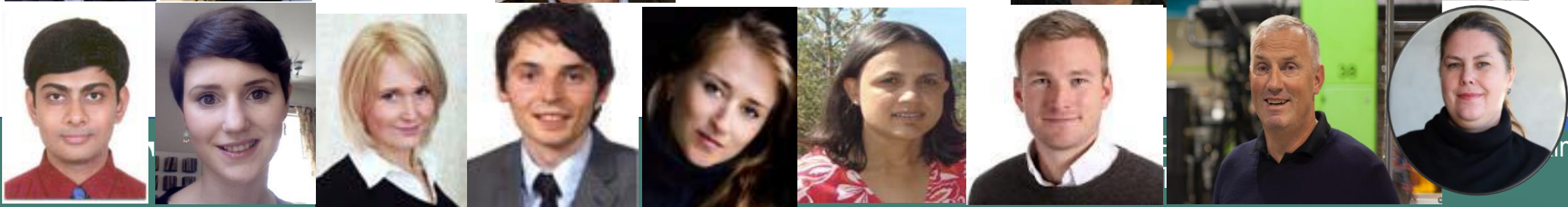
- Blue Circular Economy (BCE) (IIF)
- Circular Ocean (IIF)
- Sweet Spots (IIF, IHB, IIR)
- AOPW (led from Ålesund from 2022)

New joint,
interdisciplinary
initiatives:

9 PhDs in Sweet Spots
and MAPLE

1 PhD in
Marine Plastic
Pollution in the Circular
Economy

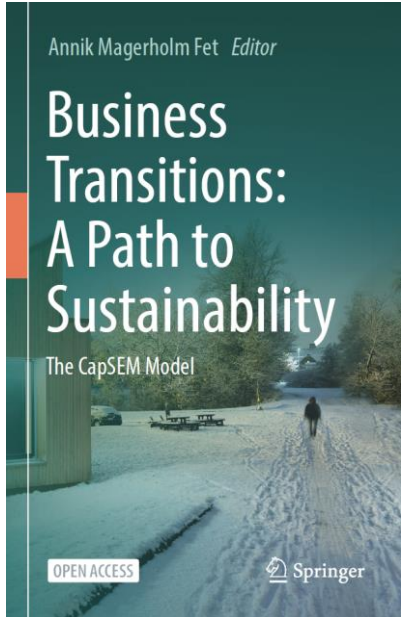
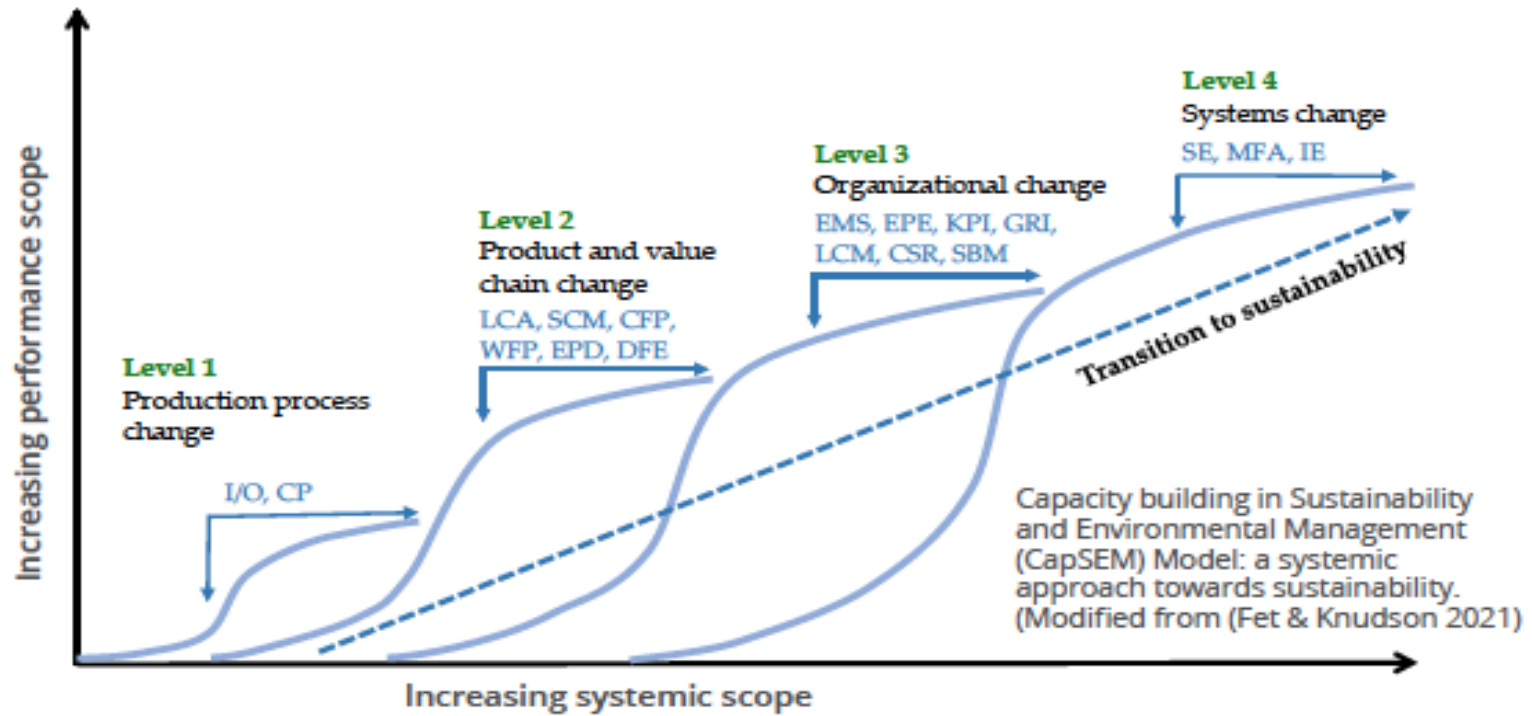
People from my research groups over time



anability:



The CapSEM Model



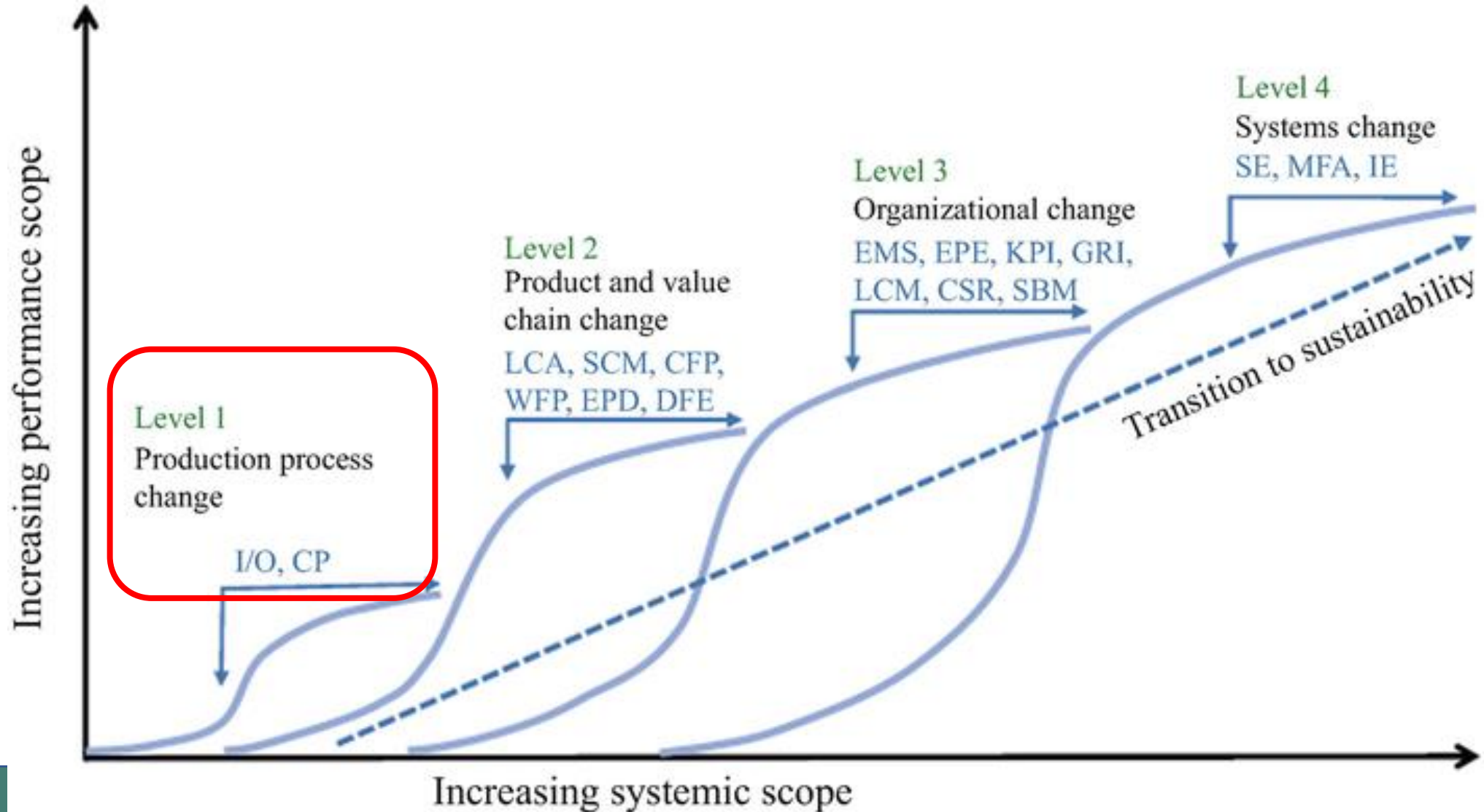
1 Production process change	2 Product & value chain change	3 Organizational change	4 Systems change
I/O – Input-Output Analysis CP – Cleaner Production	LCA – Life Cycle Assessment SCM – Supply Chain Management CFP – Carbon Footprint of Products WFP – Water Footprint of Products EPD – Environmental Product Declaration DFE – Design for Environment	EMS – Environmental Management System EPE – Environmental Performance Evaluation KPI – Key Performance Indicator GRI – Global Reporting Initiative LCM – Life Cycle Management CSR – Corporate Social Responsibility SBM – Sustainable Business Models	SE – Systems Engineering MFA – Material Flow Analysis IE – Industrial Ecology

Circularity at different levels

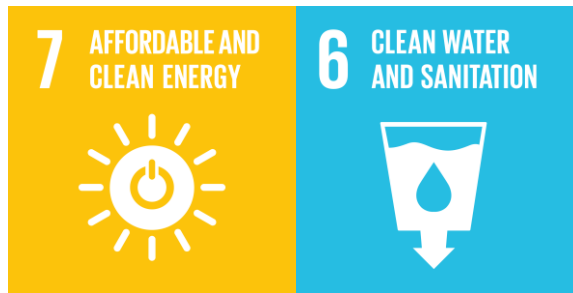
Systemising methodologies: why use the CapSEM Model?

- Increase in regulations which business has to deal with
- The CapSEM Model provides the opportunity to systematise methodologies that allow companies to compare results
- The CapSEM model aims at streamlining the implementation of a circularity over 4 levels

The CapSEM Model



Level 1: Input – output analyses of industrial processes



Emissions and wastes



Circularity options level 1

Cleaner Production strategies appear on the first level of application of the CapSEM Model

Benefits include:

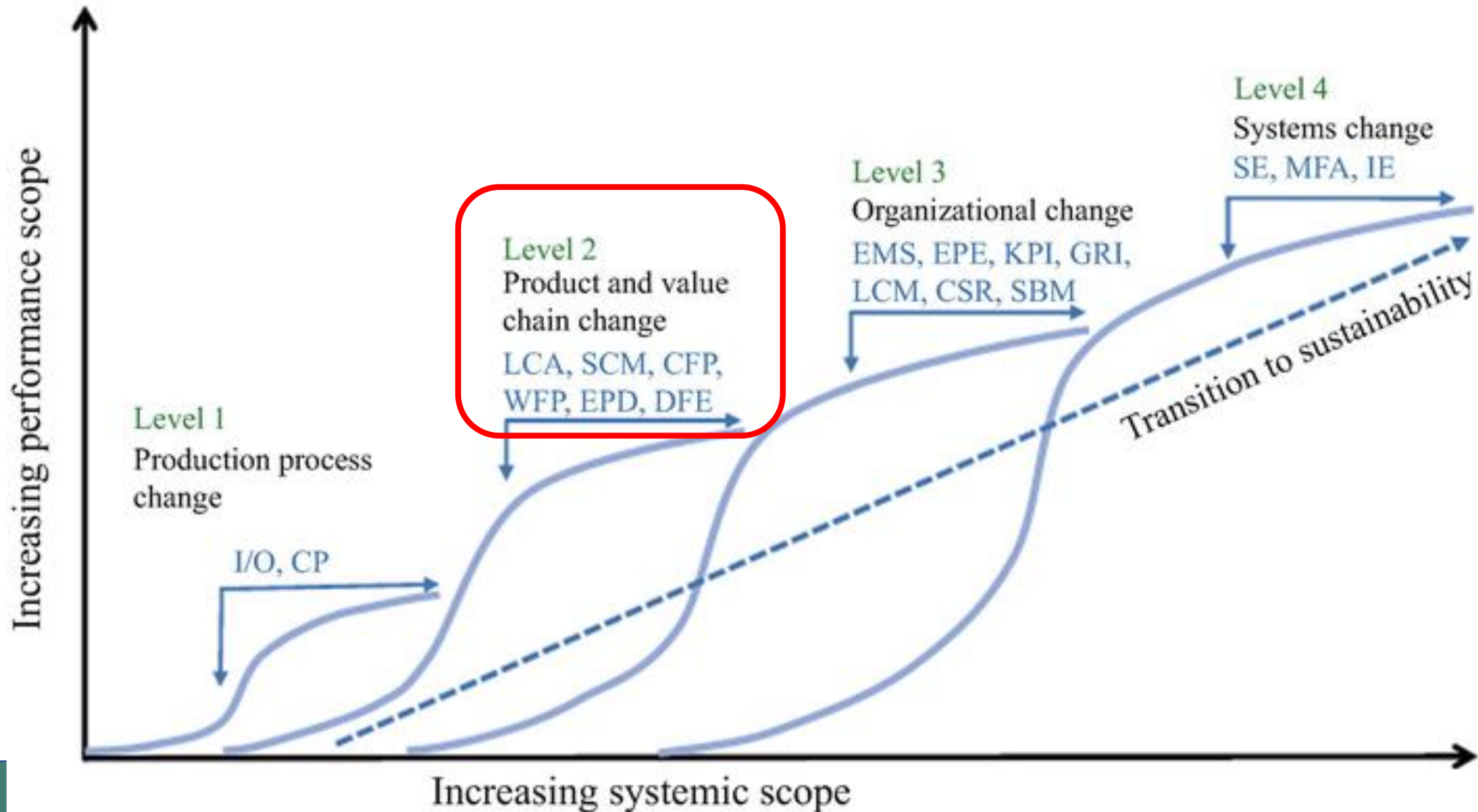
- Good housekeeping
- Driven by economic benefits
- Foundation for other levels through its Input- Output approach

Examples of circularity level 1

- Waste treatment - > recycling and recovery of materials
- Use of excess energy in other production-lines
- Substitution of hazardous materials -> more materials can be recycled



The CapSEM Model

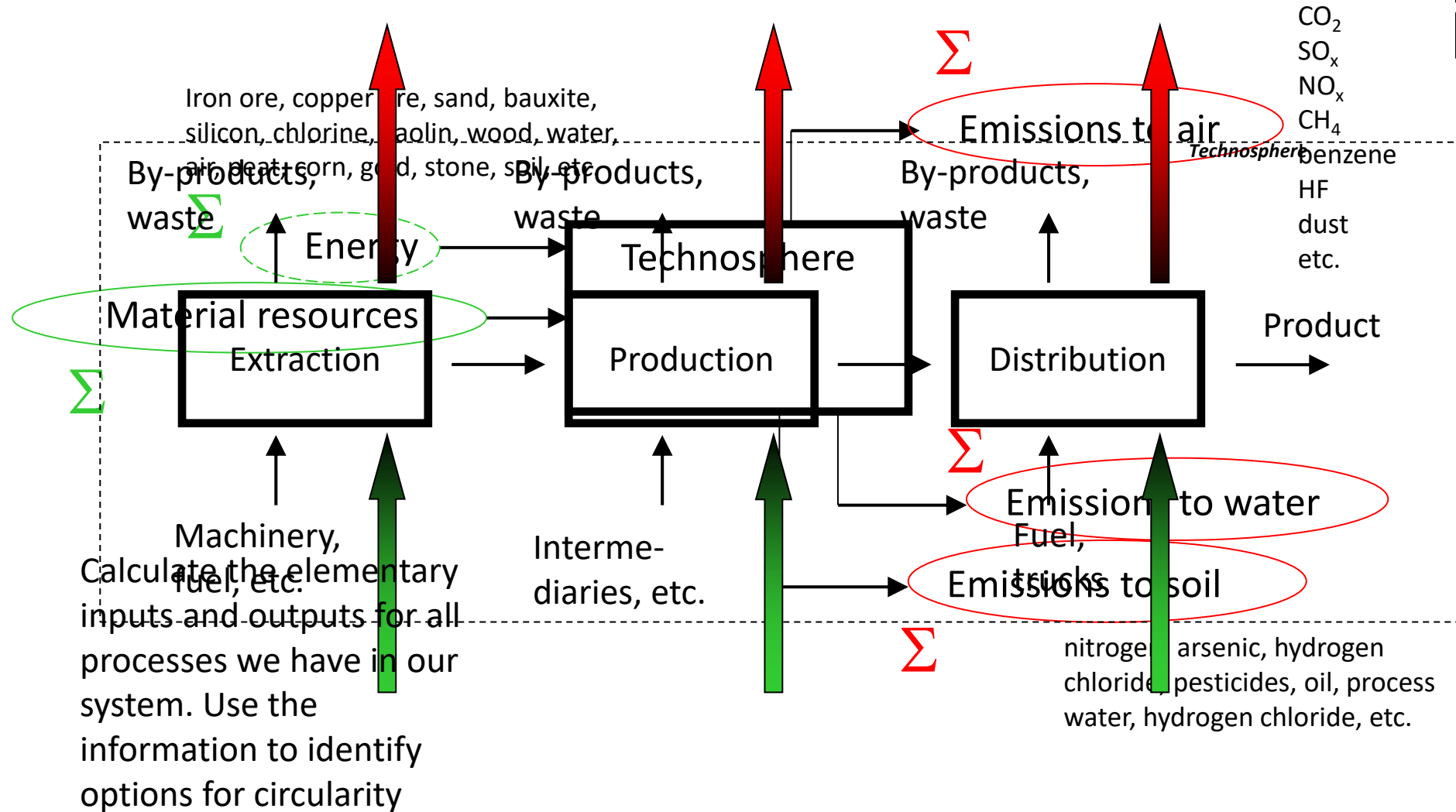


Level 2: Product focus and life cycle assessment tools

Life Cycle



Life Cycle Inventory



Circularity at level 2

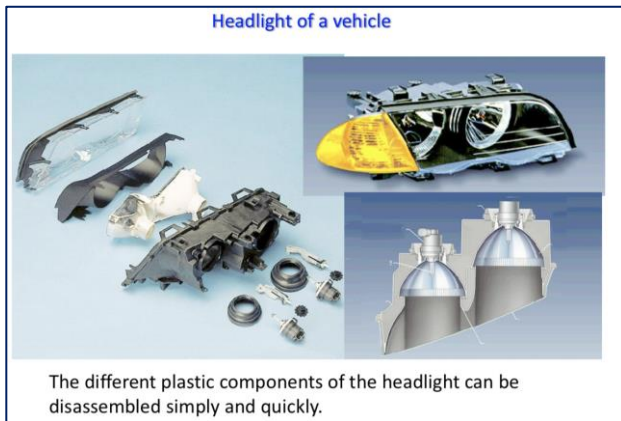
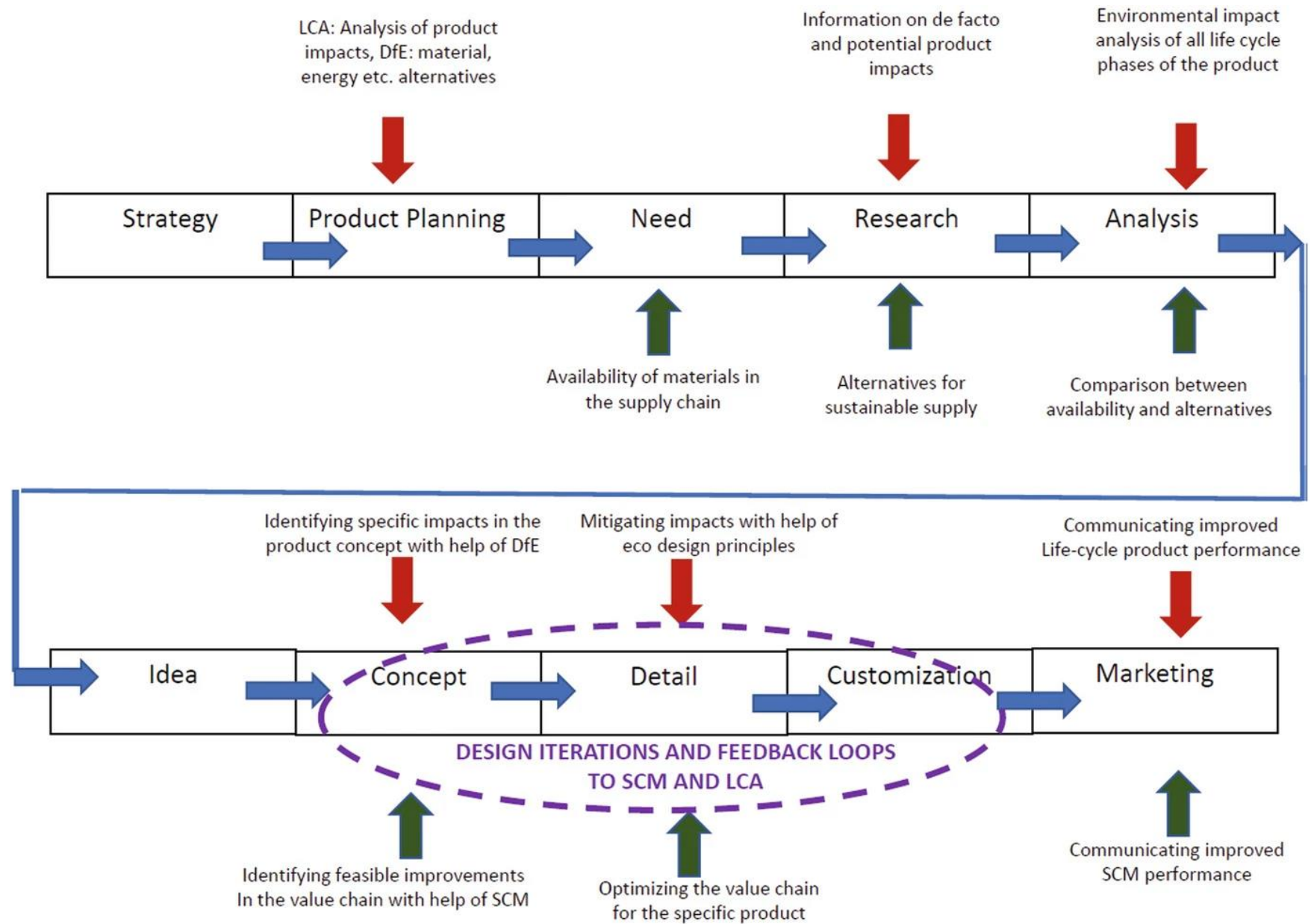
Level 2 of the Model addresses products and value chains

It encompasses:

- LCA methodology helps to find hot-spots with potential for reduction of materials, e.g. by recycling options both upstream and downstream in the supply chain.
- Design for Environment (or DfE), and Environmental Product Declaration (EPDs) are useful for finding opportunities for circularity of products

From Ch 5: Looking Beyond the Factory Gates:

Life Cycle Assessment
Supply Chain Management
Design for Environment



ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025

Owner of the declaration	Nordic Comfort Products AS
Program holder and publisher	The Norwegian EPD Foundation
Declaration number	NEPD-1885-804-EN
Issue date	03.10.2019
Valid to	03.10.2024

S-1500



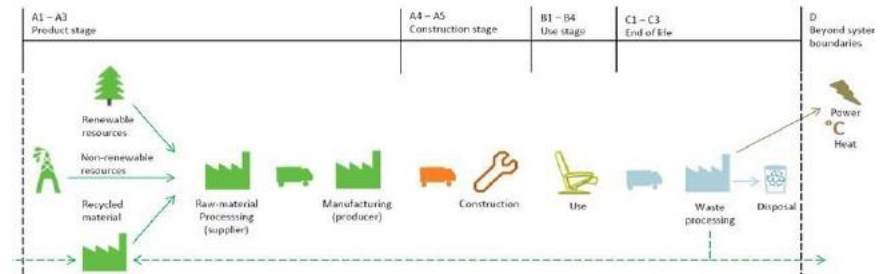
The S-1500 chair references the textures, colors and crafts of its origin in the North of Norway. The chair-shell is made from 100% recycled plastic from the fish farming industry in the north of Norway, and the chair's subframe is obtained by partially recycled Norwegian steel. The chair is a redesign of Bendt Winge's classic R-48 chair. Also produced by NCP.

Key environmental indicators	Unit	Cradle to Gate A1-A3
Global warming	kg CO ₂	9
Total energy use	MJ	109
Amount of recycled materials	%	48 %

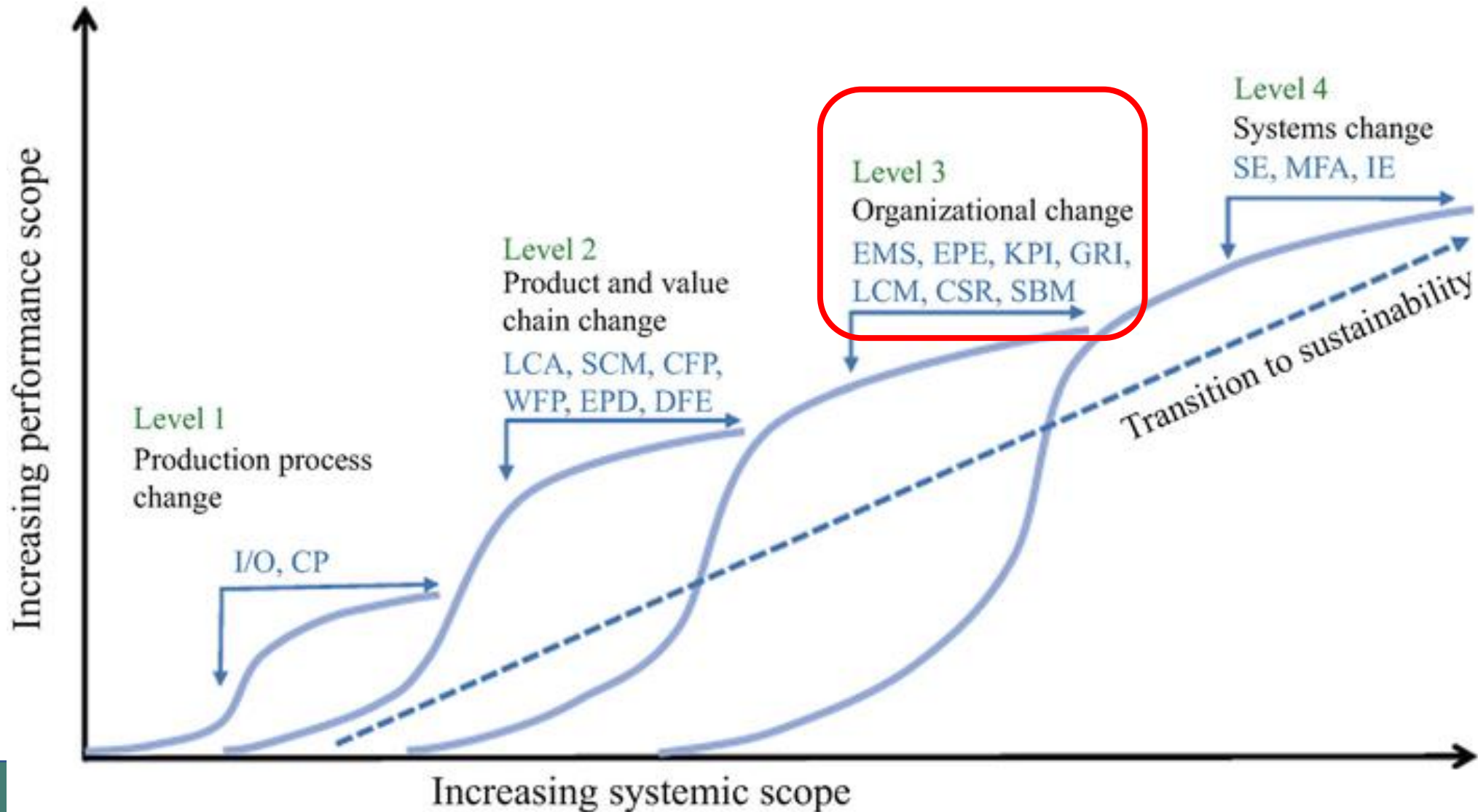
Materials	Recycled material in manufactured product		Recyclable material at end of product life	
	kg	%	%	kg
Steel	2,70	63 %	20 %	0,54
Polypropylene	1,52	36 %	100 %	1,52
Polyethylene	0,05	1 %	0 %	0,00
Total	4,27		48 %	

LCA: Scenarios and additional technical information

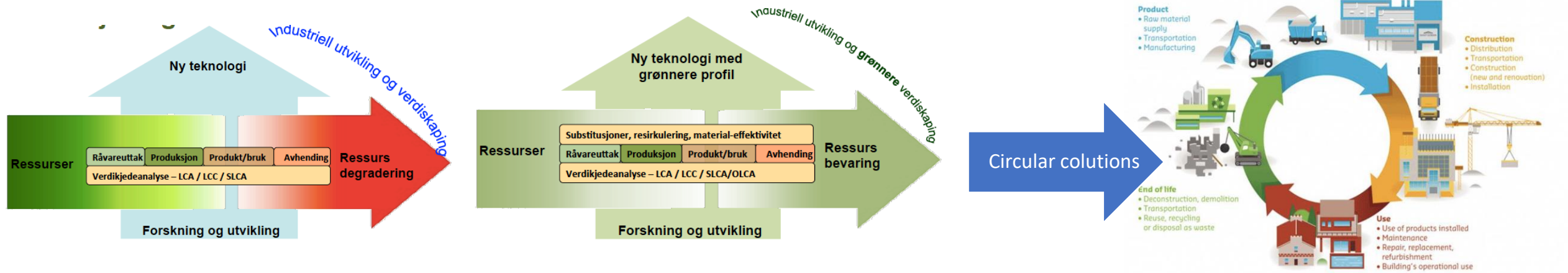
	Material recovery	Energy recovery	Disposal
Aluminium	70,1 %	0,0 %	30 %
Steel	70,1 %	0,0 %	30 %
Plastic	64,3 %	30,8 %	5 %
Cardboard	94,5 %	5,5 %	0 %



The CapSEM Model



Level 3: Strategic Implementation in the organisation



- A toolbox for strategic decision support and greening of value chains
- Business Models for Sustainability - BMfS



Circularity level 3: our main focus

The Model addresses circularity at an organisational and management level here, for example:

- Management systems for implementation circularity
- Standards
- Criteria for purchasing
- Procedures for Implementation
- Networking

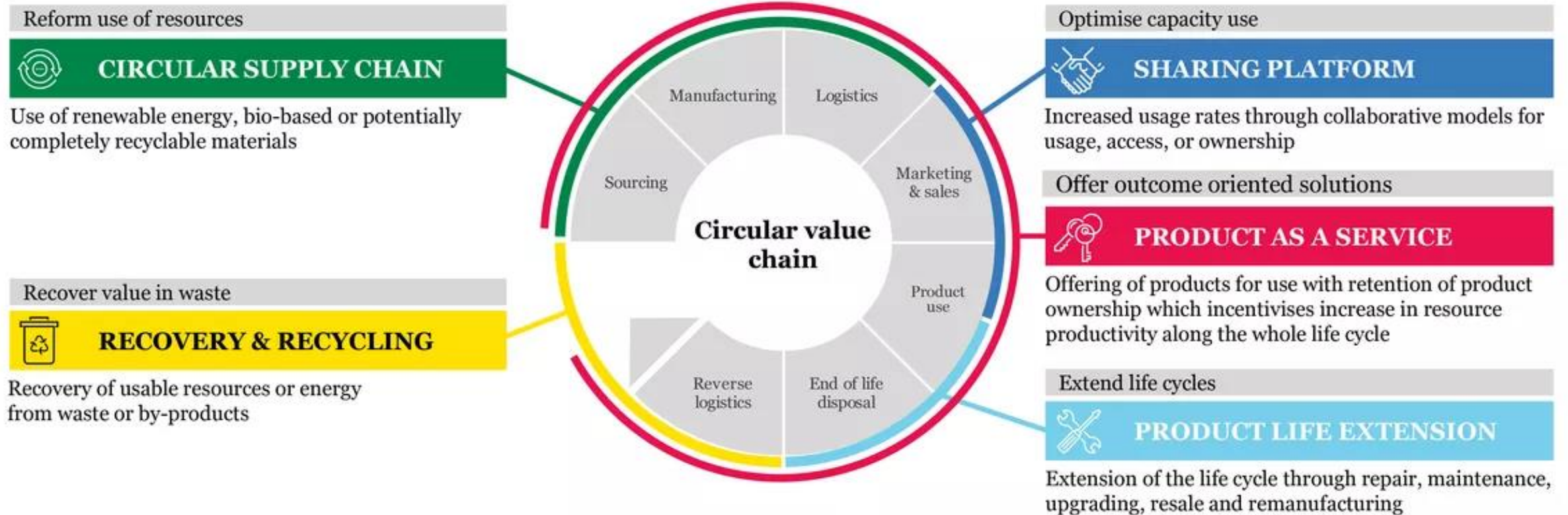
This drives/encourages businesses towards organisational change, to introduce

- Business models for circularity

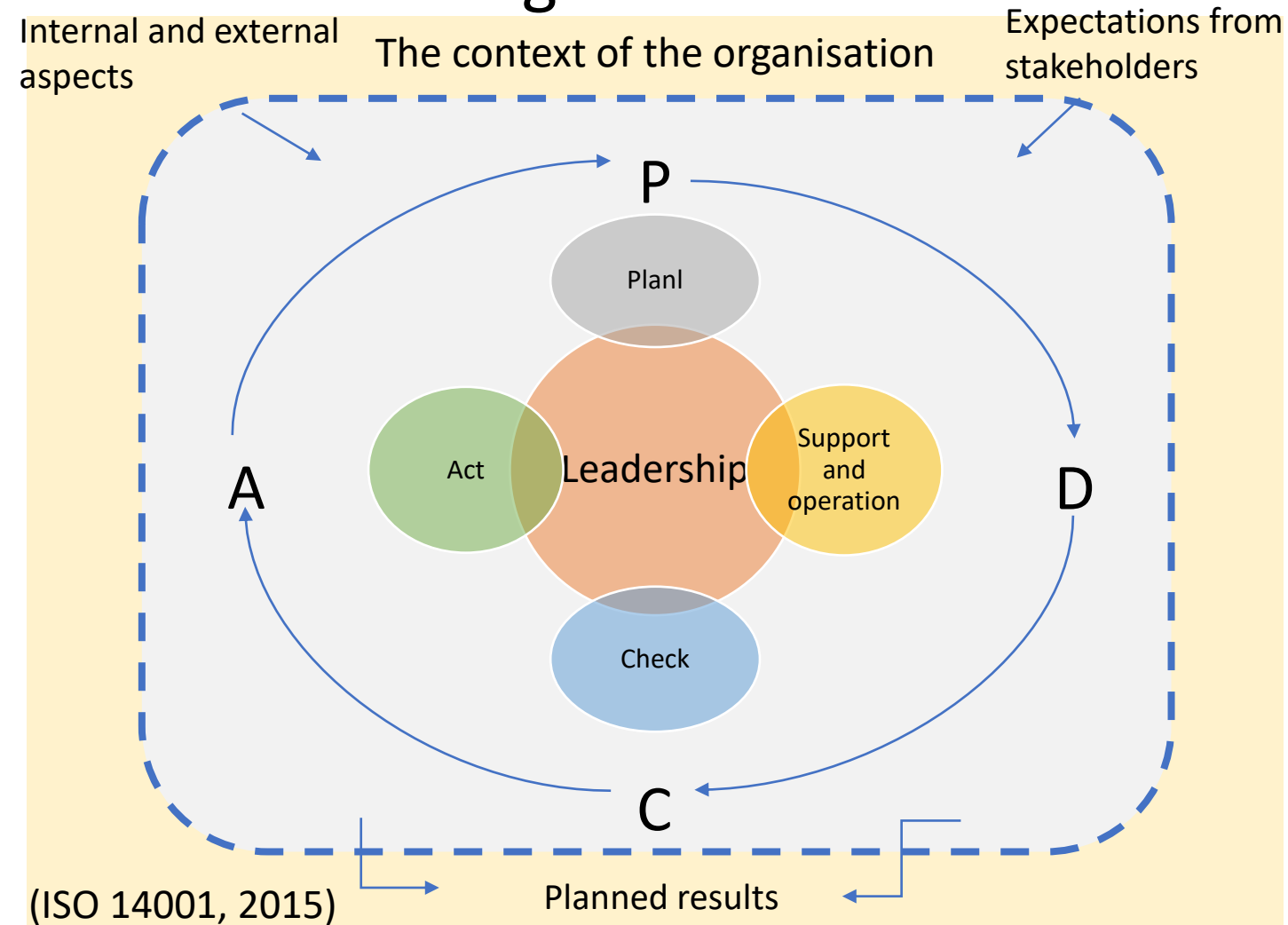
And be part of

- Industrial symbiosis

Business models for circularity



Key elements in environmental management



We need a common language



ISO/DIS 59004 Circular Economy – Terminology, Principles and Guidance for Implementation

ISO/DIS 59010 Circular Economy – Guidance on the transition of business models and value networks

ISO/DIS 59020 Circular Economy – Measuring and assessing circularity

The Green Deal

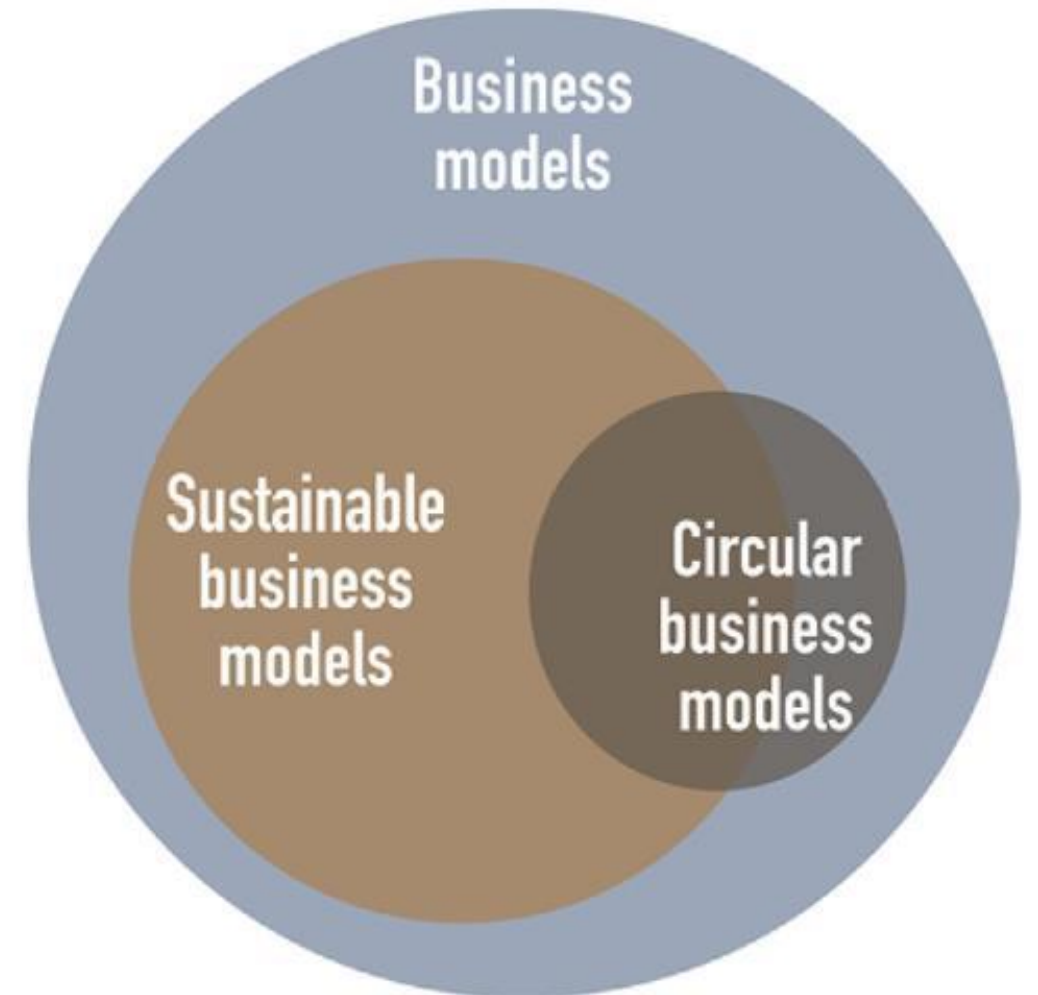


Business Models for Sustainability



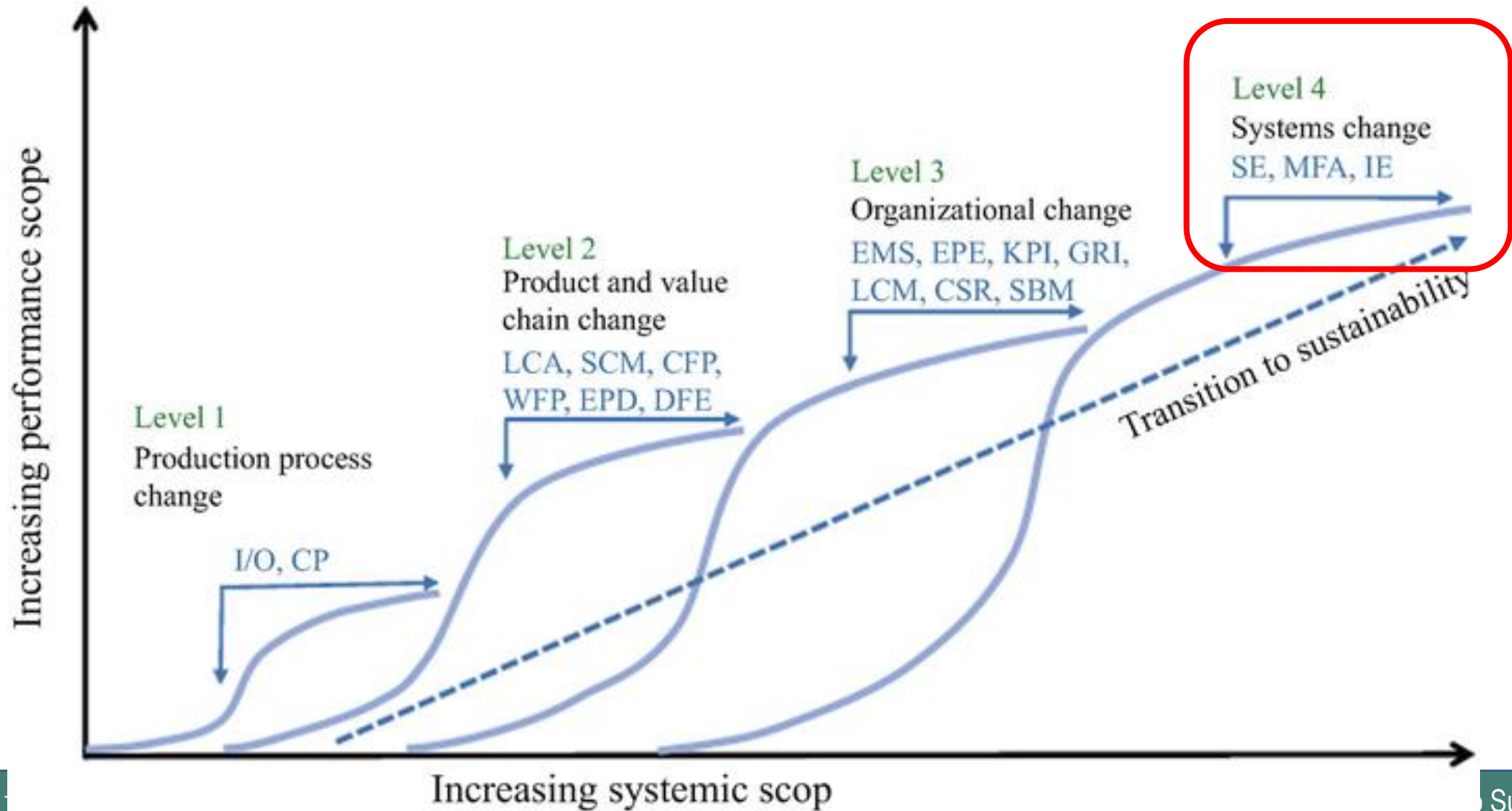
www.bh4s.no

- Business models for sustainability
- Toolbox for implementing the SDGs
- Reporting and communication



(Geissdoerfer, Vladimirova, & Evans, 2018)

The CapSEM Model



Circularity level 4

Level 4 addresses circularity at the societal level

The right infrastructure is a pre-requisite for circularity at a larger/societal level

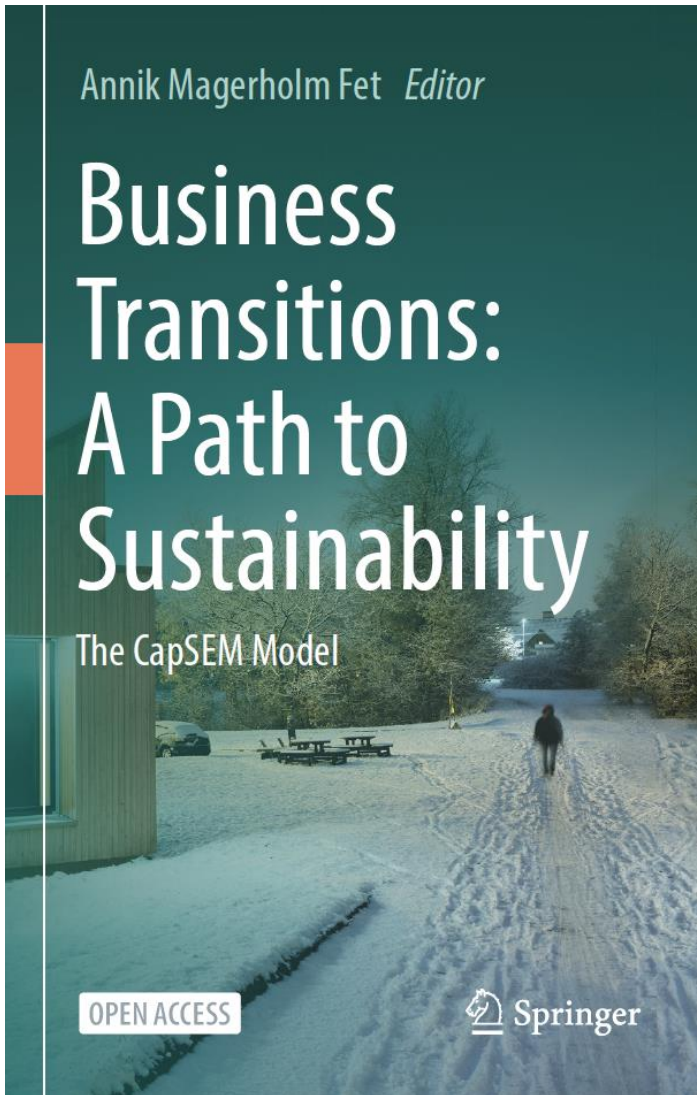
The feedback coming from Levels 1 and 2 will also help with continuous improvement for both Level 3 and 4

There are many opportunities and developments at this Level, e.g. partnership

Industrial symbioses (waste/by-products - raw materials) is one example:

- Industrial parks (localised companies share production systems)
- Industrial parks (built environment to facilitate sharing)
- Industrial parks (social inclusion, social economy organisations/ training and work opportunities)

The way forward – Long term transition to sustainability



Five advices:

1. **Systemic changes** - be a "game-changer" in terms of consumption and circularity
2. **Focus on interdisciplinarity** – understand the complexity inherent in circular systems
3. **"Net positive management"** – regenerative measures that help develop the environment, not just protect against destruction
4. **Digitalization for sustainability** - increased use of "IoT" and digital solutions for less resource use and better circularity
5. **Responsibility in the values chain** - create cooperation between the actors for better system understanding

Thank you for listening
Annik.Fet @ntnu.no

[Business Transitions: A Path to Sustainability: The CapSEM Model | SpringerLink](#)