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Advancing Sustainable Development through Multi-Use: Insights from the European OLAMUR & SeaDots projects

Dorothy Dankel, Senior Research Scientist SINTEF Ocean, Bergen, Norway



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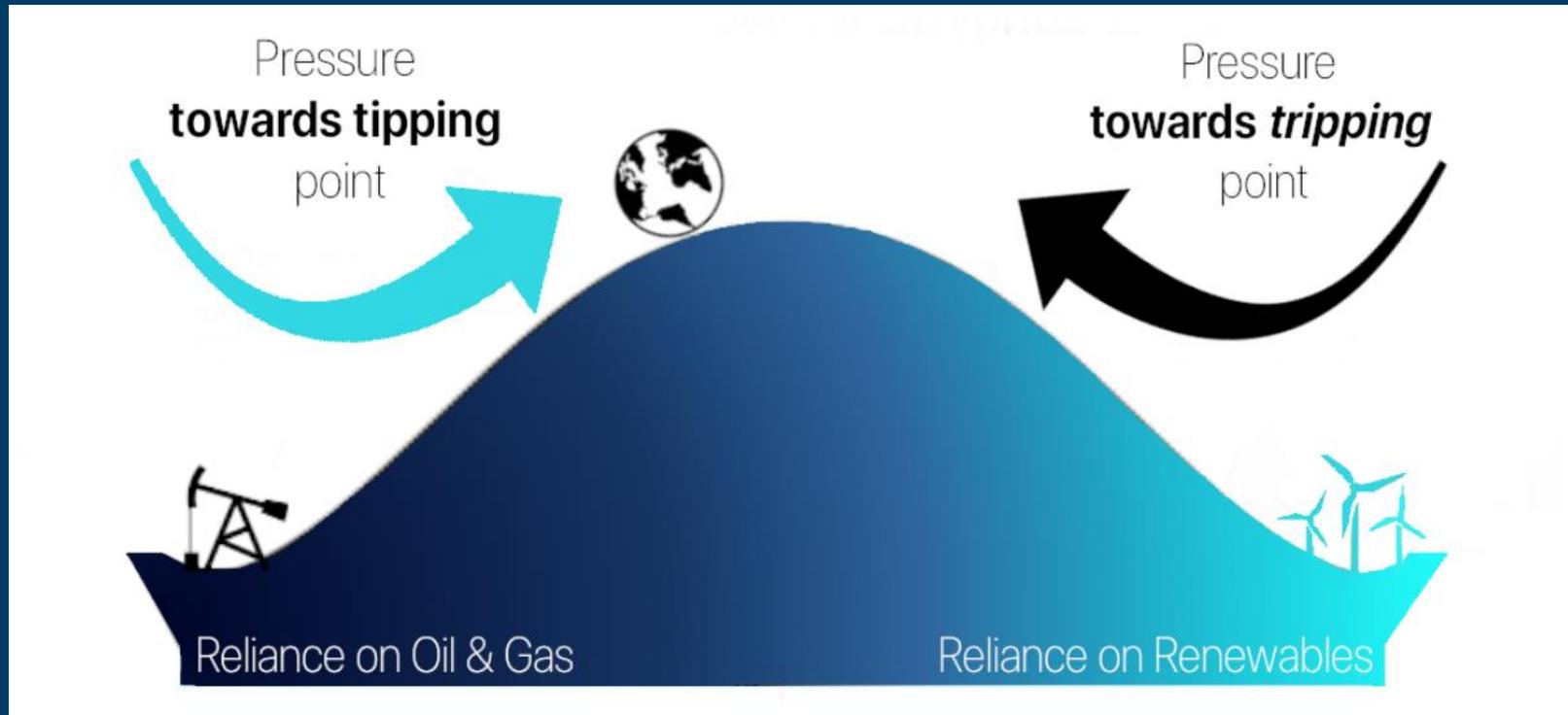
At SINTEF, we develop tools and insights for sustainable development of wind energy to create a successful export industry, reduce cost and uncertainty, and address and resolve environmental and societal conflicts.

How can we support biodiversity at the same time as we develop offshore wind farms and technology for a better society?

And how can this work be seen together with climate and sustainability goals?



Photo: Dorothy Dankel



We can co-design for sustainability and co-existence

<https://www.uib.no/en/bow/146273/tipping-point-offshore-wind-and-coexistence-marine-space>



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If business as usual isn't a sustainable option, how can we do things differently?

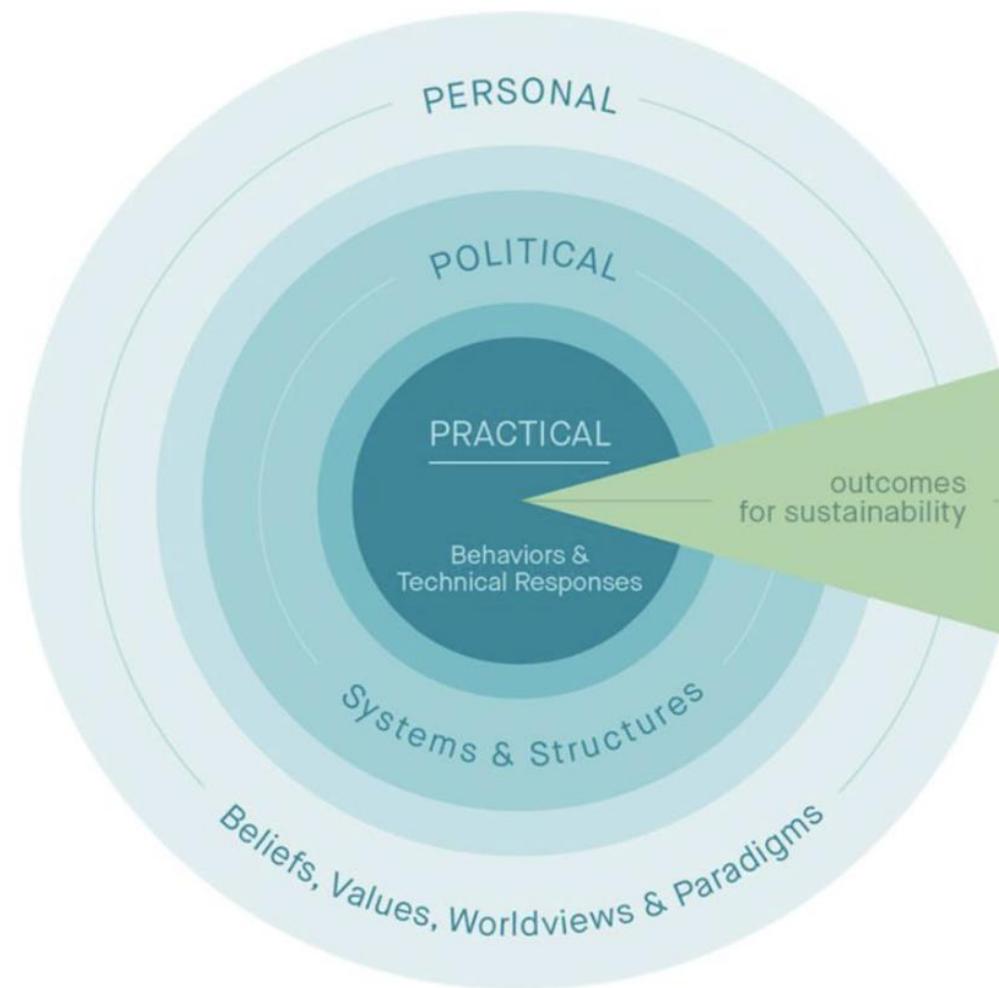


Fig. 1 Three Spheres of Transformation. *Source* O'Brien and Sygna (2013), based on Sharma (2007)



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Our grand normative framework:

The United Nations Sustainable Development Goals (2016–2030)





OLAMUR

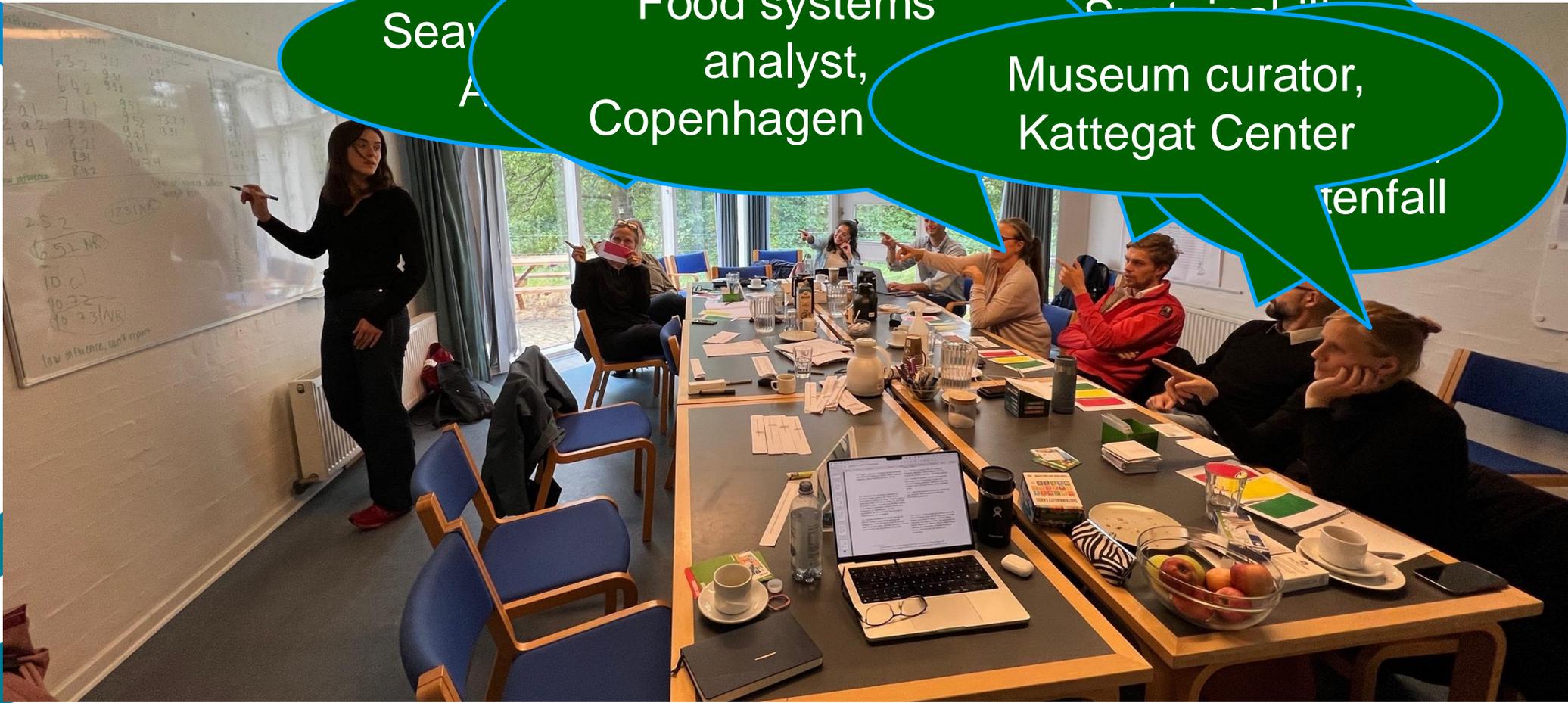
Triple-layer business model for offshore wind

Marianne Thomsen ,University of Copenhagen (Denmark)
Dorothy Dankel, Anne Gaspers, Emily Cowan, SINTEF Ocean (Norway)
Ian Overton, Palak Gupta, Jochen Hinkel, Global Climate Forum (Germany)

**OLAMUR : Offshore Low-Trophic Aquaculture
in Multi-use Scenario Realisation in
North and Baltic Seas**

OLAMUR Task 7.1: SDG Target Relevance-Tracing: Kriegers Flak Multi-Use Demo

October 2023, Roskilde, Denmark



Seav
A

Food systems
analyst,
Copenhagen

Museum curator,
Kattegat Center

tenfall





Nordhordaland UN Biosphere Reserve, SDG Workshop, Knarvik, Norway December 2024

17 SUSTAINABLE
DEVELOPMENT
GOALS

169 TARGETS

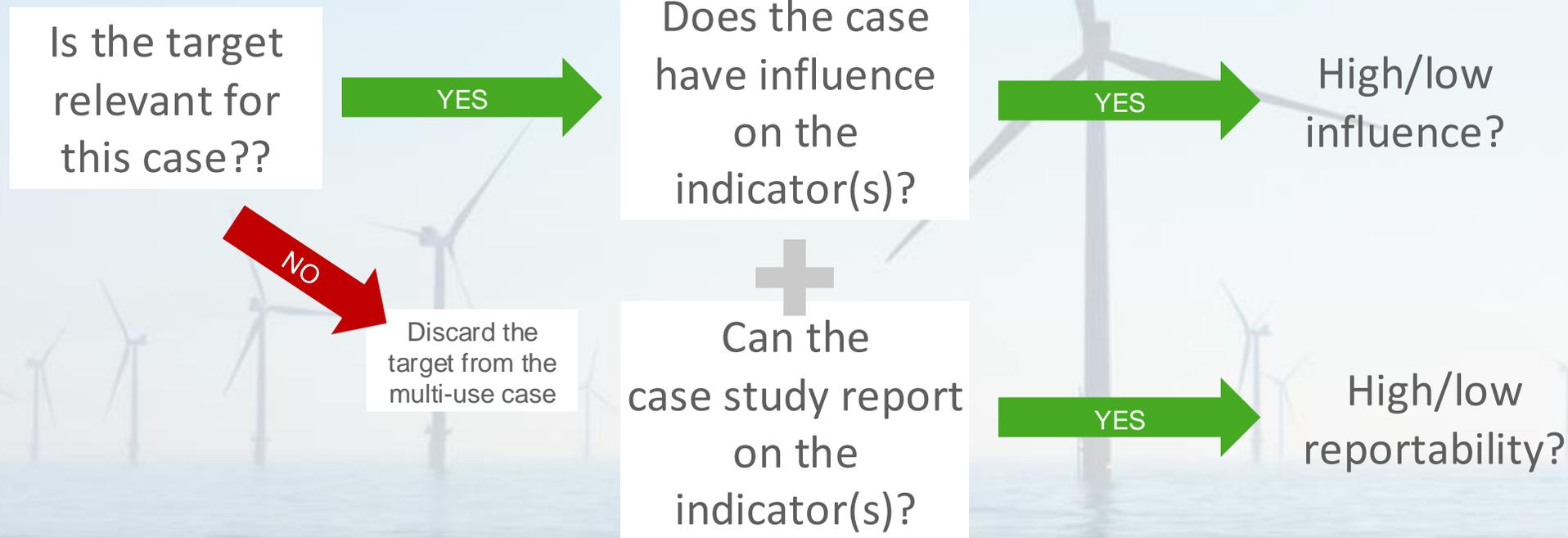
248 INDICATORS



17 SUSTAINABLE DEVELOPMENT GOALS

169 TARGETS

247 INDICATORS



Example



SDG Target 12.2 By 2030, achieve the sustainable management and efficient use of natural resources

Is the target relevant for this case?



SDG Indicator 12.2.1 Material footprint, material footprint per capita, and material footprint per GDP

Can the case study report on the indicator(s)?



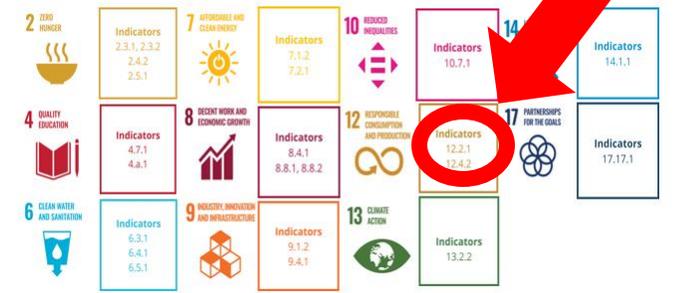
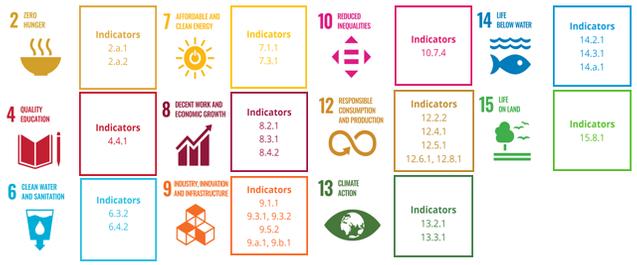
High reportability



Can the case study influence the indicator(s)?



Record and map the indicator(s)

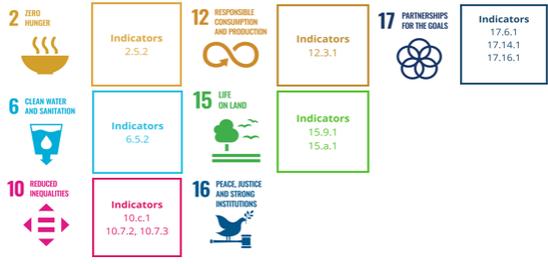


High 'reportability' on indicator

Low 'reportability' on indicator

Low influence on indicator

High influence on indicator



High influence on
cannot report on
indicator





Data from Nordhordaland Biosfæreområde
SDG Target & Indicator Relevance-Tracing Workshop
Kriegers Flak demo site

Relevant SDG Target Cluster with UN Indicators

13.2.1 Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)

TARGET 13-2

INTEGRATE CLIMATE CHANGE MEASURES INTO POLICIES AND PLANNING

TARGET 14-1

REDUCE MARINE POLLUTION

14.1.1 Index of coastal eutrophication and floating plastic debris density

TARGET 17-14

ENHANCE POLICY COHERENCE FOR SUSTAINABLE DEVELOPMENT

17.14.1 Number of countries with mechanisms in place to enhance policy coherence of sustainable development

TARGET 8-4

IMPROVE RESOURCE EFFICIENCY IN CONSUMPTION AND PRODUCTION

8.4.1 Material footprint, material footprint per capita, and material footprint per GDP
8.4.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP

TARGET 4-4

INCREASE THE NUMBER OF PEOPLE WITH RELEVANT SKILLS FOR FINANCIAL SUCCESS

4.4.1 Proportion of youth and adults with information and communications technology (ICT) skills, by type of skill

THE GLOBAL GOALS
For Sustainable Development



How do we operationalize this SDG cluster?

How do we operationalize these elements of sustainability that we know we can and should attain?

A Doughnut for the Anthropocene: humanity's compass in the 21st century

Kate Raworth

Environmental Change Institute, Oxford University, Oxford

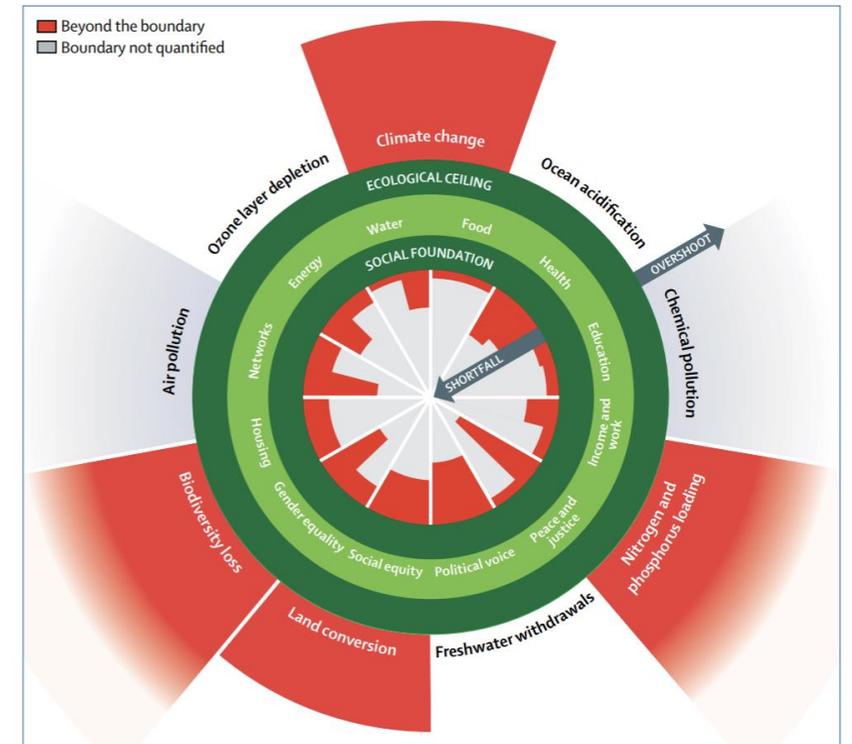
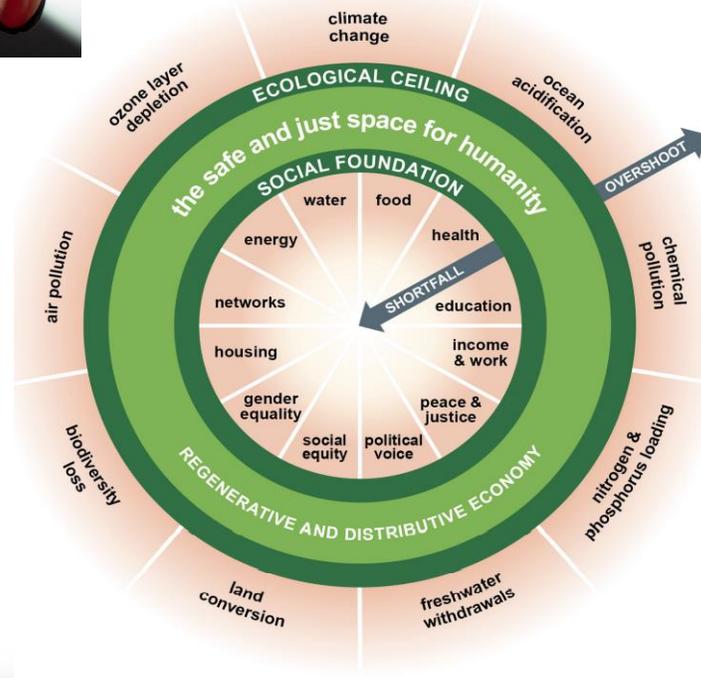


Figure: Shortfalls and overshoot in the Doughnut

Dark green circles show the social foundation and ecological ceiling, encompassing a safe and just space for humanity. Red wedges show shortfalls in the social foundation or overshoot of the ecological ceiling. The extent of pressure on planetary boundaries that are not currently being overshoot is not shown here (see appendix for all graphics).

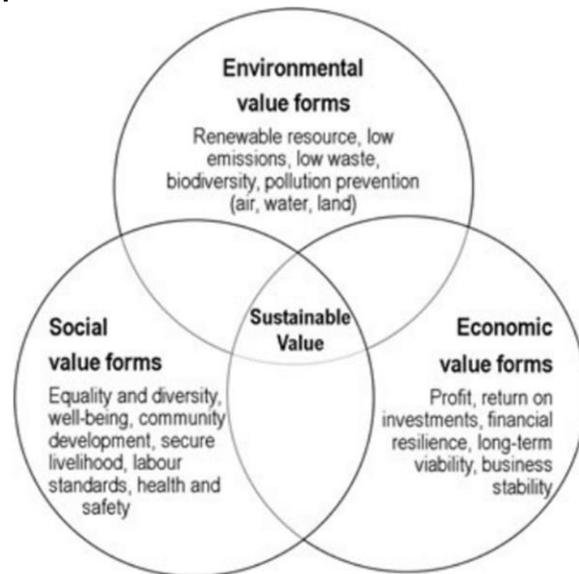
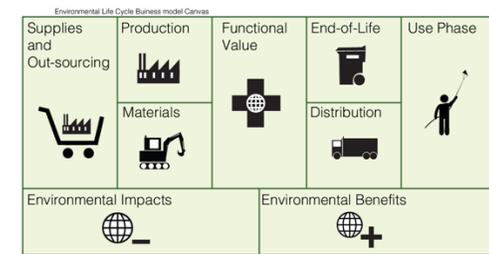


What is Triple layer business model?

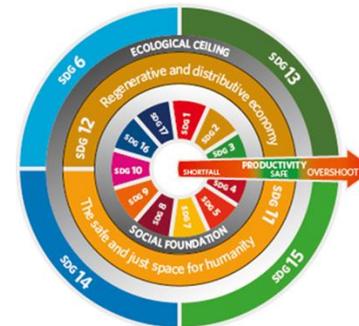
“A business model describes the rationale of how an organization creates, delivers and captures value.”

Osterwalder and Pigneur, 2010

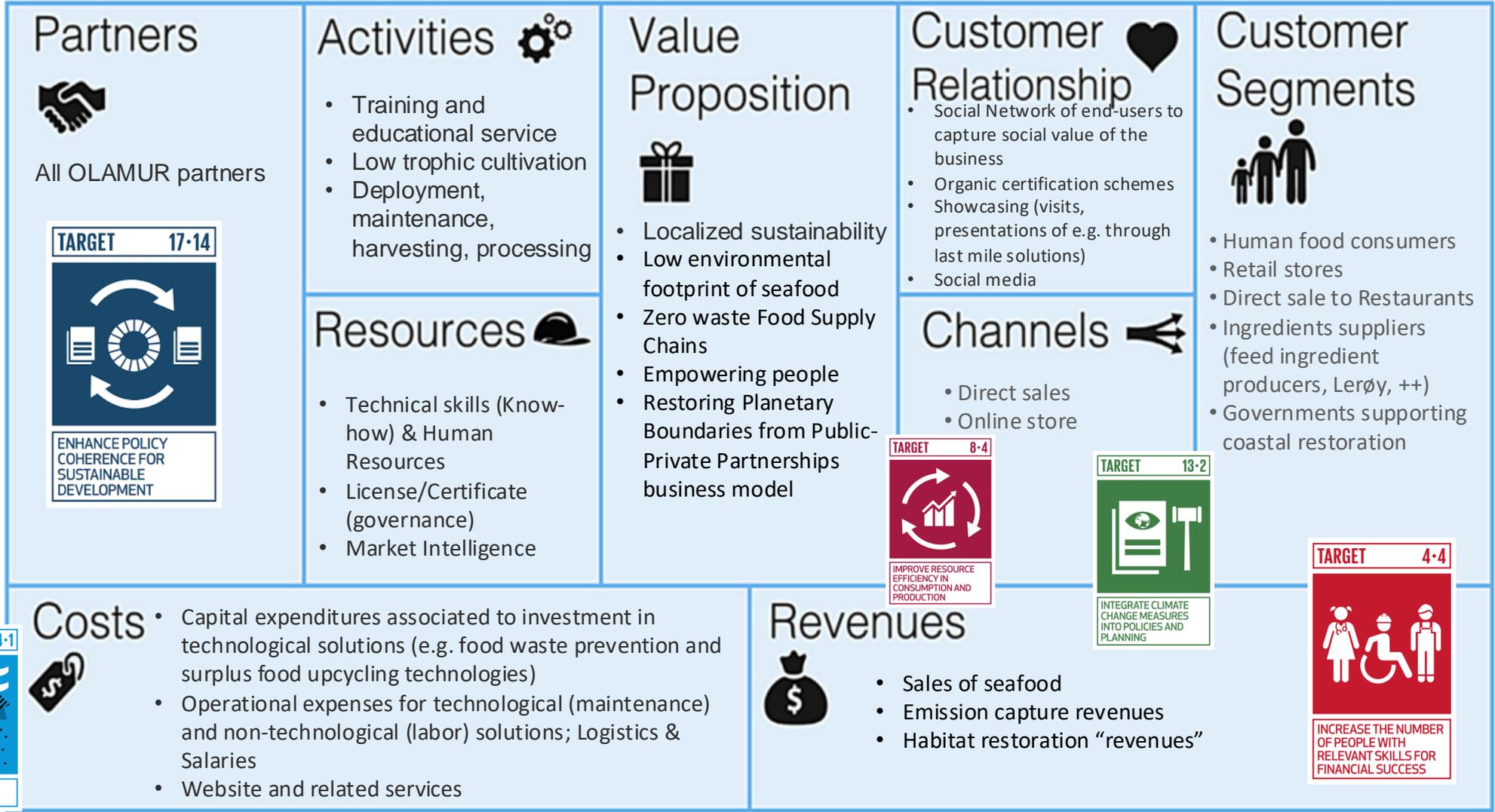
“A sustainable business model as the rationale of how an organization creates, delivers and captures economic, environmental and social forms of value simultaneously.”



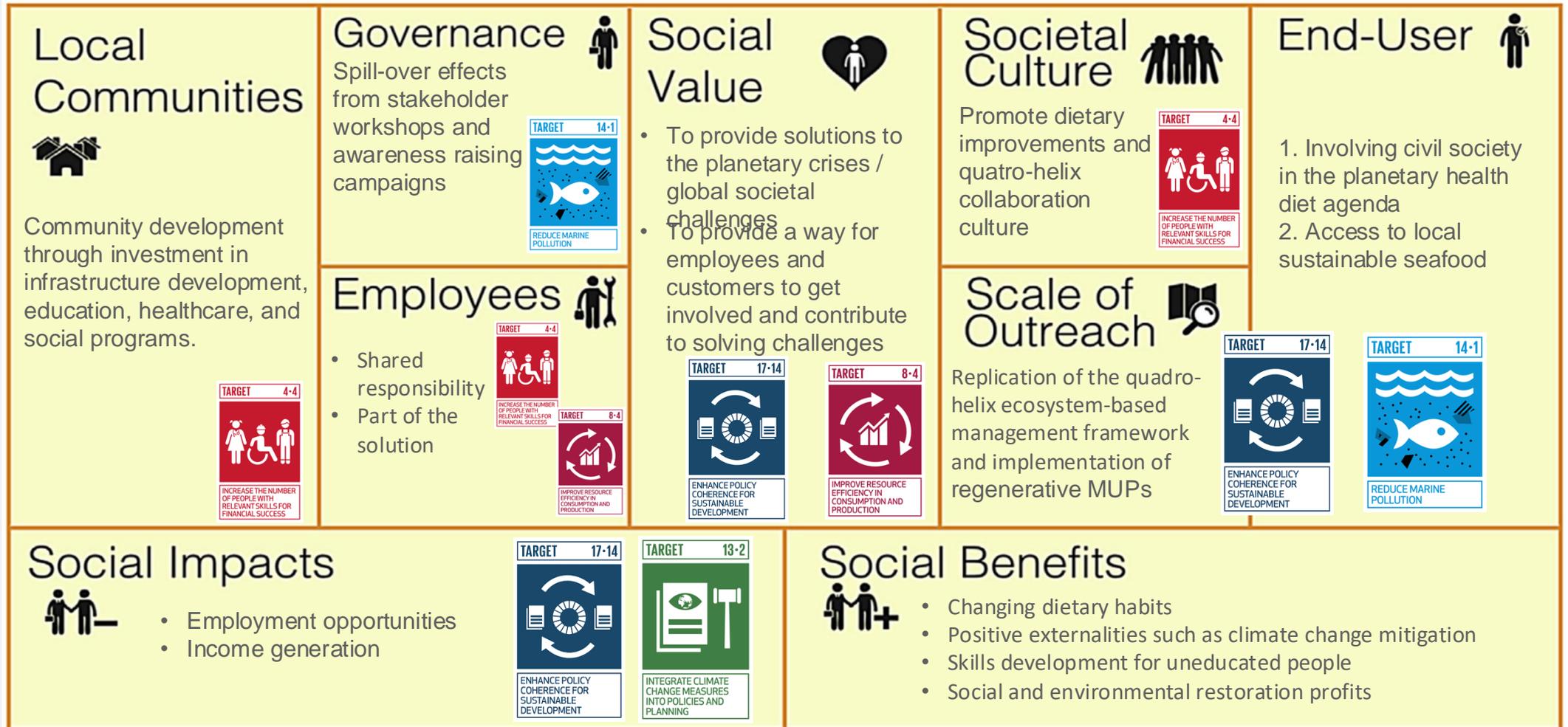
Joyse et al. 2015



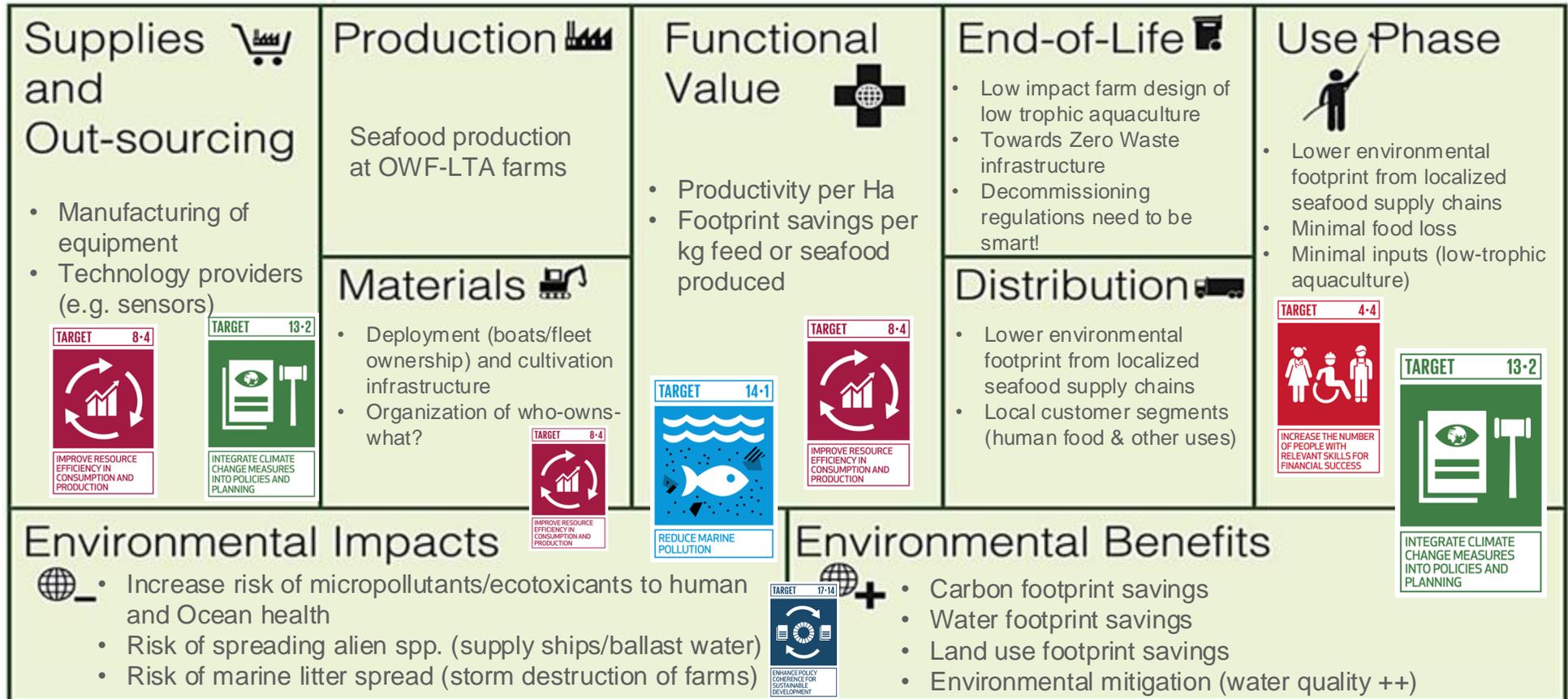
Economic Business Model Canvas



Social Stakeholder Business Model Canvas



Environmental Life Cycle Business Model Canvas



Environment

This business is part of the economy, which is created by our society, which in turn is ultimately, utterly and immediately dependent on the environment. These are the vital context for any business – all risks and all opportunities – including yours.

This business is also part of a value constellation of other businesses, organizations, communities, individuals, animals, plants and the environment.

When answering the questions posed by the canvas for your business consider how your answers need to reflect these vital contexts and the other eco-system actors in your value constellation.

Society

Economy

BIOPHYSICAL STOCKS

Ecosystem services are processes powered by the sun that use Biophysical Stocks to create flows of benefits humans need: clean water, fresh air, vibrant soil, plant and animal growth etc.

Which flows of these benefits are required by, harmed or improved by this business's critical Activities?

Example: See World Business Council for Sustainable Development (WBCSD)'s Corporate Ecosystem Service Review v2.0.



ECOSYSTEM SERVICE

What ultimate stocks provide the tangible key Resources that are moved, flow, and / or transformed by this business's critical Activities to achieve its Goals?

Guidance: As per laws of conservation of matter, all materials remain biophysical stocks somewhere on our single shared planet, irrespective of this business's critical Activities (past, present and anticipated future)



RESOURCES

What are the key tangible and intangible resources required in order to execute this business's critical Activities and so achieve its Goals?



ACTIVITIES

What Activities does this business perform to strive to achieve its Goals?

What Activities enable each Value Co-Creation, Value Co-Destruction?

What Activities create and deliver each Product/Service?



PARTNERSHIPS

What formal partnerships agreements/ contracts are required by this business?

To which key Resources do these partnership agreements enable this business to gain preferred access? e.g. an agreement to supply raw materials

Which critical Activities do these partnership agreements ensure are undertaken for this business? e.g. an agreement to deliver the Product/Service



GOVERNANCE

Which Stakeholders get to make decisions about: which Actors are legitimate Stakeholders, the Goals of this business, its value propositions and its Processes?

What are the Governance arrangements for this business? i.e. which Stakeholders have the power to make decisions about, what topics?



VALUE

What value is co-created and co-destroyed now and / or in the future between this business and all the Stakeholders involved?

VALUE CO-CREATIONS

What are the (positive) value propositions of this business?

What value is co-created with each Stakeholder, satisfying the Needs of the associated Actor, from their perspective (world-view), now and / or in the future?

Which value co-creations are associated with which Products/Services?



VALUE CO-DESTRUCTIONS

What are the (negative) value propositions of this business?

What value is co-destroyed for each Stakeholder, hindering the satisfaction of the Needs of the associated Actor, from their perspective (world-view), now and / or in the future?



PRODUCTS / SERVICES

What does this business offer and provide to its customer or client or user Stakeholders that co-creates value with the associated Actors to better meet their Needs?

Which offers do customer or client or user Stakeholders pay the business for, realizing (at least financial) Benefits?



PEOPLE

Who are all the people involved in this business: the people this business does it to, for and with?

RELATIONSHIPS

What type of Relationships with each Stakeholder must be established, cultivated and maintained by this business via its Channels in order for value to be co-created (or co-destroyed)?

Examples: Become aware, build trust/ interest, decision making, co-create value, experience, collaborate/support, coevolve



CHANNELS

What Channels will be used by this firm to communicate, interact, and to develop the required types of Relationship with each Stakeholder (and vice versa)?

Examples: Retail, Face-to-Face, Internet, Phone, Mail, Transport



STAKEHOLDERS

How is each Actor involved in this business? What Stakeholder roles does each Actor take?

Examples: customer, employee, investor, supplier, community, regulator, financier



ACTORS

Who and what may have an interest in the fact that this business exists? From which groups or pools of Actors do people come from who play the role of Stakeholders in this business?

Which individuals, groups or organizations does this business aim to reach and Co-Create value with to better meet those Actor's Needs?

Examples: Humans, NGOs, Government, Media, other life and nature (usually represented by an NGO) etc.



NEEDS

What fundamental Needs of the Actors is this business intending to satisfy or may hinder?

Guidance: For inspiration on possible Needs review Maslow's Hierarchy of Needs or Max-Neef's Fundamental Human Needs (Preferred).



COSTS

How does this business choose to measure the Costs incurred by its business model (Environmentally, Socially, Economically)?



GOALS

What is this business's definition of success: environmentally, socially and economically?

What are the Goals that the Stakeholders have agreed align with the why/purpose/ vision they have chosen for this business (measured in appropriate units)?



BENEFITS

How does this business choose to measure the Benefits that result from its business model (Environmentally, Socially, Economically)?



OUTCOMES

What outcomes demonstrate whether this business has achieved its Goals, achieving its Stakeholder's definition of success over time?

How does this business measure the benefits and costs to determine whether or not these outcomes are achieved (in applicable environmental, social and monetary units)?



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**We need to partner with people who show
their commitment to sustainability
through *curiosity* and *action***

Tools that bring data and people together

The role of Digital Twinning to combine data from different sectors and areas to develop a common understanding

Whose data?

Whose digital twin?

What process?



Håvard Legreid, visual artist
& Digital Twinner

DIGITAL TWINS



Virtual
representations
of real-world 'things'

assets (physical twin), processes,
people, places, systems, and devices

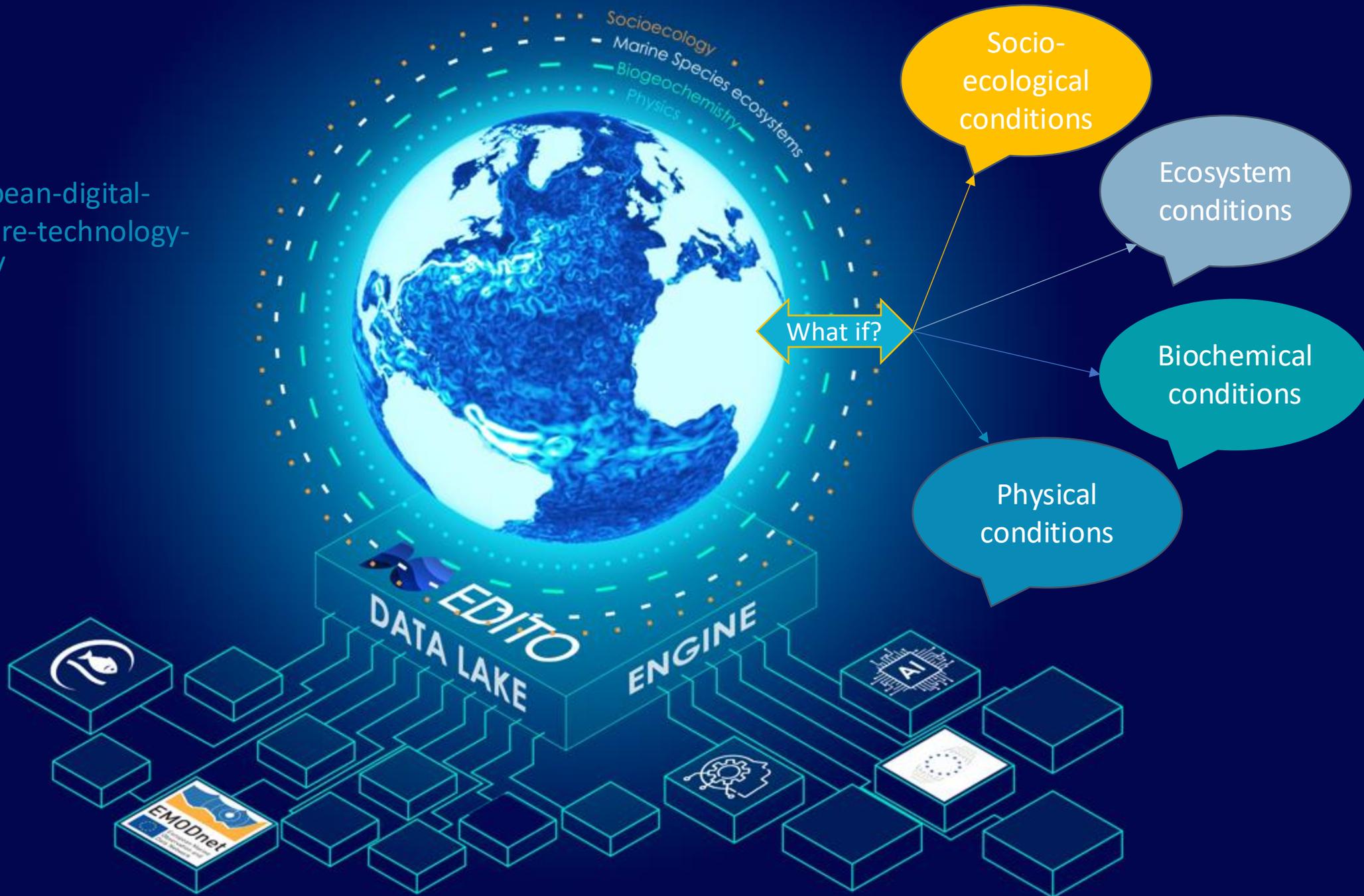
Synchronised
at specific frequency
and fidelity
'reacting' to

incoming data streams

Observations & model data



<https://edito-infra.eu/european-digital-twin-ocean-core-technology-infrastructure/>





SOCIAL-ECOLOGICAL

ocean management

APPLICATIONS

with

DIGITAL OCEAN TWINS



Co-funded by
the European Union

SEADOTs project is co-funded by the EU
Horizon Europe Research and Innovation
Programme under Grant Agreement No.
101156488

SEA DOTs



Alternative futures

Inform political decision making
Assist spatial planning
Enable adaptive management

Ambition

Safeguard ocean ecosystems
Sustainable resource use
Social and economic well-being

Southern North Sea

Case study examining the ecological impacts, economic advantages, and implications of shared marine spaces by the example of offshore wind and kelp/mussel farming.

What if scenarios

Predictive management

Decision support

Applications

Baltic Sea

Case study exploring potential ecological and socio-economic trade-offs and synergies between sustainable fisheries, offshore wind and marine protected areas.

Digital Ocean Twins

New data

Norwegian North Sea

Case study assessing the potential socio-ecological-technical impacts of offshore wind development on a small-island community at Utsira in Norway.

Geo-spatial attributes

socio-economic data and models

socio-ecological data and models

Human activities

netcompany

intrasoft



WP5
ENGAGEMENT
(INTRA)

WP3
APPLICA-
TIONS &
FRAME-
WORK
(ZEN)

WP4
DOT
DEMON-
STRATORS
(HEREON)

NORWEGIAN NORTH SEA
Socio-ecological effects of wind farm
developments on small communities

SOUTHERN NORTH SEA
Socio-economics and environmental
effects from co-existing industries

BALTIC SEA
Decision support for MSP in climate
change scenarios for fisheries a.o. sectors

WP1
DATA
(OCC)

WP2
SES
(SOCEAN)

WP6 PROJECT MANAGEMENT, TECHNICAL & SCIENTIFIC COORDINATION (SOCEAN)

Geophysical systems and data

Ecosystem data

Ocean models

**EU
Digital
Twin of
the Ocean**

Ocean observations

Ute Brönnner, R. Arnason, R. V. L. d'Oliveira Bouman, D. Dankel, N. Gligoric, H. Hasler-Sheetal, C. Ipektsidis, S. Keiser, S. Niiranen, J. Pein, J. Rocha, A. S. Rodriguez, J. Staneva, K. R. Sørheim, L. Veylit, P. Zaborowski

info@seadots.com

SEADOTs has received funding from the European Commission under grant agreement No 101156488.

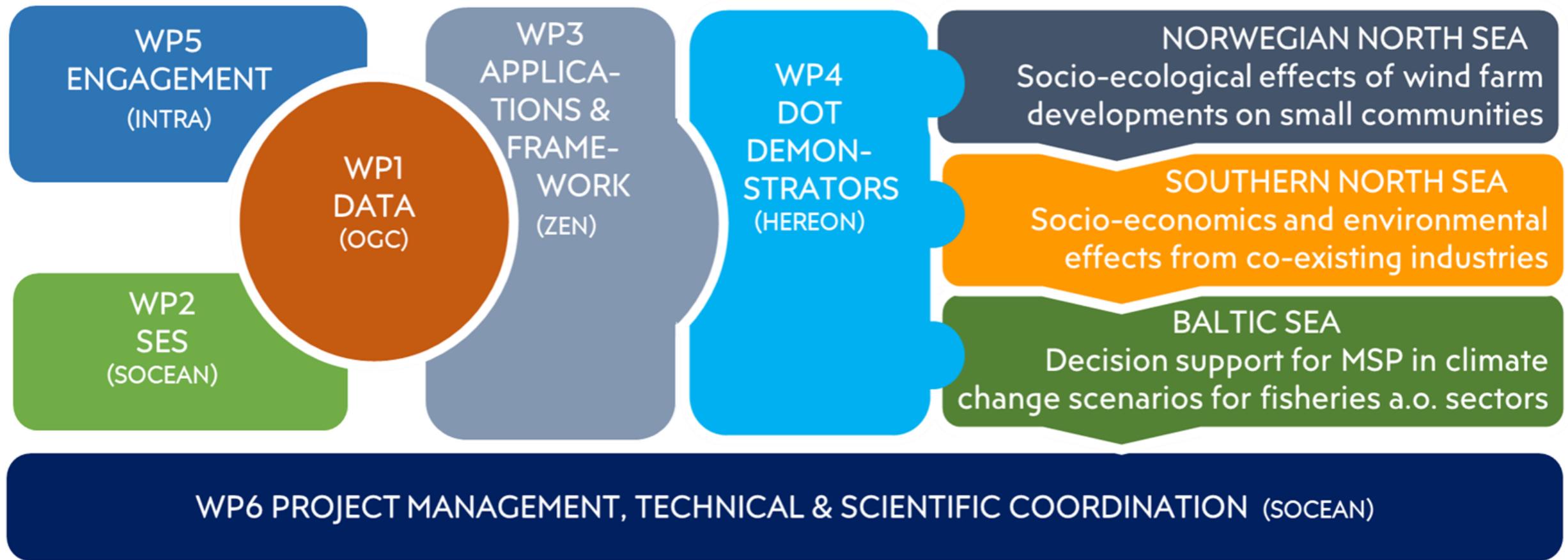
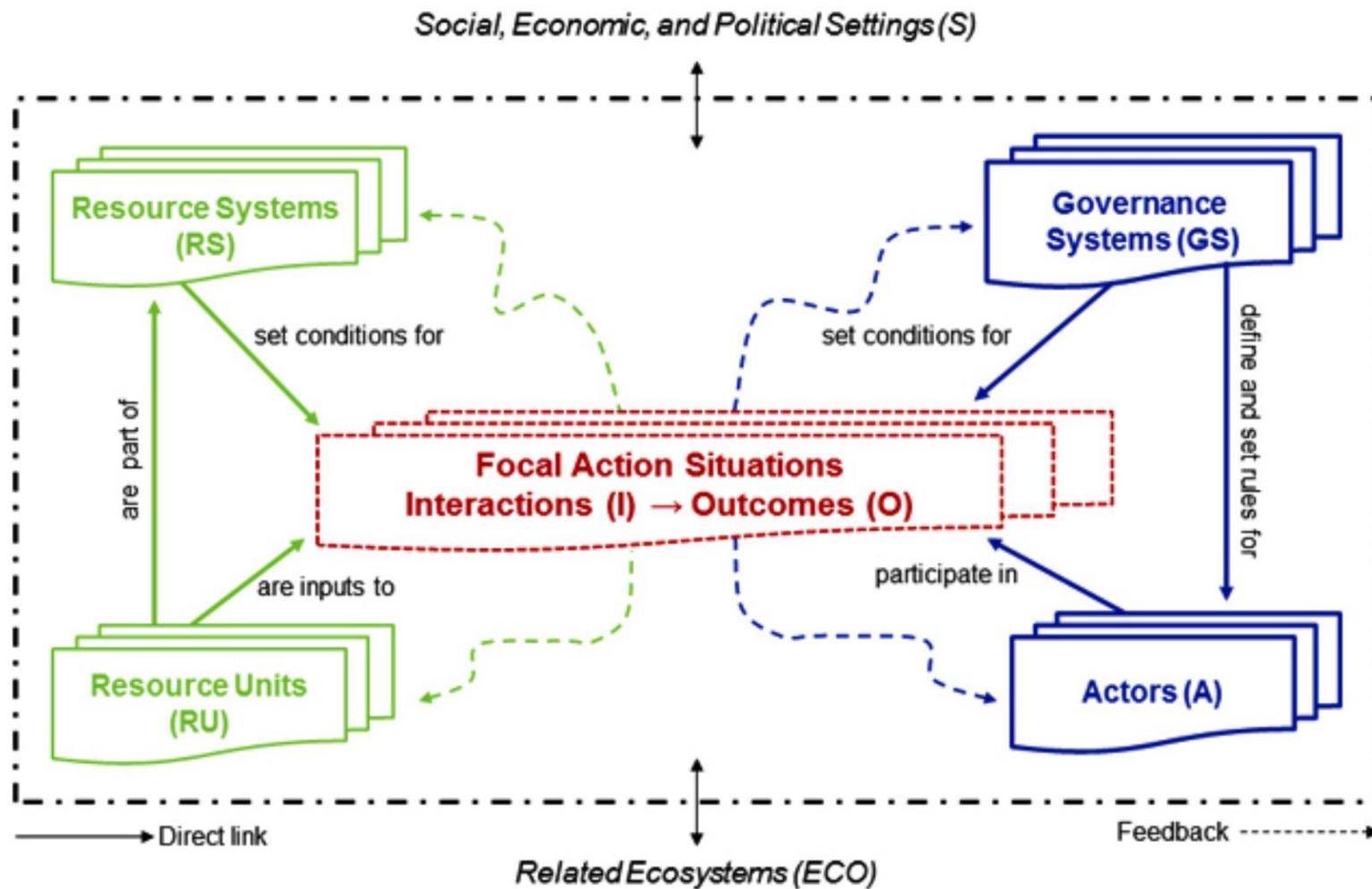


Fig. 1. Conceptualization of the social-ecological systems framework from McGinnis and Ostrom (2014). First-tier variables are shown with their interactions and outcomes.

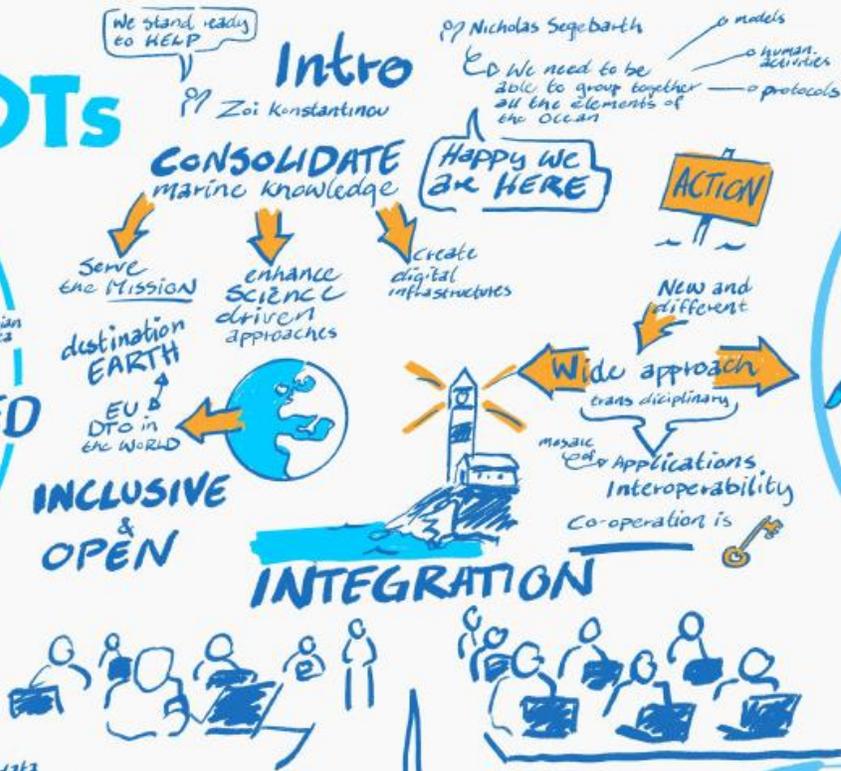


Source: Partelow 2018,
DOI: 10.5751/ES-10594-230436

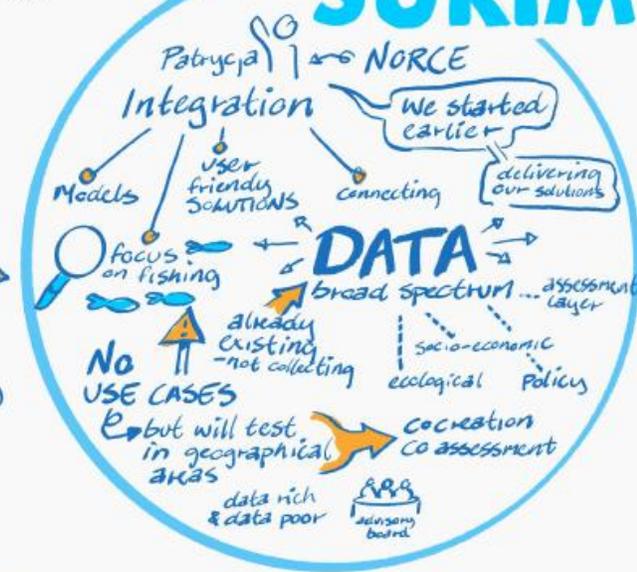
SEADOTs



Intro



SURIMI





SINTEF

But who really cares about
sustainability?

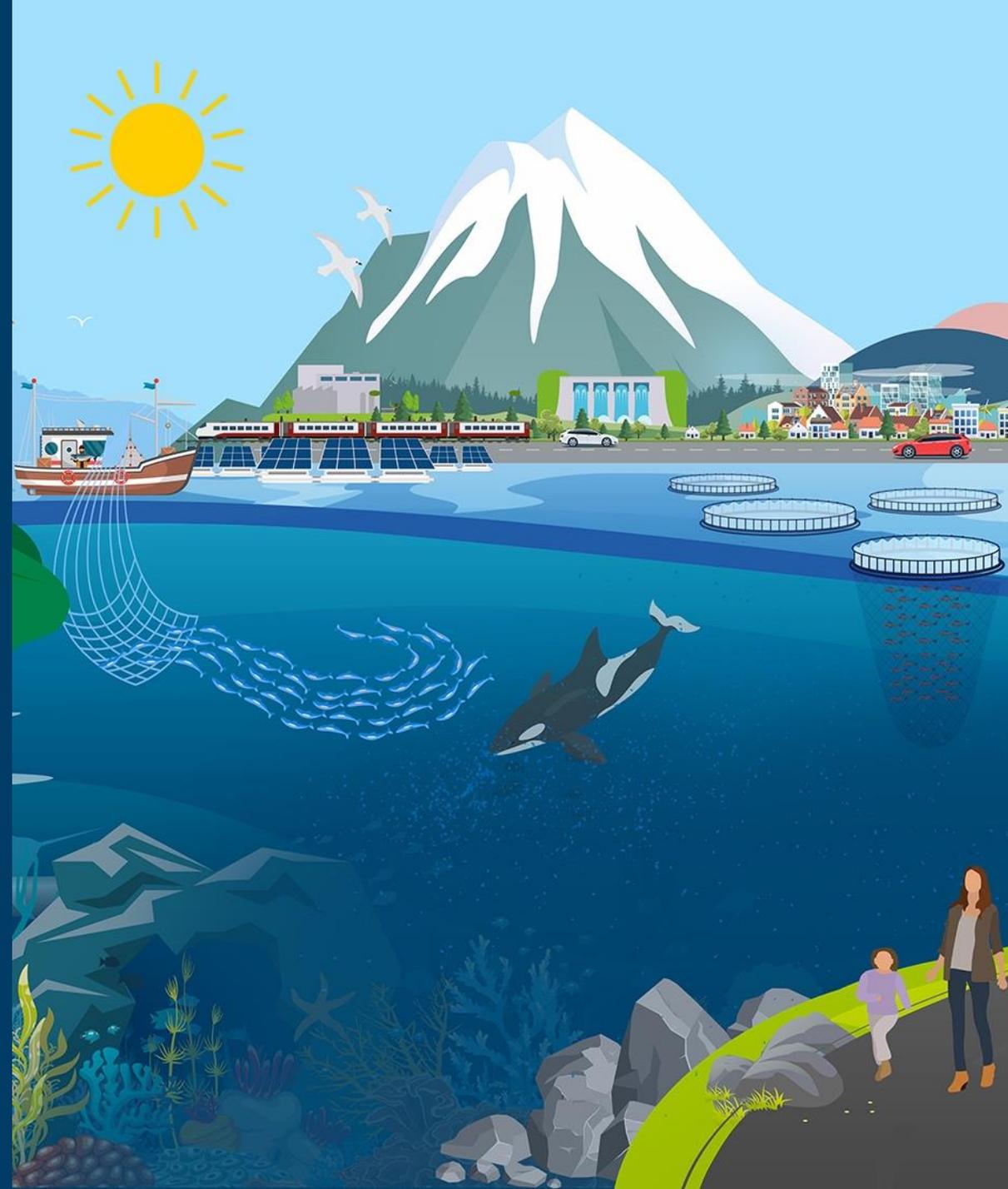
CSRD

EU's Corporate Sustainability Reporting Directive

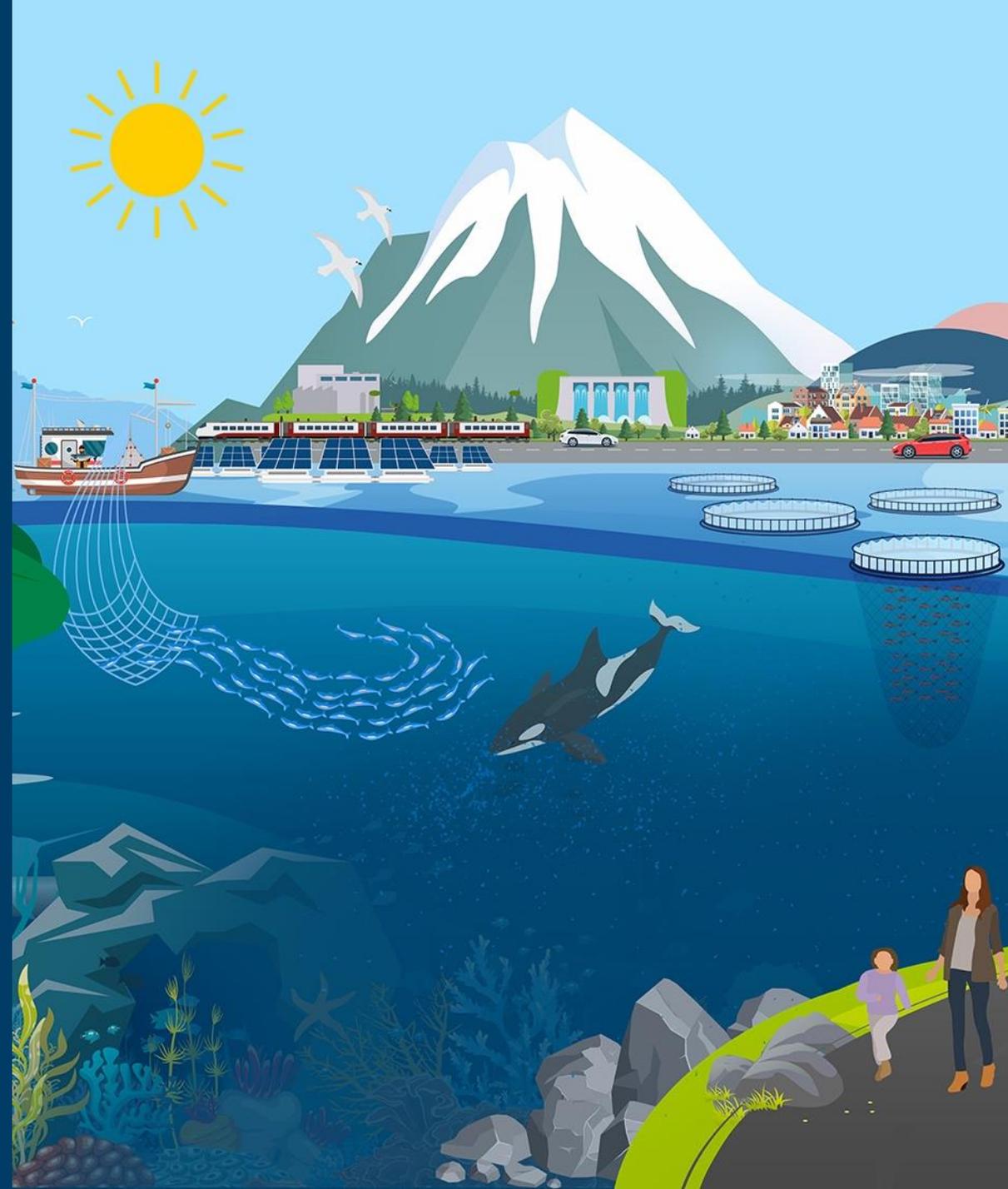
Double materiality

Requires companies to report on:

- 1) Impact Materiality: How the company's activities impact *people* and the *environment* across its entire value chain
- 2) Financial Materiality: How sustainability issues affect the company financially in the short, medium, and long term



To implement measures to improve sustainability conditions, we must have a genuine *transformative change*





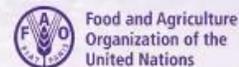
ipbes

Assessment Report on The Underlying Causes of Biodiversity Loss and the Determinants of **Transformative Change** and Options for Achieving the 2050 Vision for Biodiversity

www.ipbes.net

The Intergovernmental Science-Policy Platform
on Biodiversity & Ecosystem Services

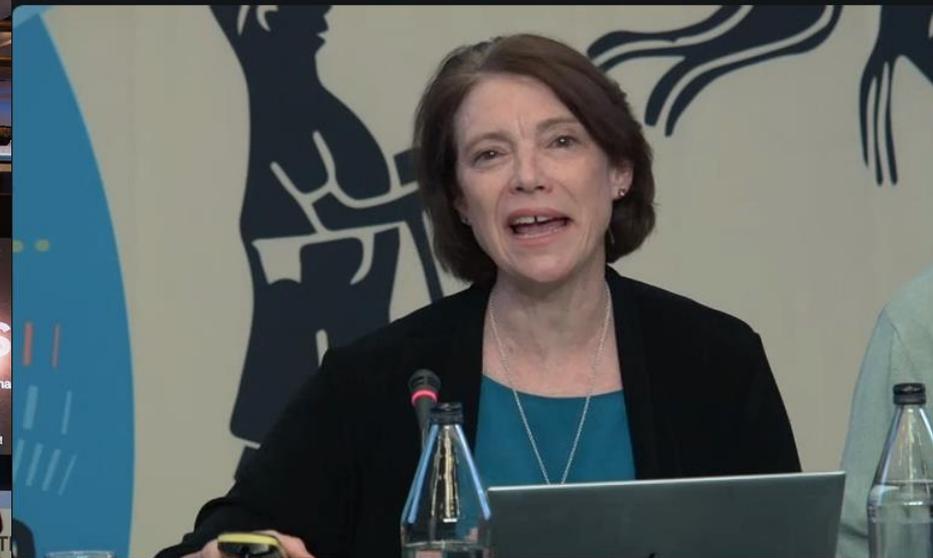
#TransformativeChange



Finally, the experts have pinpointed the principles underlying the loss of biodiversity and nature, and show us how we can work towards **transformative change.**



11th Plenary Session of IPBES
December 18, 2024
Windhoek, Namibia



Prof. Karen O'Brien, lead author

IPBES photo by Kiara Worth



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IPBES Transformative Change Assessment Summary

- 1. Root Causes:** Disconnection from nature, unequal power structures, and prioritizing short-term material gains drive biodiversity loss.
- 2. System Change:** Requires fundamental reorganization of technological, economic, and social systems.
- 3. Collective Action:** Demands whole-of-society engagement, especially empowering Indigenous and local communities.
- 4. Guiding Principles:** Focus on equity, inclusion, respectful human-nature relationships, and adaptive precaution.
- 5. Economic Potential:** Immediate biodiversity action could generate \$10 trillion in opportunities and support 395 million jobs by 2030.



A woman with long, wavy red hair is shown in profile, looking towards the left. She is wearing a bright pink, quilted jacket. The background is a soft-focus coastal scene with a blue sky and a greyish-blue horizon. The overall mood is serene and forward-looking.

A possible narrative from 2050

By 2050, Europe has revolutionized its energy landscape with nearly 500 GW of offshore wind capacity, transforming from just 20 GW in 2024. This €800 billion investment delivers a quarter of Europe's electricity, creates hundreds of thousands of jobs, and positions the continent as a global renewable energy leader.

The offshore wind sector has successfully balanced clean energy production with marine environmental protection, demonstrating a holistic approach to sustainable development that supports multiple ecological and economic objectives.

To realize the 2050 offshore wind vision, European R&D must focus on:

Technological breakthroughs in **turbine efficiency, energy storage, cost reduction** and **nature/social-ecological positivity**.

Environmental integration, developing ecosystem-friendly solutions and **circular economy** approaches.

Fostering a **collaborative innovation ecosystem** for Marine Spatial Planning, connecting **researchers, industry, and policymakers** to accelerate progress and implementation.





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Technology for a better society