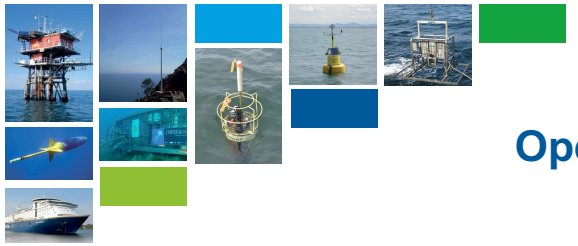

Malta Summer School 2018
Operational Oceanography for Blue Growth

The Ocean Economy 2030

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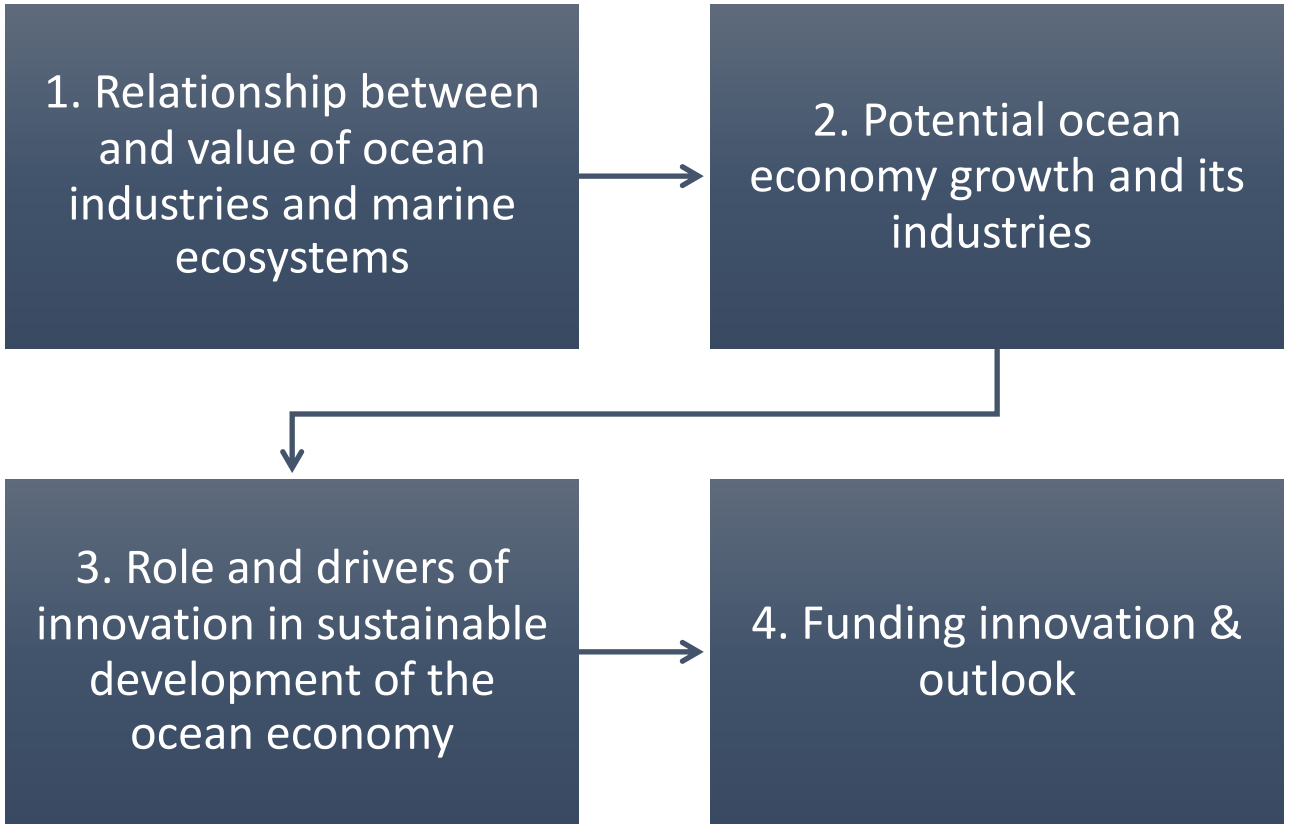
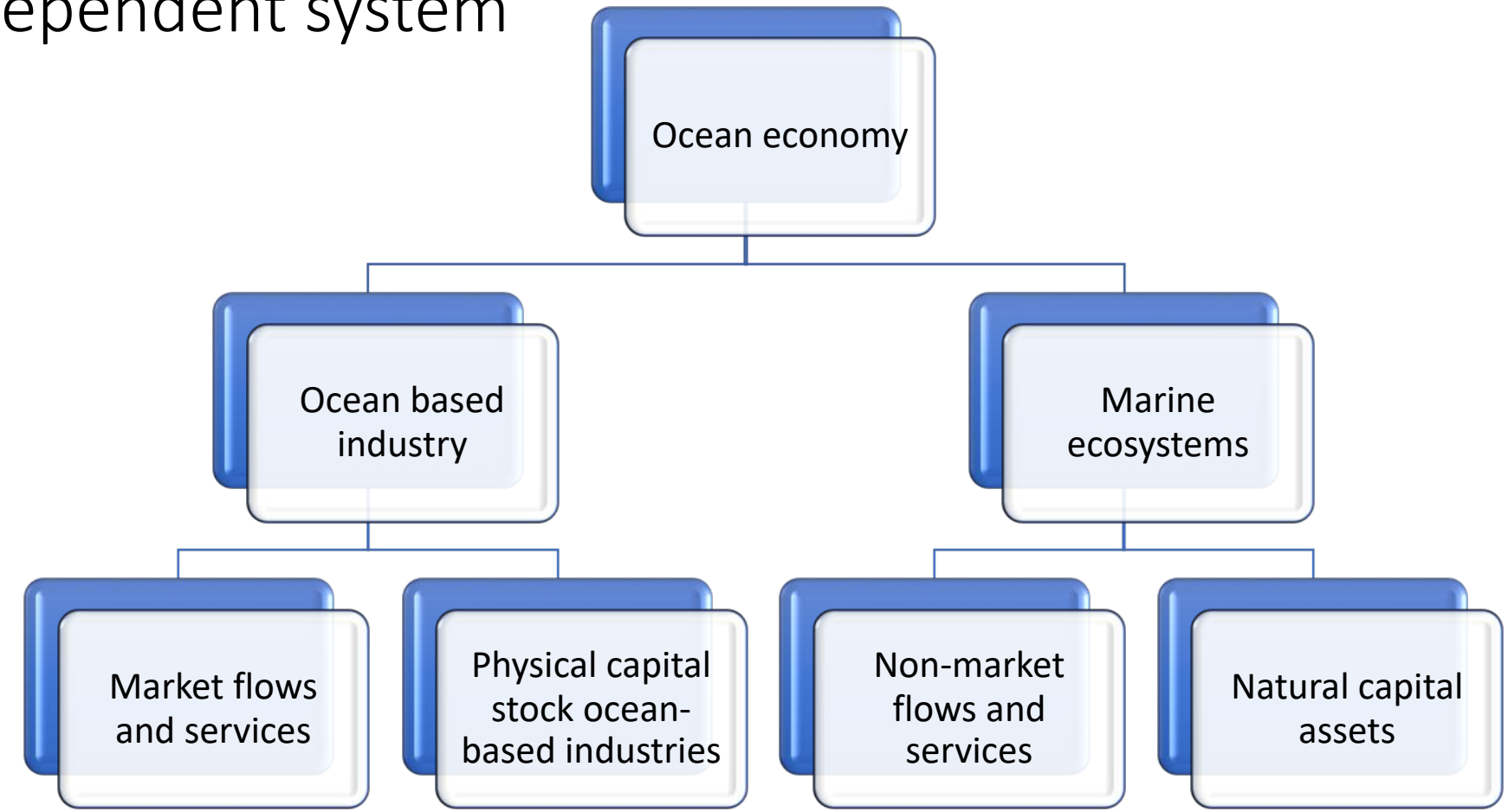
Presentation overview



OECD Report

http://www.oecd.org/futures/oceaneconomy.htm

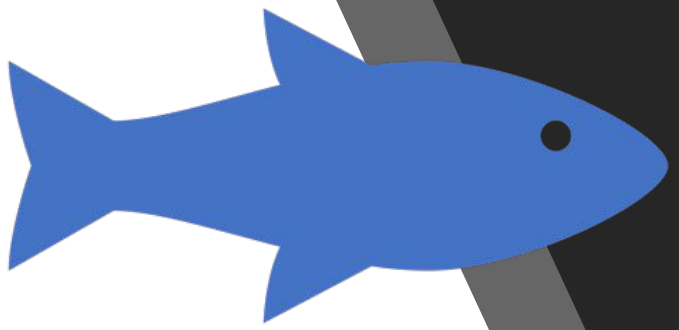
The Concept of the Ocean Economy: an interactive, interdependent system



Source: OECD (2016), *The Ocean Economy in 2030*, OECD Publishing.

1. Industries & Ecosystems

Global environmental change: impacts on ocean health and economy



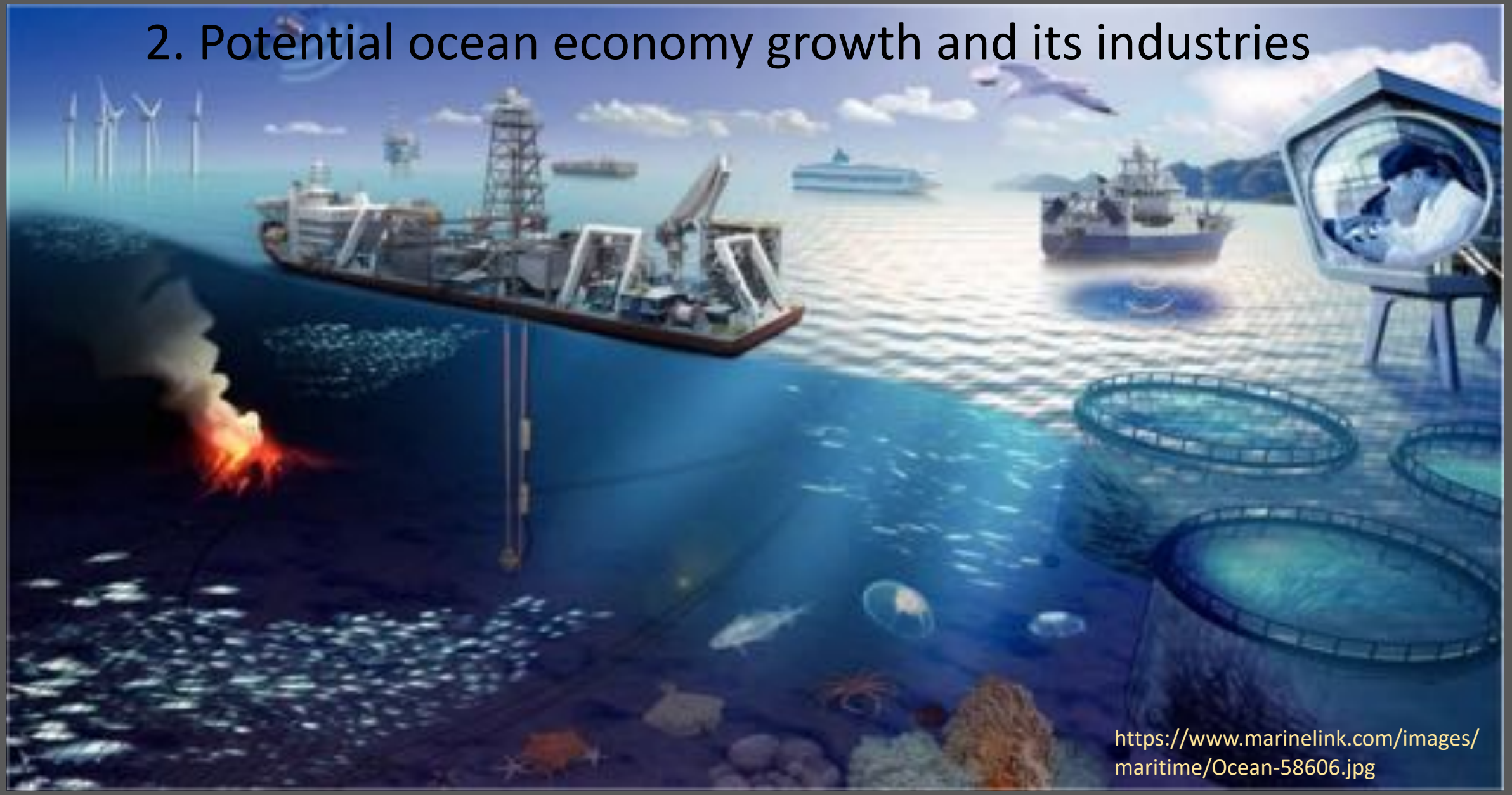
- Increasing acidification
  - Habitat degradation, Coral decline, Food web disruption
- Increases in sea temperature and sea levels
  - Coastal flooding, distribution and abundance of biota, changes in biodiversity
- Marine Pollution
  - Habitat loss, biodiversity decline, changes to ecosystem structure and function
- Impacts
  - on coastal tourism, reduced marine food production, coastal infrastructure, ports and harbours, ship routing

1. Industries & Ecosystems

Examples of marine ecosystem services and scale

Category (examples)	Geographic scale
Food (e.g. fisheries and aquaculture)	Local/regional/global
Fuel (e.g. mangrove wood)	Local/regional/global
Water	Local/regional
Natural products (e.g. sand, pearls, diatomaceous earth)	Local/regional/global
Genetic and pharmaceutical products	Local/regional/global
Lifecycle maintenance, habitat and gene pool protection	Global
Atmospheric composition, carbon sequestration and climate regulation	Local/regional/global
Shoreline stabilization/erosion control	Local
Natural hazard protection (e.g. from storms, hurricanes and floods)	Local/regional
Pollution buffering and water quality	Local/regional
Soil, sediment, and sand formation and composition	Local/regional
Tourism	Local/regional/global
Recreation	Local/regional/global
Spiritual values	Local/regional/global
Education and research	Local/regional/global
Aesthetics	Local

2. Potential ocean economy growth and its industries

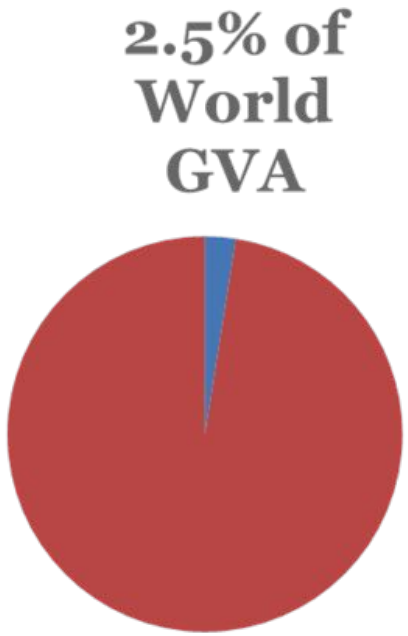


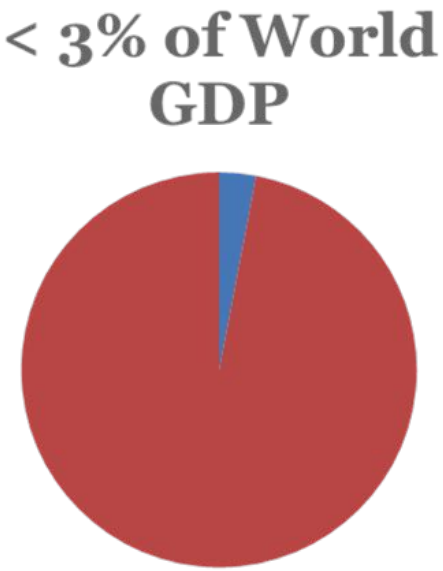
https://www.marinelink.com/images/maritime/Ocean-58606.jpg

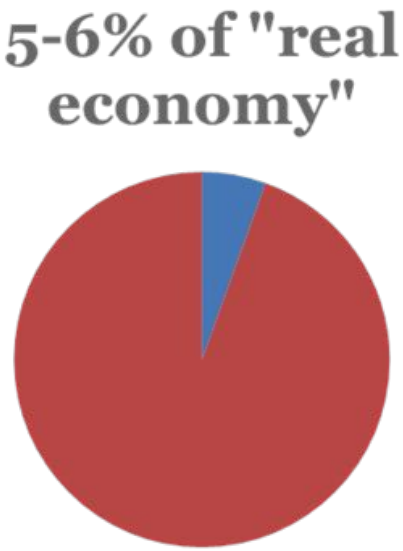
Estimate of economic value of world marine ecosystems

- Ecosystem services provided by one “average” hectare of open seas = USD 490 per year (De Groot, 2012)
- Ecosystem services provided by one “average” hectare of coral reef = USD 300 000 per year (De Groot 2012)
- Global carbon sequestration through absorption by ocean and seas ranges between USD 74bn and USD 222bn per year (GOC, 2014)
- Direct value of output for coral reefs, sea-grass, mangroves and marine fisheries = USD 6.9trillion (WWF, 2015)
- (note much uncertainty in these figures!)

Ocean industries and their net contribution to world economy in 2010

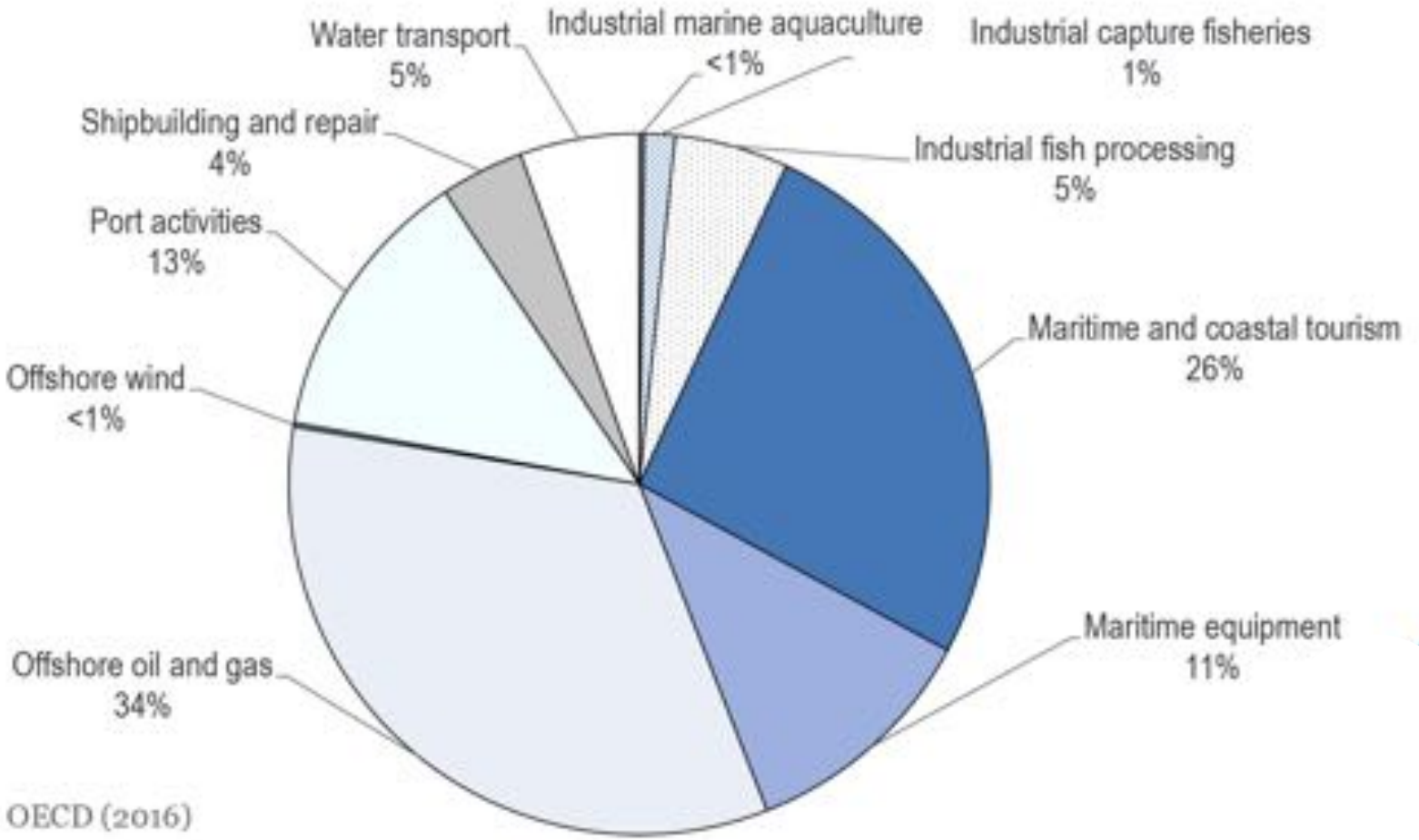






1.5 trillion USD in 2010

Gross value-added of ocean-based industries in 2010 by industry



Source: OECD (2016)

Marine industries with prospects for high long-term growth of business and employment

- Shipping
- Shipbuilding
- Marine equipment and supplies
- Offshore wind
- Marine aquaculture
- Maritime tourism, cruise industry
- Port activities

Role of innovation in sustainable development of the ocean economy

A KEY CONCLUSION OF THE OECD OCEAN ECONOMY 2030 REPORT:

IN BALANCING OCEAN BUSINESS GROWTH WITH THE NEED FOR SUSTAINABLE USE OF THE OCEAN, *INNOVATION* HAS A PRE-EMINENT ROLE TO PLAY

4. Drivers of innovation (a non-exhaustive list)

Market development: growing existing markets, new & emerging markets

Market forces: competition, cost efficiencies…..

Disaster response, risk mitigation……

Political peer pressure

Regulation

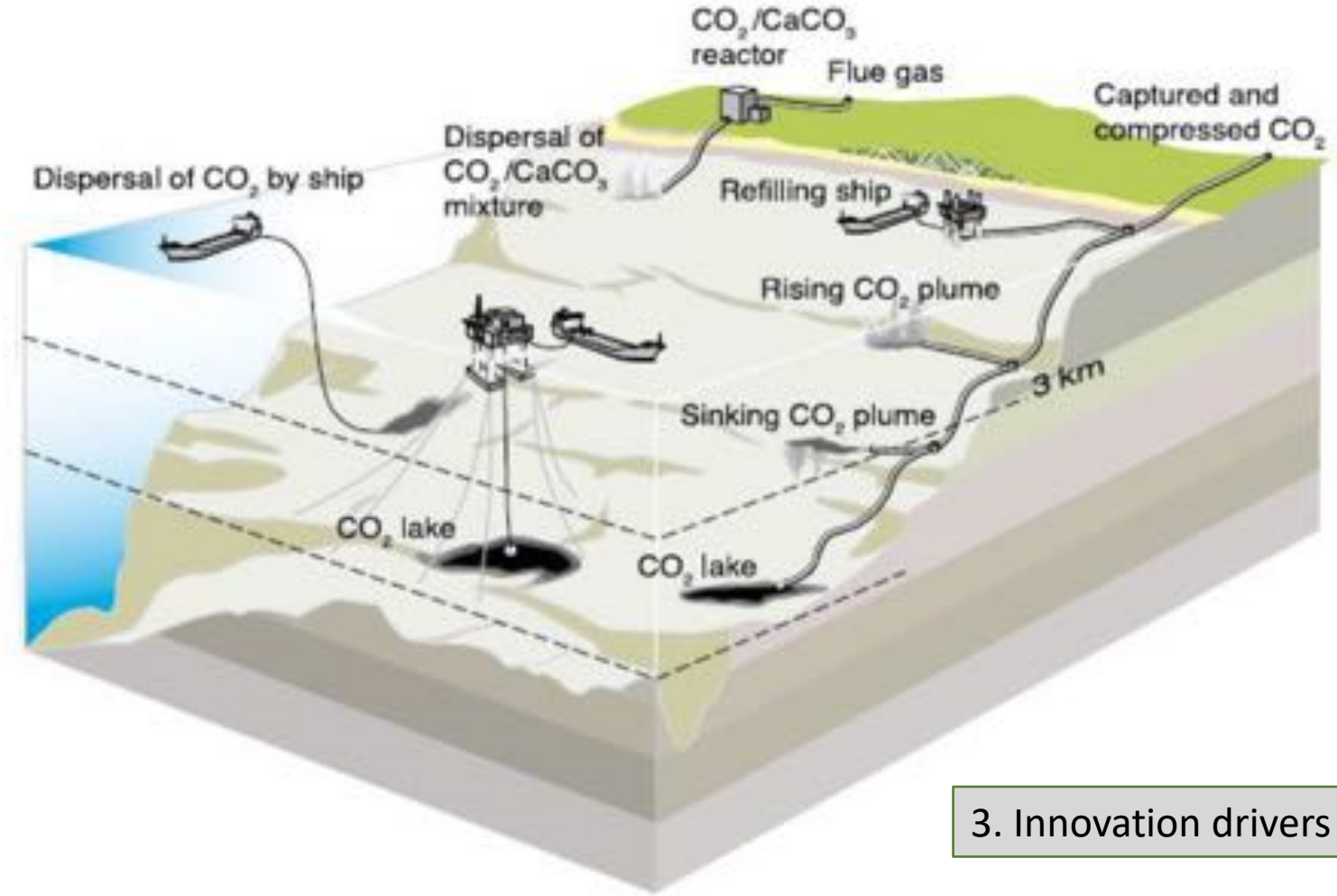
Opportunism – capitalising on necessity

3. Innovation drivers

New markets: potential business opportunities

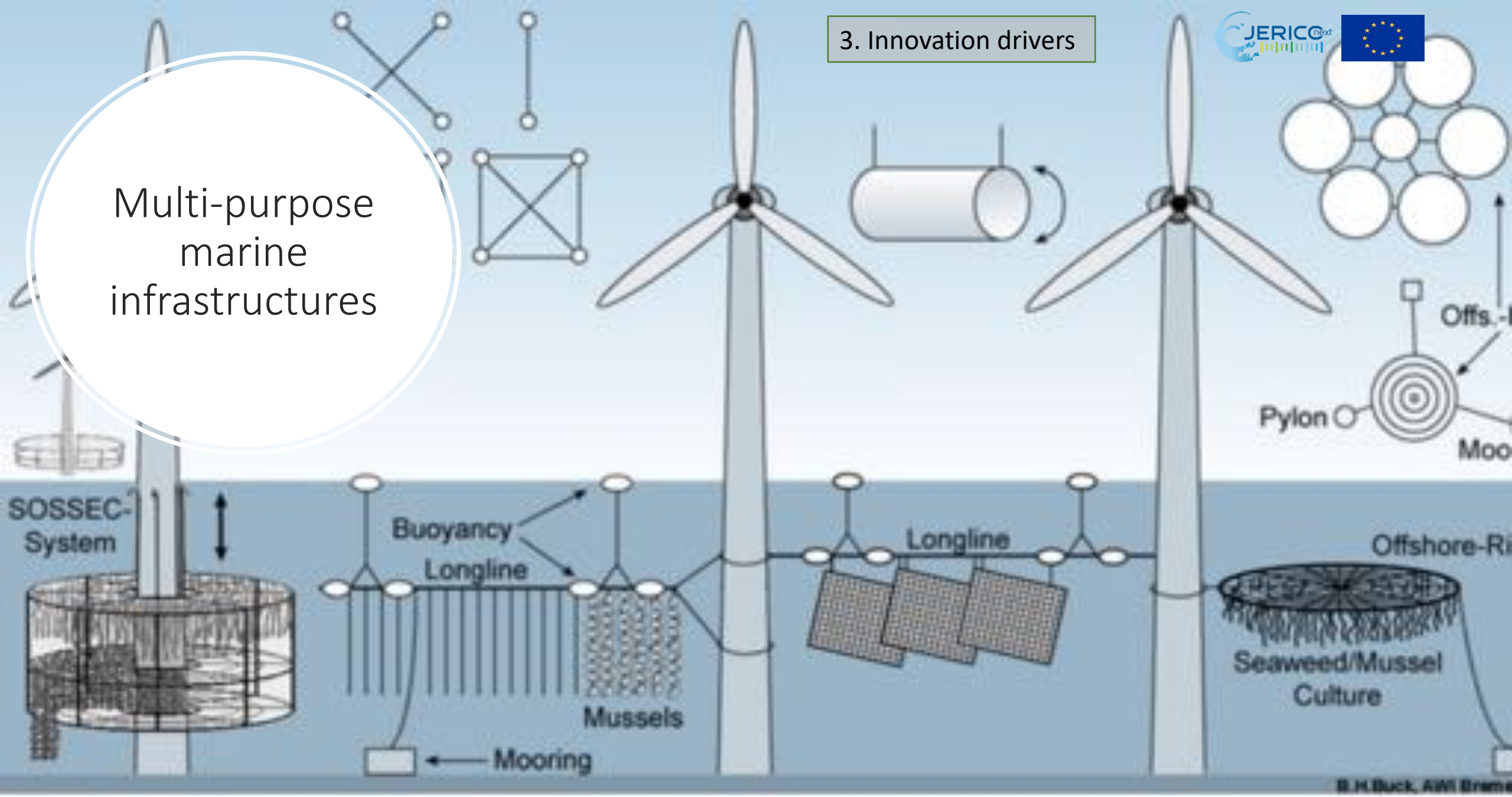
Carbon capture & storage

- Saline aquifers
- Public support
- Up front costs



3. Innovation drivers

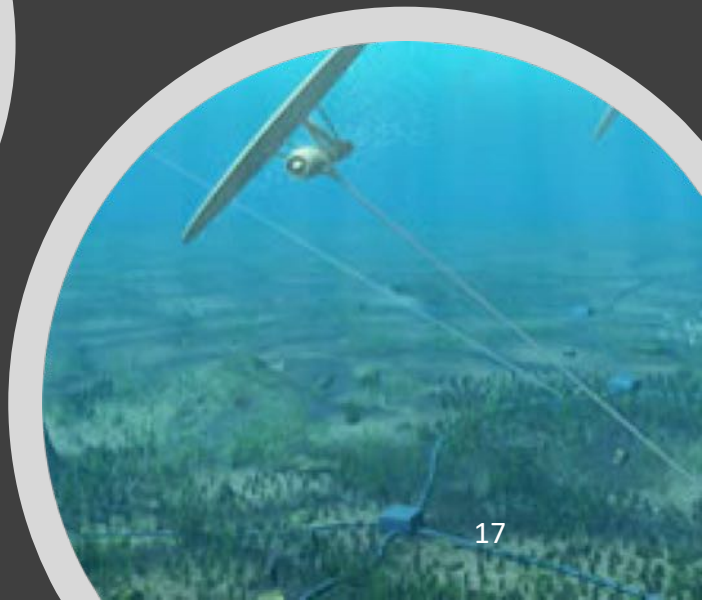
Multi-purpose marine infrastructures



Source: Prof. Bela Buck, AWI

Emerging markets: Ocean Renewable Energy

- tidal, wave, current, osmosis, ocean thermal energy, conversion (OTEC)
- 337 GW of wave and tidal energy by 2050 (Nuclear 383 GW 2015)
- Decarbonising national economies (e.g. 8% UK needs from tides)
- 1.2 million direct jobs by 2050 – in deprived coastal communities
- Challenge: from demonstration to operational scale



Minesto – Underwater Kite

Deep Green

- Underwater kite and turbine (0.5-2.5 m/s)
- Holyhead Deep Project 0.5 MW full scale pilot
- Installation of a 10 MW marine energy array in 2017

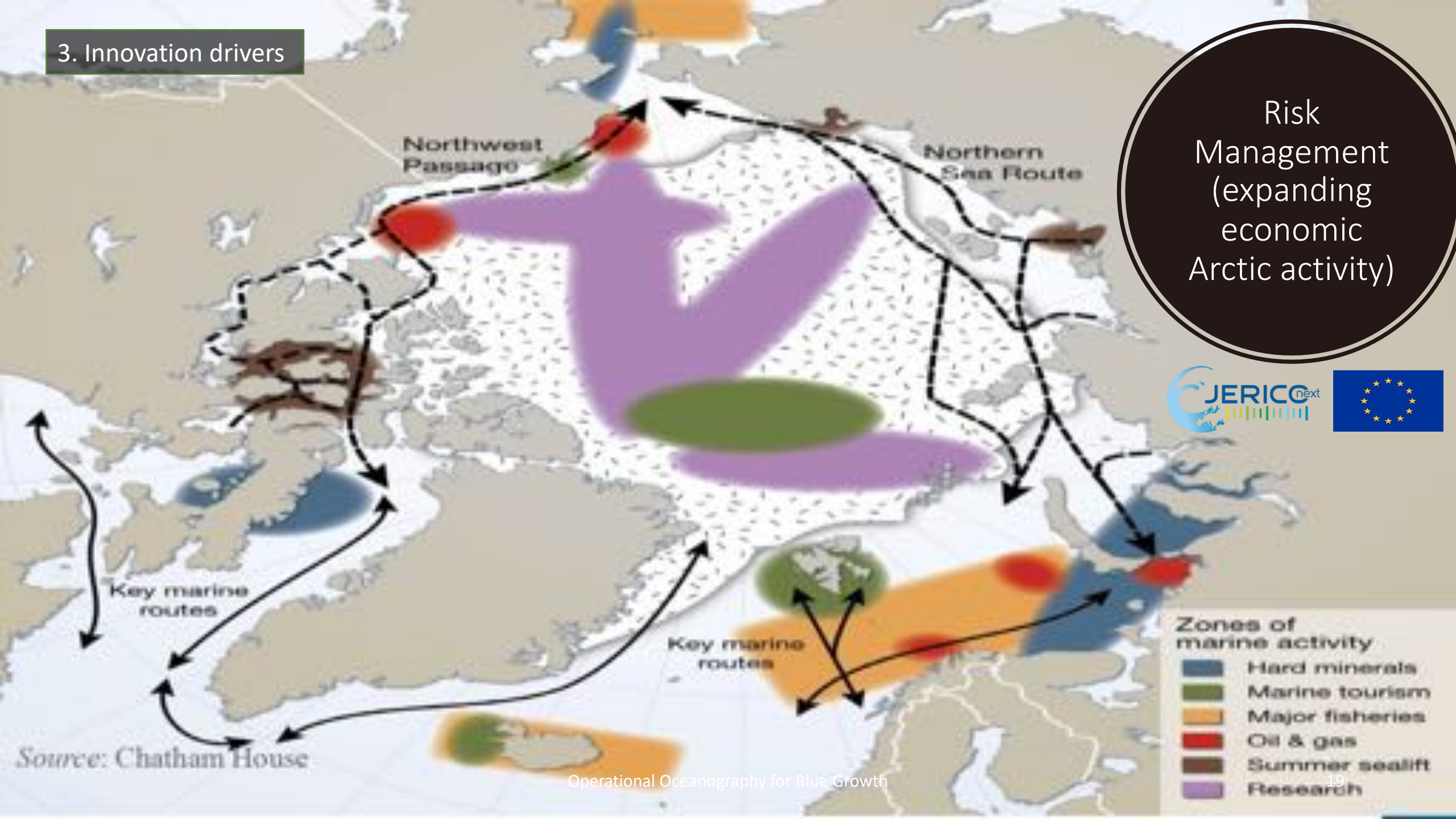
Why Holyhead ?

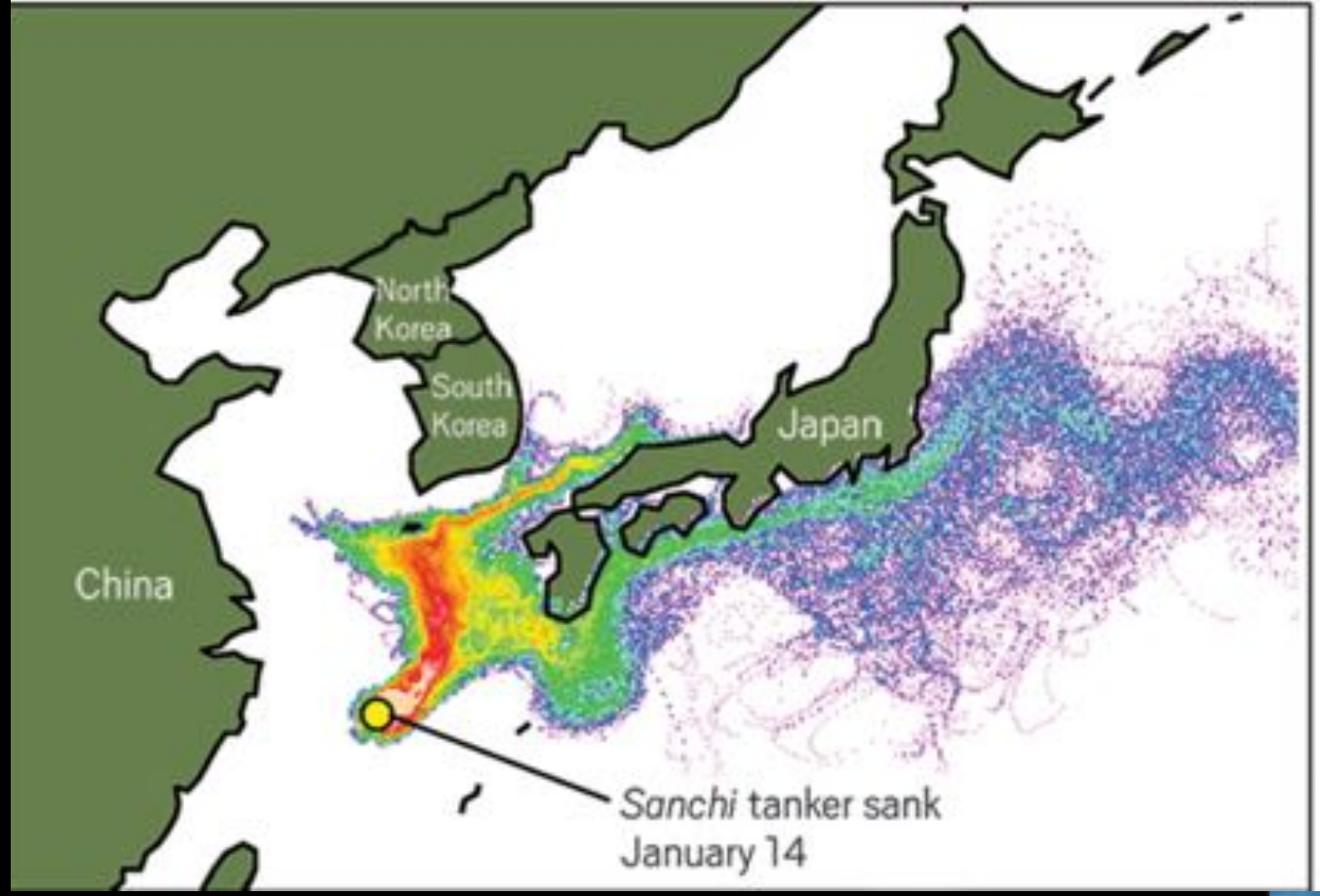
"Unique collaborative research opportunities offered by Bangor University and SEACAMS"

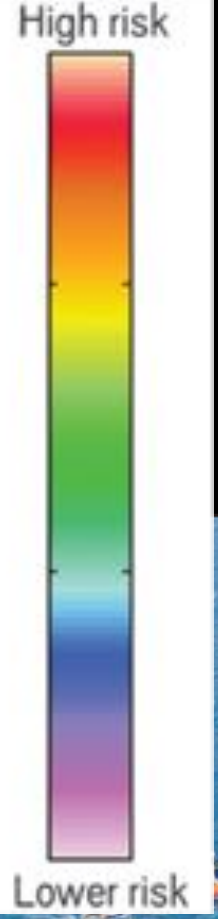
"Vision - the Holyhead Deep project is to be a part of the transition from fossil fuels to renewable energy, making the UK and Wales a global leader for a sustainable future"

3. Innovation drivers

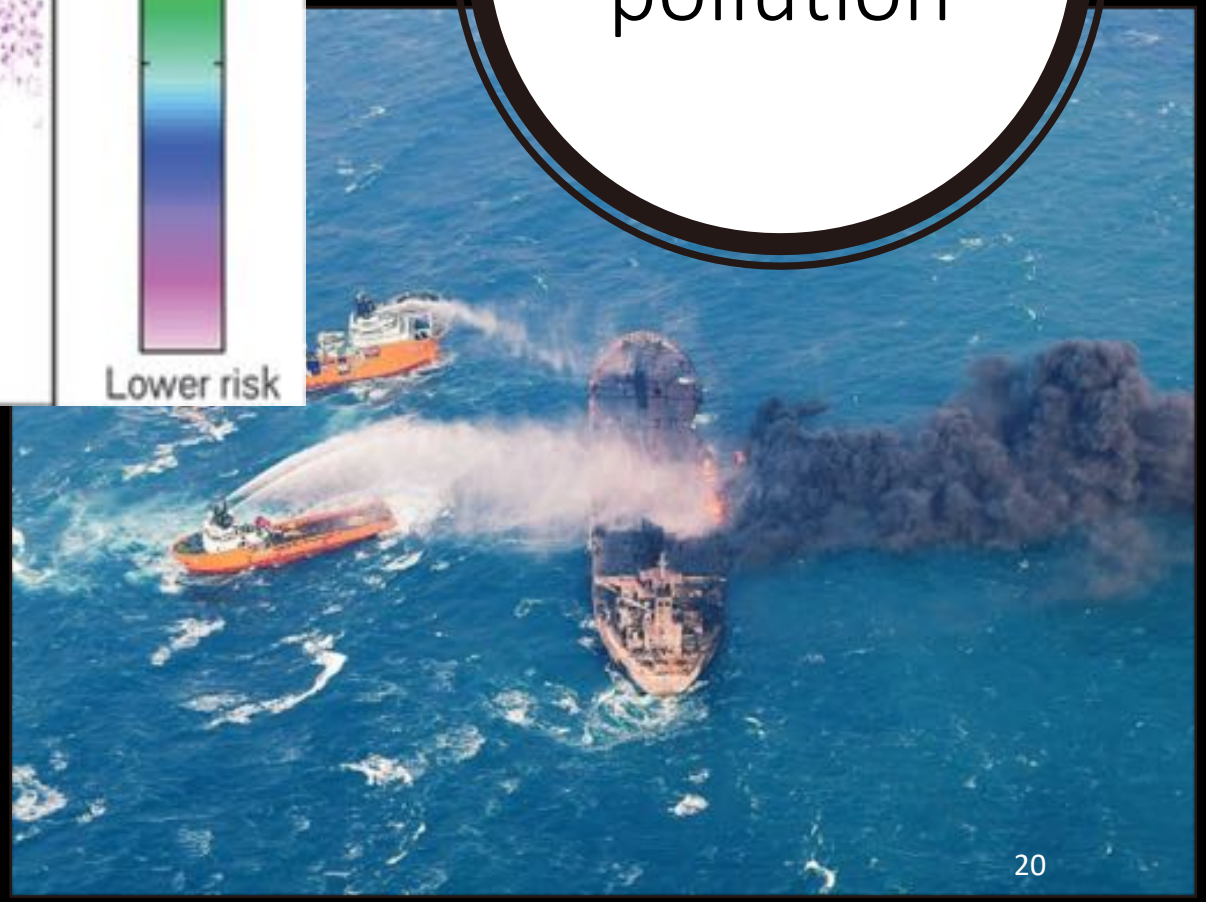
Risk Management (expanding economic Arctic activity)







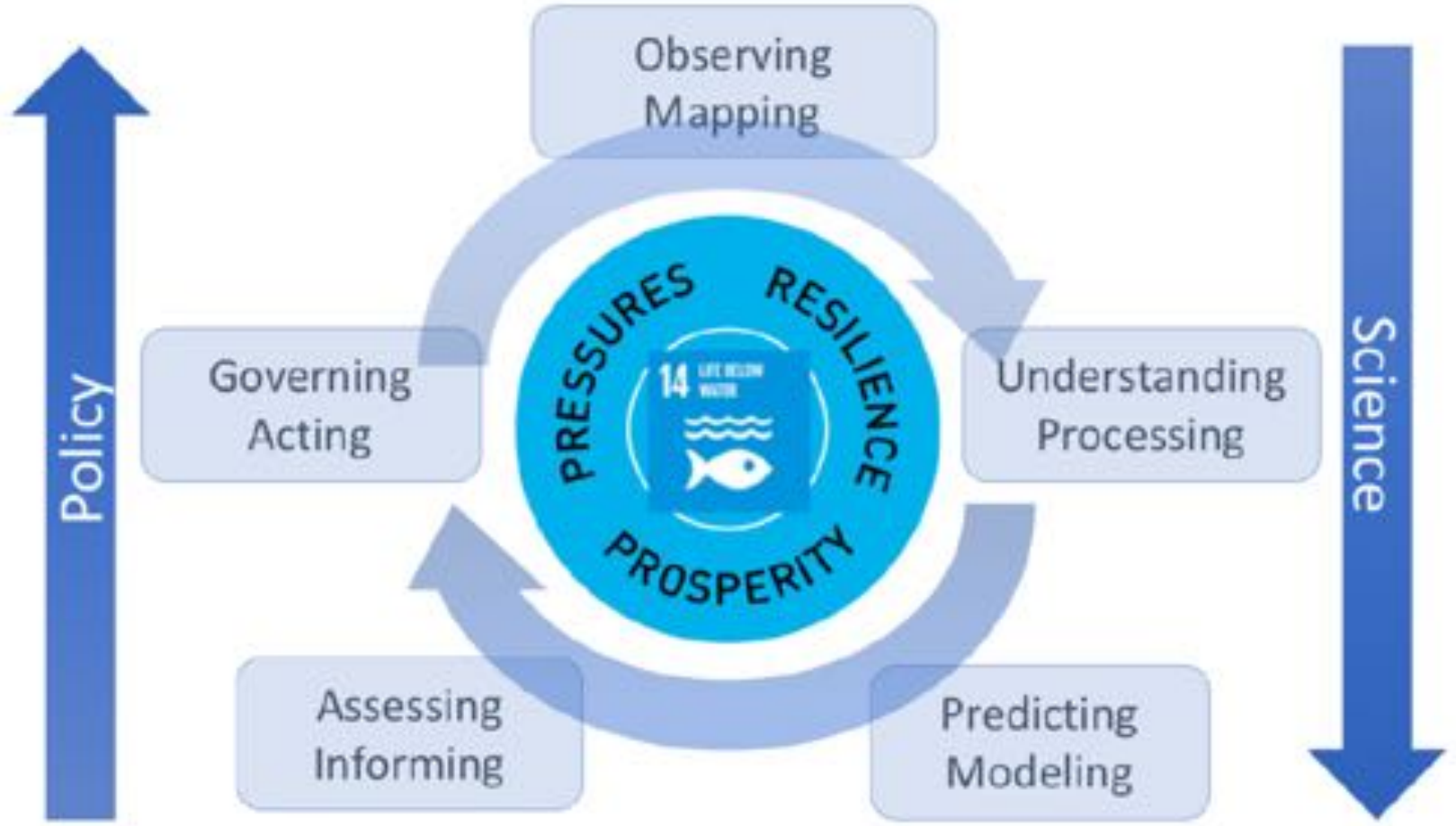
Repeated pollution



East China Sea Oil Tanker Sanchi Fire

3. Innovation drivers

Political Peer Pressure



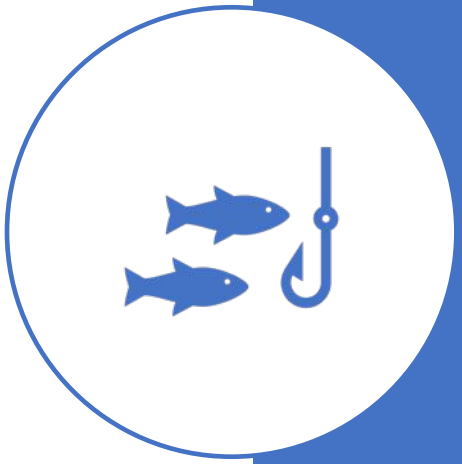
3. Innovation drivers

Visbeck: DOI: 10.1038/s41467-018-03158-3

UNDP Sustainable Development Goals (SDG)

Goal 14 – Life Below Water

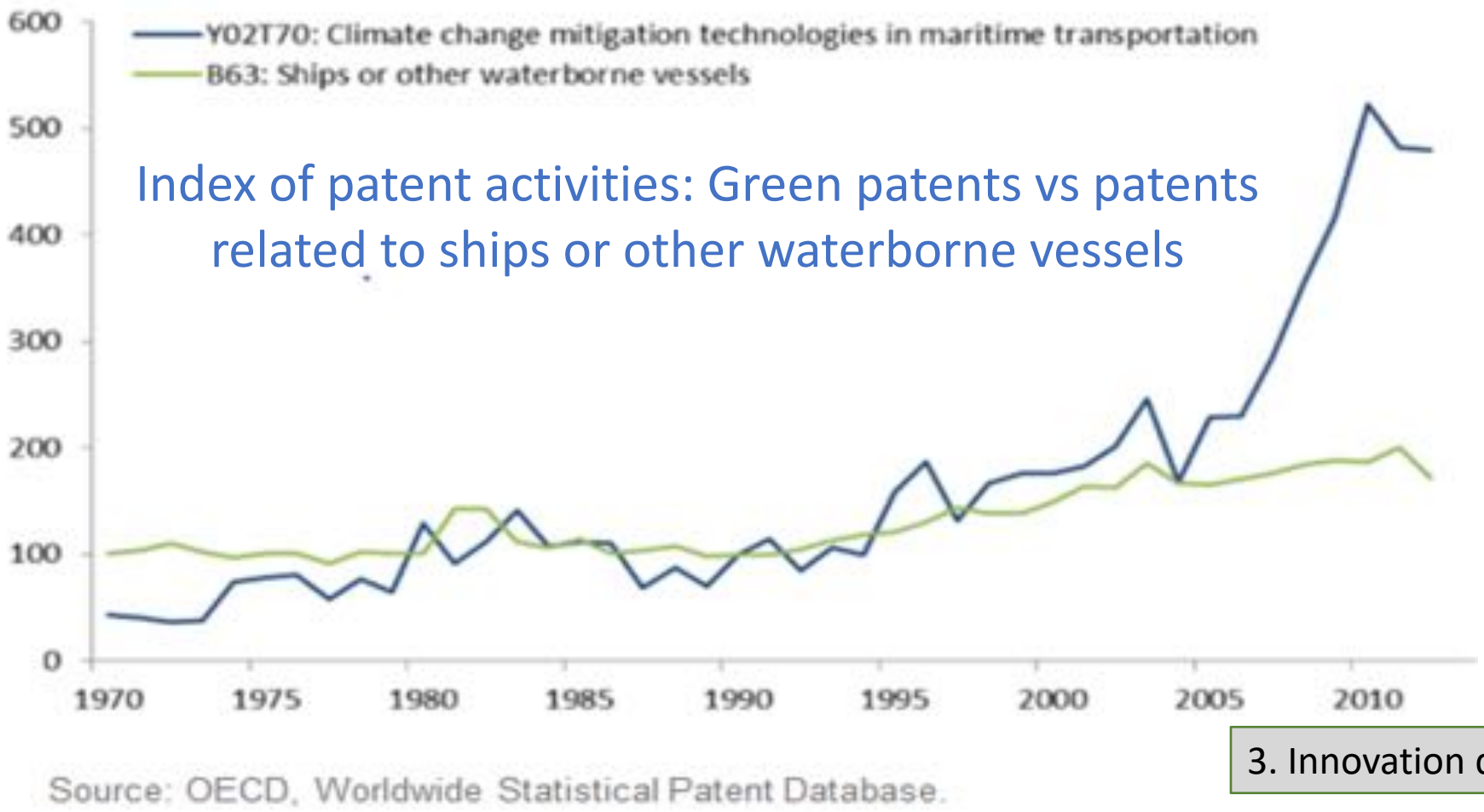
- 14.1 –By 2025, reduction of marine pollution of all kinds
- 14.2 –By 2020, sustainable management and protection of marine and coastal ecosystems
- 14.3 –Addressing impacts of ocean acidification through enhanced scientific cooperation
- 14.4 –By 2020, end overfishing and illegal, unreported and unregulated fishing and implement science-based management plans
- 14.5 –By 2020, conserve at least 10% of coastal and marine areas



Regulation

Innovation in shipbuilding for climate change mitigation:

- hull design,
- propulsion,
- emission technology
- new fuels…..



3. Innovation drivers

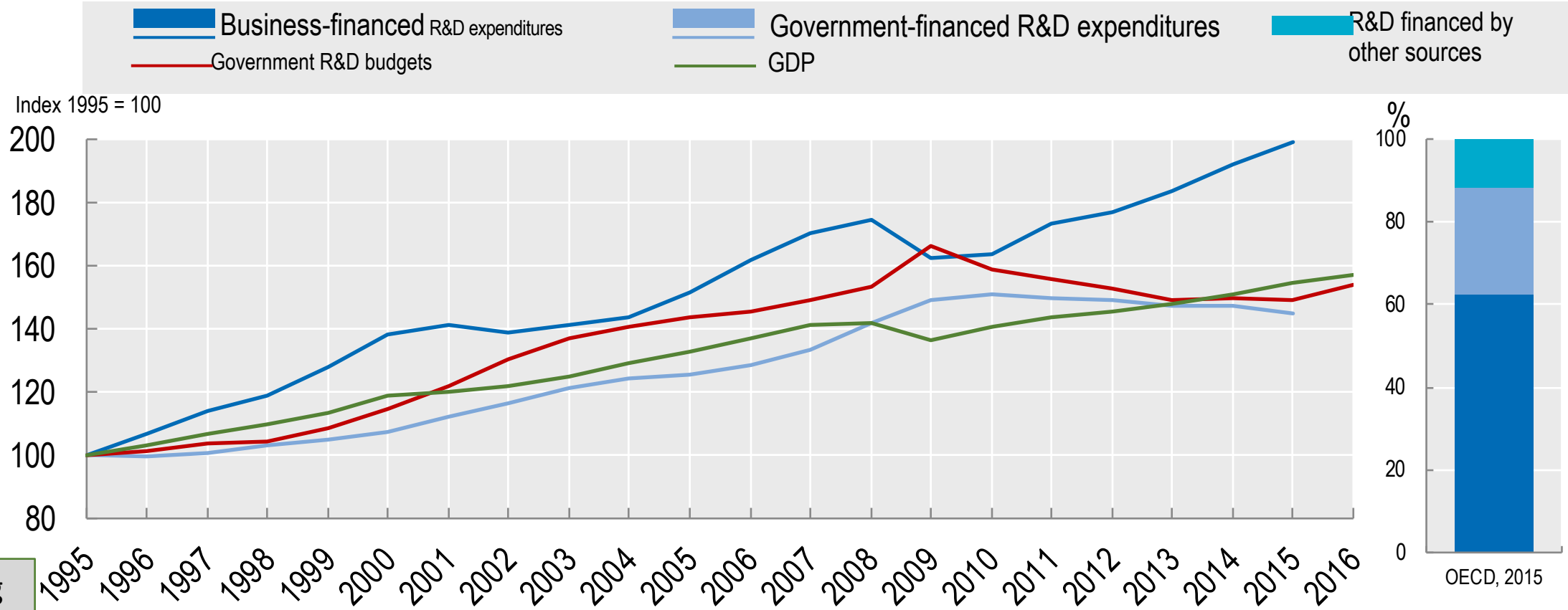
Capitalising on necessity – Rigs to Reef

- 600 rigs decommissioning planned within 5y
- 6000 decommissioned by 2040

4. Funding innovation and outlook

Public Research and Development Funding Decline

R&D expenditures over the business cycle by source of financing, OECD area, 1995-2016

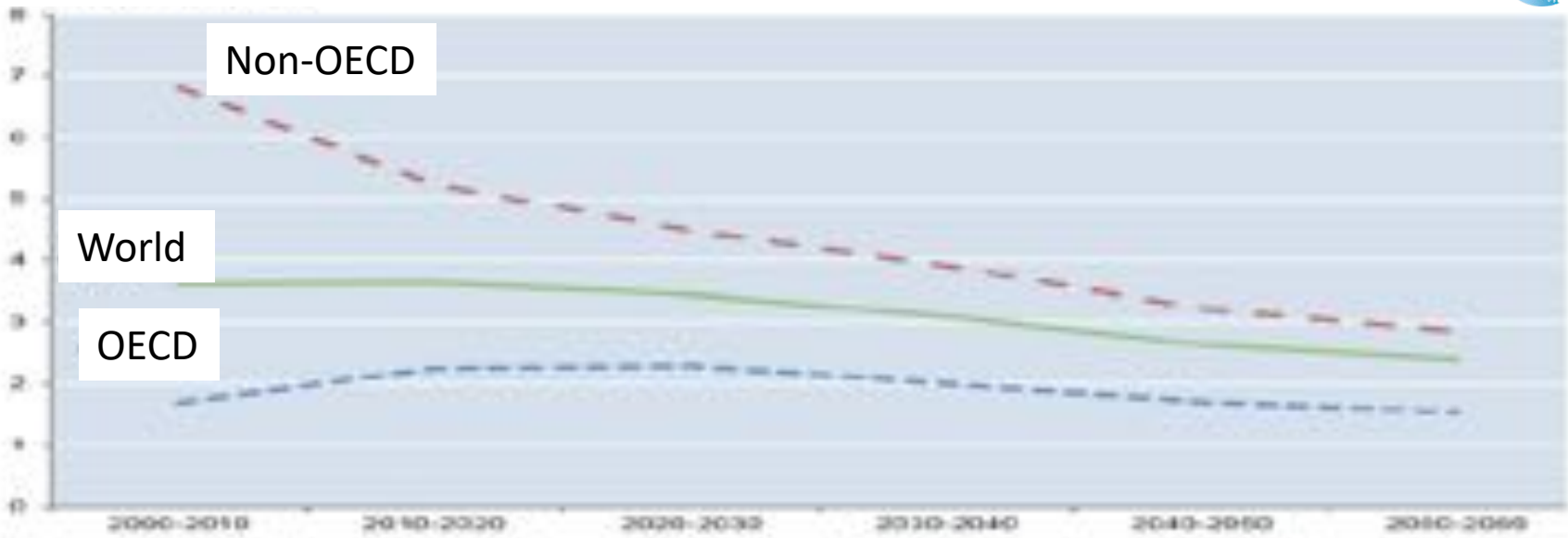


4. Funding innovation

Source: OECD Main Science and Technology Indicators Database (http://oe.cd/msti).

Long term global economic output

% average annual rate



Source: OECD Long-Term Economic Outlook, 2014

Trade increasing but at slower rates

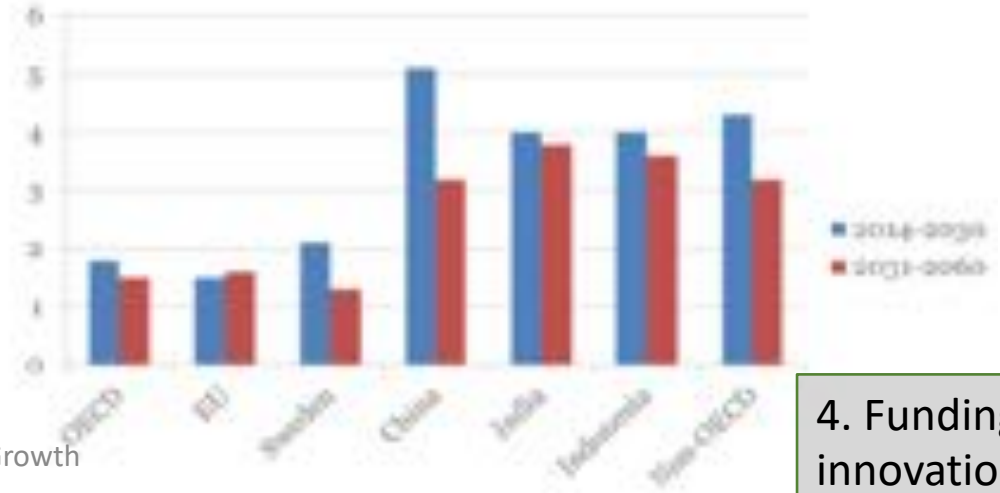
Projected average growth of seaborne trade:

2017-19: 4.1%

2020-29: 4.0%

2030-40: 3.3%

Trend productivity to 2030 vs 2060
Source OECD 2014

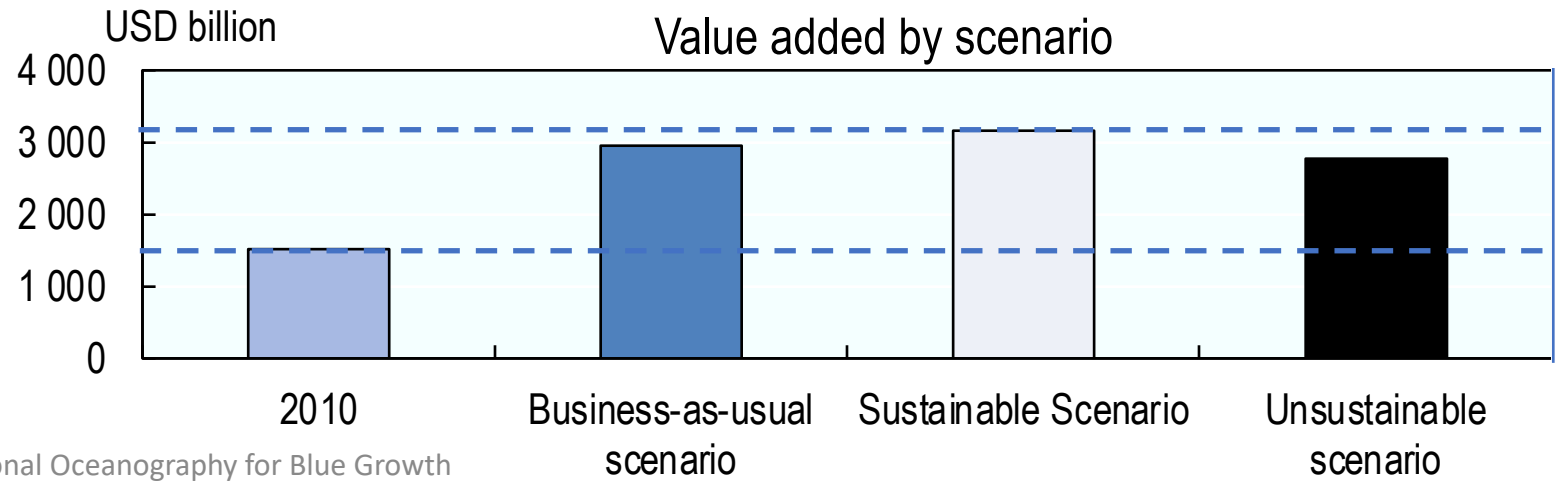


4. Funding innovation

Scenarios for Future Ocean Economy in 2030

"**Sustainable scenario**" assumes **high economic growth** & low environmental deterioration due to the **development of** resource-efficient and climate-friendly **technologies** combined with a supportive governmental framework that provides the right incentives to allow the ocean economy to **thrive economically** while **meeting environmental standards**.

"**Unsustainable scenario**" assumes **low economic growth** and serious environmental deterioration. Coupled with **faster** than expected **climate change** and **environmental damage** and **low rates of technological innovation**, the ocean economy experiences a challenging outlook beyond 2030.



4. Funding innovation

Overview

- Public spending on R&D not keeping pace with economic growth
- Anticipated further reductions in R&D due to other pressures
- How will R&D offset loss of public investment in science and technology?
  - Collaboration
- Likely increase in expectations for investments in science and technology to create impact – demonstrable economic growth & other societal benefits