This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 862626

Ocean integration:
How can we improve coordination between ocean observing activities?

EuroSea T3.9

Adèle Révelard, on behalf of all co-authors

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This work has led to the position paper:

Révelard A, Tintoré J, Verron J, Bahurel P, Barth JA, Belbéoch M, Benveniste J, Bonnefond P, Chassignet EP, Cravatte S, Davidson F, deYoung B, Heupel M, Heslop E, Hörstmann C, Karstensen J, Le Traon PY, Marques M, McLean C, Medina R, Paluszkiewicz T, Pascual A, Pearlman J, Petihakis G, Pinardi N, Pouliquen S, Rayner R, Shepherd I, Sprintall J, Tanhua T, Testor P, Seppälä J, Siddorn J, Thomsen S, Valdés L, Visbeck M, Waite AM, Werner F, Wilkin J and Williams B (2022) **Ocean Integration: The Needs and Challenges of Effective Coordination Within the Ocean Observing System.** Front. Mar. Sci. 8:737671. doi: 10.3389/fmars.2021.737671

Outline

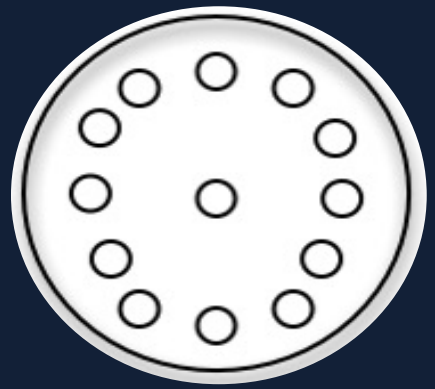
Ocean integration…

1. What does it mean?
2. Why do we need it?
3. The barriers and solutions (examples from different fields)
4. Proposal for specific actions

Ocean integration: what does it mean?

Integrated science = interdisciplinary or transdisciplinary science

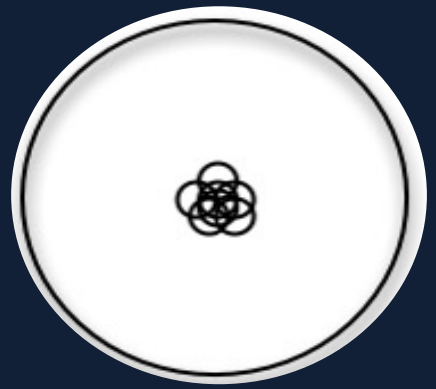
Multidisciplinary



Additive approach

Each persist in its own way of working

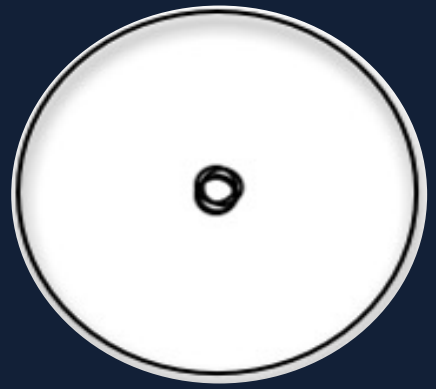
Interdisciplinary



Interactive approach

Synthesizes knowledge and method from multiple disciplines

Transdisciplinary



Holistic approach

Produces a new, novel form or way of working, beyond the reach of individual disciplines

Adapted from Alexander Refsum Jensenius, music researcher, https://www.arj.no/2012/03/12/disciplinarities-2/

Ocean integration: what does it mean?

Ocean = complex system ➡ need to combine data from:

- multiple disciplines *(physics, geochemistry, biology)*
- multiple *in situ* platforms *(buoys, moorings, gliders, ships, etc.)*
- multiple remote platforms *(satellites, HF Radar)*
- multiple numerical models

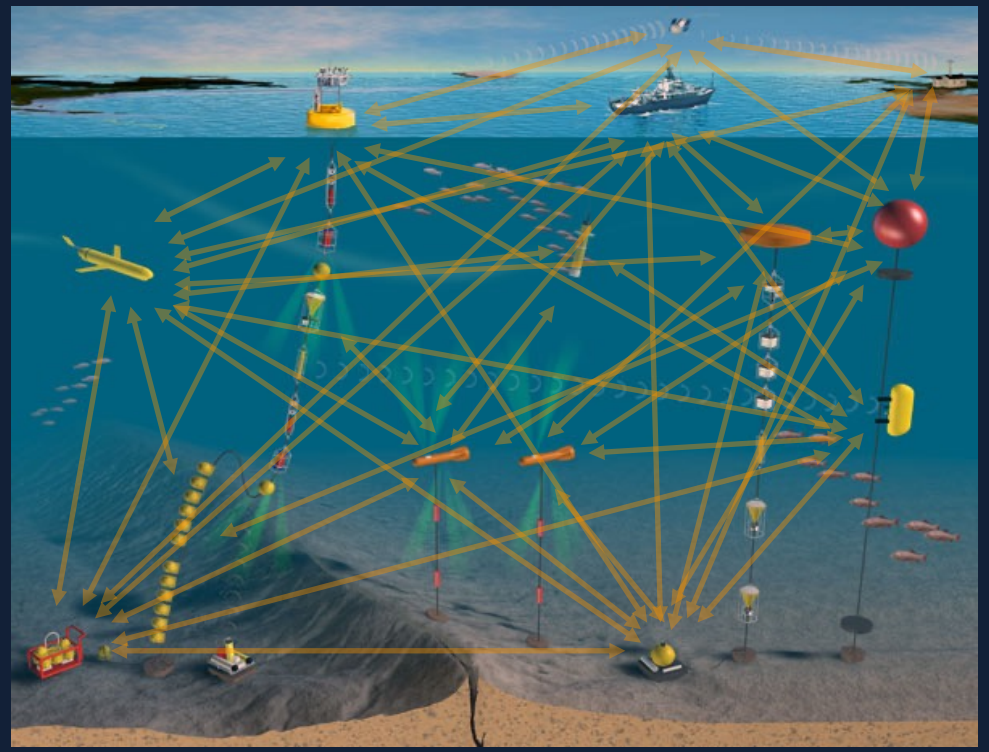
Ocean integration

=

optimally coordinate all these elements

so they are **shaped to each other**

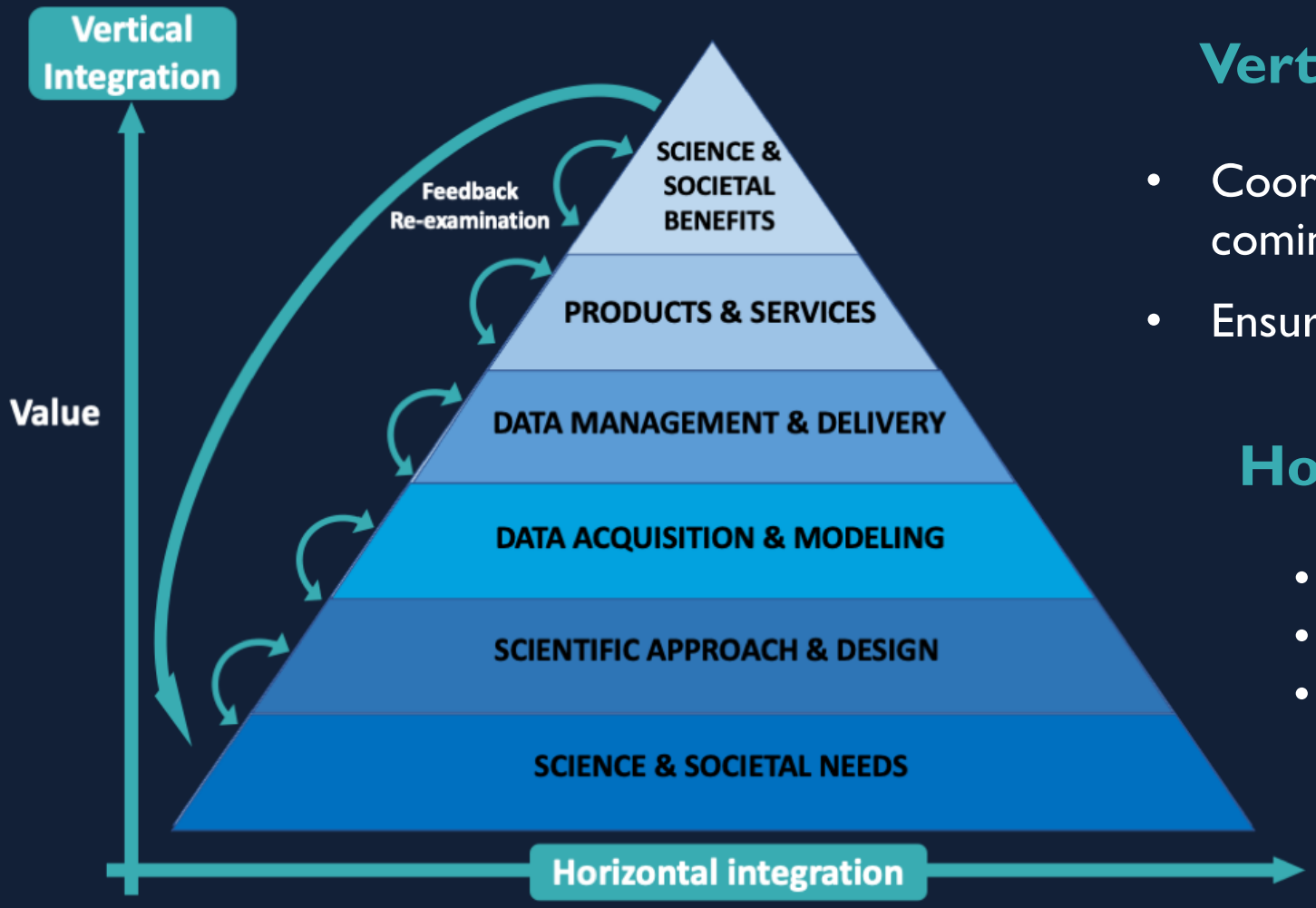
and **form a coherent whole**



Adapted from NOAA

Ocean integration: what does it mean?

Ocean integration = vertical + horizontal integration



Vertical = along the value chain

- Coordinate the different stages of a single data, coming from one single platform (Argo, satellite, etc.)
- Ensure the final data is fit-for-purpose

Horizontal = at the same value level

- Create synergies between partners
- Elaborate products combining multiple data
- Ensure data are fit-for-multiple purposes

Adapted from Pearlman et al. (2019) and EMB (2021)

Ocean integration: why do we need it?

Current issues restricting our ability to advance faster:

- **Gaps in ocean observing coverage**
  - → Important processes insufficiently measured
  - → Observing networks only partially adequate for addressing new scientific challenges
  - → Observing networks do not resolve multiple spatiotemporal scales

Global Ocean Science Report, 2017; 2020
IOC, 2017;
NASEM, 2017; 2020
EOOS, 2018;
IPCC, 2019;
EMB, 2013, 2019,;
OceanObs'19;
Tanhua et al. 2019;
Davidson et al. 2019

- **Insufficient sharing**
  - → Lots of observations are not FAIR
  - → Most observations cannot be used to their full extent
  - → Difficulties in implementing data assimilation and model verification

- **Duplication of effort**
  - → Little communication between teams, institutions or nations
  - → Most observations are not fit-for-multiple purposes
  - → Non-optimum use of resources

Data do not exist
Data exist but they are not available
Data exist but they are not fit-for-use

(EOOS, 2018)

Ocean integration: why do we need it?

Urgent need:
assist a better ecosystem-based management of the ocean

Ocean integration is **essential** to

commensurate with the **ambition** of the

UN Decade of Ocean Science

and the **Digital Twin of the Ocean**

What are the barriers and solutions to integration?

Examples from different fields

The obstacles to transdisciplinary research

Interpersonal & organizational barriers

- Difficulties in **communication**
- **Lack of clarity** regarding the goals/definition of integration
- **Diverging project objectives** between participants
- **Lack of ownership** in the project's integration phase

Parker et al., (2002)
Jakeman and Letcher (2003)
Wickson et al. (2006)
Tress et al. (2006, 2007)

Time demands & external barriers

- The considerable **time demands** of integration
- The lack of necessary **resources**

Academic traditions & epistemological barriers

- The **difficulty of coping** with **different academic traditions**
- The tendencies for **limited trust in other knowledge domains**
- The **academic merit system**

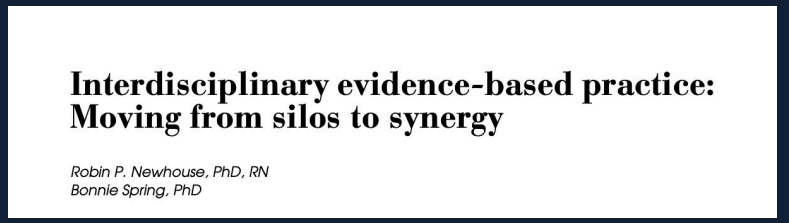
The obstacles to transdisciplinary research

"Obstacles are embedded in the ***traditional disciplinary structures, norms and practices*** of our science systems" OECD report, 2020

Major barriers:

- The **silos of expertise**
- The **disciplinary-oriented** structures
- The **academic merit system**

OECD (2020)
Stirling (2015)
Newhouse and Spring (2010)
Kragt et al. (2011)



The obstacles to transdisciplinary research

Research metrics tend to **prioritize progress in narrow specialized fields**

- Encourage quantity over quality
- Shift towards more mainstream, less risky research
- Societal relevance undervalued
- Long-term goals undervalued
- Coordination/communication undervalued

Reinforcing the silos!

Fewer numbers, better science

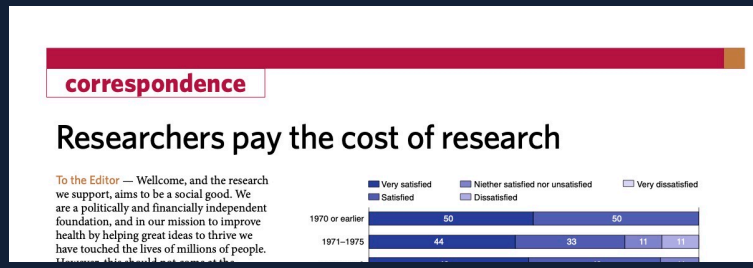
Scientific quality is hard to define, and numbers are easy to look at. But bibliometrics are warping science — encouraging quantity over quality. Leaders at two research institutions describe how they do things differently.

REDEFINE EXCELLENCE

Fix incentives

publish about 2,500 peer-reviewed scientific publications per year, with higher than average citation rates.

A few years ago, an evaluation committee



correspondence

Researchers pay the cost of research

To the Editor — Wellcome, and the research we support, aims to be a social good. We are a politically and financially independent foundation, and in our mission to improve health by helping great ideas to thrive we have touched the lives of millions of people.

Blurred distinction

The idea of research excellence is ubiquitous, but what it means depends on the context.

Excellence is everywhere in science. Or that seems to be the plan: to make excellence ubiquitous in research. This month, the University of the West Indies in Kingston, Jamaica, became the latest academic institution to encourage its scientists to excel, setting up a Regional Centre for Research Excellence in the Caribbean.

The Metric Tide, 2015. Hicks et al., 2015; Benedictus and Miedema, 2016; Van Noorden, R. (2018); Nature editorial, 2018; Bleasdale, 2019; Coriat, 2019; Moher et al., 2020; OECD report, 2020, Lubchenco and Rapley, 2020; Hernández- Aguilera et al., 2021; Delgado-López-Cózar, 2021

Solutions to foster integrative research

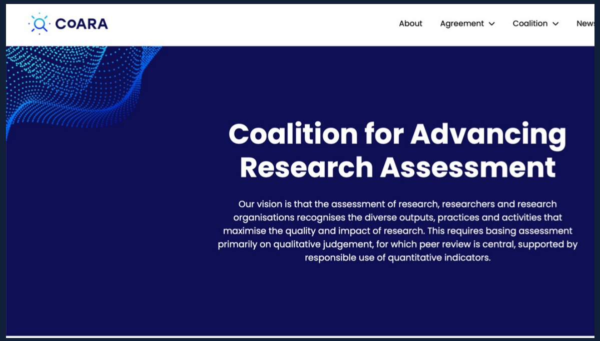
At the academic-system level:

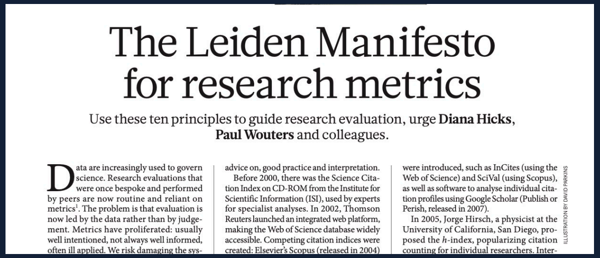
- Introduction of **thematic/challenge-based approaches**
- Creation of **transversal cross-department** structures
- Changes in **peer review, evaluation and promotion criteria**
- A **reform of the research assessment system (in progress!)**

Newhouse and Spring (2010)
OECD report (2020)
DORA (Raff, 2012)
Hicks et al. (2015)
VSNU et al. (2019).
Woolston (2021)
EU scoping report (2021)

"Scientific excellence" should include:

- The **full range of research outputs**
- The **diversity of research activities**
- **Team science & collaboration**
- **Contribution to the overall research system**


CoARA
About
Agreement
Coalition
Coalition for Advancing Research Assessment
Our vision is that the assessment of research, researchers and research organisations recognises the diverse outputs, practices and activities that maximise the quality and impact of research. This requires basing assessment primarily on qualitative judgement, for which peer review is central, supported by responsible use of quantitative indicators.


The Leiden Manifesto for research metrics

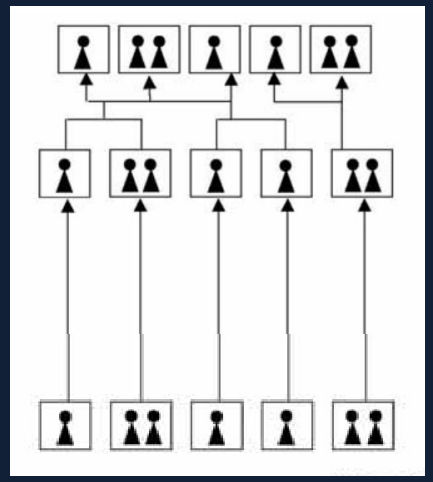
Use these ten principles to guide research evaluation, urge **Diana Hicks**, **Paul Wouters** and colleagues.

Solutions to foster integrative research

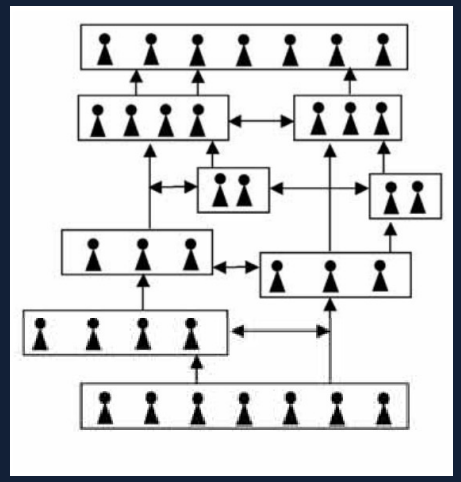
At a project level:

Tress et al. (2006)

- Make integration **an integral part of the project**
- Define a **common research question**
- Develop an **integration implementation plan**
- Have **strong leadership**
- Have high-level **interpersonal skills**
- Choose an **integrative project design**



Parallel project



Integrative project

17

Ten steps to success in integrative research projects

Bärbel Tress[#], Gunther Tress[#] and Gary Fry[##]

Organisational silos: a common matter in business

Silos exist because of:

- Internal **competition**
- Lack of **communication**
- **Lose of focus** of overall company **goals**

Common solutions:

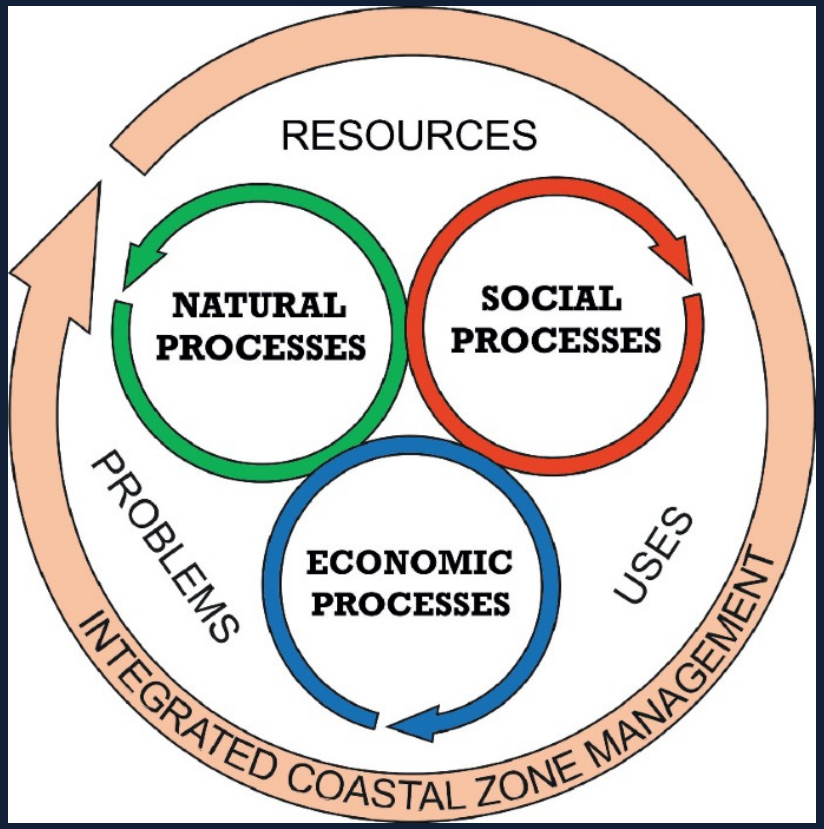
1. Define a **common goal**
2. Have a **strong leadership**
3. Stimulate high-level **interpersonal skills**
4. Remove **internal competitiveness**
5. Redesign the **organizational structure**

Integration for managing the world's natural resources

Integrated approach = coordinated management for sustainability

Ensuring the resource is used responsibly, effectively, and equitably

Examples:
- Integrated water resource management *(IWRM)*
- Integrated coastal zone management *(ICZM)*
- Integrated forest management *(IFM)*
- Marine protected areas *(MPAs)* management



Morales, 2022

Integration = taking into account many aspects :

- **Knowledge and expertise** integration
- **Ecosystem** integration
- **Social** integration
- **Economic** integration
- **Stakeholder** integration
- **Spatial** integration

Integration for managing the world's natural resources

How to manage resources responsibly, effectively, and equitably?

Top-down management

Requires:

- A **central authority**
- Strong **leadership**

Advantages:

- Set **clear goals and guide** implementation
- **Good alignment** with international priorities

Disadvantages:

- **Rules non congruent with local conditions**
- Dictatorial, users **less engaged**

Community-based management

Elinor Ostrom
(1933-2012)

Requires:

- Users agree on **goals and implementation**
- Users agree on **rules, moral and ethical standards**

Advantages:

- More **ability to bring together diverse knowledge**
- Everyone **feels part of the process, more engaged**

Disadvantages:

- Can **slow down processes**
- The **issue of ego** *(self-interest vs. overall goal)*

Ostrom, 2009; Khadka et al., 2011; Gayner et al. 2014; Serra-Llobet et al. 2016;

Collective impact organisation

When a core group of **community leaders** decide to **abandon their individual agendas** in favour of a **collective approach**

Kania and Kramer (2011)

What for?

- For **solving complex social problems** *(i.e. reforming public education, restoring wetland environments, etc.)*
- When **problems are too complex** for one single entity to be able to accomplish it alone

Hanleybrown et al. (2012)

➡ Put forward by Weller et al. (2019) for the creation of an **ocean partnerships for sustained observations**

(with non-profits, philanthropic organizations, U.S. federal agencies, and private sector)

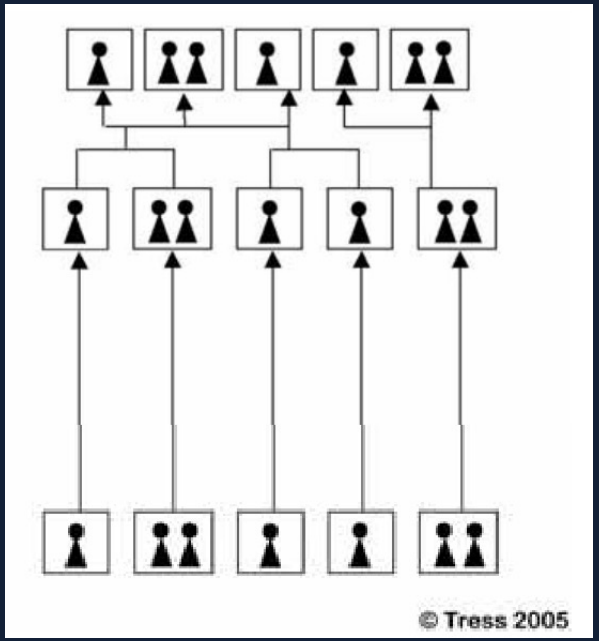
+ funders supporting the long-term collective process !

So…what about ocean integration?

Ocean integration: what are the issues?

In ocean observing, there are **organisational silos** because:

- **Research-based** system, driven by discovery and understanding
- **Unpredictable short-term** research-based funding
- **Discipline/platform-oriented** organization
- **Disparate** landscape
- **Fragmented** governance, with weak leadership
- **Hypercompetitive** culture, driven by scientific "excellence"



➡ **Platforms/networks/disciplines tend to run in parallel**

NASEM, 2017; 2020
IOC, 2017;
EOOS, 2018;
OceanObs'19;
Tanhua et al. 2019;
Davidson et al. 2019
EMB, 2021

Ocean integration: possible way forward

Ocean integration could be achieved through:

- **Building a collective impact organisation**
  - → Agreeing on a common agenda & values
  - → Designing a hybrid governance structure
  - → Establishing clear design & implementation plan
- **Reaching sustainability**
  - → Elaborating long-term funding strategies
  - → Efficiently communicate the added-value of integration
- **Promoting a culture shift**
  - → Facilitating the transition from research to operational
  - → Connecting the diverse communities
  - → Fostering FAIR data and open science practices
  - → Reforming the ocean research assessment system

frontiers in Marine Science

POLICY AND PRACTICE REVIEWS
published: 25 January 2022
doi: 10.3389/fmars.2021.737671

Ocean Integration: The Needs and Challenges of Effective Coordination Within the Ocean Observing System

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Edited by:
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Specialty section:
This article was submitted to Ocean Observation, a section of the journal Frontiers in Marine Science

Received: 07 July 2021
Accepted: 13 December 2021
Published: 25 January 2022

Citation:
Révelard A, Tintoré J, Verron J, Bahurel P, Barth JA, Belbéoch M, Benveniste J, Bonnefond P, Chassignet EP, Cravatte S, Davidson F, deYoung B, Heupel M, Heslop E, Hörstmann C, Karstensen J, Le Traon PY, Marques M, McLean C, Medina R, Paluszkiewicz T, Pascual A,

Révelard et al. (2022)
doi: 10.3389/fmars.2021.737671

Ocean integration: how to proceed?

Next step: a transdisciplinary and multi-faceted 10-year project

Two main objectives:

1) **Undertake a collective reflection** on how to implement incremental innovative actions at the governance, funding, management and cultural levels that will create the enabling conditions for a new organizational framework to arise

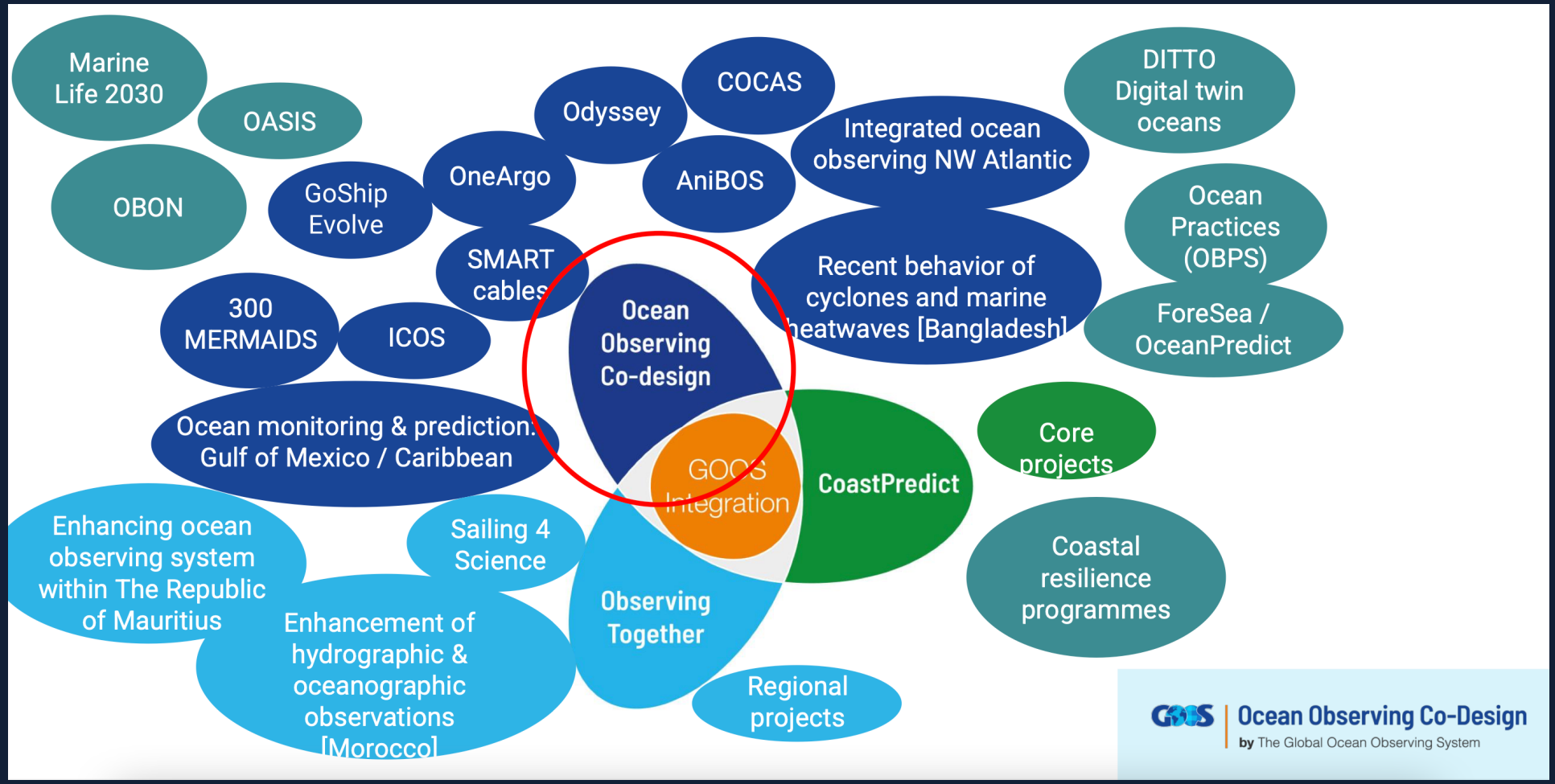
2) **Demonstrate the feasibility and the added-value** of this integrated approach at the regional scale through pilot studies

With:

- An initial workshop in 2023 with key representatives from multiple sectors to share ideas and establish a strategic plan and roadmap for implementation
- A diversity of expertise to tackle the problem under a number of angles
  (scientific, financial, political, organizational, cultural)

Ocean integration: how to proceed?

Next step: a transdisciplinary and multi-faceted 10-year project



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 862626

Merci !

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More information in this position paper:

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