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SFI Smart Ocean

How to create value from digitalisation of the ocean

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Overview

- What is a centre for research-based innovation
- History of SFI Smart Ocean and where we are today
  - Background, key challenges and possible solutions
  - SFI Smart Ocean main objectives and research areas
- Innovation potential

What is a centre for research-based innovation?

Purpose

- *"Build and strengthen Norwegian research groups that work in close collaboration with partners from innovative industry and public enterprises."*

Main objective

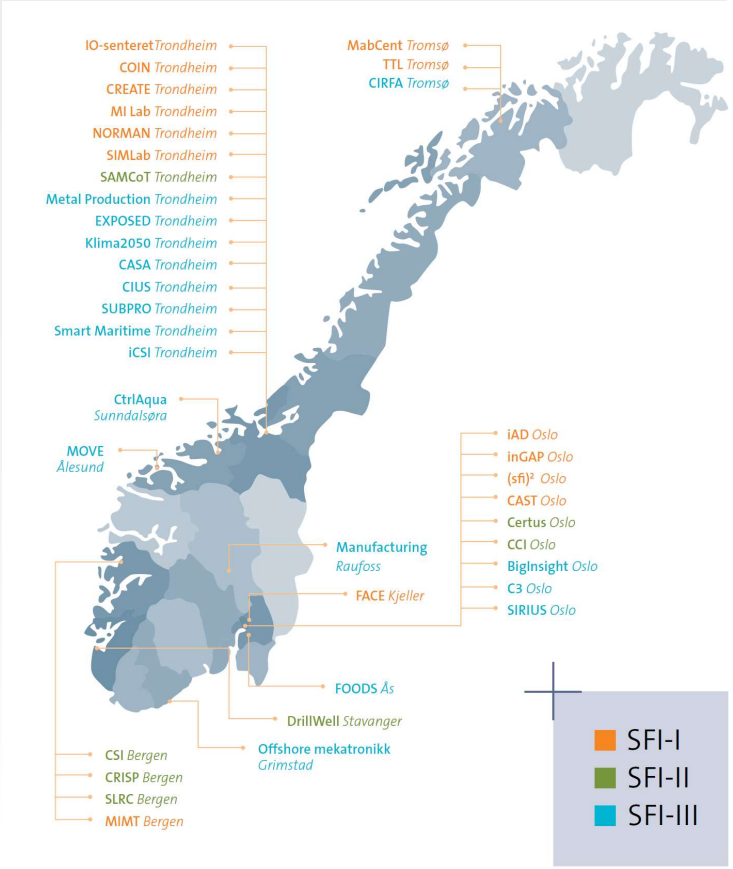
- "*Enhance the capability of the business sector to innovate by focusing on long-term research based on forging close alliances between research-intensive enterprises and prominent research groups*."

sfi Centre for Research-based Innovation

The Research Council of Norway

What is a centre for research-based innovation?

- Budget ~ 20 MNOK per year over 8 years
- Min. 25% private funding
- Max. 50% public funding
- Cash and in-kind from industry
- Start-up → large companies
- Different entry levels of funding
- Goal: ~ 10 to 20 companies
- Next announcement «SFI-IV» expected late fall 2018



The gain of cooperation

- SFI feedback and evaluation:
  - Cooperation with highly qualified researchers and complementary competences
  - Cooperation and access to physical resources
  - Enhanced innovation opportunities
  - Stronger ability for international research funding and cooperation
- Industry involvement – success factor for innovation

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You: “What’s in it for me?”

Figure C: Have the partners at the SFI center made any innovations that you believe will strengthen the sector or industry you are part of?

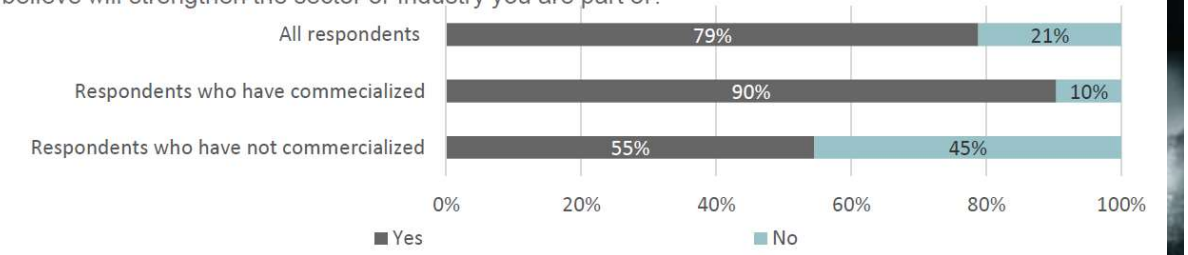
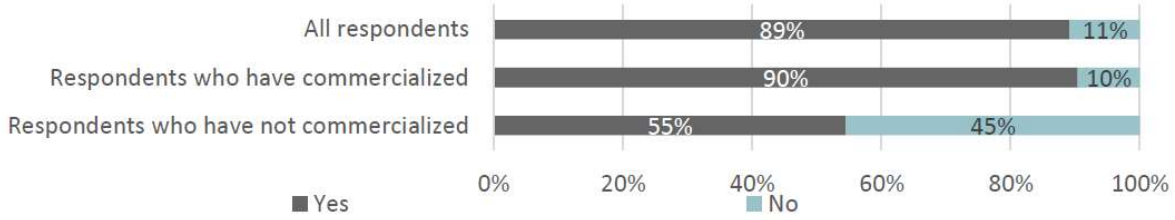


FIGURE 6.6

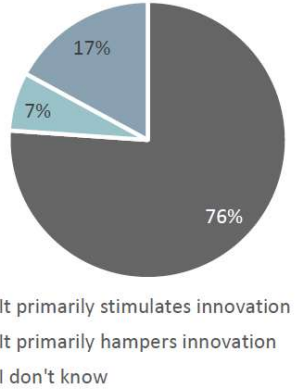
Firgure A: Has the SFI center or SFI centers you are affiliated with been a success?



damvad ANALYTICS

FIGURE 3.1

“In your opinion, does the consortia agreement for the SFI primarily stimulate or primarily hamper innovation?”



rce: DAMVAD Analytics Survey for Partners in SFI centres, 2017.
e: n=205

The Research Council of Norway

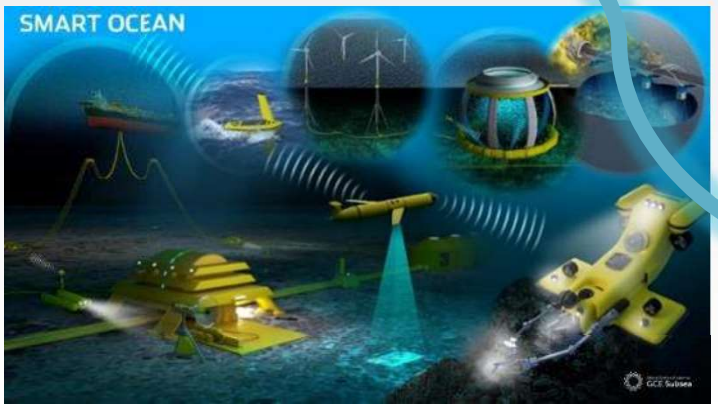
SFI Smart Ocean – digitalisation of the ocean

Goal: Enable digitalisation for ocean based industries as seen for land based industry

Innovation: Enabling solutions in a far more hostile environment and at different conditions

SFI Smart Ocean - timeline

2016: Questionnaire all R&D partners in GCE Subsea
Start-up SFI R&D pre-project group



2017:

Meetings with R&D partners, related SFI initiatives and industry.

Subsea innovation day.

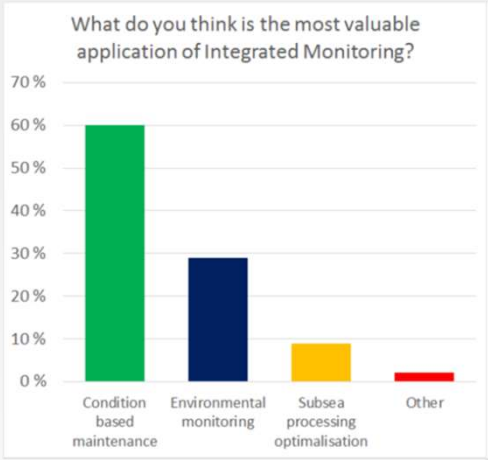
One-on-one research group meetings and R&D workshop.

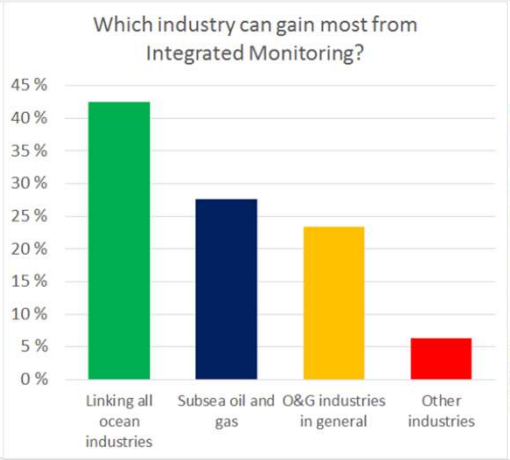
2018: UiB, HVL and NORCE/CMR have outlined the SFI Smart Ocean concept.

More partners are welcome.

SFI Smart Ocean - background

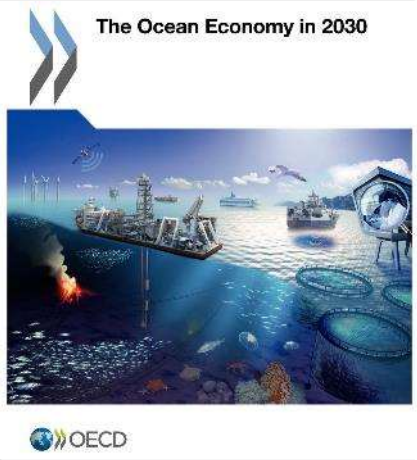
UN Sustainability goals





Innovation day feedback

Global Centres of Expertise
GCE Subsea



Ocean industries can double their contribution to the global economy by 2030 (OECD)

Key applications and challenges to be solved

Safe and cost efficient resources and environment management and operation.

- Condition based maintenance
- Environmental monitoring
- Sustainable utilisation of ocean resources
- Production optimisation

Global Centres of Expertise
GCE Subsea

Solutions and features of special interest

Safe and cost efficient resources and environment management and operation.

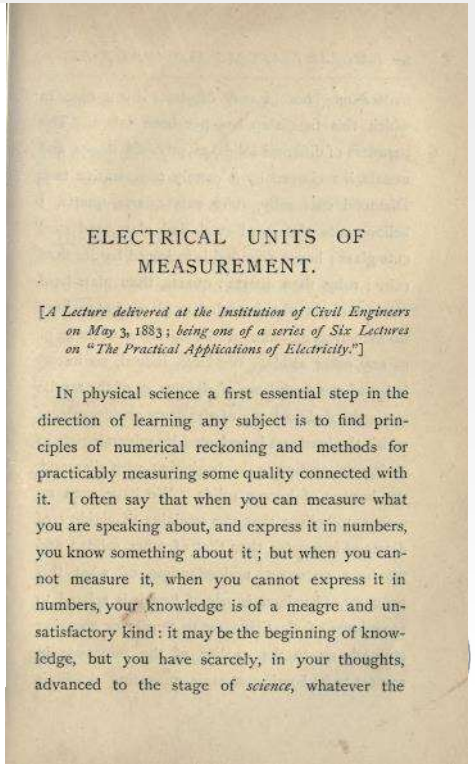
- New/smarter sensors
- Platform, network, and observation methodology
- Advanced data analysis

Global Centres of Expertise
GCE Subsea

The importance of measurements

"….when you can measure what you are speaking about, and express it in numbers, you know something about it; when you cannot measure it, your knowledge is of a meager and unsatisfactory kind….."

Sir William Thompson (later Lord Kelvin) 1824 - 1907
Address to Institute of Civil Engineers 1883



ELECTRICAL UNITS OF MEASUREMENT.

[*A Lecture delivered at the Institution of Civil Engineers on May 3, 1883; being one of a series of Six Lectures on "The Practical Applications of Electricity."*]

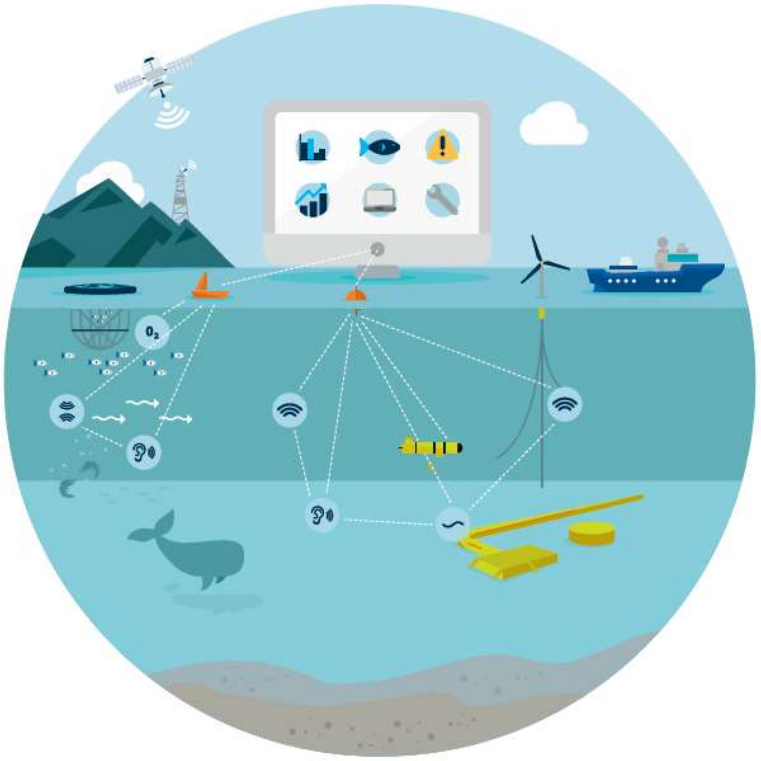
IN physical science a first essential step in the direction of learning any subject is to find principles of numerical reckoning and methods for practicably measuring some quality connected with it. I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of *science*, whatever the

SFI Smart Ocean

Where are we?

Ocean based smart distributed sensing

Real-time measurements with high spatial- and temporal resolution



Sustainable blue growth
Knowledge through measurements

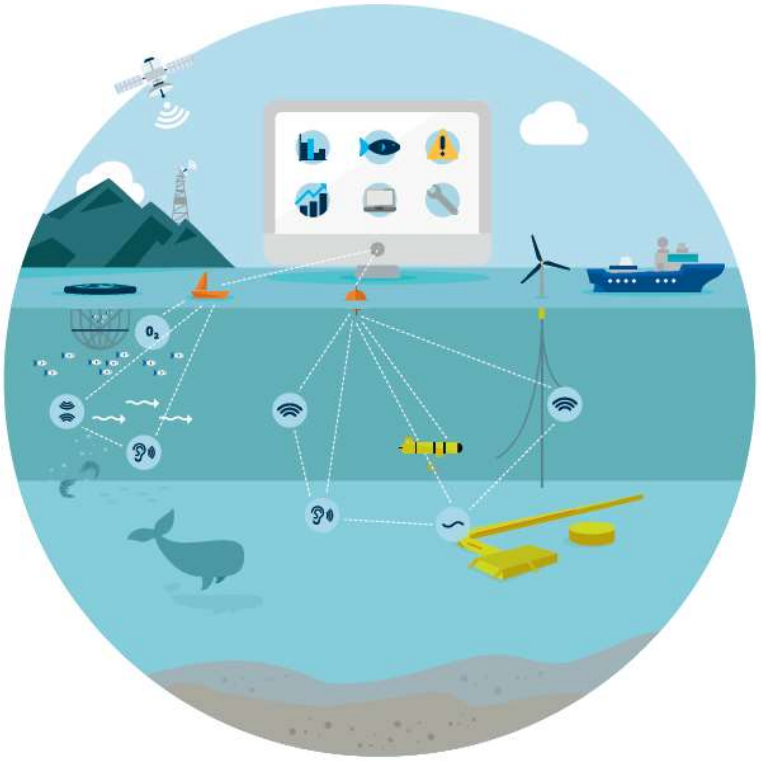
Our focus

based on your input

Distributed environmental and ecological sensing

&

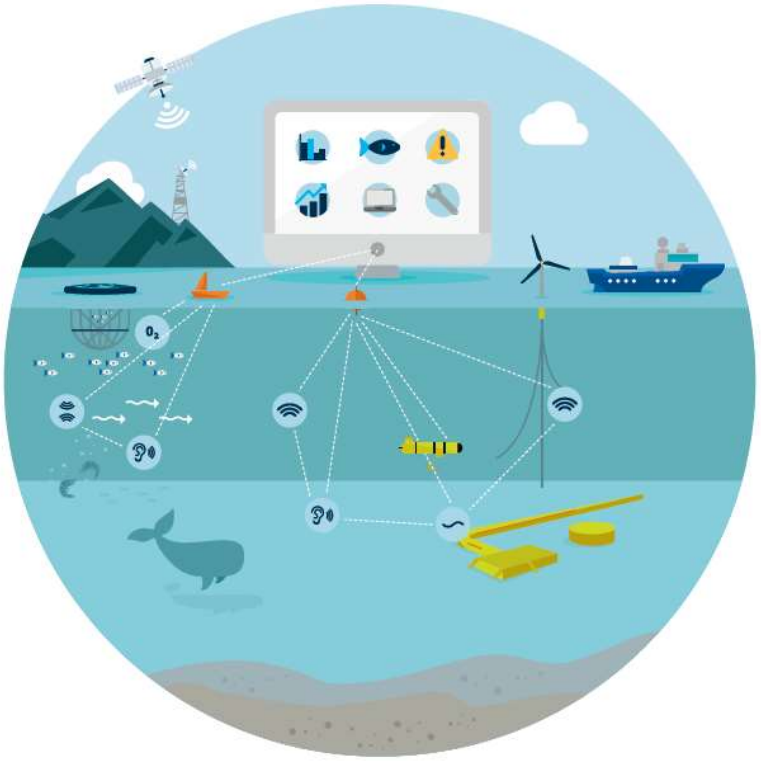
distributed sensing of marine structures



Sustainable blue growth
Knowledge through measurements

Research areas

- Monitoring strategies
- Underwater communication and Smart sensing
- Enabling sensor technology
- Data Science
- Software

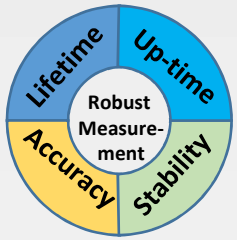


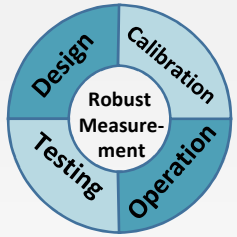
Sustainable blue growth
Knowledge through measurements

Monitoring strategies

Robustness in the whole system

- Optimal layout of the total system
- Quality of measurement data





Research tasks

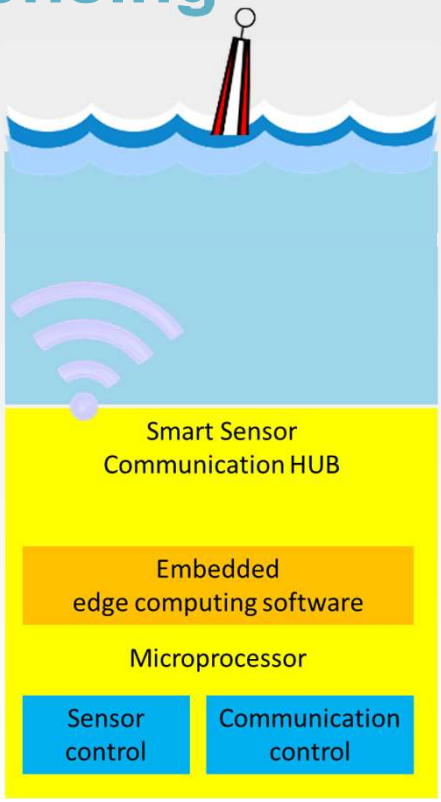
- **Optimal architecture of underwater monitoring system**
- **Total system modelling and simulation, from sensor to support**
- **Methods for online uncertainty and risk assessment**
- **Methods for remote condition assessment of sensors**

Gain for industry

Identify weak parts of total measurement and communication system and how to by design make them more robust .

Communication and Smart sensing

- Real-time monitoring
- Communication telemetry and positioning system
- Low power
- Reliable communication
- Prepossessing of data in sensor/network edge
- Adaptive sensing

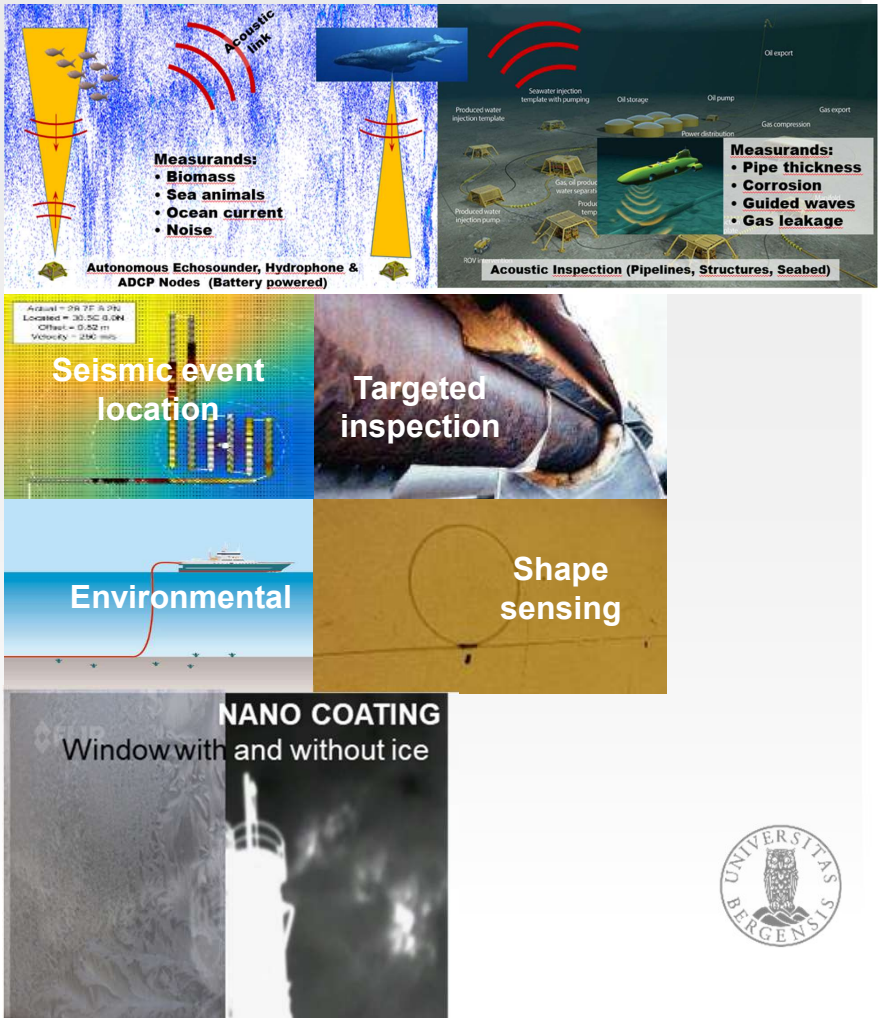


Sensor technology

- **Acoustic sensor technology:**
  - Autonomous echo sounder
  - Hydrophone
  - Acoustic Doppler Current Profilers (ADCP)

- **Novel distributed fibre optic sensors:**
  - Acoustic: motion, events
  - Humidity: corrosion
  - Strain: structure integrity
  - Temperature: environmental, exploration

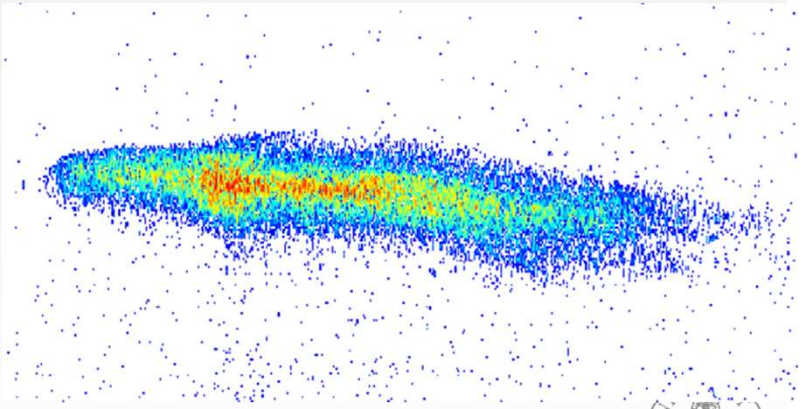
- **Nano-coating technologies:**
  - Anti bio-fouling
  - Oleo-phobic (oil repellent)
  - Anti-icing/non-fogging
  - Ultra-strong diamond coating



Data science

- **Machine learning:** Methodology for automated event and condition monitoring
- **Advanced data analysis:** Combination of measurement parameters, trend analysis, etc.
- **Image analysis:** object detection, counting and measuring
- **Video analysis:** mapping, event and object detection

Illustration by Tommy Thorseth for NORCE/CMR

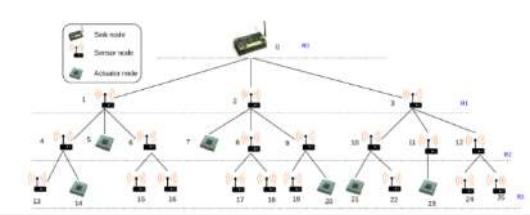


Images from NORCE/CMR

Software

Measurement and data

- sensor and control (sub)systems

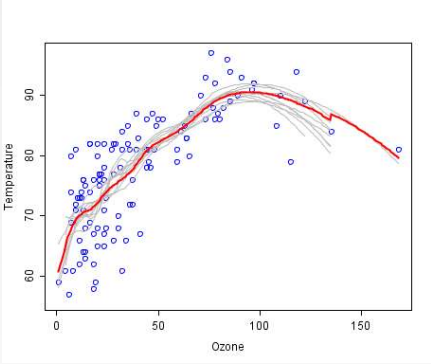


Information flow

- services and components

Knowledge

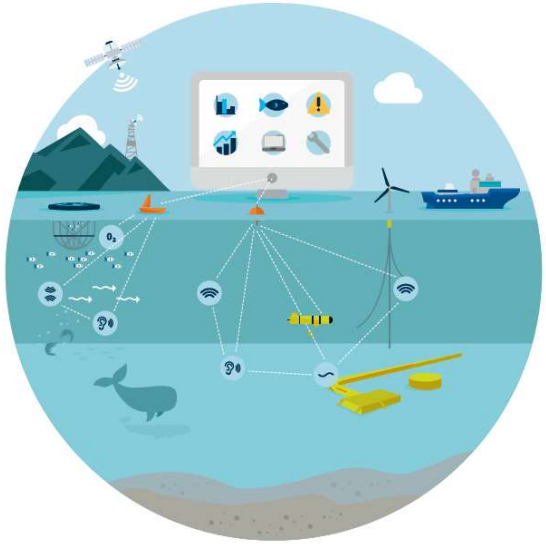
– data analysis and predication

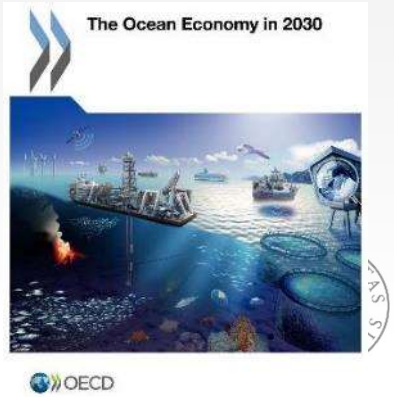


software

Potential for innovation

- Technology → Software
- Smart city, smart ocean, smart healthcare: **gather data, analyse data and evidence-based action**
- SFI Smart Ocean: smarter systems and facilitate new innovations
- Multi-disciplinary areas - technology and software





Thank you for your attention

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Eco-Lighthouse