

27-29 May 2024 



imdis

International conference on Marine Data and Information Systems



MARIS



National
Oceanography
Centre



iImagine



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Blue-Cloud2026



Foras na Mara
Marine Institute

Ireland's Digital Ocean

Enhancing Ocean Sustainability and
Informed Decision-Making through
Ocean Digital Twins and Effective Data
Management

Eoin O'Grady, Tara Keena, Andrew Conway,
Mick Gillooly

IMDIS Conference

Bergen, Norway 29th May 2024

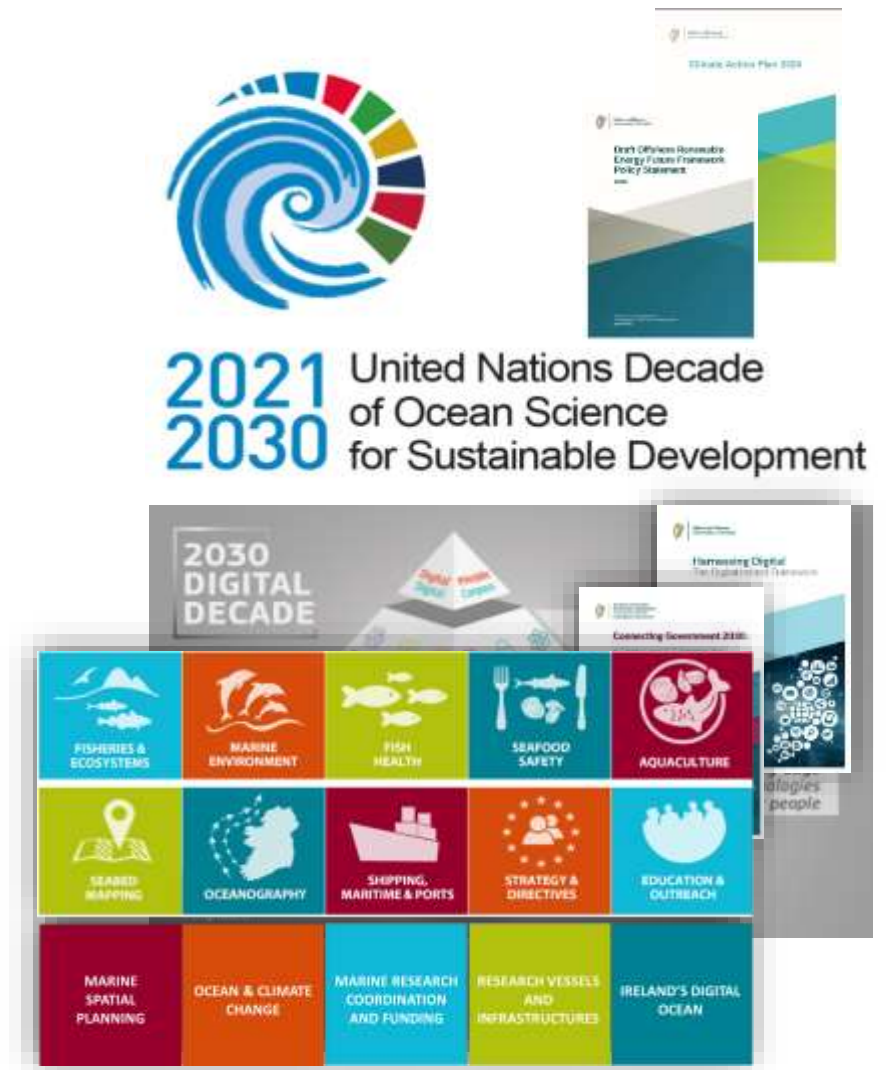


Relevant & Timely Information are Critical for Sustainable Marine Development, Management & Adaption



Decades of Ocean Science & Digital Aligning

- Decade of Ocean Science and the EU Digital Decade aligning and influencing National plans and strategies.
 - “The **science** we need for the **ocean** we want” in a **digital world**”
- Environmental strategies and plans are helping to drive environmental management and adaptation
 - Offshore Renewable Energy Future Framework
 - Climate Action Plan
 - National Marine Planning Framework & Marine Strategy Framework Directive
- National data and digital strategies are driving digital transformation and supporting evidence-based decision making
 - Harnessing Digital - The Digital Ireland Framework, Connecting Government 2030 and Open Data Strategy (2023-2027)
 - AI - Here for Good: National Artificial Intelligence Strategy for Ireland
 - Impact 2030: Ireland’s Research And Innovation Strategy
- The Marine Institute is working across these areas and leading a transition in the area of national marine digital services to support sustainable development.



OUR VISION

Digital Twins of the Ocean will make marine knowledge readily available to policy makers, stakeholders, businesses, scientists, and citizens.

'Repurposing the Wheel, Not Reinventing' Developing Ireland's Ocean Digital Twins

Our Digital Ocean Services with evolving Digital Twin capabilities will be transformative and will build on capabilities such as...

- Integrated Data Services with Quality Management.
- Analytical Tools and Capabilities building on scientific and domain expertise, with new advanced visualisation & models.
- Targeted Services with Digital Twins elements to deliver user-focused information, understanding and decision-support.



“Our digital transition will transform how we operate, engage with our stakeholders, and deliver programme requirements in areas such as climate, ocean renewable energy, maritime transport, blue bio-economy, marine spatial planning, and marine resource management.”

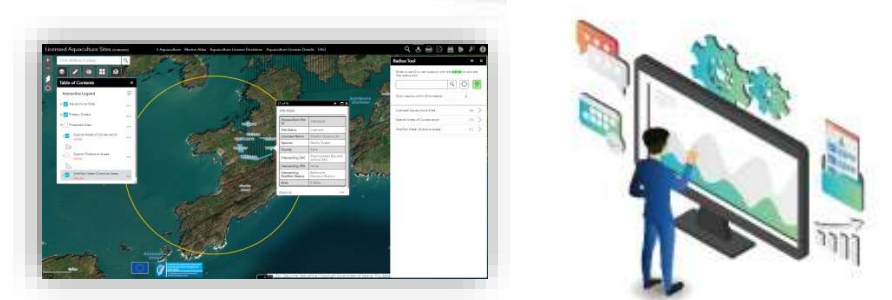
Marine Institute, Strategy 2023-2027



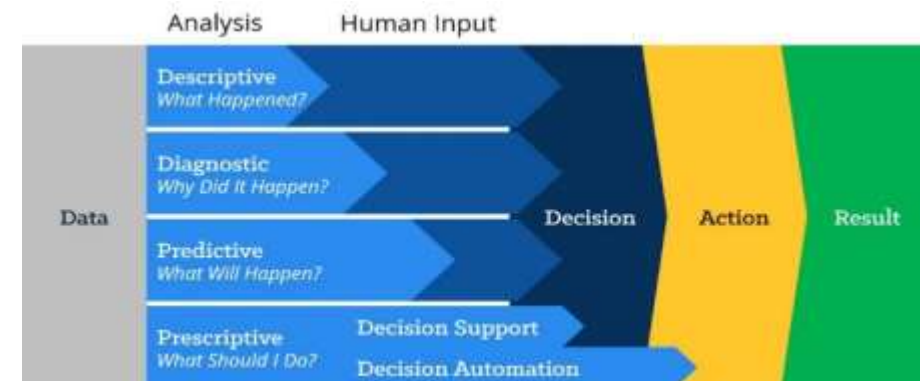
Why Digital Twins?

Enhanced Understanding & Responsive Decision-Making

- **Bridges the user-science gap** making scientific and technical information more readily usable for non-experts
- **Interactive visual information makes information more accessible for non-experts** e.g. with “real-world” visualisations, intuitive user interfaces and summarised outputs.
- **Combines data from multiple sources & disciplines**, providing users with a more integrated view, for better coverage and quality and reduced technical barriers.
- **Supports the integrated use of models for scenario planning**, services for “what-was”, “what-is” and “what-if” questions, using advanced analytics, e.g. habitat changes based on modelled temperature and seabed data analysis. Allows decisions to be better explained.



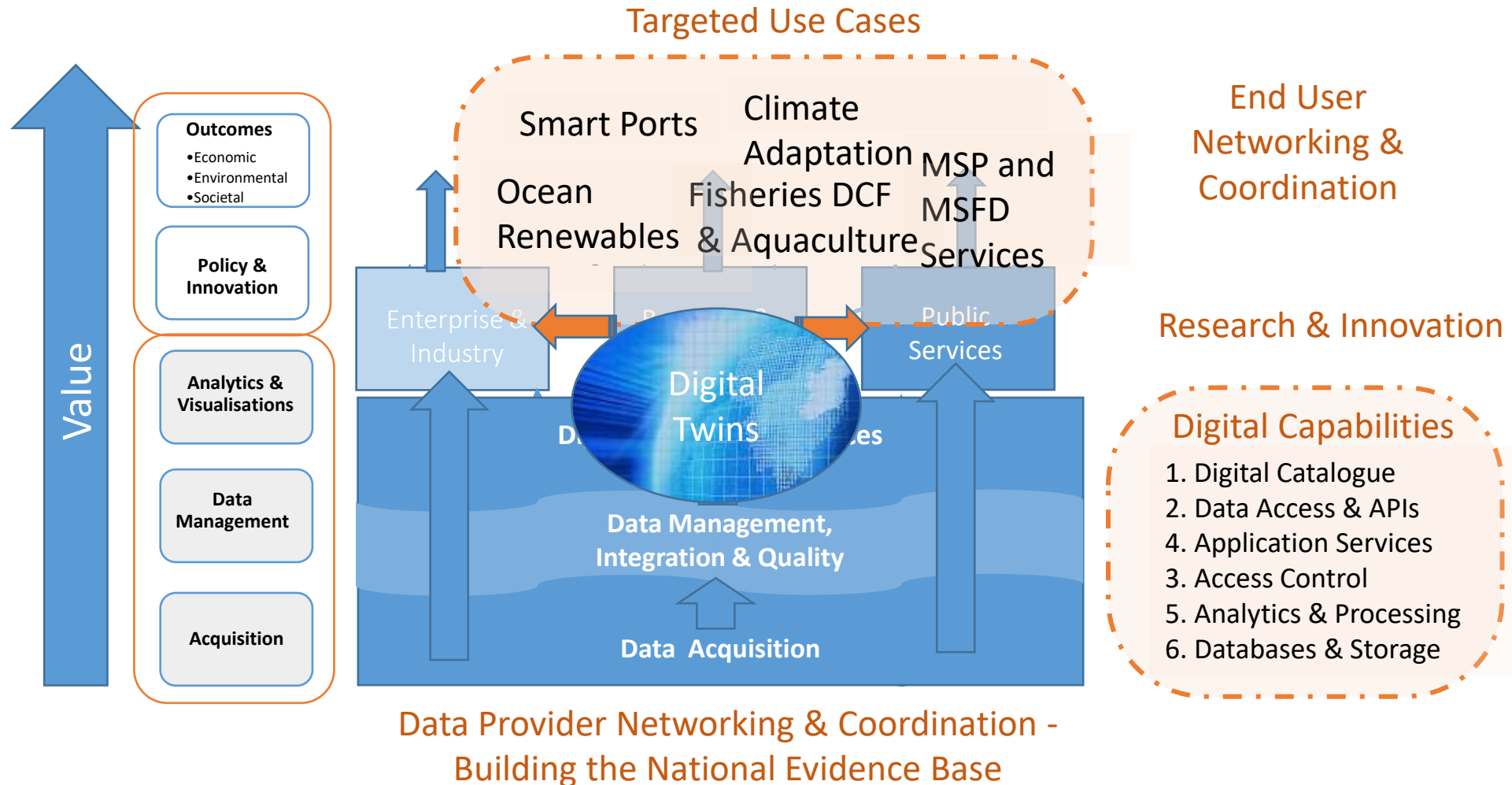
Source: EC, 2023



Adapted from Gartner Research, 2015

Source: Gartner, 2023

Developing Marine Digital Services



Bringing it all together



Policy-maker
Local Authority
Planner
Scientist
Engineer
Public



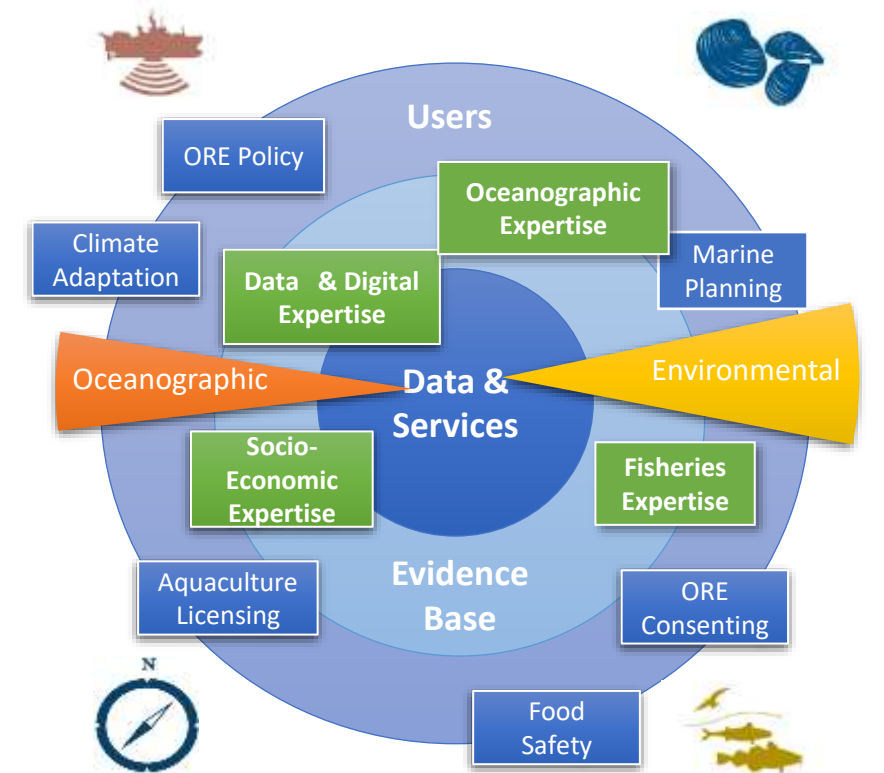
Source: EC, 2023



Building on...
Digital Ocean Platform
Digital Marine Atlas
Digital Licensing
Digital Food Safety
Digital Stockbook

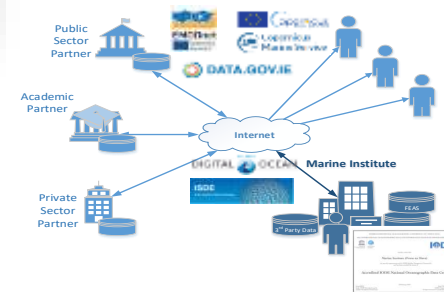
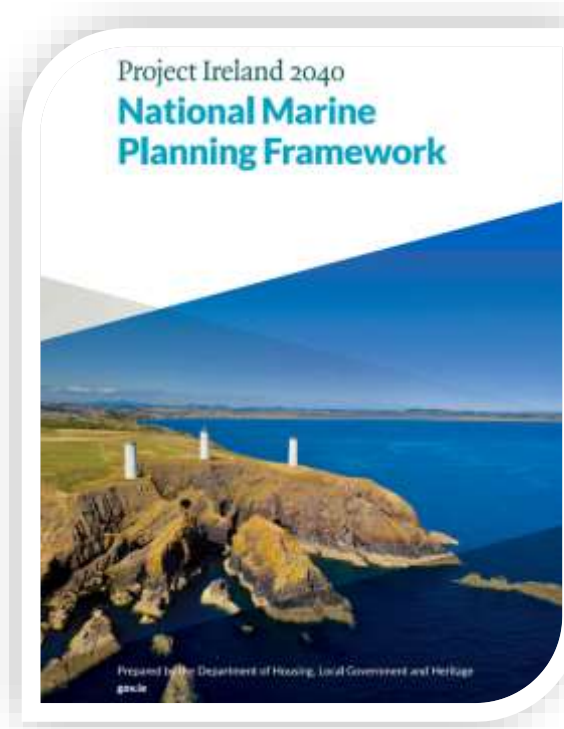
Building on Data that you can Trust

- **Trusted decision making relies on data underpinned by quality assurance**, to determine suitability for specific uses (and reuse).
- With input from national and international partners a **trusted evidence-base is being developed for national programmes** e.g. for the National Marine Planning Framework, Offshore Renewable Energy, the Climate Action Plan, etc,
- The Marine Institute's **Data Management Quality Management Framework** has been extended to over 120 data processes, complementing scientific ISO and INAB quality assurance.
- With new data from many sources, and sophisticated analytics such as Artificial Intelligence, the need for **trusted data processes & ecosystems** is increasing.



Developing the Marine Evidence Base

- **Data from 30+ partners and sources** incl. from national and international programmes e.g. **ICES**, **EMODNET**, etc.
- **Quality Assurance of data and related processes** via the Marine Institute's **IODE-accredited Data Management Quality Management Framework**.
- **Standardised data** allowed the development of data products by scientific and domain experts.
- **Digital Services** including **MarinePlan.ie** and **Ireland's Marine Atlas** provide online access for different Government, industry, academic and public stakeholders.
- The **evidence base and digital tools** now serve as key building blocks for future marine services.



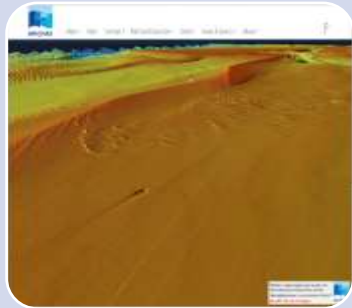
140+ Datasets, 40+ Maps, Dashboards, Viewers, and MarinePlan.ie portal



Adding Enhanced Analysis & Visualisation



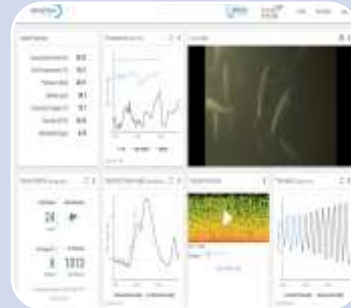
Real-time metocean observations via IoT service



Interactive seabed data visualisation & analysis services



Numerical model data with time-series selector



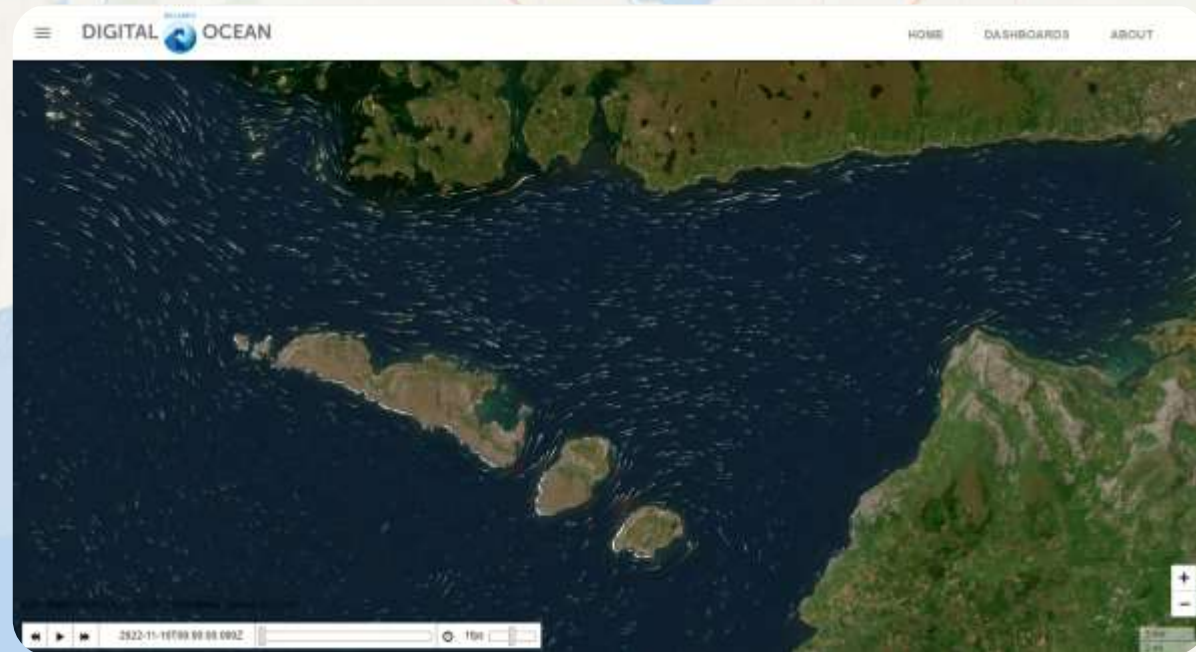
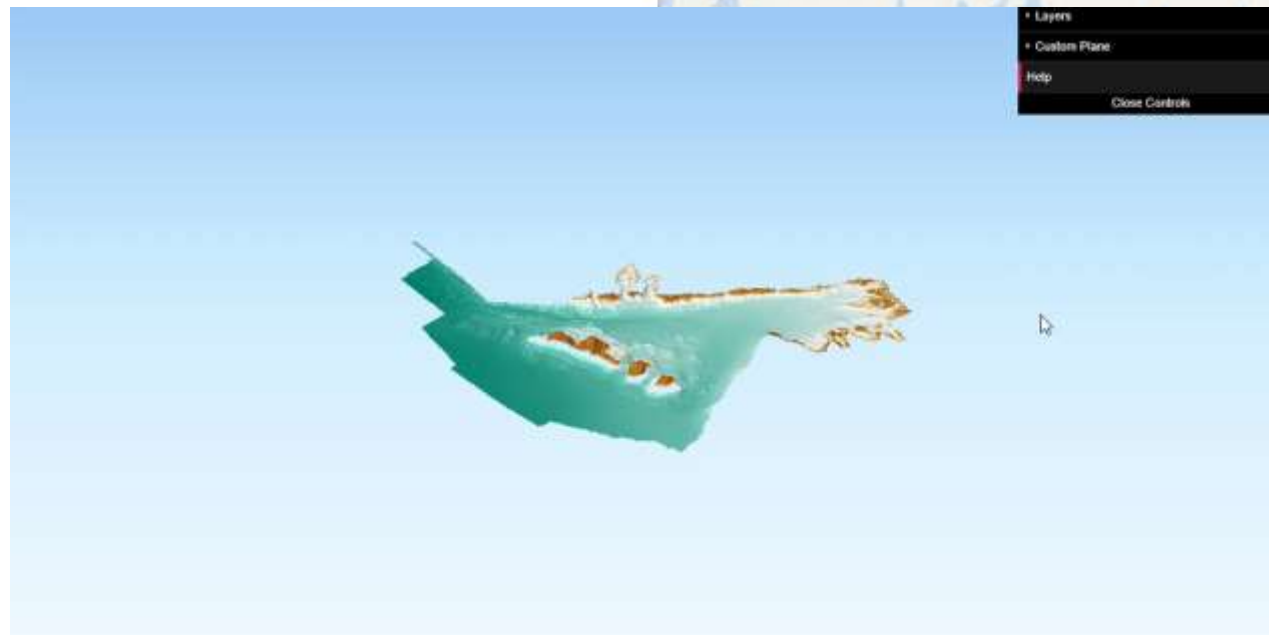
Streaming video and acoustic data via HEAnet



Automated Analysis & Processing Services



Interactive & Mixed Reality 3D visualisation for new digital perspectives



DIGITAL IRELAND'S OCEAN

HOME DASHBOARDS ABOUT

RMS Lusitania

Shipwreck 3D Model

RMS Lusitania by INFOMAR

View on Sketchfab

CANCEL

Lat, Long: 51.4124

Data from INFOMAR

Blackhead Bay

Fanor Bay

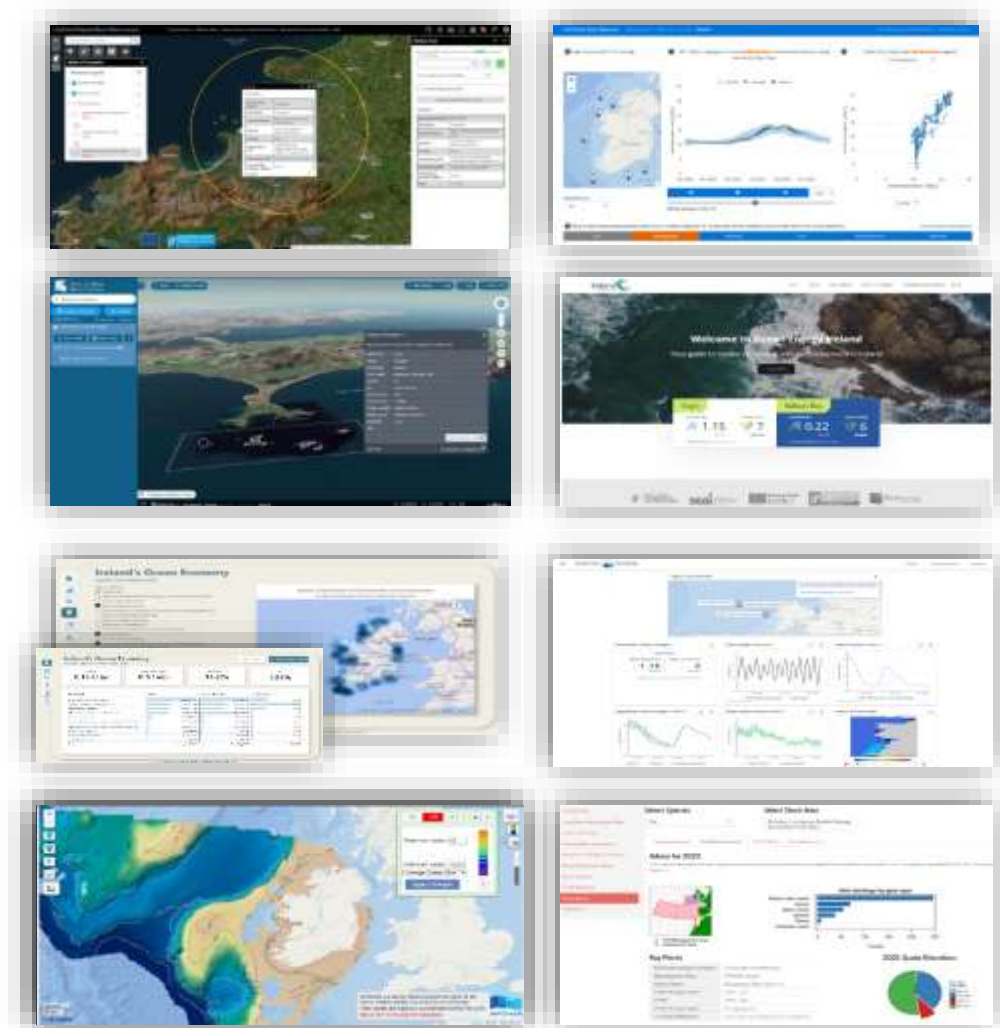
INFOMAR

Esri Ocean Basemap - © Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org, INFOMAR and other contributors

A good starting point...

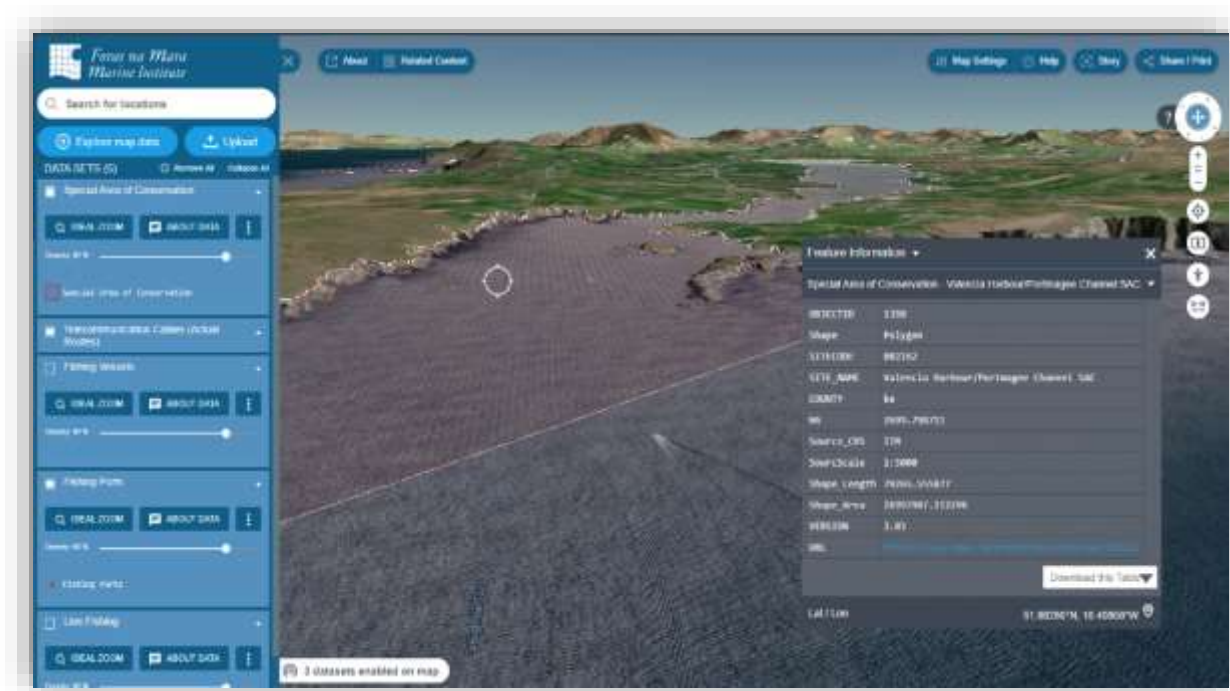
Current Digital Services

- Marine Planning
 - MarinePlan.ie
 - Ireland's Ocean Economy Dashboard services.
 - Ireland's Marine Atlas
- Seabed Data Viewers (INFOMAR)
 - Dynamic seabed viewer
 - 3D Interactive shipwrecks
 - Augmented Reality HoloLens
- Ireland's Digital Ocean services
 - Ocean Energy Ireland RT data feeds
 - SmartBay RT dashboards
 - ADRIFT search and rescue
- Fisheries & Aquaculture Management
 - AQUAMIS licensing decision support
 - HABs Bulletin for aquaculture food safety
 - Digital Stockbook & Species Dashboards



Incremental evolution of services...

Ireland's Marine Atlas



- The Marine Institute is developing the next iteration of Ireland's Marine Atlas
- It integrates quality-assured marine data from many different sources.
- It is an important national reference service for marine information, and supports national programmes e.g. Maritime Spatial Planning Directive, ORE Development.
- With integration of 3D, modelling and seabed capabilities it will evolve Digital Twin capabilities to become more relevant to an increasingly broad user base.
- These capabilities and services will add to the toolbox for more targeted decision support services.

Foras na Mara
Marine Institute

Search for locations

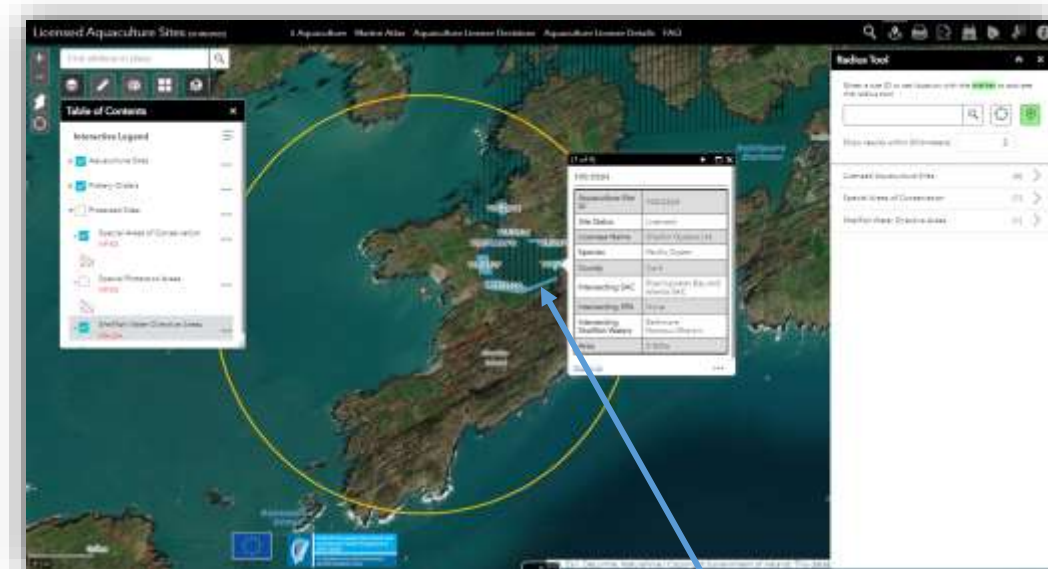
Explore map data Upload

DATA SETS (5) Remove All Collapse All

- Special Area of Conservation
 - IDEAL ZOOM ABOUT DATA
 - Opacity: 80 %
 - Special Area of Conservation
- Fishing Ports
 - IDEAL ZOOM ABOUT DATA
 - Opacity: 80 %
 - Fishing Ports
- Ports
 - IDEAL ZOOM ABOUT DATA
 - Opacity: 80 %
 - Ports
- Special Protection Areas
 - IDEAL ZOOM ABOUT DATA
 - Opacity: 80 %
 - Special Protection Areas
- Irish Designated Continental Shelf

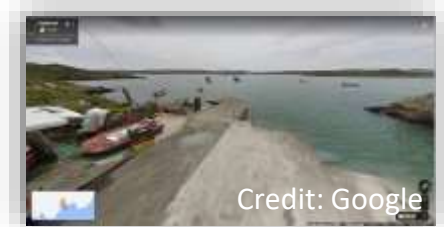


Digital Twin Capabilities for Decision Support



- Digital Twins supports improved **understanding** and evidence-based **decision making**.
- They can provide improved **visualisation** of the impact of new developments e.g. new windfarm, coastal defences, etc, and **enhance the ability to communicate** the basis for decisions.
- They can help **model near-future scenarios** to support marine management, sea safety and operations.
- The adoption of Digital Twins will enable **enhanced understanding** and **decision-making** for a wide range of marine use cases.

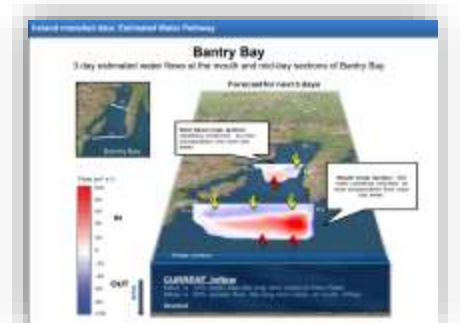
Visualise & Analyse



Credit: Google
Augmented Visualisation



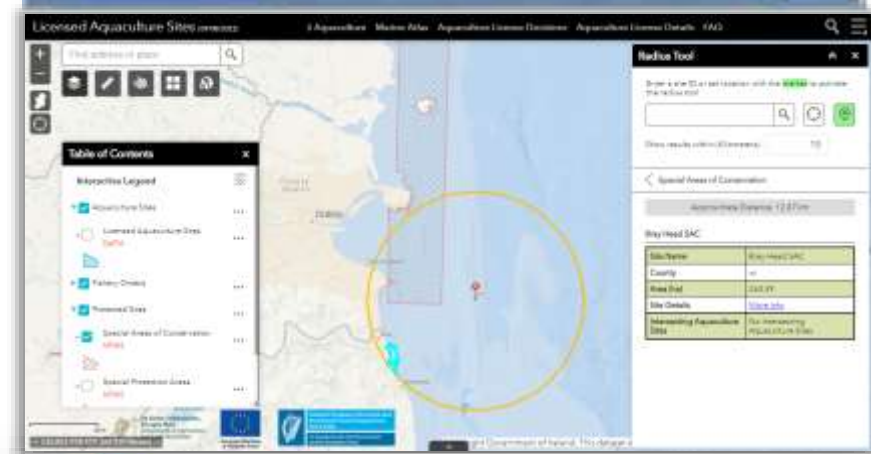
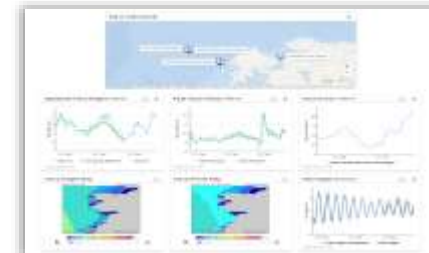
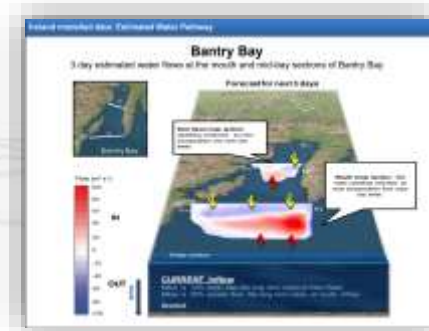
3D Seabed & Infrastructure Data



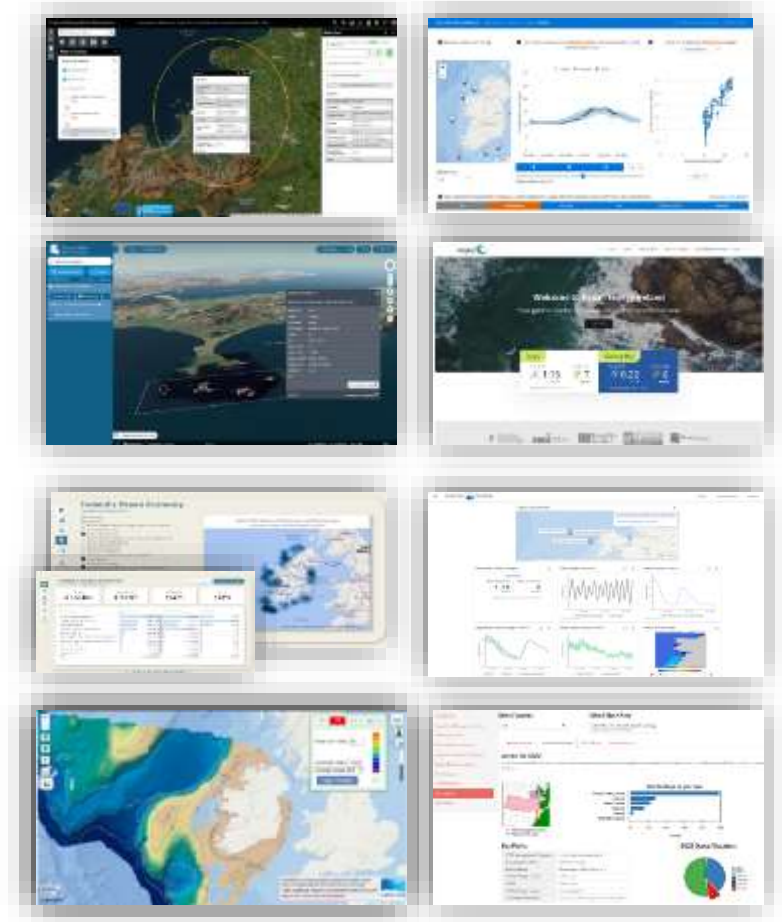
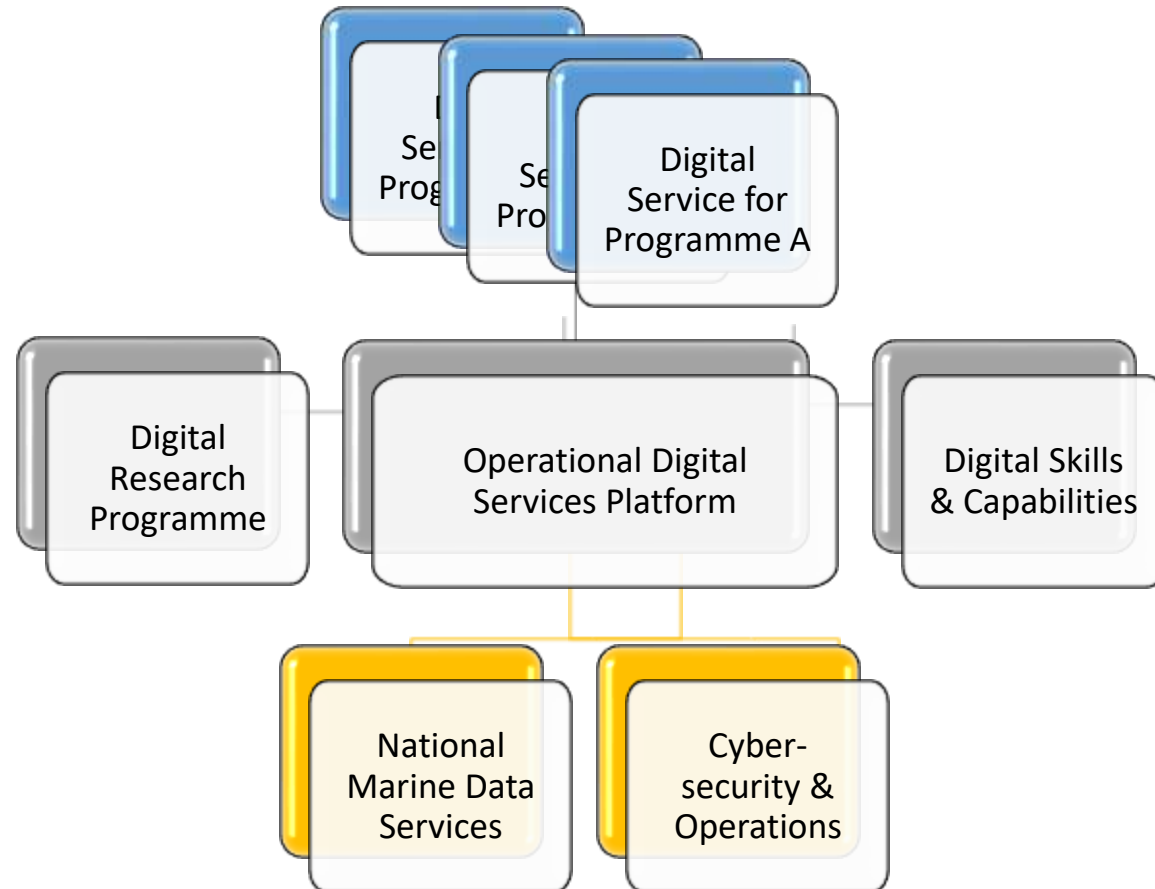
Dynamic models, real-time observations, future analytics

Digital Twin Use Cases

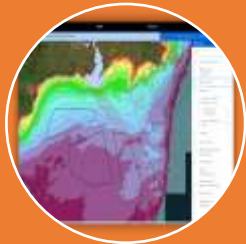
- Marine Planning & Licensing
- Marine Transport & Ports
- Ocean Renewable Energy
- Aquaculture Management
- Fisheries & Ecosystem Management
- Climate Adaptation & Resilience
- Environmental Management
- Outreach & Education



Our Programme View for Developing Digital Services



Enabling Sustainable Marine Development and Management



ORE Decision Making - Digital Tool & Evidence Base



Marine Planning – Evidence Base & Services



Fisheries Management - Digital Data & Dashboards



Marine Environment Management – Visualisation & Analysis



Aquaculture Licensing – Decision Support



Climate Change – Visualisation & Analysis



Maritime & Ports incl. for ORE



Aquaculture HABS & Food Safety

National Marine Digital Service Platform

Bringing it all together



Policy-maker
Local Authority
Planner
Scientist
Engineer
Public



Source: EC, 2023



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Digital Marine Atlas
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Digital Stockbook

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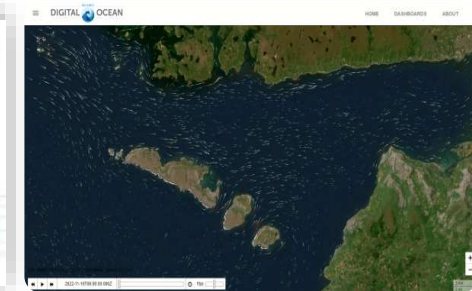
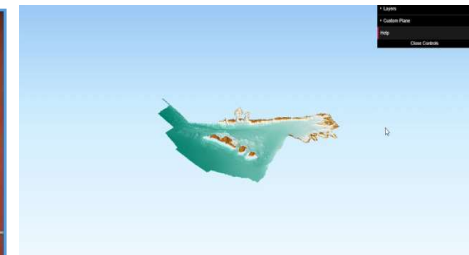
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“Our digital transition will transform how we operate, engage with our stakeholders, and deliver programme requirements in areas such as climate, ocean renewable energy, maritime transport, blue bio-economy, marine spatial planning, and marine resource management”

Evolving digital capabilities will play a key part in the digital transformation of our services, building on...

- Integrated Data Services with Quality Management
- Analytical Tools and Capabilities with new advanced visualisations & modelling
- Targeted Services incorporating Digital Twins elements to deliver user-focused information and decision-support.

'Repurposing the Wheel, Not Reinventing' Developing Ireland's Ocean Digital Twins



NMPF Data Providers

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