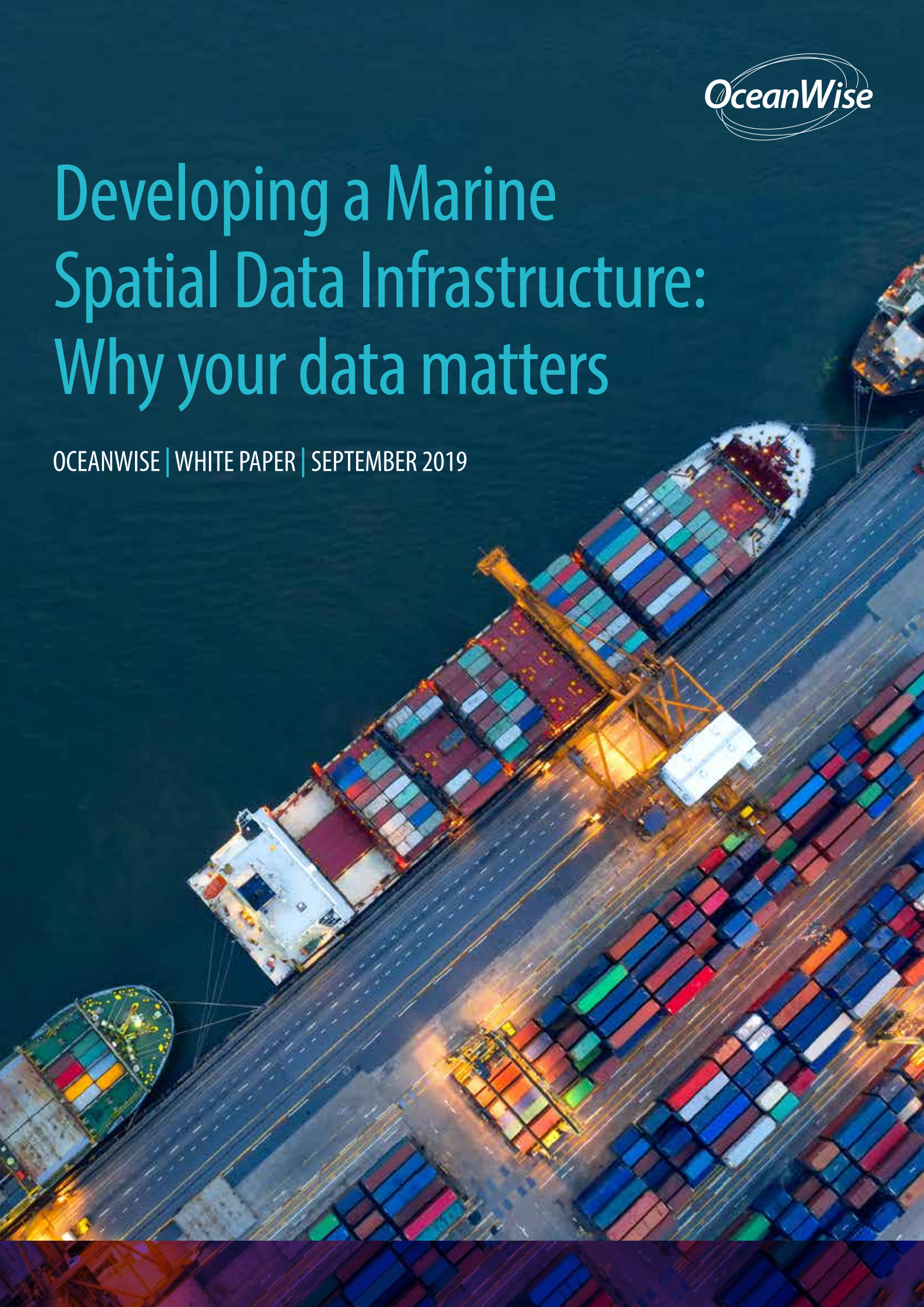
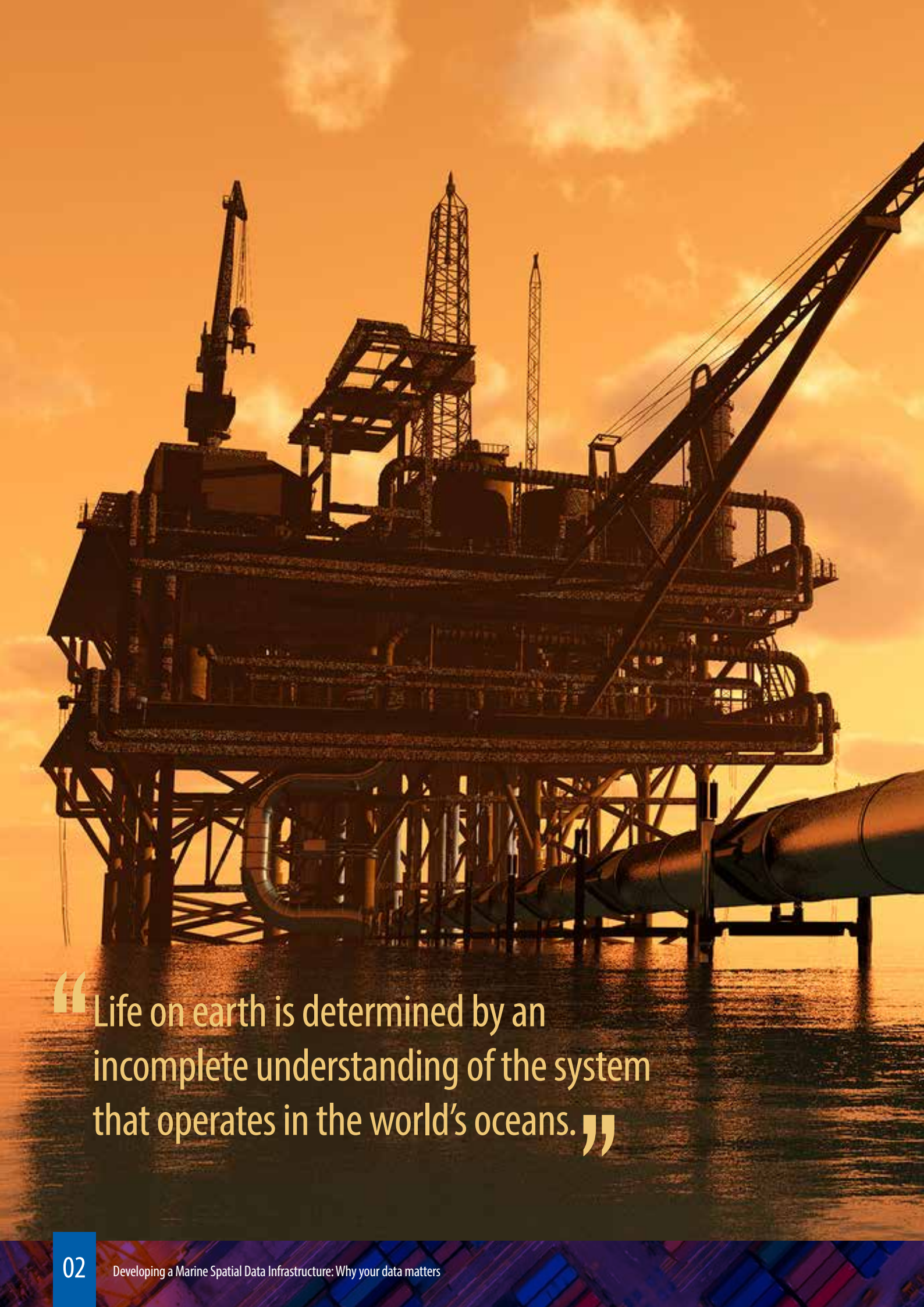


# Developing a Marine Spatial Data Infrastructure: Why your data matters

OCEANWISE | WHITE PAPER | SEPTEMBER 2019





“Life on earth is determined by an incomplete understanding of the system that operates in the world’s oceans.”



# Contents

- 4 Introduction
- 5 What is a Spatial Data Infrastructure?
- 6 What is a Marine Spatial Data Infrastructure?
- 8 What is Marine Spatial Planning?
- 9 What are the constraints to MSDI development?
- 10 Who should be interested?
- 11 Benefits of this approach
- 12 Getting started!

Written and produced by OceanWise Ltd

[info@oceanwise-global.com](mailto:info@oceanwise-global.com) | [www.oceanwise-global.com/msdi](http://www.oceanwise-global.com/msdi) | +44 (0) 1420 768 262

# Introduction

**The marine and coastal zones of the world host a growing number of overlapping and at times competing uses and activities, including commercial, recreational, cultural, energy, scientific, conservation, defence and security interests.**

The quality of life on earth is determined in large part by an incomplete understanding of the interacting systems that operate in the world's oceans and coastal areas. The system controls our climate in that it influences rainfall and sea level, it controls access to major resources and raw materials and holds vast amounts of energy potential whilst supporting an explosion of population growth. Increased understanding and control of this system can be accomplished through development of robust and active programmes of real-time observations, data capture and evaluation, data management, data sharing and exchange, and improved access to information that underpins modelling and visualization of the underwater and coastal environments – in short the development of a Marine Spatial Data Infrastructure (MSDI).

This paper discusses the relevance of MSDI to the development of a framework for coastal and marine spatial planning programmes at the local, national, and / or regional levels. It provides an approach to introduce and inform how MSDI acts as a component

framework within a National Spatial Data Infrastructure (NSDI) through the development and delivery of a series of global initiatives. Working through the auspices of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), established to underpin the UN's Sustainable Development Goals, and the recently formed Working Group on Marine Geospatial Information, these initiatives utilize a panel of recognized leaders and experts in the various components of MSDI development.

Stakeholders are strongly urged to endorse this innovative approach to MSDI which will act as the catalyst for the development of capability and capacity to deliver an integrated approach to the management of the coastal zone, oceans and seas. Such development can only be achieved through a partnership approach involving decision makers, planners, scientists, technologists and users that is designed to drive efficiencies in operations and activities and deliver cost savings and other benefits to government, commerce and the citizen at large.



# What is a Spatial Data Infrastructure?

To explain MSDI it is necessary to put it in the context of a Spatial Data Infrastructure. The term Spatial Data Infrastructure (SDI) is often used to denote the relevant base collection of technologies, policies and institutional arrangements that facilitate the availability of, and access to, spatial data.

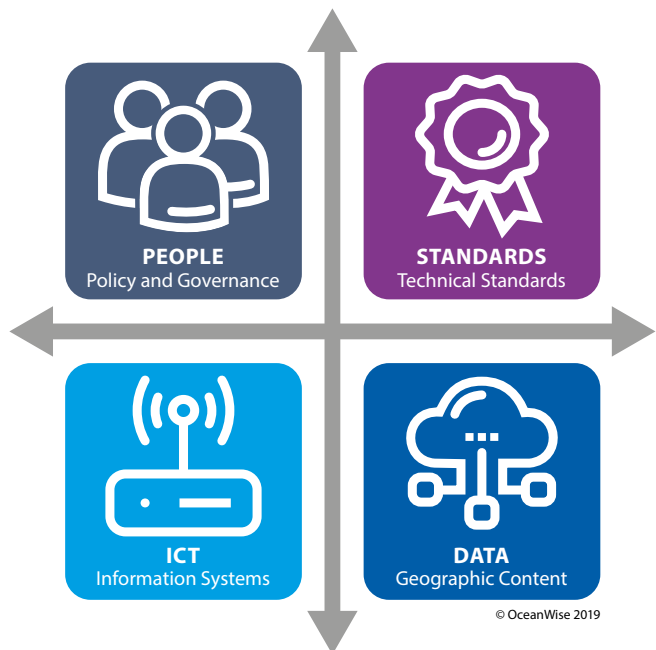
An SDI is a framework comprised of the following components:

**Policy and Governance:** The defining of the requirement to create interoperable information. The identification of which organizations are willing or mandated to cooperate in the sharing and exchange of information and to make such information readily available as a means of implementing policy and supporting 'spatially enabled organisations'.

**Standards:** The foundation of the data collection, management, updating and distribution efforts. Some international standards (e.g. ISO and OGC) include geographic information and technology infrastructure to enable data discovery and delivery, and metadata for cataloguing, discovery and retrieval.

**Geographic Content:** The data and metadata that is combined in the SDI. A common reference or coordinate system on which key 'core' reference content can be registered is essential.

**Information Systems:** The computers, networks and software, including GIS software, that connect the components of SDI and facilitates data management, visualization and distribution.



“Coastal zones of the world host a growing number of competing uses and activities.”


# What is a Marine Spatial Data Infrastructure?

**As the marine component of an SDI, Marine Spatial Data Infrastructure (MSDI) encompasses all marine and maritime related geographic and business information. For MSDI to be successful, it must be based on clear, broad-based goals that define the desired outcomes to be achieved.**

Typical data content includes marine limits and boundaries, conservation and environmental protection areas, marine habitats, oceanography, bathymetry (seabed elevation), hydrography, geology, marine infrastructure, shipwrecks, offshore installations, pipelines, and submarine cables.

Along the coastlines, currently accepted data on climate change indicates sea level change; incidence of storm events (which are becoming more violent

and frequent); higher wave energy and surges that have an impact on fixed structures, and significant beach erosion and flooding inundation. Controllable and equitable use of coastal resources for urban planning, renewable energy, tourism, conservation, preservation of natural habitat, and offshore, near shore, and inland navigation will be made possible within an MSDI developed framework.



“MSDI...  
must be based on  
clear, broad-based goals.”

## Marine Spatial Data Infrastructure themes common and applicable to most coastal states include:

**Maritime Baseline:** The line from which maritime limits and boundaries are measured and derived according to international legislation (e.g. UNCLOS).

**Marine Cadastre:** The management system extending from the baseline to the extent of national jurisdiction. Defines ownership, usage and extraction rights which may vary with height above the seabed and overlap spatially.

**Climate:** The modelled and observed geospatial and temporal characteristics of the atmosphere, hydrosphere and land surface system.

**Bathymetry:** Seabed elevation expressed as a surface or digital terrain model, soundings, contours and depth areas. The datum to which bathymetry is measured and maintained can vary according to usage e.g. in nautical charting or engineering<sup>1</sup>.

**Seabed Character and Bedforms:** The complexion of the seabed in terms of its surface geology and sediment composition.

**Maritime Limits and Boundaries:** Sovereign seabed areas defined by specific legislation and / or usage.

**Offshore Minerals:** Minerals and hydrocarbons occurring on or under the seabed.

**Shoreline or Coastline:** The mean position of the incidence of specified water levels e.g. mean high water and the land as observed and measured over many tidal cycles.

**Marine Transportation:** Commercial, defence, and recreational in terms of surface navigation aids controlling where vessels might traverse.

**Obstructions:** Man-made features that exist on the seabed that are not in use (e.g. shipwrecks, discarded fishing gear and other similar items).

**Physical Oceanographic Features:** Temporal elements in the water column that describe the condition of the oceans (e.g. salinity, light attenuation, currents and waves).

**Gazetteer:** A geographical dictionary or directory and reference for information about places and place names.

Within this basic framework MSDI provides a basis for data discovery, evaluation, retrieval, and applications for users and providers within all levels of government, the commercial sector, the non-profit sector, academia and by citizens in general.

1. Datums vary dependent on use. LAT is used for charting but MSL is used for engineering, construction and conservation.

# What is Marine Spatial Planning?

**Marine Spatial Planning (MSP) is an adaptive, integrated, ecosystem-based transparent spatial planning process based on sound science. It is being developed for analysing current and anticipated use of the offshore, near shore and coastal zone 'space'.**

MSDI is the framework of information and processes which informs MSP decision making. In doing so, it provides the evidence to support plans for development of the most suitable sites for a range or class of activities.

It provides the information that will reduce conflicts among uses, reduce environmental impact, facilitate compatible uses, and preserve critical ecosystems to meet economic, environmental, security, and social objectives.

In practical terms, MSP provides a public policy process for society to better determine how the ocean and coasts are sustainably exploited and protected now and for future generations.

## Marine Spatial Planning themes

- ◆ Coastline and Bathymetry
- ◆ Legislation and Administration
- ◆ Marine Habitats
- ◆ Human Activities and Pressures
- ◆ Marine Protected Areas
- ◆ Cultural and Heritage Sites
- ◆ Ferry and Shipping Routes

## Key benefits of Marine Spatial Planning

- ◆ Coastal zone management
- ◆ Coastal inundation and flood plain modelling
- ◆ Climate change adaptation
- ◆ Conflict management in use of sea space
- ◆ Conservation and education
- ◆ Fisheries management
- ◆ Ecosystem approach to managing sea space
- ◆ Monitoring and assessment
- ◆ Management and enforcement
- ◆ Improved decision making



# What are the constraints to MSDI development?

**Bringing land and sea data together as one continuous surface requires new tools, new data collection, standardization of data specifications, improved data management and dissemination, and education (with a view to ensuring a sustainable outcome).**

One key area is datums; because land based mapping and marine based charting use different vertical datums, a seamless geodetic framework across the littoral zone is difficult to calculate.

This presents a significant challenge. However, many other major gaps in knowledge and information exist because of:

- 1 Lack of complete, up-to-date or accurate data
- 2 No processes to access data
- 3 Benefits to be gained from MSDI are not understood in many areas of the world
- 4 Eroding national or organizational technical infrastructures
- 5 Inadequate data integration and interoperability
- 6 Lack of relevant processing systems to transform data into useful information
- 7 Uncertainty over continuity of observations
- 8 Inadequate user involvement preventing value and benefit being articulated
- 9 Lack of political will to make it happen
- 10 Lack of funding and resources
- 11 Poor cross organizational cooperation

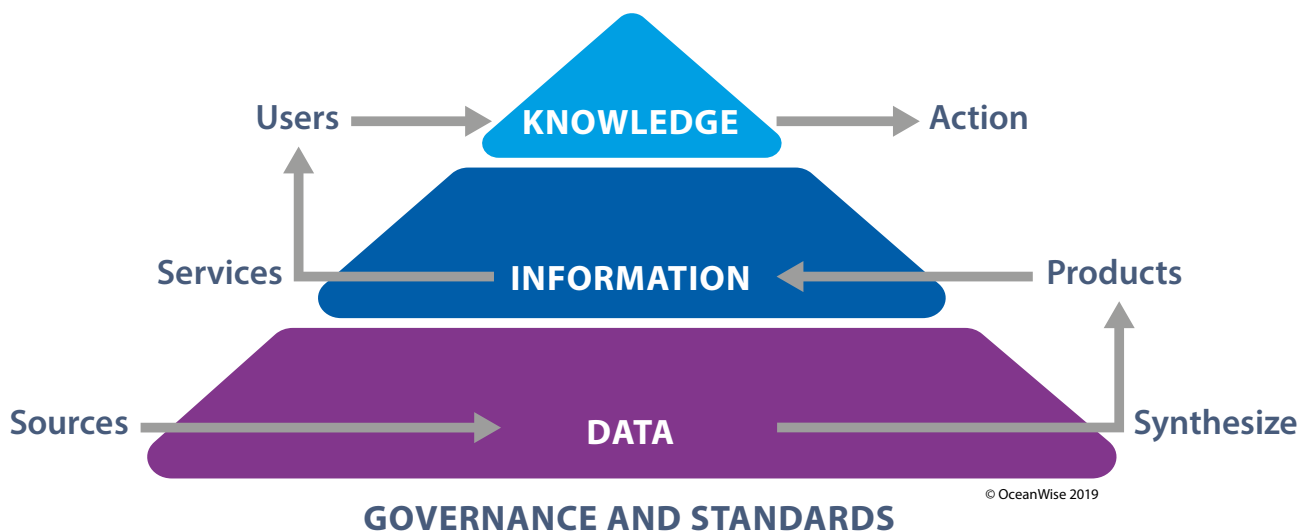
“MSDI is the framework of information and processes which informs MSP decision making.”

# The role of Hydrographic Offices

**National Hydrographic Offices are often the national de facto provider of resources to carry out data collection and support required to populate datasets.**

This is provided through the provision of vessels, oceanographic and bathymetric equipment, marine geodesy capabilities, and qualified personnel. As such, HO's are well placed to provide a key supporting role in the development of MSDI and will lead to the hydrographic office creating opportunities for national engagement by making hydrographic, bathymetric, and coastal zone data available to other national stakeholders who have a mandate that is wider or different than safety of navigation.

This will lead to an increased appreciation of the value in HO information across the wider marine data community and will stimulate a more joined-up approach at the national or regional level with the outcome that the HO will be in the mainstream of spatial data decision making; something many are not at this time. As a result, hydrographic data themes will enjoy wider appreciation and use.





“ ... HO's are well placed to provide a key supporting role in the development of MSDI. ”

# Benefits of a global approach

**The success of a strong national or regional MSDI model will depend on data and information providers accepting and implementing a set of interoperability arrangements, including technical specifications for collecting, processing, storing, and disseminating shared data, metadata, and products.**

In this sense a global and wide-reaching approach to promoting MSDI is recommended with the involvement of: The International Hydrographic Organization (IHO), Regional Hydrographic Commissions (RHC's), Intergovernmental Oceanographic Commission (IOC), Global Earth Observation System of Systems (GEOSS), Ocean Observing Initiatives, Integrated Ocean Observing System, the International Federation of Surveyors (FIG) Commission 4 on Hydrography, UN Environment Program (UNEP), private industry, and regional maritime stakeholders.

This global workshop approach will assemble domain experts from separate elements of MSDI in one place to advise on:

- 1 Support for sustainable, safe, secure, efficient, and productive uses of the ocean, our coasts, including those that contribute to the economy, commerce, recreation, conservation, homeland and national security, emergency response and disaster mitigation, human health, safety, and welfare;
- 2 Protecting, maintaining, restoring and preserving a nation's ocean, coastal resources and ensure resilient ecosystems and their ability to provide sustained delivery of ecosystem services;
- 3 Providing for and maintaining public access to the ocean and coasts;
- 4 Promoting compatibility among uses and reduce user conflicts and environmental impacts;
- 5 Streamlining and improving the rigour, coherence, and consistency of decision-making and regulatory processes;
- 6 Increasing certainty and predictability in planning;
- 7 Enhancing inter-agency, intergovernmental, and international communication and collaboration;
- 8 Stimulating public education and outreach;
- 9 Providing practical knowledge in the GIS tools needed to allow a nation to take a more proactive role in the development of an MSDI;
- 10 Assisting the organizations listed above to realize the vision for the marine environment – clean, healthy, safe, productive and biologically diverse oceans and seas. It is underpinned by the principles of sustainable development, integrated management, the conservation of biological diversity, robust science, the precautionary principle and stakeholder involvement.



“All marine science will benefit from an MSDI as processes that are observed directly will be available to all through data management.”

# Getting started!

There are five basic steps required for establishing a robust MSDI:

## 1 National MSDI Stakeholder Workshop

The first step towards a constructive process for creating an MSDI is to engage in a forum which creates a common vision, identifies challenges, and enhances capacity for its implementation.

## 2 Establish National MSDI Planning Coordination

Gain national support through the development of an inclusive and comprehensive national MSDI planning body to establish national objectives and define the programme.

## 3 Establish a National Data Information Management System

Standardised core reference data sets are key components to the establishment of the MSDI element of the national spatial data infrastructure (NSDI). They must be publicly available, easily accessible and can be shared and exchanged with MSDI stakeholders.

## 4 Public Outreach and Engagement with Stakeholders

Informing and communicating with the user community and public are critical to effective implementation. This achieves the development of knowledge, skills and understanding of the value and benefits of MSDI.

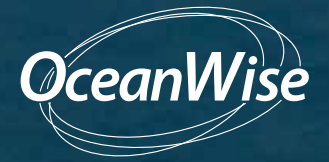
## 5 Sustainability

Making sure that the MSDI is delivered in a sustainable manner and that progress and development is monitored and reported against key targets.

Successfully implementing MSDI means adopting sound data management principles and practices. OceanWise provides training and advice on data management and MSDI development. Please contact us for more information or visit [www.oceanwise-global.com/msdi](http://www.oceanwise-global.com/msdi).

“The real power of Marine SDI is in the bringing together of disparate datasets and ideas to support a common cause.”





OceanWise Ltd is an independent company specialising in all aspects of marine environmental data acquisition, data management and other related services. OceanWise offers a range of training and consultancy services worldwide to support the understanding and implementation of Data Management, Data Policy, Data Strategy and Data Governance, with these being the foundations of SDI and MSDI development.

Written by Dr Mike Osborne and John Pepper of OceanWise Ltd.

Published and produced by OceanWise Ltd.

[info@oceanwise-global.com](mailto:info@oceanwise-global.com) | [www.oceanwise-global.com/msdi](http://www.oceanwise-global.com/msdi) | +44 (0) 1420 768 262