NLA International–Seabed 2030

Phase 3: Benefits Analysis Workstream

Document 3: Seabed 2030 Economic Impact Sectors Document

January 2023

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SECTION ONE: INTRODUCTION TO THE DOCUMENT

1.1 CONTEXT

The Nippon Foundation-GEBCO Seabed 2030 Project's vision to map the world's oceans by 2030 is insightful and ambitious setting a challenging timeline to address the 80% of the oceans that have yet to be charted to the required gridded resolution. The "Wind in the Sails" (WITS) proposal supports the Seabed 2030 Project by providing empirical evidence to enable the development of a prioritised, targeted survey strategy. The aim of this three-phase project is to unite the global hydrographic community and operators within the marine and maritime domains around an agreed global seabed mapping priority list, underpinned by a robust evidence base that articulates the true need and value of mapping the seabed in its entirety to a defined gridded depth variable resolution.

WITS phases are: *(Bold text current phase highlights the current phase of activity, Phase 3)*

- Phase 1: Rapid evidence review and fast action priority list.
- Phase 2: Detailed modeling, benefit extrapolation and prioritisation of need.
- **Phase 3: Benefits analysis and targeted community engagement to determine Prioritisation.**

1.2 'WIND IN THE SAILS' PHASE 3 TASK – PHASE 3: BENEFITS ANALYSIS AND TARGETED COMMUNITY ENGAGEMENT TO DETERMINE PRIORITISATION

WITS Phase 3 work builds on top of the phase 1 and 2 outputs and is also informed by the grounding evidence phase 1 community engagement survey findings. Phase 3 activities undertaken across FY 2022 address two key areas of focus:

- **Benefits analysis workstream**, producing a series of **Seabed 2030 parameters** for use in seabed mapping benefits analysis and to be available for use in future prioritisation decision-making, and **the articulation of Seabed 2030 seabed mapping programme benefits through the production of benefits documentation**, including Value Chain, Executive Fact Sheet, Value Proposition, and a set of Use Case Evidence, and,
- **Targeted community engagement**, to provide grounding evidence for prioritisation decisions, through:
    - **Seabed 2030 Management Engagement Ongoing**: *Fortnightly progress meetings, plus nominated peer to peer calls to inform / review documentation iterative development (to validate scope and focus as documents develop).*
    - **National body community engagement survey questionnaire**: *Global national bodies (Hydrographic Offices (HOs)) with responsibilities for hydrographic mapping/safety of respective national waters will be requested by letter to provide own views on the quantitative analysis and prioritisation of users from the WITS online survey. A survey and question set will be established for online responses by individual HOs / vested bodies and the results will be amalgamated with pre-existing "users" results to develop a combined and validated global prioritisation list.*
    - **Communications & Informed User Engagement:** *One article and one press release to be written during WITS Phase 3 Objectives 6 & 8 being completed, with NLAI attending and presenting at the Map the Gaps symposium on 27th October 2022.*

A further phase 3 workstream and area of focus, **'Seabed 2030 Prioritisation'**, which is currently planned to be addressed in FY 2023, will develop the phase 2 proposed prioritisation approach into a documented prioritisation methodology (Level 3 business process documentation produced), and, provide a tool review and design, with a prototyping of a tailored prioritisation tool workflow for Seabed 2030.

1.3 DOCUMENT PURPOSE & STRUCTURE

This document is the third of six document deliverable outputs, [Document 3], from the Phase 3 benefits analysis workstream work, where:

- **Document 1: Seabed 2030 Regional Segmentation Document [Explainer document]**, October *2022 focus/submission*, is a guidance document, and informs Seabed 2030 towards adopting a 'Regional Segmentation' of the Global Oceans into Regional Areas of Interest for the purposes of benefits analysis and seabed mapping prioritisation.
- **Document 2: Seabed 2030 Value Chain [Explainer Document],** *November 2022 focus/submitted,* is a guidance document, and describes a proposed value chain for Seabed 2030. The value chain informs benefit analysis / value analysis, and is also available to inform Seabed 2030 organisation operating model future evolution.
- **Document 3: Seabed 2030 Economic Impact Sectors Document**, [This document], *January 2023 focus/target submission,* is a guidance document, and describes a set of economic impact sectors for ongoing use in the Seabed 2030 benefit analysis and economic value assessment work.
- **Document 4: Document set of Use Cases [Up to 12 use cases]**, *February 2023 focus/target submission*, collates and documents a set of Seabed 2030 use cases. The use cases inform the Seabed 2030 benefits analysis model, evidence the evolving Seabed 2030 business case, and are available to support ongoing Seabed 2030 knowledge sharing activities and strategic communications.
- **Document 5: Seabed 2030 Executive Fact Sheet (Focus: Seabed 2030 seabed mapping),** *target submission at the end of February 2023*, is a Seabed 2030 Executive Fact Sheet on the Seabed 2030 mapping programme.
- **Document 6: Seabed 2030 Seabed Mapping Programme Value Proposition Document**, *target submission at the end of March 2023*, is a Seabed 2030 Value Proposition Document for the Seabed 2030 mapping programme.

Document readership potentially include Seabed 2030 management, decision makers, and practitioners. The wider benefits analysis and prioritisation modeling are being developed with the same readership in mind (Seabed 2030 management, decision-makers, and practitioners), and additionally are being produced with researchers and future donors / funding bodies in mind.

Document 3 structure is as follows:

- Section 1: 'Introduction to the Document' – providing Seabed 2030, and WITS Phase 3 context and provides the purpose and layout of the report.
- Section 2: a summary of the approach adopted in the Seabed 2030 Economic Impact sector review.

- Section 3: provides background and purpose details of economic impact sectors generally, and signposts readers to useful current practice to inform the Seabed 2030 approach.
- Section 4: presents a list of proposed Seabed 2030 Economic Impact Sectors, including where available/applicable at this time, some initial guidance on the level of the anticipated level of dependency for each sector on seabed mapping data (focus: High seas seabed mapping setting focus). Use case examples are identified by sector, and these include use cases being produced under task 6.4. *The table is subject to retrospective updating post task 6.4 delivery.*
- Section 5: presents 'Twenty-Four' Seabed 2030 economic impact sectors/sub-sector description sheets. These are one page overview descriptions for each target economic impact sector as identified in section 4 above.
- Section 6: 'Benefits Analysis Collation of Recommendations', providing a table of recommendations identified during the economic impact sector review work for carry across into the WITS Phase 3 wider seabed mapping benefits analysis delivery, and for Seabed 2030 ongoing reference / use as applicable.
- Section 7: WITS phase 3 next steps.
- Annex 1: Glossary - Definition of Terms.
- Annex 2: References.

SECTION TWO: SEABED 2030 ECONOMIC IMPACT SECTOR REVIEW – SUMMARY OF APPROACH

This section presents a summary of the approach adopted in reviewing and identifying the set of Seabed 2030 Economic Impact sectors.

2.1 SEABED 2030 ECONOMIC IMPACT SECTOR REVIEW – SUMMARY OF APPROACH

The purpose of the Seabed 2030 Economic Impact sector review activity is to provide guidance on, identify and describe a set of target economic impact sectors for ongoing use in the Seabed 2030 benefit analysis and economic value assessment work. The review draws on both economic value analysis industry practice and aligns with wider marine / maritime sector referencing and practices. This is stepping stone 'step' specifically to inform the benefit analysis / value analysis sector focus areas. The resulting set of sectors will be presented alongside use cases [Future Task 6.4], and validated with Seabed 2030 data centre management heads through a dedicated workshop meeting [in January 2023], with any resulting guidance and feedback, documented and integrated in this version report.

The activity is informed by the two Phase 2 Benefits Analysis Workstream Reports:

- Catalogue of Premium Models for Seabed Mapping Benefits Analysis [January 2022], and
- Proposed model for Seabed 2030 – Seabed Mapping Benefits Analysis and Prioritisation [April 2022].

And the current Phase 3 task areas, notably, Task 6.2 - Seabed 2030 Value Chain, and Task 6.4 Seabed 2030 Use Cases.

Sector review additional desk study and stakeholder engagement is key, primarily through the dedicated 'workshop', but also through wider stakeholder engagement, where applicable, and the ongoing (fortnightly) Seabed 2030 management WITS project progress meetings.

The activity was undertaken through the following logical steps,

Step 1: [Desk study] Review phase 2 guidance on Economic Impact Sectors, and identify an initial target set of economic sectors [applying economic analysis industry practice approach]. Review and update the economic sectors to align with 'sectors' adopted in seabed mapping benchmark practice examples, [notably AusSeabed, NEEA (USA), and the InfoMAR Marine Mapping Study Options Appraisal Report]. Finally review and align the economic sectors with 'sectors' adopted in Blue/Ocean Economy practices [Notably UN, OECD, and European Union (EMODNET and EU Blue Economy Report 2022)].
Step 2: [Desk study] Distinguish between and categorise the identified economic impact sectors as either 'established' or 'emerging' economic value sectors, and identify sectors as candidates to be more applicable [from an anticipated benefit impact perspective based on a sector's level of dependency on seabed mapping data in a High seas setting] to Seabed 2030 interest or not. [A 1st step initial filter view].

Step3: [Desk study/Engagement] Identify and integrate into the proposed sector identification logic any current or initial Seabed 2030 management view on sectors for focus or prioritisation. [A 2nd step sector filter view'].
Step 4: [Desk study] Draft Document 3: Seabed 2030 Economic Impact Sector document, (This document).
Step 5: Identify the target set of sectors to be presented, validated and initially prioritised with the Seabed 2030 data centre management community, and to be addressed as a part agenda focus in a benefits analysis workstream workshop [Workshop 2 - January 2023].
Step 6: [Desk study] Hold the workshop, and collate workshop 2 findings and outcomes, and as applicable, update Document 3: Seabed 2030 Economic Impact Sector document (this document). Issue the Document 3 draft version for Seabed 2030 management review.
Step 7: Meet with Seabed 2030 management to discuss the sector work findings and outputs and any associated recommendations, with the objective to reach a consensus for adoption initially for the current WITS work and for use in seabed mapping benefits analysis.
Step 8: [Desk study & Stakeholder engagement] Update the economic impact sectors document to take account of Seabed 2030 management review comments, finalise, and make the document available for wider benefits analysis workstream use.

SECTION THREE: ECONOMIC IMPACT SECTOR CURRENT PRACTICE HIGHLIGHTS INFORMING THE ADOPTED SEABED 2030 APPROACH

This section provides background and purpose details of economic impact sectors generally, and signposts readers to useful current practice to inform the Seabed 2030 approach.

Section 3.1 to 3.4 introduce sector concepts and approaches referencing economic analysis good practice, and thereafter section 3.5 informs the Seabed 2030 sector approach, drawing on blue/ocean economy perspective and practice.

In this section, we build on the WITS Phase 2 Proposed model for Seabed 2030 – as presented in the Seabed Mapping Benefits Analysis and Prioritisation report [Phase 2 Report 2], providing where applicable, supplementary next level detail, and explanation of how the sector model can be adopted for economic value assessment.

3.1 Economic Sectors

In Economics there are key sector definitions that are applied a practice. These are provided for awareness and terminology adoption and include:

#1: Sector: Public or 'State Sector'.
#2: Sector: Private or 'Privately run business'.
#3: Sector: Voluntary or 'Not for Profit'.

Also:

#1: Primary sector [Raw Materials] – Involves the retrieval and production of raw materials such as for our interest minerals, fishing, and oil and gas.
#2: Secondary sector [Manufacturing] – Involves the transformation of raw or intermediate materials into goods, e.g., in this instance includes fisheries processing to food products.
#3: Tertiary sector [Services] – Involves supplying services to customers, e.g., banking, and accounting, etc. and in this instance can include blue financing.
Additional Sectors:
#4: Quaternary sector [Information Services] – And is where knowledge-based services are accounted for (e.g., Seabed 2030 can be considered a quaternary sector entity as a provider of data for….).
#5: Quinary sector [Human services] – activities centered on human-based services such as hospitality (e.g., and in this instance includes tourism).

3.2 Sectors, Industries and Sub-Sectors

As we see above a '**sector**' is an area of the economy in which businesses share the same or related business activity, product, or service. Sectors represent a large grouping of companies with similar business activities, such as the extraction of natural resources and agriculture.

Dividing an economy into different sectors helps economists analyse the economic activity within those sectors. As a result, sector analysis provides an indication as to whether an economy is expanding or if areas of an economy are experiencing contraction. Further, Sectors are used by

economists to classify economic activity by grouping companies that are engaged in similar business activities.

An '**industry**' can be considered a collection of organisations within a specific sector where they are typically involved in a specific internal sector activity, e.g., an oil company may be extracting oil – oil can be considered a primary sector industry, as can forestry and in this instance marine fishing, and extraction of crude petroleum and natural gas (offshore).

An industry is a group of companies that are related based on their primary business activities. In modern economies, there are dozens of industry classifications. Industry classifications are typically grouped into larger categories called sectors (see section 3.3 below).

While a sector represents a large segment of an economy that includes many companies, an industry represents a narrower focus of the companies within a particular sector. Thus, industries are the result of breaking down a sector into more defined and specific groupings. On the other hand, sectors can represent a large grouping of companies that have similar business activities, and hence why economic analysis for benefit / value analysis purposes is ideally addressed at sector level.

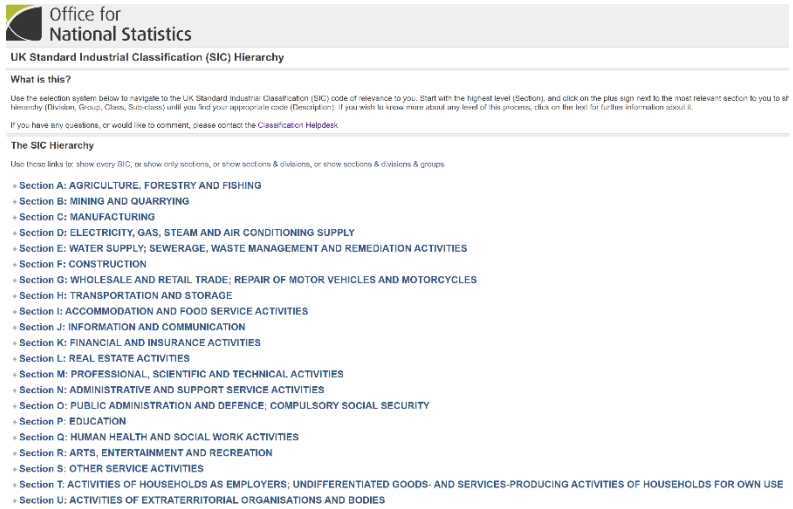
[To avoid confusion between sector and industry, it is proposed that Seabed 2030 adopt the use of the 'sectors and sub-sectors/segments', where a '**sub-sector**' or 'segment' results from the breaking down a sector into a more defined or specific grouping. Accordingly, an industry can be a sub-sector and multiple industries together can also be a sub-sector. This is helpful as this provides a level of flexibility, e.g., in some geographies aquaculture is a standalone sector and in others is a sub-sector under fisheries sector. Having both sectors and sub-sectors at Seabed 2030 disposal we retain flexibility, and if we wish to break out any sector in more granular detail we can simply call it a sub-sector].

3.3 Standard Industrial Classification of Economic Activities (SIC) and the Global Industry Classification Standard (GICS)

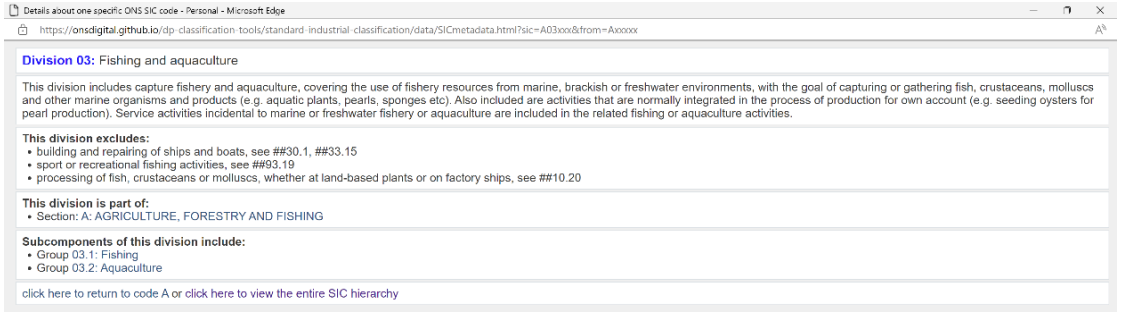
All nation economies apply a standard Industrial Classification of Economic Activities. This may vary from nation to nation. As an example, in the UK the hierarchy is based on sections, divisions, groups and then individual SIC codes. These are used both for, economy analysis as well as (as a condensed listing) for companies' house registration. In the graphic below, we see Office of National Statistics (UK HMG National Statistics Agency) use of 21 Sections, and the hierarchy breakdown for fishing and aquaculture.

See here: https://onsdigital.github.io/dp-classification-tools/standard-industrial-classification/ONS_SIC_hierarchy_view.htm

The challenge here is that Seabed 2030 would be interested in the marine dimension, e.g., with marine fisheries and marine aquaculture and would potentially want to ignore freshwater fisheries and freshwater aquaculture economic analysis.



Example Hierarchy to SIC codes:
Section A: Agriculture, Forestry and Fishing
Division: Fishing and Aquaculture
Group: Fishing
Class: #Marine Fishing and
Class: #Freshwater Fishing



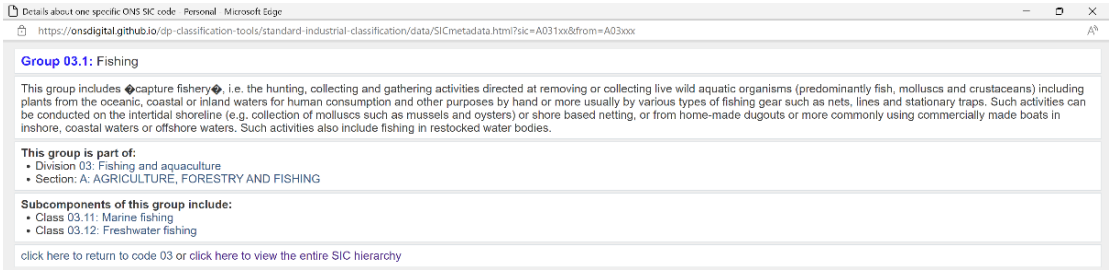


Figure 1: UK HMG Office of National Statistics Marine Fishing and Marine Aquaculture Hierarchy for economic analysis, see here: https://onsdigital.github.io/dp-classification-tools/standard-industrial-classification/ONS_SIC_hierarchy_view.html

Example Hierarchy to SIC codes:
Section B: Mining and Quarrying
Division: Extraction of Crude Petroleum and Natural Gas
Group: Extraction of Crude Petroleum
Class: Extraction of Crude Petroleum
Note does not include from point of shipment from the producing property. Nor does it include exploration which is addressed under 'Support activities for petroleum and natural gas extraction'

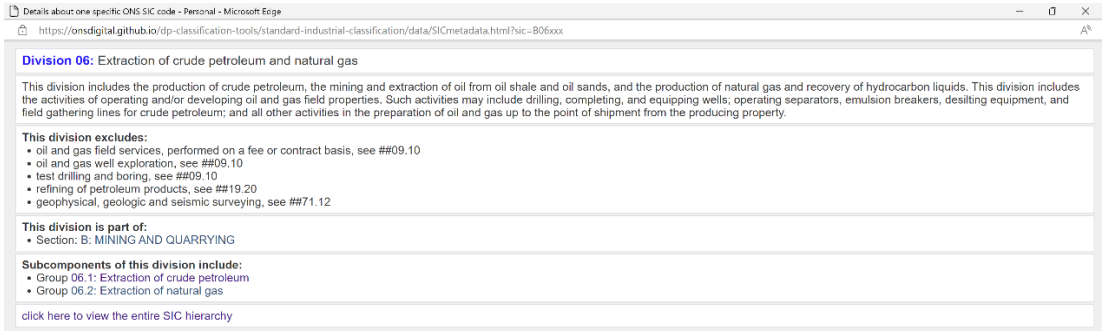


Figure 2: UK HMG Office of National Statistics Extraction of Crude Petroleum and Natural gas, see here: https://onsdigital.github.io/dp-classification-tools/standard-industrial-classification/ONS_SIC_hierarchy_view.html

However, Seabed 2030 is interested in global scenarios not limited to any one nation setting.

Potentially useful reference point Global code examples (based on production / what entities do) are presented here:

> #Industry Classification Systems see here: https://classification.codes/classifications/industry/
>
> #The Standard Industrial Classification (SIC) [USA], see here: https://classification.codes/classifications/industry/sic/
>
> #The Statistical Classification of Economic Activities in the European Community, see here: https://classification.codes/classifications/industry/

Additionally, to consider or take account of an investor perspective view, Seabed 2030 could consider the Global Industry Classification Standard (GICS). The GICS is a 4-level classification system developed in 1999 by MSCI and S&P Dow Jones Indices to categorise companies traded on public stock exchanges. The GICS is targeted at professionals in the investment business. In addition to classifying companies, the GICS is used in the creation of equity indexes. [See here: https://classification.codes/classifications/industry/gics/]

The current implementation of The Global Industry Classification Standard categorises companies into:

- 11 sectors
- 24 industry groups
- 69 industries
- 158 sub-industries

The classification is hierarchical, in that each sub-industry belongs to only one industry, each industry belongs to one industry group, and each industry group belongs to one sector. Knowing the sub-industry to which a given company belongs to, one can easily find the relevant industry, industry group, or a sector of that company.

The GICS is a "demand-oriented" classification. It attempts to group companies based on how individuals and companies purchase their products and services, instead of categorising them based on what product the company makes, or what service it provides (which would be a "production-oriented" approach). [Additionally, when Seabed 2030 is engaging investors, it may be helpful to be aware of the GICS classification, as this is the most likely investor reference].

The GICS classification was developed to "to enhance the investment research and asset management process for financial professionals worldwide". Current uses of the GICS classification reflect that purpose. The GICS codes are used: in the development and analysis of equity indexes developed by S&P Global and MSCI. For example, custom equity indexes can be created with the desired composition of different GICS sectors or industries in it (see S&P Global Custom Indexes and MSCI Custom Indexes) in GICS Direct, a database of over 44,000 companies with their corresponding GICS codes. GICS Direct℠ is a service of Standard & Poor's Financial Services LLC and MSCI. in categorizing the publicly traded companies on NYSE and NASDAQ (see Fidelity Investments e research) in analyzing the current structure of industries in the global equity investment markets. That is, since the GICS classification is updated yearly to stay relevant to the developments in industry structure, the classification itself provides an outlook into the importance of particular industries and their sectors.

3.4 Established and Emerging Sectors

From an economic value assessment perspective, established and emerging sectors are defined:

- **Established sectors** - Sectors with long-term proven contribution to the economy.
- **Emerging sectors** - New sectors showing high potential for future development.

This distinction is helpful from an economic value assessment perspective as:

1. Established sector economic reporting and assessment will be easier to access, better documented and more readily available cf. emerging sectors.
2. Emerging sectors may have potential for significant economic value growth going forward.
3. Emerging sectors may have higher levels of research, startup company participation, or be the focus of attention of large private company R&D activities / divisions.

This distinction is also helpful for a Seabed 2030 marketing and promotion awareness, as it provides a high level guide towards how Seabed 2030 may be best able to position to support different sectors, e.g., consider campaigns of engagement with research and development or lower technology readiness level (TRL) entities actions in emerging sector areas, and focus campaigns of engagement on large private companies and more established specialist SMEs in the established sector areas.

3.5 Blue / Ocean Economy Sectors

There is a Marine / Maritime dedicated set of 'Sectors': drawing on **Blue or Ocean Economy** approach. Blue/Ocean Economy is cross cutting the economic norms presented in 3.1 to 3.4 above, and different sectoral focus of definitions are used pending different entity interests, E.g., EU, OECD, UN, Blue Economy for SID sustainable development, among others. The range of example Blue / Ocean Economy Sector Designations are presented by Entity below.

European Union Blue Economy (EU Blue Economy) applies the following sector / sub-sector designation for 'Established Sectors'.

Sector	Sub-sector
Marine Living Resources	Primary production
	Processing of fish products
	Distribution of fish products
Marine non-living resources	Oil and gas

	Other minerals
Marine renewable energy	Offshore wind energy
Port Activities	Cargo and warehousing
	Port and water projects
Ship Building and Repair	Ship building
	Equipment and machinery
Maritime Transport	Passenger transport
	Freight transport
	Services for transport
Coastal Tourism	Accommodation
	Transport
	Other expenditure

Note the differentiation between primary production and processing of fish products reflecting economic norms. Further that marine renewable energy is considered established for offshore wind energy, whereas wave energy is an emerging sub-sector addressed elsewhere.

Additionally, an EU MSP for Blue Growth study in 2017, produced nine sector fiches which are very useful to Seabed 2030 sector scope coverage. These nine sector fiches are available here: https://maritime-spatial-planning.ec.europa.eu/sectors

With individual sector fiches provided for the following sectors:

1. Cables and pipelines.
2. Coastal and maritime tourism.
3. Fishing.
4. Marine aggregates and marine mining.
5. Marine aquaculture.
6. Offshore wind energy.
7. Oil and gas.
8. Shipping and ports.
9. Tidal and wave.

In the OECD study, “Blueprint for improved measurement of the international ocean economy: An exploration of satellite accounting for ocean economic activity” [Ref: Blueprint for improved measurement of the international ocean economy: An exploration of satellite accounting for ocean economic activity, OECD Science, Technology, and Industry Working Papers 2021/04], **OECD identifies a sector-based mechanism for providing ocean economic activities international comparison statistics.** The 14 sectors identified are listed below.

Ref ID	Ocean Specific Description
1	Marine fishing
2	Marine aquaculture
3	Maritime passenger transport
4	Maritime freight transport
5	Offshore extraction of crude petroleum and natural gas
6	Marine and seabed mining
7	Offshore industry support activities
8	Processing and preserving of marine fish, crustaceans, and molluscs
9	Maritime ship, boat, and floating structure building

10	Maritime manufacturing, repair, and installation
11	Offshore wind & marine renewable energy
12	Maritime ports and support activities for maritime transport
13	Ocean scientific research & development
14	Marine & coastal tourism

The OECD has developed a classification containing a list of ocean related economic activities with corresponding goods and services from the international reference classifications International Standard Industrial Classification (ISIC) Rev.4 for activities and Central Product Classification (CPC) Version 2.1 for products. This enables global comparison of ocean economy activities (value), (noting OECD has a membership of 38 nations at this time (as reported in the Phase 3 Document 1).

The extract shows provides an example of sector - activities [ISIC], and Central product Classification (CPC) cascade for Maritime Passenger Transport (Sector 3), Maritime Freight Transport (Sector 4), Offshore extraction of crude petroleum and natural gas (Sector 5), and (part of) Marine and seabed mining (Sector 6). These are useful designations for Seabed 2030 cross reference and to inform the Seabed 2030 economic value assessment work.

				86154	Support services to aquaculture
3	Maritime passenger transport				
		5011	Sea and coastal passenger water transport		
				64231	Coastal and transoceanic water transport services of passengers by ferries
				64239	Other coastal and transoceanic water transport services of passengers
4	Maritime freight transport				
		5012	Sea and coastal freight water transport		
				65211	Coastal and transoceanic water transport services of freight by refrigerator vessels
				65212	Coastal and transoceanic water transport services of freight by tankers
				65213	Coastal and transoceanic water transport services of intermodal containers by container ships
				65219	Other coastal and transoceanic water transport services of other freight
				66022	Rental services of freight vessels for coastal and transoceanic water transport with operator
5	Offshore extraction of crude petroleum & natural gas				
		0610	Extraction of crude petroleum		
				12010	Petroleum oils and oils obtained from bituminous minerals, crude
				12030	Bituminous or oil shale and tar sands
				86221	Oil and gas extraction services on resources owned by others
		0620	Extraction of natural gas		
				12020	Natural gas, liquefied or in the gaseous state
6	Marine and seabed mining				
		0729	Mining of other non-ferrous metal ores		
				14210	Copper, ores and concentrates
				14220	Nickel ores and concentrates
				14230	Aluminium ores and concentrates
				14240	Precious metal ores and concentrates
				14290	Other non-ferrous metal ores and concentrates (other than uranium or thorium ores and concentrates)
				86229	Other mining services on resources owned by others
		0810	Quarrying of stone, sand and clay		

Figure 3: OECD Blueprint for improved measurement of the international ocean economy: An exploration of satellite accounting for ocean economic activity. Annex A. List of ocean economic activities and related goods and services{Extract example].
Ref: https://repository.oceanbestpractices.org/handle/11329/1561

From a **UN perspective, the UN Blue / Ocean Economy** identify with the following established sectoral activity areas:

1) Marine fisheries
2) Seafood processing
3) Sea minerals

4) Tourism
5) Sea transport
6) High technology and other manufactures
7) Ships, ports equipment and parts thereof

And in the context of **sustainable development and the sustainable use of marine resources for Small Island Developing States and Coastal Least Developed Countries**, UN has identified the following sectors (and drivers of growth), presented in the table below.

Components of the Blue Economy

Type of Activity	Activity Subcategories	Related Industries/Sectors	Drivers of Growth
Harvesting and trade of marine living resources	Seafood harvesting	Fisheries (primary fish production)	Demand for food and nutrition
		Secondary fisheries and related activities (e.g., processing, net and gear making, ice production and supply, boat construction and maintenance, manufacturing of fish- processing equipment, packaging, marketing and distribution)	Demand for food and nutrition
		Trade of seafood products	Demand for food, nutrition, and protein
		Trade of non-edible seafood products	Demand for cosmetic, pet, and pharmaceutical products
		Aquaculture	Demand for food, nutrition, and protein
	Usage of marine living resources for pharmaceuticals and chemicals	Marine biotechnology and bioprospecting	R&D and usage for health care, cosmetic, enzyme, nutraceutical, and other industries
Extraction and use of marine non-living resources (non-renewable)	Extraction of minerals	(Seabed) mining	Demand for minerals
	Extraction of energy sources	Oil and gas	Demand for (alternative) energy sources
	Freshwater generation	Desalination	Demand for freshwater
Use of renewable non-exhaustible natural forces (wind, wave, and tidal energy)	Generation of (off-shore) renewable energy	Renewables	Demand for (alternative) energy sources
Commerce and trade in and around the oceans	Transport and trade	Shipping and shipbuilding	
		Maritime transport	Growth in seaborne trade; transport demand; international regulations; maritime transport industries (shipbuilding, scrapping, registration, seafaring, port operations, etc.)
		Ports and related services	
	Coastal development	National planning ministries and departments, private sector	Coastal urbanization, national regulations
	Tourism and recreation	National tourism authorities, private sector, other relevant sectors	Global growth of tourism
Indirect contribution to economic activities and environments	Carbon sequestration	Blue carbon	Climate mitigation
	Coastal Protection	Habitat protection, restoration	Resilient growth
	Waste Disposal for land-based industry	Assimilation of nutrients, solid waste	Wastewater Management
	Existence of biodiversity	Protection of species, habitats	Conservation

Figure 4: Sustainable Development Components of the Blue Economy [Sectors and Drivers of Growth]. Ref: The Potential of the Blue Economy, Increasing Long-term Benefits of the Sustainable Use of Marine Resources for Small Island Developing States and Coastal Least Developed Countries https://sustainabledevelopment.un.org/content/documents/15434Blue_EconomyJun1.pdf

From a **Seabed 2030 sector definition perspective, all the sector models presented in section 3.1 to 3.5 are useful and inform the Seabed 2030 sector approach**, ensuring:

- Seabed 2030 is informed on international sector models, those sector models that are useful and inform Seabed 2030 work on benefits analysis and economic value assessment approach.

- Seabed 2030 is informed on the range of sectors, so no key sector areas are omitted and a full set of sectors are considered in the Seabed 2030 benefits analysis workstream activities, and wider Seabed 2030 economic value assessment work.
- Seabed 2030 is informed on the range of sectors, so that Seabed 2030 key sectors of interest can be readily identified/reviewed to inform future Seabed 2030 stakeholder engagement and marketing activities.
- Seabed 2030 is informed on the different sector models adopted by key entity and partners operating both Internationally and notably in the context of sustainable development for SIDS and Coastal Least developed Countries where Seabed 2030 may be the only bathymetry data option available for use, or Seabed 203 data collection may be a higher priority for acquisition in these areas.

SECTION FOUR: SEABED 2030 ECONOMIC IMPACT SECTOR LISTING

This section presents a list of and documents the set of proposed Seabed 2030 Economic Impact Sectors.

4.1 Table of Seabed 2030 Economic Impact Sectors

The table below lists and documents the identified twenty-four Seabed 2030 Economic Impact Sectors / Sub-Sectors. The table includes where available/applicable at this time, some initial guidance on the proposed benefits analysis impact level and / or prioritisation [initial filter highlights). Use case examples are identified by sector, and these include use cases being produced under task 6.4. The table is subject to retrospective update post task 6.4 delivery.

The following details are documented in the table:

- Sector / Sub-Sector name.
- Sector categorisation as ‘established’ or ‘science and/or emerging’ or ‘other’.
- Sector level of dependency on seabed mapping data. in High Seas Context / Setting. (A qualitative view based on 3 levels of dependency categories [High, Medium, or Low].
- Confirmation if this study will produce a use case ‘case study’ – task 4.
- Example use cases, *(and providing a cross-reference for readers to the benefits analysis workstream task 4 – use case production task).*

Sector / Sub-Sector name	**Sector categorisation** *Sectors are categorised as 'established' or 'emerging' or 'other'*	**Sector level of dependency on seabed mapping data in High Seas Context / Setting.** *(A qualitative view based on 3 levels of dependency categories [High, Medium, or Low]*	**Study to Prepare a Use Case**	**Example use cases,** *(And providing a cross-reference for readers to the benefits analysis workstream task 4 – use case production task)*
Established Sectors [7 Sectors]				
Government Policy (Including Marine Protected Areas)	Established Sector	High *Includes coverage of MPAs / provision of data as foundation data, e.g., EMODNet etc. / MSP / leasing activities.*	Yes	#Use Case: Government Policy – The establishment of Marine Protected Areas. #Use Case: Seabed Mapping Publication as Foundation Data.
Marine and Coastal Fisheries & Aquaculture (esp. mariculture)	Established Sector	Low in a High Seas setting. High in an EEZ setting, (e.g., SIDS)	Yes	#Use Case: Small Island Developing States (SIDS) Marine Fisheries and Marine Aquaculture. Other example use cases include: #Use Case: Marine Biodiversity & Fisheries. #Use Case: Grounding evidence informing the decision-case towards the banning of bottom trawling. International Requirements e.g. In Mediterranean Sea bottom trawling is banned at depths below 1000m / 3281 feet depths, since 2005. Also Sea Mounts Latest Distribution in relation to bottom trawling.
Marine and Coastal Tourism	Established Sector	Low *Sea mounts discovery and consideration of*	No	Not progressed for this study purposes. Other example use cases include:

		proportion of shallow water in high seas exists.		#Use Case: Cruise Ships via High Seas: Navigation & Safety at Sea [See Shipping and Ports Use Case also].
Oil and Gas	Established Sector	Medium and predominantly in EEZ. *Most Oil companies download EMODNET data for planning purposes. Deeper water – leasing in national waters. Planning for high resolution surveys.*	Yes – shared with Renewable Energy and Marine Aggregates and Marine Mining.	#Use Case [Shared]: Planning of high resolution surveys for resources management [Oil and Gas, Marine Aggregates and Marine Mining (Including for Resource Evaluation and Preservation), and renewable energy]. Other example use cases include: #Use Case: Seabed mapping is used for oil and gas exploration, extraction facilities planning, design, build and operations. Also, pipelines see cable and pipelines use cases, and shipping safety at sea and navigation. [Note oil and gas extraction will typically be located in EEZ water area as opposed to high seas].
Shipping and Ports	Established Sector	Medium (Shipping High seas) – *used for route planning. High EEZ setting (both shipping and ports).*	No	Not progressed for this study purposes. Other example use cases include: #Use Case: Shipping: Navigation & Safety at Sea. # Use Case: Shipping Accident at Sea, including incident investigation and vessel recovery. # Use Case: Shipping: Recovery of Cargo at/over Sea.
Cable and Pipelines	Established Sector	High	Yes	#Use Case: Subsea Cable Planning - Cable Planning including (i) Cabling in Arctic instance – determining where cable across Arctic will go. And (ii) Cable routes, in context of where to survey and where to encourage the placement of cables. Other example use cases include: #Use Case: Cable Planning.

				#Use Case: Cable Asset Management, including Condition Monitoring and Inspection. #Use Case: Pipeline Planning. #Use Case: Pipeline Asset Management, including Condition Monitoring and Inspection
Defence and Maritime Affairs (Safety and Security)	Established Sector	High *Link to National capability – notably, subsea activity where such capabilities are more advanced in some nations c.f. others.*	Yes TBC	#Use Case: Australia Sovereign Rights - AusSeabed Use Case seabed mapping support to claims for sovereign rights and increase marine jurisdiction of a nation. Other example use cases include: #Use Case: Search & Rescue in High Seas. #Use Case: Accident at/over Sea, including incident investigation and aircraft / vessel recovery. #Use Case: National Security Border Security including EEZ navy monitoring adjacent to EEZ high sea area, coast guard operations to enforce EEZ, etc. #Use Case: EEZ Expansion [Review of continental shelf and subsea landform factors), e.g., Pakistan EEZ is Extended Continental Shelf (200 - 350 nm Outer limit). #Use Case: Operations in High Seas including operations planning, navigation, and safety at sea, etc. #Use Case: EEZ seabed mapping provision including the provision of EEZ seabed mapping in the absence of an existing national hydrographic entity office.
Science and/or Emerging Sectors [7 Sectors]				
Ocean Discovery	Science and/or Emerging Sector	High	Yes	#Use Case: Ocean Discovery – Ocean Exploration.
Marine Science and Research	Science and/or Emerging Sector	High	Yes (shared case study)	See climate change shared use case. #Use Case [Shared]: Marine Science and Research and Climate Change - Improvement in Global Ocean Model, including location and identification of deep-water overflows. Pathway and changes, and climate models.

Marine and Coastal Ecosystem Services (Including Marine Biodiversity)	Science and/or Emerging Sector	Low – High pending application area *Higher for Marine Biodiversity. Tidal modelling is highly dependent. Geology highly dependent*	Yes	#Use Case: Marine and Coastal Ecosystem Services – Marine Biodiversity Monitoring. Notably mapping of areas around MPA and case study identification of suitable areas for MPAs, Deep Coral Areas, among others. Other example use cases include: #Use Case: Discovery or Monitoring of Marine Biodiversity. #Use Case: Tidal modelling. #Use Case: Seabed Geology.
Climate Change	Science and/or Emerging Sector	High *Tsunami modelling need bathymetry e.g., Sri Lanka tsunami event.*	Yes – 3 TBC Inc. shared	#Use Case: Small Island Developing States (SIDS), Sea Level Rise Coastal Inundation Modelling, Resilience, and Adaptation. #Use Case [Shared]: Marine Science and Research and Climate Change - Improvement in Global Ocean Model, including location and identification of deep-water overflows. Pathway and changes, and climate models. #Climate Change – Improved Climate Modelling through use of seabed mapping. Other example use cases include: #Use Case: Polar Region Bathymetry: Critical Knowledge for the Prediction of Global Sea Level Rise. #Use Case: Carbon Sequestation – the baling and sinking of sargassum bales to the ocean floor [Company Seafields], e.g., 'Seafields has a solution for CO2 removal that is easy to visualise. Seafield compressed Sargassum bales are natural 'carbon batteries': ocean grown seaweed, sunk to the abyssal plain of the ocean, which locks away the CO2 for millennia.'

Disaster Management and Disaster Risk Resilience	Science and/or Emerging Sector	Medium	Yes – 2 TBC	#Use Case: Disaster management and Disaster Risk Resilience – Tsunami Propagation, Seabed landform regarding earthquake and underwater volcano activity. Disaster Preparedness. #Use Case: Disaster management and Disaster Risk Resilience - Storm Surge Modelling [The Netherlands].
Renewable Energy I - Offshore Wind Energy	Science and/or Emerging Sector	Medium *Offshore wind is more mature and at scale c.f. tidal / wave (see below).* *High in an EEZ setting.*	Yes – shared with oil & gas and Marine Aggregates and Marine Mining	#Use Case [Shared]: Planning of high resolution surveys for resources management [Oil and Gas, Marine Aggregates and Marine Mining (Including for Resource Evaluation and Preservation), and renewable energy].
Renewable Energy II - Tidal and Wave	Science and/or Emerging Sector	Medium *High in an EEZ setting.*	See above	#Use Case [Shared]: Planning of high resolution surveys for resources management [Oil and Gas, Marine Aggregates and Marine Mining (Including for Resource Evaluation and Preservation), and renewable energy].
Other Sectors [7 Sectors]				
Hydrographic/Oceanographic Survey	Other Sector	High (Also, a cross-cutting sector)	Yes - 2	#Use Case: Hydrographic/Oceanographic Survey – Seabed mapping technology innovation facilitating global ocean coverage seabed mapping. #Use Case: Provision of Seabed Mapping support in the absence of a Hydrographic Office. Other example use cases include: #Use Case: Seabed 2030 is driving technology innovation and industrial enhancements, including autonomous vessels, sensor improvements, edge compute, data processing/production

				automation, cloud production and storage strategies, among others. #Use Case: Seabed 2030 is driving industrial expansion and growth: resulting in economic value benefits (direct benefits, e.g., increased employment and new skills in workforce. in industrial contribution towards economic value increasing demand for industry roles, (all roles as well as specialist roles), among others. #Use Case: Seabed 2030 resulting in increasing customer base for survey companies. Including Economic impact as associated with, increasing customers for survey companies. #Use Case: Seabed 2030 Data Fusion – concept of Seabed 2030 / GEBCO as more than seabed knowledge, in the context of enabling added value through combining Seabed 2030 data with other ocean data.
Human Capital	Other Sector (Also a cross-cutting sector)	Low [Impact is high in global survey context]	Yes	#Use case: Human Capital – Seabed Mapping Industry Employment Opportunities Growth and Capacity Building , resulting from global seabed mapping. Other example use cases include: #Use Case: Seabed 2030 is driving workforce development, expansion and growth, e.g., hydrographic survey technologies manufacture, and data end user communities, resulting in economic value benefits (direct benefits, e.g. increased employment and new skills in workforce). Also see Hydrographic / Oceanographic Survey Sector Use Case. #Use Case: Seabed 2030 is driving inclusion at global community level.
Marine and Coastal Development	Other Sector	Medium *High EEZ setting (e.g., SIDS) Also*	Yes	#Use Case: Small Island Developing State (SIDS) Coastal Development and the use of seabed mapping as a foundation data for Marine Spatial Planning.

		development in response to sea level rise has a high level of dependency.		Other example use cases include: #Use Case: SIDS applied use of seabed mapping for marine and coastal development. #Use Case: The provision of seabed mapping in the absence of an existing national hydrographic entity office. #Use Case: Link to Marine Spatial Planning, and the use of seabed grounding evidence towards marine and coastal development decision-making.
Marine Aggregates and Marine Mining [Resource evaluation and Preservation]	Other Sector	High	Yes – shared with oil & gas and renewable energy	#Use Case [Shared]: Planning of high resolution surveys for resources management [Oil and Gas, Marine Aggregates and Marine Mining (Including for Resource Evaluation and Preservation), and renewable energy]. Other example use cases include: #Use Case Deep Sea Mining. Including perspective between Seabed 2030 grid data and Deep Sea Mining Area Link – in the context of areas that may be identified for deep sea mining, and that we need to survey/understand what is there ahead of any mining proceeds.
Biotechnology *Inc. Pharma Industries*	Other Sector	High *Indirect dependency as will look at marine species that will provide solutions for x. Hydro thermal vents, closely related to biological / ecosystem research.*	Yes - TBC	#Use Case: Biotechnology – Supporting Marine Bio pharmacy.

Insurance	Other Sector	Medium *(A cross-cutting sector provision of insurance services in other sectors such as parametric insurance for crisis and disaster).* *Insurance has growing involvement – coastal and shallow water natural capital etc. Climate change aspect of insurance.*	No	Not progressed for this study purposes. Other example use cases include: #Use Case: Use of Seabed Mapping Data towards insurance claims review. See https://london-marine.co.uk/ Note this is cross-cutting e.g., aircraft / vessel recovery use case. Cable/pipeline infrastructure in High Seas insurance etc.
Investment	Other Sector	Medium *Investment supporting ocean discovery.* *Investment - Monitoring carbon capture (Climate)*	No	Not progressed for this study purposes.
Ship Building, Ship Breaking, and offshore (structures) decommissioning	Other Sector	Low *Decommission of offshore structures need draft clearance – any unmapped obstacles etc* *.*	No	Confirmed not as applicable for High seas context / setting c.f. EEZ. Not progressed for this study purposes.

Desalination – confirmed not as applicable	Other Sector	Low	No	Confirmed not as applicable for High seas context / setting c.f. EEZ. Not progressed for this study purposes.
Marine Archaeology / Heritage	Other Sector	Low	No	Not progressed for this study purposes.

SECTION FIVE: TWENTY-FOUR SEABED 2030 ECONOMIC IMPACT SECTORS DESCRIPTION SHEETS

This section presents 'Twenty-Four' Seabed 2030 economic impact sectors description sheets. These are ~one page overview descriptions for each target economic impact sector as identified in section 4 above.

Individual sectors are presented by dedicated sub-section below.

Details on each sector are presented using a common table approach, including the following:

- Sector Name
- Sector categorisation as 'established' or 'science and/or emerging' or 'Other'.
- Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data. [See *]
- Sector Description - an 'overview description' presenting thematic 'scope' and including Seabed 2030 sector context.
- Seabed 2030 Example Use Cases *(providing a cross-reference for readers to the benefits analysis workstream task 4 – use case production task).*

*With a Seabed 2030 Lens [a High Seas 'Seabed Mapping Grid Data' context focus], categorise the sector using 3 levels of dependency, as follows:

#1: High dependency [i.e., Seabed 2030 high seas grid data is critical to the sector [A 'must have' position]

#2: Medium dependency [i.e., Seabed 2030 high seas grid data provides a level of enhanced value in the sector [A 'good to have' position]

#3: Minimal dependency [i.e., Seabed 2030 high seas grid data has minimal value to the sector [A 'doesn't matter' or 'limited relevance' or 'no relevance' position]

5.1 Economic Impact Sector 1: Government Policy (Including Marine Protected Areas)

Sector Name	**Government Policy (Including Marine Protected Areas)**
Sector Category	An established sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	High *Includes coverage of MPAs / provision of data as foundation data, e.g., EMODNet etc. / MSP / leasing activities.*
Sector Description	This sector includes institutions, legislature, and policy development at all governmental tiers (international, national, provincial, and local), addressing marine / maritime interests and concerns. For Seabed 2030 purposes, it is proposed to focus in on key strategic areas of marine / maritime policy development, including: • Maritime affairs (safety and security). • Coastal and marine resource management. • Ecosystem integrity. • Socio-economic development. • Human health, wellbeing, and shared prosperity.

	• Climate change. • Science and research. And to include key policy areas where seabed mapping is a foundation data and/or used as a data input to inform policy development and decision-making. Examples being: • The designation of International / National borders and boundaries. • Blue economy activities licensing / leases, e.g., oil and gas leases, mining leases, commercial capture fisheries licensing and controls, among others. • Marine Protected Areas (MPAs). • Marine Spatial Planning (MSP). • Integrated Coastal Zone Management (ICZM). The publication of seabed mapping data as a foundation data to be accessed and used across by public and private sectors through marine spatial data infrastructures (MSDI) and regional data platforms such as EMODnet is also addressed under this sector.
Seabed 2030 Example Use Cases	#Use Case: Government Policy – The establishment of Marine Protected Areas. #Use Case: Seabed Mapping Publication as Foundation Data.

5.2 Economic Impact Sector 2: Marine and Coastal Fisheries & Aquaculture (esp. Mariculture)

Sector Name	**Marine and Coastal Fisheries & Aquaculture (esp. Mariculture)**
Sector Category	An established sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Low in a High Seas setting. High in an EEZ setting, (e.g., SIDS)
Sector Description	This sector comprise 2 key subsectors, capture fisheries and aquaculture and two water settings (marine and coastal). Applying a World Bank adopted definition, capture fisheries is the harvesting of finfish, crustaceans (e.g., lobster, crab and shrimp), and cephalopods (e.g., cuttlefish and squid) from the wild. Capture fisheries, includes land-sea interaction. The primary production - capture and landing is a key focus for Seabed 2030, but also the processing & distribution value chain elements are included in the sector but are of less interest to Seabed 2030. The FOA defines aquaculture as “The farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants.” FOA elaborates “Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of

	the stock being cultivated, the planning, development and operation of aquaculture systems, sites, facilities and practices, and the production and transport. ” For Seabed 2030 purposes, primary production is the focus, then in future, noting that processing & distribution value chain elements are included in the sector, but are of less interest to Seabed 2030. Marine and Coastal Fisheries & Aquaculture (esp. Mariculture) are of significant economic contributors Small Island Developing States (SIDS) and Coastal Least Developed Countries economies.
Seabed 2030 Example Use Cases	#Use Case: Small Island Developing States (SIDS) Marine Fisheries and Marine Aquaculture. Other example use cases include: #Use Case: Marine Biodiversity & Fisheries. #Use Case: Grounding evidence informing the decision-case towards the banning of bottom trawling. International Requirements e.g. In Mediterranean Sea bottom trawling is banned at depths below 1000m / 3281 feet depths, since 2005. Also, Sea Mounts Latest Distribution in relation to bottom trawling.

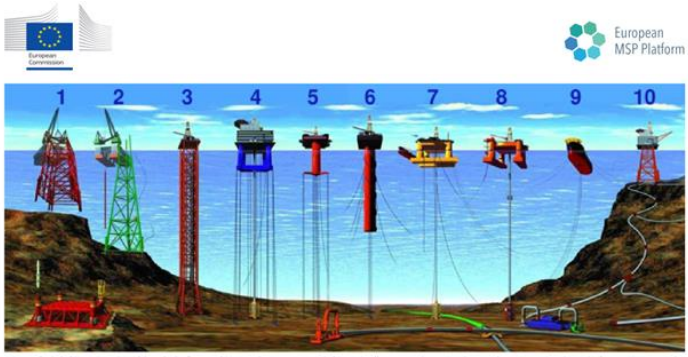
5.3 Economic Impact Sector 3: Marine and Coastal Tourism

Sector Name	**Marine and Coastal Tourism**
Sector Category	An Established Sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Low *Sea mounts discovery and consideration of proportion of shallow water in high seas exists.*
Sector Description	Marine and Coastal Tourism includes both International Domestic Tourism. It can be useful to consider tourism by location and sub-sector as follows: <u>By Location:</u> -Coastal tourism covers tourism in the coastal area as well as the supplies and manufacturing industries associated to these activities. -Maritime tourism covers tourism in the maritime area. <u>By sub-sector:</u> -Beach-based tourism covers beach-based recreation and tourism (e.g., sunbathing, walking in the beach, kite competitions, etc.), and non-beach related land-based tourism in the coastal area (all other tourism and recreation activities that take place in the coastal area for which the proximity of the sea is a condition), as well as the supplies and manufacturing industries associated to these activities. -Water-based tourism covers tourism that is largely water-based rather than land-based (e.g. swimming, canoeing, surfing, wind-surfing, sport fishing, diving, snorkelling, underwater cultural heritage, whale watching, seabirds watching, boating, yachting, nautical sports, etc.), but includes also the operation of landside facilities,

	manufacturing of equipment, and services necessary for this segment of tourism. Cruise-based tourism can be also considered part of coastal and maritime tourism. Also cruise can also reside in the shipping and ports sector, depending on engagement stakeholder preferences. The EU MSP approach assigns cruise-based tourism in the shipping and ports sector. A useful sector reference can be found here: https://maritime-spatial-planning.ec.europa.eu/sites/default/files/sector/pdf/mspforbluegrowth_sectorfiche_tourism.pdf
Seabed 2030 Example Use Cases	Not progressed for this study purposes. Other example use cases include: #Use Case: Cruise Ships via High Seas: Navigation & Safety at Sea [See Shipping and Ports Use Case also].

5.4 Economic Impact Sector 4: Oil and Gas

Sector Name	**Oil and Gas**
Sector Category	An established sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Medium and predominantly in EEZ. *Most Oil companies download EMODNET data for planning purposes.* *Deeper water – leasing in national waters.* *Planning for high resolution surveys.*
Sector Description	The production of oil and natural gas are often coupled as the two are typically found together in nature. The industry is commonly divided into three main operational sectors: upstream, midstream, and downstream. The upstream sector incorporates the exploration and extraction of crude oil and natural gas reserves, while midstream focuses on transporting and storing the extracted products. The oil and natural gas then reach downstream processing facilities where they are refined, distributed and sold to the end customer. The product that reaches the end customer can take a number of forms including natural gas, liquefied petroleum gas (LPG), petrol, diesel fuel, jet fuel, heating oil, kerosene, asphalt and other petrochemicals. See here: https://www.energyinst.org/exploring-energy/topic/oil-and-gas For Seabed 2030 purposes, we include oil and gas exploration, extraction through to processing (refinery), and exclude pipelines which are addressed in the cables and pipelines sector and also exclude operating and service vessels which are addressed in shipping and ports 'service' element. The oil and gas sector is locked in physically to the specific location where geological processes lead to those materials to be extracted. Thus, both a spatial and seabed profile dimension are of key importance for this sector, as the

	spatial availability of the resource cannot be altered. The material transport to ports also typically follows a linear structure connecting the collection point to the point of delivery (by ship or pipelines), which will generally follow the most direct route in order to minimize shipping costs. In other to avoid potential spills, during extraction all other uses are to be spatially avoided so that focus remains on a safe exploration. At the same time, the advent of directional drilling has reduced the amount of surface structures required for hydrocarbon extraction activities, since many wells can be operated from a single platform, and at a distance of several kilometres. Similarly, extended reach drilling can be used to access offshore reserves from onshore facilities, as per EU example as undertaken from the German North Sea coast. The figure below shows the example range of installation types used in the oil and gas sector, noting 'interaction' with seabed.  Figure 2: 1 & 2) conventional fixed platforms; 3) compliant tower; 4 & 5) vertically moored tension leg and mini-tension leg platform; 6) spar; 7 & 8) semi-submersibles; 9) floating production, storage, and offloading facility; 10) sub-sea completion and tie-back to host facility[4].
Seabed 2030 Example Use Cases	#Use Case [Shared]: Planning of high resolution surveys for resources management [Oil and Gas, Marine Aggregates and Marine Mining (Including for Resource Evaluation and Preservation), and renewable energy]. Other example use cases include: #Use Case: Seabed mapping is used for oil and gas exploration, extraction facilities planning, design, build and operations. Also, pipelines see cable and pipelines use cases, and shipping safety at sea and navigation. [Note oil and gas extraction will typically be located in EEZ water area as opposed to high seas].

5.5 Economic Impact Sector 5: Shipping and Ports

Sector Name	Shipping and Ports
Sector Category	An established sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Medium (Shipping High seas) – *used for route planning. High EEZ setting (both shipping and ports).*
Sector Description	Shipping and ports sector can be broken down by considering activities: (i) the origin/destination of the ships' journey. (ii) the purpose of traffic as well as. (iii) the size of ports. *By purpose of the traffic: including Cargo [Liquid bulk, dry bulk, containers, Ro-ro]. Passenger [Ferries, Cruise], and Service e.g., to offshore wind farms, oil and gas platforms, aquaculture installations.* *Size of ports: range in scale from very large (hubs) to small/regional ports.* In this sector, there is an emphasis on cargo and passenger traffic types as well as on short sea shipping. However, for Seabed 2030 purposes, service traffic and the applicable leg of deep sea shipping should also be considered, too. Leisure boats and fishing activities also create traffic. These forms of navigation are not covered under this sector and are addressed as part of the coastal and maritime tourism and fishing sectors. Cruise-based tourism has been identified under the coastal and maritime tourism sector, and can also reside in the shipping and ports sector, depending on engagement stakeholder preferences.
Seabed 2030 Example Use Cases	Not progressed for this study purposes. Other example use cases include: #Use Case: Shipping: Navigation & Safety at Sea. # Use Case: Shipping Accident at Sea, including incident investigation and vessel recovery. # Use Case: Shipping: Recovery of Cargo at/over Sea.

5.6 Economic Impact Sector 6: Cable and Pipelines

Sector Name	Cable and Pipelines
Sector Category	An established sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	High
Sector Description	This sector includes both offshore cable and offshore pipelines. Cables may include communication and energy cables and pipelines may include oil and gas pipelines. Cable-laying or pipeline-laying vessels are included in this sector as a key use case for Seabed 2030 grid data. Cables and pipelines are either locked in physically to a specific location between the field of collection and the point

	of delivery or seek to take the direct route between two connection points. Cable and pipeline design lifetime typically range between 20 to 50 years (for pipelines); 40 to 50 years (for grid cables), and a technical lifetime of 25 years for communication cables. Requirements are typically defined to include buffers associated with cables and pipelines. For example, EU has adopted the following approach, *please see italic text below:* *Cables, with respect to offshore wind energy development and also applying to nearshore wave and tidal devices, the International Cable Protection Committee (ICPC) recommends that existing cables in shallower waters (up to a depth of 75m) are given a default 500m exclusion zone on either side. The actual distance will vary between Member States14: in the UK, the Marine Management Organisation recommends a 250m exclusion zone either side of existing cables15; in Denmark 200m exclusion zone either side is recommended; in the Netherlands there is a maintenance zone of 500m; whilst in Belgium there is a 250m protected area and a 50m reserved area on either side. The exclusion zone increases to 750m on either side for telecommunication cables.* *Similarly, energy cables might require space for their laying, bundling (by parallel routing), energy transformation (at the transformer substation platform), interconnection (at grid interconnector sites) and cross connection (at cables crossing areas). In case of parallel routing, distances of 100 - 200m should be maintained after every second cable system depending on the geological site conditions. As stated in the BSH (2014): "when placing bundling platforms, a 500m distance from priority and reservation areas for shipping and all existing and approved uses should be maintained".*
Seabed 2030 Example Use Cases	#Use Case: Subsea Cable Planning - Cable Planning including (i) Cabling in Arctic instance – determining where cable across Arctic will go. And (ii) Cable routes, in context of where to survey and where to encourage the placement of cables. Other example use cases include: #Use Case: Cable Planning. #Use Case: Cable Asset Management, including Condition Monitoring and Inspection. #Use Case: Pipeline Planning. #Use Case: Pipeline Asset Management, including Condition Monitoring and Inspection.

5.7 Economic Impact Sector 7: Defence and Maritime Affairs (Safety and Security)

Sector Name	Defence and Maritime Affairs, (Safety and Security)
Sector Category	An established sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	High *Link to National capability – notably, subsea activity where such capabilities are more advanced in some nations c.f. others.*
Sector Description	This sector can be defined as 'The military use of the sea, or the use of marine and coastal areas for purposes of security and defence.' This includes search and rescue (coastguard), wider military and civil defence concerns. Military and civil defence, as well as safety and security-related uses are not synonymous and may be led by different maritime agencies and also shared use of assets. Military defence usually comprises activities that are designed to ensure capability for armed combat. This involves armed combat capability on, above and under the water, which is ensured by means of naval exercise areas and artillery ranges and air bases, for example. Civil defence safeguards the civil population, ensures the most important societal functions, and contributes to military defence in the event of war. Security is a generic term that can relate to a broad range of military and domestic issues including crime prevention and prosecution (e.g. illegal fishing, disaster relief, or combating fires). For example in Europe, Sweden has termed security and defence "total defence"; while other countries in a European setting deal with them as separate issues. A useful sector reference can be found here: https://maritime-spatial-planning.ec.europa.eu/sites/default/files/sector/pdf/3_military.pdf
Seabed 2030 Example Use Cases	#Use Case: Australia Sovereign Rights - AusSeabed potentially referenceable Use Case seabed mapping support to claims for sovereign rights and increase marine jurisdiction of a nation. Other example use cases include: #Use Case: Search & Rescue in High Seas. #Use Case: Accident at/over Sea, including incident investigation and aircraft / vessel recovery. #Use Case: National Security Border Security including EEZ navy monitoring adjacent to EEZ high sea area, coast guard operations to enforce EEZ, etc. #Use Case: EEZ Expansion [Review of continental shelf and subsea land form factors), e.g., Pakistan EEZ is Extended Continental Shelf (200 - 350 nm Outer limit). #Use Case: Operations in High Seas including operations planning, navigation, and safety at sea, etc. #Use Case: EEZ seabed mapping provision including the provision of EEZ seabed mapping in the absence of an existing national hydrographic entity office.

5.8 Economic Impact Sector 8: Ocean Discovery

Sector Name	Ocean Discovery
Sector Category	A science and/or emerging sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	High
Sector Description	Ocean Discovery includes the mapping, observation, and exploration of oceans. NOAA present a case for ocean discovery, through 'Much remains to be learned from exploring the mysteries of the deep. From mapping and describing the physical, biological, geological, chemical, and archaeological aspects of the ocean to understanding ocean dynamics, developing new technologies, and unlocking other secrets of the ocean, NOAA is working to increase our understanding of the ocean realm. Ocean exploration is about making discoveries, searching for things that are unusual and unexpected. As the first step in the scientific process, the rigorous observations and documentation of biological, chemical, physical, geological, and archaeological aspects of the ocean gained from exploration set the stage for future research and decision-making. Further, See here: https://oceanexplorer.noaa.gov/backmatter/whatisexploration.html NOAA Ocean Exploration state that through ocean exploration, they collect data and information needed to address both current and emerging science and management needs. Exploration helps to ensure that ocean resources are not just managed, but managed in a sustainable way, so those resources are around for future generations to enjoy. See here: https://oceanexplorer.noaa.gov/about/welcome.html Ocean discovery is directly aligned to Seabed 2030 mission and highly dependent on seabed mapping data, technologies and processes.
Seabed 2030 Example Use Cases	#Use Case: Ocean Discovery – Ocean Exploration.

5.9 Economic Impact Sector 9: Marine Science and Research

Sector Name	Marine Science & Research
Sector Category	A science and/or emerging sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	High
Sector Description	Marine Scientific Research (MSR) is scientific research concerned with improving our understanding of the ocean, how we use/interact with the marine environment and our impacts on the marine environment. MSR research may be related to ocean chemistry, air-sea interactions, applications of ocean science, geophysical research, data assimilation techniques, studies on chemical contaminants, marine

	resources management, economic and social impacts of marine pollution, among others. For Seabed 2030 purposes, we are more concerned with how the seabed setting interacts with / informs wider marine scientific research and how the seabed setting is itself a key marine environment for MSR in its own right. Example stakeholders may include: Ocean scientific research & development, research based institutions and academia. There is cross-cutting synergy with the Hydrographic / Oceanographic survey sector and other sector interests, which may be the purpose of MSR, such as climate change, among others.
Seabed 2030 Example Use Cases	See climate change shared use case #Use Case [Shared]: Marine Science and Research and Climate Change - Improvement in Global Ocean Model, including location and identification of deep-water overflows. Pathway and changes, and climate models.

5.10 Economic Impact Sector 10: Marine and Coastal Ecosystem Services (including Marine Biodiversity)

Sector Name	**Marine and Coastal Ecosystem Services (including Marine Biodiversity)**
Sector Category	A science and/or emerging sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Low – High pending application area *Higher for Marine Biodiversity.* *Tidal modelling is highly dependent.* *Geology highly dependent.*
Sector Description	Ecosystem services are all the processes and outputs that nature provides us with. There are four major types of ecosystem services: provisioning, regulating, supporting and cultural. For example, these include provisioning services (food, water), regulating services (wastewater treatment, pollution control), supporting services (shelter), and cultural services (recreation and tourism). For Seabed 2030 purposes we are interested in ecosystem services associated with the marine and coastal settings. Examples of ecosystem services provided by different marine and coastal habitats included:

Provisioning services	Regulating services	Supporting services	Cultural services
Food	Biological regulation	Biochemical	Cultural and amenity
Fiber, timber, fuel	Freshwater storage and retention	Nutrient cycling and fertility	Recreational
Medicines, other resources	Hydrological balance		Aesthetics
	Atmospheric and climate regulation		Education and research

	<table><tr><td></td><td>Human disease control Waste processing Flood/storm protection Erosion control</td><td></td><td></td></tr></table> Noting, obvious examples of provisioning services include food (e.g., fish) and timber (e.g., mangroves). Other services are less obvious. For instance, mangroves support nutrient cycling and provide substantial regulating services e.g., act as a barrier to storm surges and coastal flooding and prevent coastal erosion. They are also important habitats for juvenile fish and crustaceans. This sector is also interested in the complex nature of coastal and marine resources in terms of ecology, patterns of utilization and types of users, demands holistic management solutions, possibly in a 'blue economy' context. For example this includes informing marine environment interests, marine protection and pollution monitoring / incidents such as oil spill. Also, marine biodiversity, among others. As with Marine and Coastal Fisheries & Aquaculture (esp. Mariculture), Marine and Coastal Ecosystem Services are significant economic contributors to Small Island Developing States (SIDS) and Coastal Least Developed Countries economies.
Seabed 2030 Example Use Cases	#Use Case: Marine and Coastal Ecosystem Services – Marine Biodiversity Monitoring. Notably mapping of areas around MPA and case study identification of suitable areas for MPAs, Deep Coral Areas, among others. Other example use cases include: #Use Case: Discovery or Monitoring of Marine Biodiversity. #Use Case: Tidal modelling. #Use Case: Seabed Geology.

5.11 Economic Impact Sector 11: Climate Change

Sector Name	**Climate Change**
Sector Category	A science and/or emerging sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	High *Tsunami modelling need bathymetry e.g., Sri Lanka tsunami event.*
Sector Description	It is useful to apply a UN definition, where Climate change is defined as referring to long-term shifts in temperatures and weather patterns. Please see here: https://www.un.org/en/climatechange/what-is-climate-change The UN describes climate change as: "Climate change refers to long-term shifts in temperatures and weather patterns. These shifts may be natural, such as through variations in the solar cycle. But since the 1800s, human

	activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil and gas. Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures. Examples of greenhouse gas emissions that are causing climate change include carbon dioxide and methane. These come from using gasoline for driving a car or coal for heating a building, for example. Clearing land and forests can also release carbon dioxide. Landfills for garbage are a major source of methane emissions. Energy, industry, transport, buildings, agriculture, and land use are among the main emitters." From a marine / maritime perspective climate change can be considered climate change features/concerns that are associated with the marine / maritime setting including: [Marine / Maritime] climate change science, Net Zero, Adaptation, Causes and Effects, Finance, and sustainable development goal where climate action is a global goal. Seabed 2030 interest focus in on the use of seabed mapping to inform or provide input to grounding evidence to climate change models or inform or input to climate adaptation research or decision-making.
Seabed 2030 Example Use Cases	#Use Case: Small Island Developing States (SIDS), Sea Level Rise Coastal Inundation Modelling, Resilience, and Adaptation. #Use Case [Shared]: Marine Science and Research and Climate Change - Improvement in Global Ocean Model, including location and identification of deep-water overflows. Pathway and changes, and climate models. #Climate Change – Improved Climate Modelling through use of seabed mapping. Other example use cases include: #Use Case: Polar Region Bathymetry: Critical Knowledge for the Prediction of Global Sea Level Rise. #Use Case: Carbon Sequestation – the baling and sinking of sargassum bales to the ocean floor [Company Seafields], e.g., 'Seafields has a solution for CO2 removal that is easy to visualise. Seafield compressed Sargassum bales are natural 'carbon batteries': ocean grown seaweed, sunk to the abyssal plain of the ocean, which locks away the CO2 for millennia.'

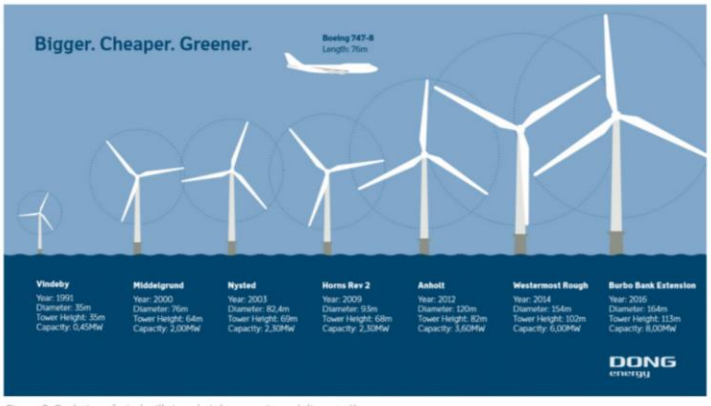
5.12 Economic Impact Sector 12: Disaster Management and Disaster Risk Resilience

Sector Name	**Disaster Management and Disaster Risk Resilience**
Sector Category	A science and/or emerging sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Medium

Sector Description	**Disaster Management** aims to reduce, or avoid the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery. The disaster management cycle illustrates the ongoing process by which governments, businesses, and civil society plan for and reduce the impact of disasters, react during and immediately following a disaster, and take steps to recover after a disaster has occurred. Consensus identifies four phases to the disaster management process.  **Disaster Risk Management** (DRM) is defined by UNISDR (2009) as the systematic process of using administrative directives, organisations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster. *Comment: This term is an extension of the more general term "risk management" to address the specific issue of disaster risks. Disaster risk management aims to avoid, lessen or transfer the adverse effects of hazards through activities and measures for prevention, mitigation and preparedness.* **Disaster Risk Reduction** (DRR) is defined by UNISDR (2009) as The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

	For the above, see here: https://www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf With a marine / maritime lens DRM/DRR brings a focus towards natural, man-made and complex disasters in ocean and coastal settings, for example tsunami, typhoon, tide surge, oil spill, nuclear accident, among others. Seabed mapping is a foundational data for DM, DRM and DRR, and is used as an input to understand and mitigate threats such as Tsunami and storm surge as identified in use cases below.
Seabed 2030 Example Use Cases	#Use Case: Disaster management and Disaster Risk Resilience – Tsunami Propagation, Seabed landform regarding earthquake and underwater volcano activity. Disaster Preparedness. #Use Case: Disaster management and Disaster Risk Resilience - Storm Surge Modelling [The Netherlands].

5.13 Economic Impact Sector 13: Renewable Energy I - Offshore Wind Energy

Sector Name	**Renewable Energy I - Offshore Wind Energy**
Sector Category	A science and/or emerging sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Medium *Offshore wind is more mature and at scale c.f. tidal / wave (see below).* *High in an EEZ setting.*
Sector Description	Off-shore wind energy is energy produced by off-shore wind. Sector activities associated with the offshore wind farm sector can be broken down by lifecycle activities, including Development and consenting, Design and Manufacturing, Construction and installation, Operation and maintenance & Decommissioning. Offshore wind farm projects can be differentiated by the size of the individual units. An evolution has taken place. overtime and wind mills have increased in height, capacity, and diameter. The figure below shows evolution of offshore windfarms.  Figure 2: Evolution of wind mill sizes, height, capacity and diameter[12].

	The spatial set up of an Offshore Wind Farm (OWF) is important to understand the spatial needs of the sector. An offshore wind farm is a group of wind turbines that are interconnected through a medium-voltage system; the medium voltage is then increased at a substation by using a transformer to send the power to its destination, typically the power grid on land. In locating an offshore wind farm, consideration must be given not only to the turbines themselves, but also the connections between turbines, the substation, and efficient connection to the grid on land. The spatial arrangement of the individual turbines is also important in the development of an offshore wind farm. Wind turbines extract energy from the wind and downstream there is a wake where wind speed is reduced, affecting the turbines downwind. To maximise energy production, responsible organisations (industry and government) should be aware of these wake effects on other turbines, neighbouring wind farms and possible future wind farms. A dense wind farm with turbines close to each other might seem spatially and economically the best option, but the wake might make the development less profitable. See here: https://maritime-spatial-planning.ec.europa.eu/sites/default/files/sector/pdf/mspforbluegrowth_sectorfiche_offshorewind.pdf Seabed mapping is an input informing feasibility, design, build and decommissioning of Offshore Wind Farm Structures.
Seabed 2030 Example Use Cases	#Use Case [Shared]: Planning of high resolution surveys for resources management [Oil and Gas, Marine Aggregates and Marine Mining (Including for Resource Evaluation and Preservation), and renewable energy].

5.14 Economic Impact Sector 14: Renewable Energy II - Tidal and Wave

Sector Name	**Renewable Energy II - Tidal and Wave**
Sector Category	A science and/or emerging sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Medium *High in an EEZ setting.*
Sector Description	Tidal and wave renewable energy is an emerging sector with the development of tidal and wave energy technologies advancing both in Europe and globally. Both sectors are expected to expand significantly in the next decade. Wave energy is dependent on wave height, speed, length and the density of the water, whereas tidal energy is generated by the difference in surface height in a dammed estuary, a bay or a lagoon (tidal range) and the kinetic energy in the currents caused by the tides (tidal stream). Seabed mapping is a key input for tidal and wave feasibility, design and build notably in EEZ setting.

Seabed 2030 Example Use Cases	#Use Case [Shared]: Planning of high resolution surveys for resources management [Oil and Gas, Marine Aggregates and Marine Mining (Including for Resource Evaluation and Preservation), and renewable energy].

5.15 Economic Impact Sector 15: Hydrographic/Oceanographic Survey

Sector Name	**Hydrographic/Oceanographic Survey**
Sector Category	An 'Other' Sector (Also a cross-cutting sector)
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	High
Sector Description	For the purposes of the Seabed 2030 sector economic benefits analysis, this sector can be considered as the collection of various industries, technologies and practitioner community involved in hydrographic and oceanographic surveying. Whilst recognising this is a key sector for Seabed 2030, specifically for the Seabed 2030 benefits analysis workstream study activities it is recommended that the study focusses in on Hydrographic/Oceanographic Survey sector use cases activity areas that are associated with key economic value generation. These include three key areas: 1. Resulting and driving / enabling advances and increasing demand for seabed mapping technologies and innovation. 2. Seabed 2030 global seabed mapping coverage driving sector industrial expansion and growth, including increasing employment and the development of new skills. 3. Increasing customer base for survey companies. And are proposed addressed through the preparation of a single sector use case as a key informing grounding evidence to be available for use in the Seabed 2030 value proposition document.
Seabed 2030 Example Use Cases	#Use Case: Hydrographic/Oceanographic Survey – Seabed mapping technology innovation facilitating global ocean coverage seabed mapping. #Use Case: Provision of Seabed Mapping support in the absence of a Hydrographic Office. Other example use cases include: #Use Case: Seabed 2030 is driving technology innovation and industrial enhancements, including autonomous vessels, sensor improvements, edge compute, data processing/production automation, cloud production and storage strategies, among others. #Use Case: Seabed 2030 is driving industrial expansion and growth: resulting in economic value benefits (direct benefits, e.g., increased employment and new skills in workforce. in industrial contribution towards economic value increasing demand for industry roles, (all roles as well as specialist roles), among others.

	#Use Case: Seabed 2030 resulting in increasing customer base for survey companies. Including Economic impact as associated with, increasing customers for survey companies. #Use Case: Seabed 2030 Data Fusion – concept of Seabed 2030 / GEBCO as more than seabed knowledge, in the context of enabling added value through combining Seabed 2030 data with other ocean data

5.16 Economic Impact Sector 16: Human Capital

Sector Name	**Human Capital**
Sector Category	An 'Other' Sector (Also a cross-cutting sector)
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Low [Impact is high in global survey context]
Sector Description	World Bank defines human capital as the earnings over a person's lifetime. Further human capital in a developmental context considers factors that impact the ability to earn, for instance including socio-economic elements such as: • Human Development Index (HDI) • Gender equality • Poverty, education, and employment • Health and food security • Human and labour rights Human capital also includes experience and skills and has as a perceived relationship with economic growth, productivity, and profitability, and can be enhancement through new technology, innovation and skills investment. Seabed 2030 interest in this sector is proposed associated with the impact of a global survey on driving workforce development, expansion and growth and its resulting / associated economic value. The proposed use cases will seek to articulate this resulting value in applicable industries context.
Seabed 2030 Example Use Cases	#Use case: Human Capital – Seabed Mapping Industry Employment Opportunities Growth and Capacity Building, resulting from global seabed mapping. Other example use cases include: #Use Case: Seabed 2030 is driving workforce development, expansion and growth, e.g., hydrographic survey technologies manufacture, and data end user communities, resulting in economic value benefits (direct benefits, e.g. increased employment and new skills in workforce). Also see Hydrographic / Oceanographic Survey Sector Use Case. #Use Case: Seabed 2030 is driving inclusion at global community level.

5.17 Economic Impact Sector 17: Marine and Coastal Development

Sector Name	Marine and Coastal Development
Sector Category	An 'Other' Sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Medium *High EEZ setting (e.g., SIDS) Also development in response to sea level rise has a high level of dependency.*
Sector Description	Marine and Coastal development covers a wide range of human activities and associated infrastructure in a marine and coastal setting, including port development, urban development, coastal defences and land reclamation. Seabed 2030 key interest in this sector centre on the use of seabed mapping as foundation data and a key informing input to Coastal Zone Management (ICZM) and Marine Spatial Planning (MSP), coastal development disaster risk resilience, and key marine and coastal infrastructure feasibility, design and build, among others.
Seabed 2030 Example Use Cases	#Use Case: Small Island Developing State (SIDS) Coastal Development and the use of seabed mapping as a foundation data for Marine Spatial Planning. Other example use cases include: #Use Case: SIDS applied use of seabed mapping for marine and coastal development. #Use Case: The provision of seabed mapping in the absence of an existing national hydrographic entity office. #Use Case: Link to Marine Spatial Planning, and the use of seabed grounding evidence towards marine and coastal development decision-making.

5.18 Economic Impact Sector 18: Marine Aggregates and Marine Mining [Resource evaluation and Preservation]

Sector Name	Marine Aggregates and Marine Mining [Resource evaluation and Preservation]
Sector Category	An 'Other' Sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	High
Sector Description	Marine aggregates and marine mining sector can be broken down by i) the extracted materials (sand and gravel); ii) the location where the activity takes place (shallow mining or deep sea mining). Shipping operational and service activities to/from the delivery place (i.e., ports) can also be addressed under in shipping and ports sector, pending stakeholder interests. World Bank considers that Marine Aggregates and Marine Mining includes marine aggregate dredging for use in construction, shallow-water and deep-sea mining / dredging for specific minerals (e.g., phosphate crusts or iron sands in shallow water and manganese nodules, cobalt crusts and seafloor massive sulfides in deep waters), mining or

	dredging for precious materials (e.g., precious corals or diamonds), and salt extraction. Marine aggregates and marine mining sectors are locked in physically to the specific location where geological processes lead to those materials to be extracted. Thus, the seabed mapping and spatial aspect is of the greatest importance for these sectors, noting that the spatial availability of the resource cannot be altered. The material transport to ports tends to follow a linear model connecting the collection point to the point of delivery, which will follow the most direct route in order to minimize shipping costs. In order to avoid potential spills, during extraction other sector uses are avoided so a focus remains on a safe exploration (especially for deep-sea mining development). Note in MSP context, each cargo takes about 3-6 hours to dredge. Maritime spatial plans and mapping can identify potential geological resources allocated zones that are far bigger than the locations where eventually the actual dredging may will take place in the future (through "mineral safeguarding"), but this also means that large areas might appear as being excluded to other uses by the marine aggregates industry. Seabed mapping is a key input to marine aggregates and marine mining exploration and operation / extraction activities. Also resource evaluation and preservation and the survey of what is there ahead of mining proceeds / leases, among others.
Seabed 2030 Example Use Cases	#Use Case [Shared]: Planning of high resolution surveys for resources management [Oil and Gas, Marine Aggregates and Marine Mining (Including for Resource Evaluation and Preservation), and renewable energy]. Other example use cases include: #Use Case: Deep Sea Mining. Including perspective between Seabed 2030 grid data and Deep Sea Mining Area Link – in the context of areas that may be identified for deep sea mining, and that we need to survey/understand what is there ahead of any mining proceeds.

5.19 Economic Impact Sector 19: Biotechnology *Inc. Pharma Industries*

Sector Name	**Biotechnology *Inc. Pharma Industries***
Sector Category	An 'Other' Sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	High *Indirect dependency as will look at marine species that will provide solutions for x. Hydro thermal vents, closely related to biological / ecosystem research.*
Sector Description	Marine biotechnology is the creation of products and processes from marine organisms through the application of

	biotechnology, molecular and cell biology, and bioinformatics. It is the field of science that deals with ocean exploration for development of new pharmaceutical drugs, chemical products, enzymes, and other products and processes. It also deals with the advancement of aquaculture and seafood safety, bioremediation, biofuels, among others. See here: https://www.isaaa.org/resources/publications/pocketk/52/default.asp Of particular interest to seabed 2030 may be the provision of seabed data to support the monitoring of specialist habitats associated with biotechnology, e.g., seabed environment around subsea volcanic vents and other seabed landscape structures, among others. Further, the overwhelming role of marine biodiversity for the future of marine resources, ecosystem management, bioprospecting as well as marine biotechnology is a focus area – intersecting Marine and Coastal Ecosystem Services, and where in a seabed setting.
Seabed 2030 Example Use Cases	#Use Case: Biotechnology – Supporting Marine Bio pharmacy.

5.20 Economic Impact Sector 20: Insurance

Sector Name	**Insurance**
Sector Category	An 'Other' Sector (Also a cross-cutting sector)
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Medium (A cross-cutting sector provision of insurance services in other sectors such as parametric insurance for crisis and disaster). Insurance has growing involvement – coastal and shallow water natural capital etc. Climate change aspect of insurance.
Sector Description	Insurance is a means of protection from financial loss. It is a form of risk management, primarily used to hedge against the risk of a contingent or uncertain loss. The Association of British Insurers (ABI) defines insurance as: Insurance is a financial product sold by insurance companies to safeguard individuals, organisations and / or their property against the risk of loss, damage, or theft (such as flooding, burglary or accidents). When you buy a policy you make regular payments, known as premiums, to the insurer. If you make a claim your insurer will pay out for the loss that is covered under the policy. See here: https://www.abi.org.uk/data-and-resources/tools-and-resources/glossary/?sw=i Potential Seabed 2030 insurance sector interests, may include foundation data support to underwriting and risk and

	disaster (in marine setting), and intelligence for specialist insurance types / vehicles, such as parametric insurance. For example parametric insurance refers to the contract that pays out a pre agreed indemnity when a predefined event occurs by or beyond the predefined parameters. It is specialized insurance against disasters caused by climate change, where the loss is extensive and difficult to measure with traditional methods. Further data support to claims review towards accidents at sea, aircraft/vessel recovery activities and the insurance of cable/pipeline infrastructure assets may be interesting areas for Seabed 2030 engagement.
Seabed 2030 Example Use Cases	Not progressed for this study purposes. Other example use cases include: #Use Case: Use of Seabed Mapping Data towards insurance claims review. See https://london-marine.co.uk/ Note this is cross-cutting e.g., aircraft / vessel recovery use case. Cable/pipeline infrastructure in High Seas insurance etc.

5.21 Economic Impact Sector 21: Investment

Sector Name	**Investment**
Sector Category	An 'Other' Sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Medium *Investment supporting ocean discovery.* *Investment - Monitoring carbon capture (Climate)*
Sector Description	An investor is any person or other entity (such as a firm or mutual fund) who commits capital with the expectation of receiving financial returns. A potential focus area may be on Seabed 2030 provision of data to inform intelligence support to investor decision-making and inform the management of investor risks. This focusses in on portfolio management, blue/green finance among others and may address specific areas such as the monitoring, reporting and verification of ESG interests where in a marine / coastal setting.
Seabed 2030 Example Use Cases	Not progressed for this study purposes.

5.22 Economic Impact Sector 22: Ship Building, Ship Breaking, and Offshore (Structures) Decommissioning

Sector Name	**Ship Building, Ship Breaking, and Offshore (Structures) Decommissioning**
Sector Category	An 'Other' Sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Low *Decommission of offshore structures need draft clearance – any unmapped obstacles etc.*

	Confirmed not as applicable for High Seas context / setting c.f. EEZ.
Sector Description	Shipbuilding is the construction of ships and other floating vessels. It normally takes place in a specialized shipyard facility. Shipbuilding and ship repairs, both commercial and military, are referred to as "naval engineering". The construction of boats is a similar activity called boat building. Boat building (e.g. small fishing boats) may be a key commercial activity in coastal areas. Shipbreaking is an industry that dismantles ships for the purpose of scrapping or disposal. Ship breaking may be a key activity for individual nations. For example, In Bangladesh, ship breaking activities pose both challenges and opportunities for our coastal zone management. The industry has turned into a promising sector and has contributed in economic growth and earned a good reputation for being a profitable industrial sector. Of potential interest for Seabed 2030, is the presence / emergence of ship building / breaking industrial footprints and resulting / potential local impacts monitoring, e.g., associated marine / coastal pollution, among others. This may drive a demand for seabed profiling for ingress/egress to Shipyards and surrounding areas, and potentially data support towards dredging and other underpinning site environment factors. The requirements for seabed data for this sector will predominantly be near shore requirements as well as shipping navigation to and from key shipbuilding/breaking locations. Accordingly this is seen as more applicable in EEZ setting and less relevant to High Seas. Decommissioning of offshore structures need draft clearance intelligence as well as the mapping of any unmapped obstacles.
Seabed 2030 Example Use Cases	Confirmed not as applicable for High Seas context / setting cf. EEZ. Not progressed for this study purposes.

5.23 Economic Impact Sector 23: Desalination

Sector Name	**Desalination**
Sector Category	An ‘Other’ Sector – confirmed not as applicable
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Low – confirmed not as applicable. Confirmed not as applicable for High Seas context / setting c.f. EEZ.
Sector Description	Desalination is a process that takes away mineral components from saline water. More generally, desalination refers to the removal of salts and minerals from a target

	substance, as in soil desalination, which is an issue for agriculture. Saltwater (especially sea water) is desalinated to produce water suitable for human consumption or irrigation. Desalination is used on many seagoing ships and submarines. However, most of the modern interest in desalination is focused on cost-effective provision of fresh water for human use. Along with recycled wastewater, it is one of the few rainfall-independent water resources. Globally, according to a study carried out by researchers from the Institute for Water, Environment and Health at the United Nations University (UNU-INWE) in 2019, there are approximately 16,000 desalination plants in operation — spread throughout 177 countries — and altogether they generate around 95 million m3/day of fresh water. Of potential interest is the emergence of desalination in terms of coastal development and notably feature as a result of water security concerns. From a seabed 2030 perspective desalination infrastructure occurs predominantly in an EEZ setting and accordingly is seen as not as applicable for High seas context / setting c.f. EEZ.
Seabed 2030 Example Use Cases	Confirmed not as applicable for High Seas context / setting cf. EEZ. Not progressed for this study purposes.

5.24 Economic Impact Sector 24: Marine Archaeology / Heritage

Sector Name	**Marine Archaeology / Heritage**
Sector Category	An 'Other' Sector
Sector Level of Dependency on Seabed 2030 Seabed Mapping Grid Data	Low
Sector Description	Marine archaeology (also known as maritime archaeology) is a discipline within archaeology as a whole that specifically studies human interaction with the sea, lakes, and rivers through the study of associated physical remains, be they vessels, shore-side facilities, port-related structures, cargoes, human remains and submerged landscapes. Of potential interest to Seabed 2030 are the international 'marine heritage' sites that can be found here: https://whc.unesco.org/en/list/, and here: https://whc.unesco.org/en/list/?search=&themes=7&order=country The latter, including 50 World Heritage Sites covered under UNESCO World Heritage Marine Programme. These heritage sites may be a driver for Seabed prioritization as identified in the WITS Phase 2 benefits analysis and prioritisation study. This sector is seen as low level of dependency on seabed mapping data, but the potential of seabed mapping to impact and support the preservation of heritage sites is significant, albeit a fairly niche area at a global scale.
Seabed 2030 Example Use Cases	Not progressed for this study purposes.

SECTION SIX: BENEFITS ANALYSIS WORKSTREAM COLLATION OF FINDINGS/RECOMMENDATIONS

This section provides a table of recommendations identified during the benefits analysis workstream Seabed 2030 Economic Impact Sectors work for carry across into the WITS Phase 3 wider seabed mapping benefits analysis delivery, and for Seabed 2030 ongoing reference / use as applicable.

There are 3 recommendations, all aimed towards the WITS Phase 3 ongoing benefits analysis workstream delivery activities.

Ref.ID	Recommendation
1.	The Seabed 2030 Economic Impact Sectors have been reviewed and are proposed used to inform the delivery of the WITS Phase 3 benefits analysis workstream follow-on activities generally, and specifically for the use case production work, and informing the value proposition documentation, please see items 2 and 3 further below.
2.	A proposed set of Seabed 2030 Economic Impact Sectors have been reviewed, identified, and documented. These sectors are recommended for focus and use in the benefits analysis workstream economic value assessment work.
3.	Example use cases have been identified for each of the proposed Seabed 2030 Economic Impact Sectors. These identified use cases are recommended / proposed used in the seabed mapping use cases production work [the benefits analysis workstream task 4 activity], and generally in the wider seabed mapping economic value assessment activity.

SECTION SEVEN: WITS PHASE 3 NEXT STEPS

This report is the WITS Phase 3 benefits analysis workstream deliverable document on Seabed 2030 Economic Impact Sectors. It is a guidance document and describes a proposed set of Economic Impact Sectors for Seabed 2030. This economic impact sector review is a stepping stone that informs the Seabed 2030 benefit analysis / economic value assessment activities, and is also available to inform Seabed 2030 prioritisation future process development.

The projects next steps are to progress with the Phase 3 benefits analysis workstream activities focusing on the definition / production of a set of Seabed 2030 Use Cases.

The project phase 3 benefits analysis workstream will close with the issue of the six deliverable documents that together represent the WITS Phase 3 benefits analysis workstream outputs. Together the documents also include a set of recommendations for Seabed 2030 consideration relating to Seabed 2030 seabed mapping benefits analysis and seabed mapping area prioritisation.

ANNEX 1: GLOSSARY / DEFINITION OF TERMS

Abbreviation	Term	Definition
To be added	To be added	To be added (TBA) as a single set from all phase 3 reports

ANNEX 2: REFERENCES

A single set of references will be collated and presented in the final version document.