

December 2014

Rebuilding the Classification System of the Ocean Economy

Dr. Kwang Seo Park
Korea Maritime Institute

Dr. Judith T. Kildow
National Ocean Economic Program

Follow this and additional works at: <https://cbe.miis.edu/joce>



Part of the [Economic Policy Commons](#), and the [Other Economics Commons](#)

Recommended Citation

Park, Dr. Kwang Seo and Kildow, Dr. Judith T. (2014) "Rebuilding the Classification System of the Ocean Economy," *Journal of Ocean and Coastal Economics*: Vol. 2014: Iss. 1, Article 4.

DOI: <https://doi.org/10.15351/2373-8456.1001>

This Research Article is brought to you for free and open access by Digital Commons @ Center for the Blue Economy. It has been accepted for inclusion in *Journal of Ocean and Coastal Economics* by an authorized editor of Digital Commons @ Center for the Blue Economy. For more information, please contact ccolgan@miis.edu.

Rebuilding the Classification System of the Ocean Economy

Acknowledgments

The author wishes to thank Ed Barbier, Rex Caffey, Sherry Larkin, John Whitehead and two anonymous reviewers for their insights and suggestions that greatly improved the manuscript.

1. Introduction

Today, an increasingly global society seeks unilateral economic development and environmental protection. A paradigm shift is considered imperative to combat the global crises that threaten human civilization. Global crises can be divided into three overall categories. The first is climate change, which causes rises in seawater temperature, sea-level rise, ocean acidification and more. The second is resources depletion, which results in an insufficient supply of the food, energy and water essential to a healthy ecosystem. The third is economic decline, as the world economy has fallen into a recession after the 1998 global financial crisis from which it has not yet recovered. These crises present global, national and regional challenges to all society.

In the 21st century, many major ocean countries have reassessed the value of their oceans and coasts and have actively established strategies to develop and protect them. On April 16, 2013, the United States issued a final plan to manage its oceans and outline a strategy that aims to reconcile competing interests among fishing, offshore energy exploration and recreational activities. In March 2011, China released its 12th 5-year Plan for National and Social Development that for the first time adopted a “5-year plan” for economic development, which identifies developing the ocean economy as a key national development strategy. In 2010, South Korea announced its second Marine and Fisheries Development Basic Plan. South Korea believes that the major global crises such as climate change, resources depletion and economic decline should be overcome through utilization of the ocean and coast.

Ocean and coastal ecosystems provide human beings with considerable economic and ecological services. The Southeast England Development Agency in the U.K. (2009) estimated total sales of the world’s marine industries to be approximately U.S. \$4 trillion in 2007, providing a value-added equivalent of 3-4% to the world’s GDP . Meanwhile, while it is difficult to assign a dollar value to some of the benefits ocean ecosystems provide, another 2003 report shows that coral reefs within ocean ecosystems generate U.S. \$29.8 billion in yearly net benefits in goods and services to world economies, including tourism, fisheries and coastal protection.

As the importance of the world’s oceans and coasts has increased, many countries have begun to focus on the ocean economy. Some countries have estimated and released accounts of their ocean economy or ocean industries. For

example, in 2014, the National Ocean Economics Program (NOEP) in the U.S. announced estimates of the size of the ocean economy from 2005 to 2010. In 2010, the ocean economy comprised over 2.7 million jobs and contributed over \$258 billion (1.8%) to the GDP of the United States (the total contribution of the ocean economy, including indirect and direct contribution, is estimated at \$633 billion or 4.4% of national GDP). In the case of China, the State Oceanic Administration (SOA) has estimated the size of the ocean industry annually since 2003. According to research conducted by many countries, the ocean economy or ocean industries produce from 1% to 5% of their country's GDP. For example, China estimated total production of its ocean industries at 9.6% of its GDP in 2012. In South Korea, the Korea Maritime Institute (KMI) estimated the total value-added of the ocean industry at 5.5% (direct 2.46% and indirect 3.04%) of GDP in 2005.

J.T. Kildow *et al.* (2009) have addressed the need to estimate the ocean economy. According to their report, the size, nature and growth trends in such industries provide governments a scientific basis for tracking changes in the state of the ocean-related economy as well as those industries that create inputs for and receive the outputs of its activities. In addition, governments are largely involved in regulating offshore resources such as fisheries, and oil and gas exploration, as well as marine transportation, ship building and other marine construction activities.

However, it is difficult to compare the ocean economy among countries because the definition, classification standards, and scope of the ocean economy differ from country to country. Even the over-arching term "ocean economy" can vary and may be referred to as the "ocean industry," "marine economy," "marine industry," and so on. Classification standards and the scope of the ocean economy differ from country to country, too. . For example, the ocean economy is divided into six main sectors in the U.S. but 18 in the U.K. The U.K. excludes seafood processing from the ocean economy. France includes thermal and nuclear electricity generation, whereas other nations do not.

The major differences among countries in classification standards and scope arise mainly due to three issues: 1. whether public sectors are included or not; 2. whether activities related to the ocean are included or not; and 3. whether new ocean industries (industries still in R&D or early commercial stages of an industrial development cycle, such as the offshore wind industry and marine bio-industry) are combined or not. In summary, we cannot compare ocean economies exactly among countries because of the differences in classification standards and overall scope.

It seems clear that the probability of success in strategic ocean decision-making increases significantly when the availability of information and data on the ocean economy also increases. But the data continue are still dispersed and heterogeneous. This study aims to provide concrete practical proposals for the definition, classification standard and scope of the ocean economy. Although Juan C. Suris-Regueiro *et al.* (2013) studied this issue, they only focused on the EU region. This study is the first attempt to deal with the entire global ocean economy. The following section will redevelop the terminology and definition of the ocean economy. The next section will look at the classification standards and scope of the ocean economy in various major countries. The subsequent section will show a concrete proposal for the classification standard and scope of the ocean economy. Lastly, the final section offers conclusions, an evaluation current study's limits and suggestions for future research.

2. REESTABLISHING TERMINOLOGY AND REDEFINING TERMS

2.1 Reestablishing Terminology

In order to classify the ocean economy, the related terminology and definitions must first be established. The terminology related to the ocean economy is used differently around the world, including such terms as “ocean industry,” “marine economy,” “marine industry,” “marine activity” and “maritime sector.” At least three terms—“ocean,” “marine,” and “maritime”—are used to mean “ocean.” “Ocean” is usually used in the U.S. and Ireland, but “Marine” is widely used in the UK, France, Australia, Canada, and New Zealand. “Maritime” is commonly used in Spain. In China, Japan, and South Korea those terms are mixed when they are translated into English (see Table I).

It is not necessary to distinguish among these terms because they are interchangeable among the nations (though we should distinguish “maritime” from “ocean” and “marine” because in most languages and international institutions the term “maritime” refers primarily to ship) However, “ocean” could be used as a representative term among them as it is more inclusive than other terms. For example, the use of “ocean” usually differs distinctly from “coast” as well as “land”. NOEP clearly uses the term “ocean economy” to distinguish it from coastal economy. Therefore, in keeping with the NOEP report, this paper uses the term “ocean.”

Table 1. Terminology Use Related to the Ocean Economy by Country.

	Terminology Related to 'Ocean'			Terminology Related to 'Economy'			
	Ocean	Marine	Maritime	Economy	Industry	Activity	Sector
USA	•			•			
UK		•				•	
France		•		•			
Australia		•			•		
Ireland	•			•			
Canada	•	•			•		
Spain			•				•
New Zealand		•		•			
China*				•	•		
Japan*					•		
Korea*					•		

* Terminology related to the ocean is not distinguished in China, Japan and South Korea because they are non-English speaking countries.

However, regarding the terms “economy” and “industry,” it is necessary to distinguish between the two. Figure 1 demonstrates why “economy” includes much more than “industry.” “Industry” deals with the private sector of market goods and services. On the other hand, “economy” includes both the public and private sectors. Furthermore, “economy” also includes non-market goods and services. In other words, industry is a subset of economy.

Still, most countries include both the private and public sectors in their ocean economy, but exclude non-market value. The non-market value of the ocean economy has not been estimated in all countries, and is not easily done. Consequently, it would be preferable to focus on market value instead of non-market value at present, though in the future it would be wise to include the non-market value given its potentially significant ability to affect the measurable aspects of the ocean economy

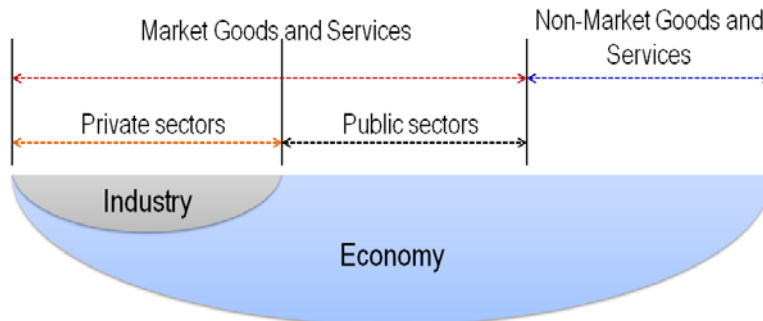


Figure 1. Difference between industry and economy

In conclusion, the term “ocean economy” is used here as a representative term. The term “ocean” itself is sometimes used interchangeably with “marine” but the term “economy” cannot be used interchangeably with “industry.” When referring only to the private sector, it would be preferable to use the term “ocean industry,” not “ocean economy.” Significantly, non-market value is excluded from the ocean economy in this article.

2.2 Redefining Terms

Given that ocean economy terminology varies from country to country, a uniform definition of the ocean economy has not yet been established. Colgan (2003) introduced the concept of “ocean GDP” to identify the contribution of the ocean to the United States’ GDP and defined it as “the economic activities and industries that utilize ocean resources in a production process or produce a product or service.” Using a similar approach, Pontecorvo *et al.* (1980) and Pontecorvo (1988) estimated the contribution of the ocean sector to the U.S. Economy for the years 1977 and 1987.

Nonetheless, the definition of the ocean economy varies from country to country (see Table 2). The NOEP states that the concept of the ocean economy derives from the ocean (or Great Lakes), its resources a direct or indirect input of goods and/or services to an economic activity. Thus, such an industry would be explicitly connected to the ocean through its activities, or partially related to the ocean and located in a near-shore zip code. This adheres in part to the definition of an industry in the North American Industrial Classification System (e.g. deep sea freight transportation) and to geographic location (e.g. a hotel in a coastal town).

Ireland’s definition matches the NOEP’s and the U.K.’s definition is also similar. The U.K. includes those activities that involve working on or in the sea. Those activities also involve the production of goods or the provision of services that directly contribute to activities on or in the sea.

Australia defines the ocean economy as an “ocean-based activity” and focuses on whether the ocean resource is the main input or not. New Zealand defines the ocean economy as “economic activities that take place in the ocean, or use the marine environment, or produce goods and services necessary for those activities, or make a direct contribution to the national economy.”

Moving on to Asian countries, China defines the ocean economy as the “sum of all kinds of activities associated with the development, utilization and protection of the marine environment.” Japan defines it as the “industry exclusively responsible for the development, use, and conservation of the ocean.” South Korea defines the ocean economy as the “economic activity that takes place in the ocean, puts goods and services into ocean activity, and the activity that uses the ocean resources as an input.”

Table 2. Definition of the Ocean Economy by Country

Country	Main Substance
U.S.	The economic activity, which is (a) an industry whose definition explicitly ties the activity to the ocean, or (b) which is partially related to the ocean and is located in a shore-adjacent zip code.
U.K.	Those activities which involve working on or in the sea. Also those activities that are involved in the production of goods or the provision of services that will directly contribute to activities on or in the sea.
Australia	Ocean-based activity (“Is the ocean resource the main input? Is access to the ocean a significant factor in the activity?”).
Ireland	Economic activity which directly or indirectly uses the sea as an input.
China	The sum of all kinds of activities associated with the development, utilization and protection of the marine.
Canada	Those industries that are based in Canada’s maritime zones and coastal communities adjoining these zones, or are dependent on activities in these areas for their income.
New Zealand	The economic activity that takes place in, or uses the marine environment, or produces goods and services necessary for those activities, or makes a direct contribution to the national economy.
Japan	Industry exclusively responsible for the development, use and conservation of the ocean.
South Korea	The economic activity that takes place in the ocean, which also includes the economic activity, which puts the goods and services into ocean activity and uses the ocean resources as an input.

Though the definition of the ocean economy varies among countries, several common words are found within them. Firstly, the term “ocean” or “marine” is used by all countries because the ocean economy essentially takes place close to the ocean. For example, fishing is an industry that takes place in the ocean. In light of the fact that the ocean economy basically consists of economic activities that produce goods and services (outputs) using ocean inputs, we also see the repetition of terms such as “economic activity input and output,” “directly,” “indirectly” and “goods and services.” For example, the ship building industry produces goods used in ocean activities, and seafood processing uses the ocean products as an input.

Therefore, to define ocean economy, a combination of industrial and geographical perspectives is required. . Thus, the ocean economy is related to economic activity as an industrial aspect, and directly or indirectly related to the ocean (including the coast) as a geographical aspect. Figure 2 shows the relationship between ocean and ocean economy.

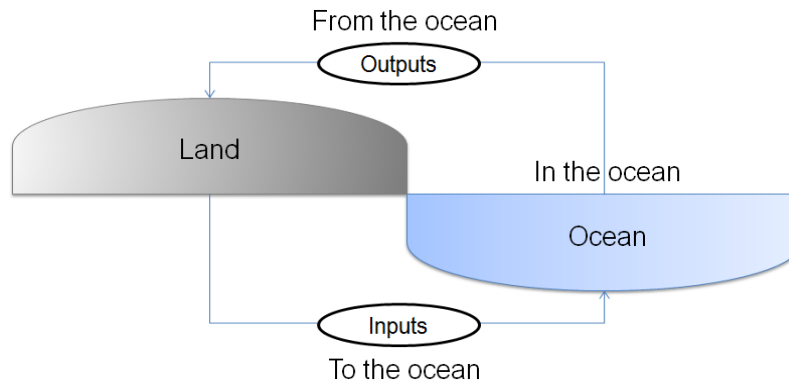


Figure 2. Relationship between ocean and ocean economy

In conclusion, the ocean economy can be defined as the economic activities that take place in the ocean, receive outputs from the ocean, and provide goods and services to the ocean. In other words, ocean economy can be defined as the economic activities that directly or indirectly take place in the ocean and use outputs from the ocean, while incorporating goods and services into the ocean's economic activities.

3. CLASSIFICATION STANDARDS AND THE SCOPE OF THE OCEAN ECONOMY BY COUNTRY

3.1 The United States

The NOEP, creator of the terms ocean economy and coastal economy, provides a full range of the economic information and data across the U.S. The ocean economy consists of all economic activities that derive all or part of their inputs from the ocean or Great Lakes. The definition of the ocean economy is a function of both industry and geography. While most of the ocean economy is located in coastal regions, a portion of it (for example, boat building and seafood retailers) is located in non-coastal regions.

The estimation of economic activity associated with the ocean is inherently limited by data availability, conceptual difficulties, and the need to make subjective choices about what to include and exclude. The choices made in the design of statistical measures of ocean economic activity should be informed by clear objectives for the system. The NOEP’s methodology has the following objectives: (1) comparability across industries and space; (2) comparability throughout time; (3) theoretical and accounting consistency; and (4) replicability.

Table 3. Classification of the Ocean Economy in the U.S.

Sectors	Categories
Construction – Marine	Marine-related construction
Living Resources – Marine	Fishing, fish hatcheries and aquaculture, seafood processing, seafood markets
Minerals – Offshore	Limestone, sand and gravel, oil and gas exploration, oil and gas production
Ship & Boat Building	Boat building and repair, ship building and repair
Tourism & Recreation – Coastal	Amusement and recreation services, boat dealers, eating and drinking places, hotels and lodging places, marinas, recreational vehicle parks & campgrounds, scenic water tours, sporting goods retailers, zoos, aquaria, NEC*
Transportation – Marine	Deep sea freight transportation, marine passenger transportation, marine transportation services, search and navigation equipment, warehousing

* Not classified elsewhere.

According to the NOEP’s report, the NOEP methodology defines the ocean economy with six sectors that provide consistent information across time and space (see Table III). These sectors are marine construction, living marine resources, offshore minerals, ship and boat building and maintenance, coastal tourism and recreation, and marine transportation. The industries comprising these sectors depend on the definition of industries used for government statistical purposes. However, a number of other activities are not included because the pertinent information either not consistently compiled or not publicly available.

3.2 United Kingdom

Three organizations—the Crown Estate, Associated British Ports, and Oil and Gas UK—have estimated the economics and employment statistics for marine activities in the U.K. economy. Their report demonstrates the significant economic

contribution of marine activities to the U.K economy, including employment generation. The report also emphasizes the extraordinary diversity of marine-related activities and provides an accessible guide to their relative contribution.

These organizations use a relatively narrow definition, also used in earlier U.K. analyses and similar to definitions used in analyses by other countries. This report splits U.K. marine activities into 18 sectors. Choice of these sectors matches the structure of marine activities and has enjoyed some general international acceptance. For example, in the case of the oil and gas sector, only the landed values were included. For fisheries, processing was included because of its traditional close association with ports.

There are many special characteristics in the scope of marine activities in the U.K. (see Table 4 on next page). The fishing sector includes traditional sea fishery activities, fish farming and fish processing. Oil and gas is separated from aggregates, unlike in the U.S. Offshore wind is included in marine renewable energy, but construction of offshore wind farms falls under construction. Business services related to shipping are separated from the shipping industry and decommissioning pertains to the marine environment sector.

Table 4. Classification of the Ocean Economy in the U.K.

Sectors	Categories
Fish	Sea fisheries, fish farming, fish processing
Oil and gas	Offshore extraction of oil and gas
Aggregates	Marine dredged sand and gravel
Ship & boat building and repairs	Shipbuilding and boat-building
Marine Equipment and Materials	Supply to the offshore oil and gas industry, supplies to shipbuilding and repairs, supplies to boat building
Marine Renewable Energy	Offshore wind, wave and tidal stream power
Construction	Harbor development, coastal works against erosion and flooding, construction of offshore wind farms
Shipping Operations	Transport of goods by sea
Ports	Storage of freight, vessel salvage, cargo handling, Stevedoring, bunkering passenger handling and services, and many other activities
Navigation and Safety	Lighthouse authorities, The hydrographic office, Maritime and Coastguard Agency, Health and Safety executive, Royal National Lifeboat Institution
Cables	Submarine telecommunications, power cables
Business Services	Marine insurance, ship chartering, shipping finance, ship classification, legal services, dispute resolution and accountancy services
License and Rental	License and rental marine aggregates, potash mining, oil and gas pipelines, telecommunication and power cables, aquaculture, renewable energy, moorings, wildfowling and ports marinas
Research and Development	Industry sector, university (higher education institutions), public sector
Marine Environment	Decommissioning, conservation and environment, wastewater treatment
Defense	Navy
Leisure and Recreation	Cruising, leisure craft services
Education and Training	Higher education

3.3 France

The objective of the ‘French marine economic data’ report is to assess the weight of the French maritime economy, its position with respect to international competition and its role within public services in France. The report presents a survey of marine-related activities in France and an assessment of their economic

weight in terms of value added and employment estimates (see Table 5 on next page).

In the report, the IFREMER differentiates between the industrial sector (commercial sector) and those activities linked to the non-commercial public sector. In the former case, they consider up to nine commercial sectors, while for the latter they consider four types of public activities. Within the activities that belong to the seafood sector, they distinguish five sub-sectors, another 5 under shipbuilding and six under maritime and river transport. These studies rely on official data sources from different French government ministries and other public institutions or institutes. For the cases where there are no detailed data in official statistics, they also look to information provided by different businesses or professional organizations.

Most strikingly, France categorizes electricity generation from conventional fossil fuel power plants, nuclear power plants and wind turbines as part of the marine economy, something which cannot be said about any other country. This categorization stems from the IFREMER assumption that electricity generation units are located on the coasts. On another note, maritime insurance is considered an industry in and of itself.

Table 5. Classification of the Ocean Economy in France

Sectors	Categories
Industrial Sector	
Seafood Products	Marine fishery, marine aquaculture (fish farming and shellfish farming), production of seaweed, fish markets and fish trade, seafood product processing industry
Extraction of Marine Aggregates	Silica sands and gravels, Calcareous sands and sediment
Electricity Generation	Conventional fossil fuel power plants, Nuclear power plants, Wind turbines
Shipbuilding and Repair	Construction and repair of merchant and military ships, Naval outfitting and boat building
Marine and River Civil Engineering	Construction of ports, dams, dykes, navigable canals, water supplies, locks and other water course regulation installations / Execution of work: in water (construction of coffer dams, construction of the piles of bridges), dredging, underwater (by diver or other means) / Cleaning of trenches and development of river banks and cutting of water weeds
Submarine Cables	Manufacturing, laying and maintenance of submarine cables immersed at depth and, generally buried, intended to carry communications or electrical power
Offshore Oil and Gas-related Industry	Supply of oil and gas-related services and equipment in the fields of exploration and production, refining and petrochemicals
Coastal Tourism	Spending of resident and non-resident tourists in characteristic tourist activities : spending on accommodation, catering, and all-in packages (for the non-residents), spending associated with the stays: spending on food, miscellaneous purchases, travel on site (taxi or public transport), services to private citizens, fictive rent
Maritime and River transport	Exploitation and general organization of ports, Port services to vessels and goods
Maritime Insurance	Maritime insurance and banking
Non-commercial Public Sector	
French Navy	National defense
Public intervention	Economic and social (seafarer labor schemes, social protection), Regulation and education
Coastal and Marine Environmental Protection	Prevention, Reduction and elimination of pollution; the repair of damage and the acquisition, processing and circulation of information on environment
Marine Research	Activities of French public bodies in the field of marine research and operational oceanography

3.4 Australia

For Australia, Allen Consulting Group's report provides estimates of the economic contribution of marine industries in Australia, with data from 1995–1996 to 2002–2003 (see Table 6). There was no statistical classification for marine industries as a distinct category in Australia. Therefore, the approach taken in this study to measure the economic contribution of marine industries is to compile data on those industries categorized under the marine industry based on three factors: (1) the relationship to the marine environment through the use of a marine resource (such as commercial fishing, offshore oil, and gas); (2) the provision of services through marine transportation (such as shipping and port-based industries); and (3) the use of the positive attributes of the marine environment (such as marine tourism).

Australia's marine industry is divided into six sectors: marine tourism, offshore oil and gas, fisheries and seafood, shipping, shipbuilding and port-based industries. These are major marine-based activities. The ocean economy of Australia excludes the public sector. In addition, taxi transport and air transport fall under marine tourism. Offshore petroleum refining is also included in the ocean industry, unlike in other countries. Otherwise, marine equipment and materials, and extraction of marine aggregates are excluded from the ocean sector.

Table 6. Classification of the Ocean Economy in Australia

Sectors	Categories
Marine Tourism	Travel agency and tour operator services, taxi transport, air and water transport, accommodation; cafes, restaurants and food outlets, clubs, pubs, taverns and bars, other retail trade
Refining of Petroleum from Offshore Sources	Offshore oil and gas extraction, offshore petroleum refining, exploration and services
Fisheries and seafood	Marine fishing, aquaculture, seafood processing
Shipping	Water transport *
Shipbuilding	Shipbuilding, boat building
Port-based Industries	Stevedoring, water transport terminals, port operators, other services to water transport

* This sector is defined by the ABS as water transport and water transport was also a component of marine tourism.

3.5 China

According to Rui Zhao *et al.* (2013), the Ocean Economy Accounting System (OEAS) of China was established in 2006 to provide marine policy makers in China with marine activity statistics. China's OEAS was established exclusively for ocean economy data collection to meet the practical needs of ocean economic management. The system was developed and is operated by the Chinese National Marine Data and Information Service under China's State Oceanic Administration. The purpose of the system is to develop the required range and quality of ocean economy data at the regional and national levels.

China established “Industrial classification for ocean industries and their related activities” in 2006 and has enforced it since 2007. Subsequently, the China Marine Information Economic Network (CMIEN) has issued “The Statistical Bulletin of China's Ocean Economy” every year since 2003. The current classification system of the ocean economy in China is divided into three levels: (1) 28 big-class levels, (2) 106 middle-class levels, and (3) 390 small-class levels.

According to the Statistical Bulletin of China's Ocean Economy 2012, China's ocean economy is divided into three sectors, which are main sectors, public sectors and related sectors. Sub-industries under main sectors include 12 ocean industries. Public sectors deal with 10 public activities that are conducted mainly by the government and public organizations like research, education, marine environment management and so on. Related sectors are the economic activities which produce value-added information by providing goods and services to the ocean industry as inputs.

In particular, China focuses on the main ocean industries. The unique feature of China's ocean economy is that its emerging ocean industries are divided into several independent industries. For example, the marine salt industry is separated from the ocean mining industry. The chemical industry, biomedicine industry, electric power industry and seawater utilization industry are separated and they form each industry respectively (see Table 7 on next page).

Table 7. Classification of the Ocean Economy in China

Sectors	Categories
Main Sectors	
Marine Fisheries	Includes marine culture, marine fishing, marine fisheries service, and marine aquatic processing, etc.
Offshore Oil and Gas	Refers to the ocean exploration and production activities of mining, transportation, processing of crude oil and natural gas.
Ocean Mining	Includes the activities of extracting and dressing beach placers, beach soil chloride and sand, submarine geothermal energy, and coal mining and deep-sea mining, etc.
Marine Salt	Refers to the activity of producing salt products with sodium chloride as the main component by utilizing seawater, including salt extracting and processing.
Shipbuilding	Refers to the activity of building ocean vessels, offshore fixed and floating equipment with metals or non-metals as main materials as well as repairing and dismantling ocean vessels.
Marine Chemicals	Includes the production activities of chemical products of sea salt, seawater, sea algal and marine petroleum chemical industries.
Marine Biomedicine	Refers to the production, processing and manufacturing activities of marine medicines and marine health care products by using organisms as raw materials or extracting useful components therefrom.
Marine Engineering Building	Refers to the architectural projects construction and its preparations in the sea, at the sea bottom and seacoast for such uses as marine production, transportation, recreation, protection, etc., including constructions of seaports, coastal power stations, coastal dykes, marine tunnels and bridges, land terminals of offshore oil and gas fields as well as building of processing facilities, and installation of submarine pipelines and equipment, but not the projects of house building and renovation.
Marine Electric Power	Refers to the activities of generating electric power in the coastal region by making use of ocean energies and ocean wind energy. It does not include thermal and nuclear power generation in the coastal area.
Seawater utilization	Refers to the activities of the direct use of sea water and seawater desalination, including those of carrying out the production of desalination and applying seawater as water for industrial cooling, urban domestic water, water for firefighting etc., but not the activity of the multipurpose use of seawater chemical resources.
Marine communications and transportation	Refers to the activities of carrying out and serving sea transportation with vessels as main vehicles, including ocean-going passenger transportation, auxiliary activities of water transportation, pipeline transportation, loading, unloading and transport as well as other transportation and service activities.

Coastal tourism	Refers to the tourist business and service activities with the backing of coastal zone, sea islands as well as a variety of natural and human landscapes of the ocean, mainly including marine sightseeing, living a life of leisure and recreation, going on vacation and getting accommodations, water sports, etc.
Public sectors	10 categories
Related sectors	6 categories

3.6 Japan

In the case of Japan, the Nomura Research Institute (NRI) published a report estimating the economic contribution of ocean Industries in Japan in 2005 (see Table 8 on next page). The NRI divided ocean industries into three types: ocean space activity type, marine resource utilization type, and material and services supply type. The ocean space activity type is an activity that takes place in the ocean whereas the other types do not.

The ocean space activity type means activities which exclusively explore, produce, and develop ocean resources in the ocean, and use the ocean energy, ocean space and seabed such as mining and extraction of resources. It also means marine environmental protection and safety management, etc. Therefore, this type includes fishing, transportation, salt, offshore oil and gas, and so on.

The marine resource utilization type refers to activities that exclusively produce goods and services by using the minerals, energy resources and living things that exist in the ocean. This type includes seafood processing, products of salt, etc. The materials and services supply type refers to activities which provide goods and services to the ocean space activity to support it. This type includes ship building and repair, ice making and marine equipment such as ropes and nets. These two types can be considered as the ocean industry when the input ratio in the input-out table is greater than 10%.

Table 8. Classification of the Ocean Economy in Japan

Sectors	Categories
Ocean Space Activity Type	Coastal fishing
	Offshore fishing
	Deep-sea fishing
	Sea aquaculture industry
	Salt
	Open ocean transport
	Port transport
	Water transport facilities management
	Other water transport services
	Gravel and quarrying*
	Crude oil and natural gas*
	Public works of rivers, sewer and other*
	Coastal, inland water transport*
	Fixed telecommunications*
	Goods leasing (excluding car rental)*
	Civil engineering and construction services*
	Other business services*
Race courses and team competition of bicycle racing, horse racing, etc.*	
Other entertainment*	
Professor individual plants*	
Marine Resource Utilization Type	Frozen seafood
	Product of salt, etc.
	Fisheries bottles, canned
	Other aquatic food
	Fresh seafood wholesale trade
Material and Services Supply Type	Ice-making
	Rope, net
	Heavy oil
	Steel ship
	Other ships
	Ship repair
	Other communication services

* Some ratio of this industry can be included in ocean economy.

3.7 South Korea

South Korea has no official agency in charge of accounting for the ocean economy. South Korea's ocean economy has been estimated by individuals whenever the need has arisen. For example, Kwak SJ *et al.* (2005) used five divisions, namely shipping, ports, fisheries, shipbuilding and other marine sectors. Chul-Oh Shin and Seung-Hoon Yoo (2009) also classified five sectors: marine transportation, harbor, fisheries and marine products, shipbuilding and other marine sectors.

The research by K.H Hwang *et al.* (2011) was regarded as a representative study conducted entirely to estimate the total production of ocean industries in South Korea (see Table 9 on next page). K.H Hwang *et al.* divided the ocean industry into three sectors, namely marine-based industry, forward marine-related industry, and backward marine-related industry, according to three standards: (1) marine-based industry reflects activities taking place exclusively in the ocean; (2) forward marine-related industry refers to activities that support the marine-based industry as an input; and (3) backward marine-related industry refers to activities that use outputs from the ocean.

The marine-based industry consists of five industries, which are fisheries, marine mining, ocean renewable energy, marine construction, and shipping. The sub-section of forward marine-related industry includes five activities, namely the marine equipment and materials industry, ship and offshore plant building, marine technical services, marine research and development, and marine public administration and education. The backward marine-related industry includes four activities: seafood processing, marine bio-industry, port, and marine tourism and leisure.

Whereas South Korea's classification standard of the ocean economy is very similar to Japan's, the same cannot be said about its scope. The most striking difference is that South Korea considers offshore plant building part of the ocean industry. Moreover, the oil and gas industry is included in marine mining. South Korea also groups marine technical services into a single industry.

Table 9. Classification of the Ocean Economy in South Korea

Sectors	Categories
Marine-based Industry	
Fisheries	Capture fisheries, Aquaculture, fishery-related services
Marine Mining	Oil and gas, sands and gravels, seabed mining, salt
Ocean Renewable Energy	Tidal, Offshore wind power and so on, Offshore cables
Marine Construction	Harbor development, coastal works against erosion and flooding, construction of cable and bridge, etc.
Shipping Industry	Marine passenger and freight transportation, shipping-related services
Marine-related Industry(forward)	
Marine Equipment and Materials Industry	Marine equipment manufacturing
Ship and Offshore Plant-building Industry	Ship, boat and offshore plant building and repair
Marine Technical services	Engineering, s/w development, investigation, certification, analysis, etc.
Marine Research and Development	Marine research and development
Marine Public Administration and Education	Marine public administration, Navy, Coast Guard, marine education and training
Marine-related Industry(backward)	
Seafood Processing	Seafood processing, transportation, sale
Marine Bio-industry	Marine bio food, drugs, etc.
Port Industry	Stevedoring, frozen and chilled warehouses, port-related services
Marine Tourism and Leisure Industry	Museums, beaches, parks, hotels, etc.

3.8 Other Countries

Moving beyond the countries discussed, we also find countries who classify the ocean economy based on other parameters. In Ireland, SEMRU (2010) divided the ocean economy into two sectors: established markets and emerging markets. The established markets consisted of nine industries and the emerging markets consisted of four. In particular, aquaculture was separated from sea fisheries.

According to Gardner Pinfold's report (2009), Canada's ocean economy was divided into two sectors and nine industries. We should note that oil and gas facilities installation was included in marine construction, not offshore oil and gas. Spain's ocean economy (2008) was divided into two sectors: traditional maritime sectors and coastal and sea-related recreation and tourism. Recreational boating, coastal tourism and cruise tourism were regarded as different industries. On the other hand, New Zealand (2003) divided the ocean economy into nine sectors.

4. IMPLICATIONS ACROSS COUNTRIES

4.1 Classification Standard

First, just as the terminology and definitions related to the ocean economy differ by country, so, too, do the classification standards. (Table 9 on next page). For instance, in the U.S., the ocean economy includes both industries explicitly tied to the ocean (Industrial aspect) and those which are only partially related to the ocean and are located in a shore-adjacent zip code (Geographical aspect). France divides the ocean economy into the industrial sector and the non-commercial public sector, Ireland uses the categories of established markets and emerging markets, and Canada divides the ocean economy into primary marine activities and secondary marine activities. China divided the ocean economy into three sectors but focused on the main sector. Regarding Japan and South Korea, despite differences in terminology, the countries' classification standards show striking similarities.

Table 9. Classification Standards of the Ocean Economy by Country

Country	Main substance
U.S.	Industrial aspect / Geographical aspect
France	Industrial sector / Non-commercial public sector
Ireland	Established Markets / Emerging Markets
China	Main sector / Public sectors / Related sector
Canada	Primary marine activities / Secondary marine activities
Spain	Traditional maritime sectors / Coastal & sea-related (marine) recreation and tourism
Japan	Ocean space activity type / Marine resource utilization type / Material and services supply type
S. Korea	Marine based industry / Forward marine related industry / Backward marine related industry

4.2 Scope of the Ocean Economy

In addition, the scope of the ocean economy varies considerably among countries. Table 11 (next page) shows the scope of the ocean economy according to country. For example, in the United States we see six sectors and 26 categories whereas in Japan we see only three sectors but 33 categories. This is a reflection of the many different classification sectors and categories in different countries. In other words, one industry in one country is divided into several industries in another country, with the opposite happening as well. Furthermore, some industries may be excluded from the ocean economy in one country but not in another.

Despite this disparity, we can identify the main scope and characteristics of some common industries:

- Fisheries - generally consists of fishing, aquaculture, and seafood processing. Some countries such as the U.S., France and South Korea include seafood distribution under fisheries.
- Marine mining - all countries where marine mining exists include it in the ocean economy. Some countries include the salt industry while others separate it from marine mining.
- Offshore oil and gas - all countries with an offshore oil and gas industry include it in the ocean economy. However, unlike the U.S., most countries only include exploration and production activity, choosing to separate offshore oil and gas from marine mining. Some include refining while others do not.

- Ship and boat-building - all countries where ship and boat building exists include it in the ocean economy. In South Korea, offshore plant building is also included in the ship building industry.
- Marine manufacturing - though the scope of marine manufacturing differs according to country, most include it in the ocean economy, with the exception of Australia.
- Marine construction - all countries with a marine construction industry include it in the ocean economy.
- Marine transportation - all countries include marine transportation in the ocean economy, but some countries categorize marine transport-related services as separate industries.
- Port - many countries integrate the port industry into marine transportation.
- Marine tourism – although all countries include marine tourism in the ocean economy, the industry is very complex. This makes it difficult to innumerate the differences in scope in the marine and coastal tourism industry. The U.S. only includes activities in coast-adjacent zip codes to guarantee some bearing between tourism and recreation and the coast itself.
- Public sectors such as education, national defense, R&D, and public administration - most countries include them in the ocean economy, with the exception of Australia.
- Ocean renewable energy - the U.K., China and South Korea consider separate it a separate industry (The U.S. includes federal expenditures as a separate page on its website).
- Marine bio industry - China and South Korea consider it a separate industry.

Table 11. Scope of the Ocean Economy by Country

USA	UK	France	Australia	Ireland	China	Canada	Spain	New Zealand	South Korea
Construction – marine	Fish	Seafood products	Marine tourism	Shipping and maritime transport	Marine fishery	Seafood	Inland navigation	Offshore minerals	Fisheries
Living resources – marine	Oil and gas	Extraction of marine aggregates	Refining of petroleum	Water-based tourism & leisure	Offshore oil and gas industry	Offshore oil & gas	Marine aggregates	Fisheries and aquaculture	Marine mining
Minerals – offshore	Aggregates	Energy	Fisheries and seafood	International cruise industry	Ocean mining	Marine transportation	Marine equipment	Shipping	Ocean renewable energy
Ship & boat building	Ship and boat building and repairs	Shipbuilding and repair	Prioritize	Other marine services	Marine salt industry	Ocean based recreation/leisure	Maritime services	Government and defense	Marine construction
Tourism & recreation – coastal	Marine equipment and materials	Marine and river civil engineering	Shipbuilding	Sea fisheries	Shipbuilding industry	Marine construction	Maritime works	Marine tourism and recreation	Shipping industry
Transportation – marine	Marine renewable energy	Submarine cables	Port-based industries	Aquaculture	Marine chemical industry	Manufacturing	Navy and coastguard	Marine services	Marine equipment and materials industry
	Construction	Offshore oil and gas-related industry		Seafood processing	Marine biomedicine industry	Services	Offshore supply	Research and education	Ship and offshore plant building industry
	Shipping operations	Coastal tourism		Oil & gas exploration and production	Marine engineering building industry	Federal government	Recreational boating	Manufacturing	Marine technical services
	Ports	Maritime and river transport		Marine manufacturing	Marine electric power industry	Provincial /territorial government	Seaports	Marine construction	Marine research and development
	Navigation and safety	Maritime insurance		High tech marine products and services	Seawater utilization industry	Universities and research	Shipbuilding		Marine public administration and education
	Cables	French navy		Marine commerce	Communications & transportation industry	NGOs	Shipping		Seafood processing
	Business services	Public intervention		Marine biotechnology and bio-products	Coastal tourism		Coastal tourism		Marine bio industry
	License and rental	Coastal & marine environmental protection		Marine renewable energy			Cruise tourism		Port industry
	Research and development	Marine research					Fisheries		Marine tourism and leisure industry
	Marine environment								
	Defense								
	Leisure and recreation								
	Education and training								

From Table 11, we can extract common terms such as fisheries, marine construction, marine transportation, marine and coastal tourism, marine mining and so on. We can also infer the characteristics of the scope of the ocean economy from these common words:

- 1) Activities that explore and develop ocean resources
- 2) Activities that use ocean space
- 3) Activities that protect the ocean environment
- 4) Activities that use ocean products as a main input
- 5) Activities that provide goods and services to ocean activities

Items 1-3 are the activities that take place in the ocean, whereas (4) and (5) are the activities that support the ocean activities or are derived from them. In other words, the activities of items 1-3 share the characteristic of taking place *in the ocean* while items 4-5 have the directional characteristic of *from the ocean* and *to the ocean*, respectively.

5. REDEFINING THE OCEAN ECONOMY

5.1 Reestablishing the Classification Standard of the Ocean Economy

5.1.1 Classification by Definition and Characteristics of the Ocean Economy

To determine the scope of the ocean economy, each country's classification needs to be examined. To this end, we can apply the two following classification standards:

- 1) Classification by definition and characteristics of the ocean economy
- 2) Classification by supply chain and relationships among the various components of the ocean economy

At first, as Section 2 shows, the definition of the ocean economy can be economic activities that directly or indirectly take place in the ocean, use the ocean's outputs and put goods and services into the ocean activity. In addition, as Section 3 shows, the characteristics of the scope of the ocean economy can be categorized into three phrases: *in the ocean*, *from the ocean* and *to the ocean*.

In the ocean means the economic activity that takes place in the ocean to use, protect, research and develop the ocean. *From the ocean* means the economic activity that receives goods and services from an ocean activity to use, protect, research and develop the ocean. Lastly, *to the ocean* means the economic activity that provides inputs for an ocean activity. We can rearrange the common words of ocean economy scope by country according to three characteristics seen in Table 12.

Table 12. Classification by definition and characteristics of the ocean economy

Characteristics	Classification
In the Ocean	Aggregates, aquaculture, cruise, oil & gas E&P, fisheries, leisure, marine construction, marine mining, marine tourism, minerals, non-living things, ocean renewable energy development, offshore supply services, recreation, seawater utilization, shipping, transportation, defense, marine environment management, safety, security, Navy, observation
From the Ocean	Costal tourism , marine bio industry, marine chemical industry, seafood processing
To the Ocean	Boat building, cables, communication, high tech marine products and services, marine applications, marine business services, marine equipment manufacturing, marine engineering, marine insurance, marine materials, marine sensors, marine technical services, offshore plant building, OSV building, port development , port management, port operation, rental, ship building, research & development, education, license, navigation, public administration, training

In the ocean includes marine aggregates, aquaculture, cruise, offshore oil and gas E&P, fisheries and so on. *From the ocean* includes coastal tourism, marine bio industry, marine chemical industry, and seafood processing. *To the ocean* includes ship and boat building, marine business services, marine equipment manufacturing and so on.

5.1.2 Classification by Supply Chain and Relationships in the Ocean Economy

In business, one industry is usually linked to another through a supply chain. (Figure 3). The ocean economy is no exception. For example, the fisheries industry is linked to R&D, education, fish ship and gear building, seafood processing, governmental administration and so on. Catching and farming fisheries may need R&D, education, fish ship and gear building and may be the sources of seafood processing, seafood distribution and sales. Therefore, we must decide whether or not to merge them into one. Industries within the supply chain can be integrated into one industry, while those outside the supply chain must be separated.

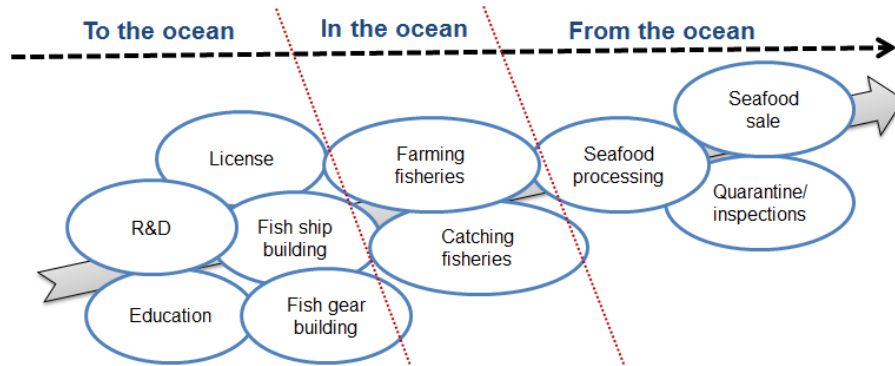


Figure 3. Example of fisheries' supply chain

Although some industries are inside the same supply chain, they cannot easily be integrated into one industry because, as Figure 4 shows, there are two cases: multiple industries provide inputs to one industry or one industry provides inputs to multiple industries. Multiple industries can be integrated into one industry when they give inputs to one industry. For example, marina, cruise, aquarium, hotels located on the coast, and so on, provide goods and services to marine and coastal tourism, allowing us to consider them part of marine and coastal tourism.

Conversely, if one industry gives inputs to multiple industries, it can be separated as a different industry. As Figure 3 shows, both R&D and education provide goods and services to fisheries. Nonetheless, they also provide goods and services to other industries, allowing us to consider it a single industry.

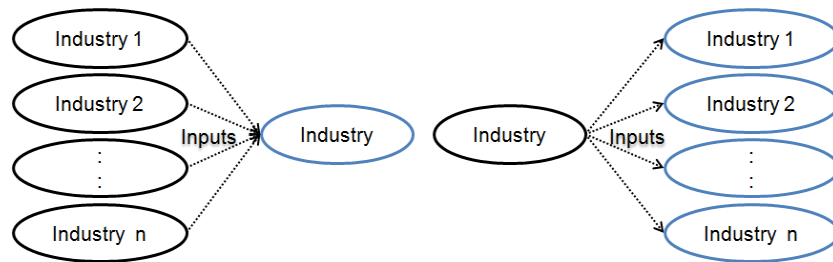


Figure 4. Relationship among the ocean industries

As seen in Section 3, the number of categories for the ocean economy can range from six to 33. A high number of categories may indicate the ocean economy is detailed but perhaps too complex and inaccessible. Lower numbers indicate the ocean economy is simple, but too general and abstract to be useful. The average number of categories is 15, which could be a reasonable target.

5.2 Redefining the Scope of the Ocean Economy

5.2.1 Reestablishing the Sectors of the Ocean Economy

Representative words can be extracted from Table 12 regarding the supply chain, relationships among different countries' ocean economies, and the number of categories, as shown below:

- 1) Fisheries
- 2) Marine mining
- 3) Offshore oil & gas
- 4) Shipping and port
- 5) Marine leisure & tourism
- 6) Marine construction
- 7) Marine equipment manufacturing
- 8) Ship building & repair
- 9) Marine business services
- 10) Marine R&D and education
- 11) Marine administration
- 12) Others

Figure 5 (next page) shows the links between 12 categories and common words the countries use to classify the ocean economy.

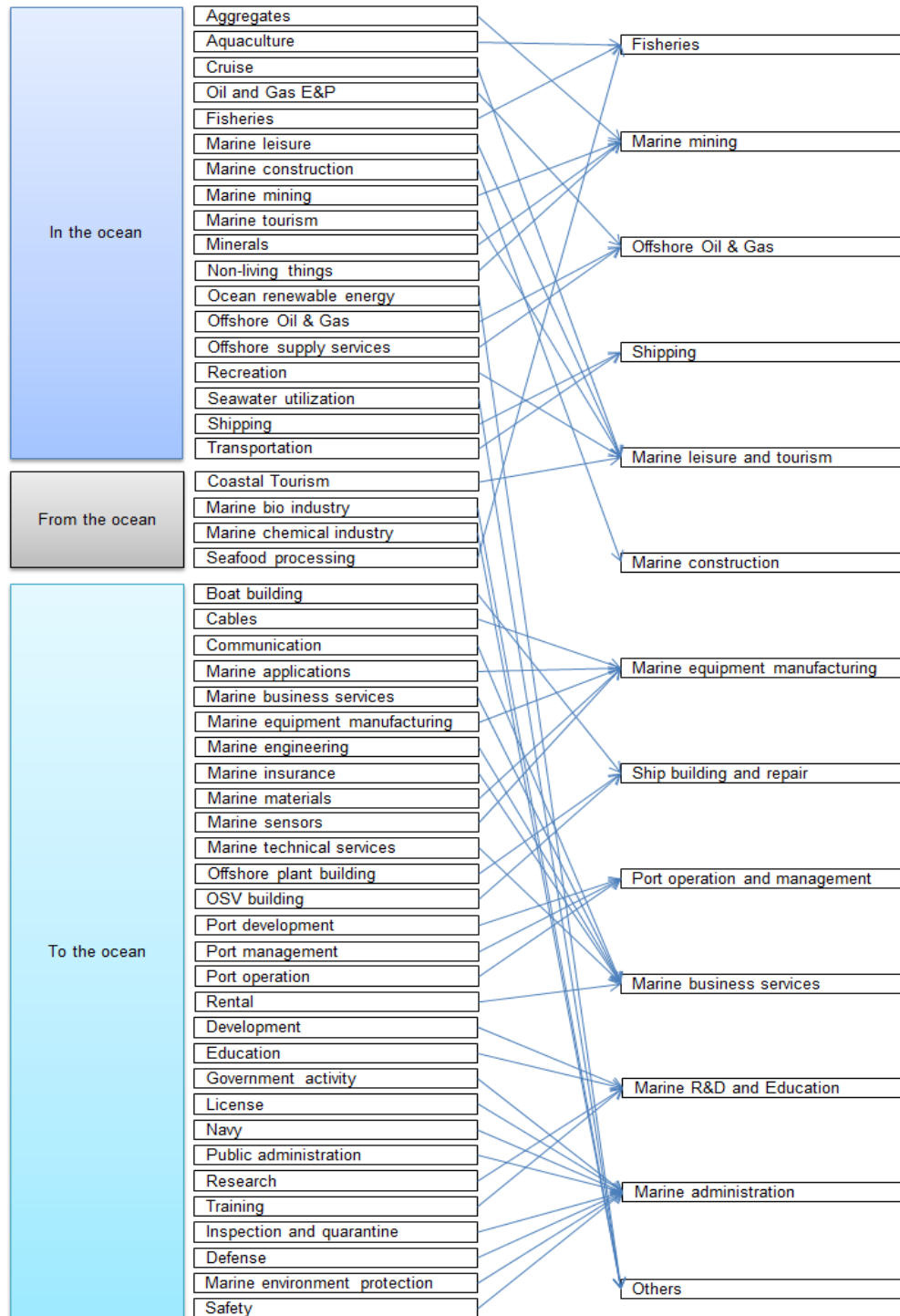


Figure 5. Links between proposed categories and common sectors

Fisheries are linked to aquaculture, fisheries and seafood processing. Marine mining represents aggregates, mineral marine mining and non-living things. Offshore oil and gas are linked to oil and gas E&P, offshore oil and gas, and offshore supply services. Shipping and port includes shipping and transportation, as well as port O&M.

The cruise industry, marine leisure, marine tourism, recreation and coastal tourism are considered part of marine leisure and tourism. Marine construction is linked to just marine construction. Marine equipment manufacturing includes cables, applications, materials and sensors, etc. Ship building includes the building and repair of ships and boats, offshore platforms, and OSVs (offshore support vessels).

Marine business services include communication, marine business services, marine engineering, marine insurance, marine technical services and rentals. Marine R&D and education include research, development, training and education. Marine administration includes government activities such as the navy and defense, licensing, marine environmental management and so on. Finally, others include activities that may be not be classified elsewhere such as ocean renewable energy, marine bio industry and sea water utilization.

Figure 6 shows us the relationship among the 12 scopes extracted in this article and in classification by NOEP and Juan C. Suris-Regueiro *et al.* First, fisheries, marine leisure and tourism, shipping and port, and marine construction are entirely the same in across these three articles, despite differences in terminology. Although the NOEP and Juan C. Suris-Regueiro *et al.* place offshore oil and gas under the umbrella of marine mining, we have chosen to separate the two in view of the fact that most countries do the same.

On another note, marine equipment manufacturing is regarded as one sector and separated from ship and boat building and repair. Nonetheless, Suris-Regueiro *et al.* combines these two sectors into one and the NOEP places them in transportation. Our categorization of marine R&D and education and marine administration match that of Suris-Regueiro *et al.*, but marine business services and others in this article are integrated into one sector. The NOEP, on the other hand, includes some of them in the transportation sector.

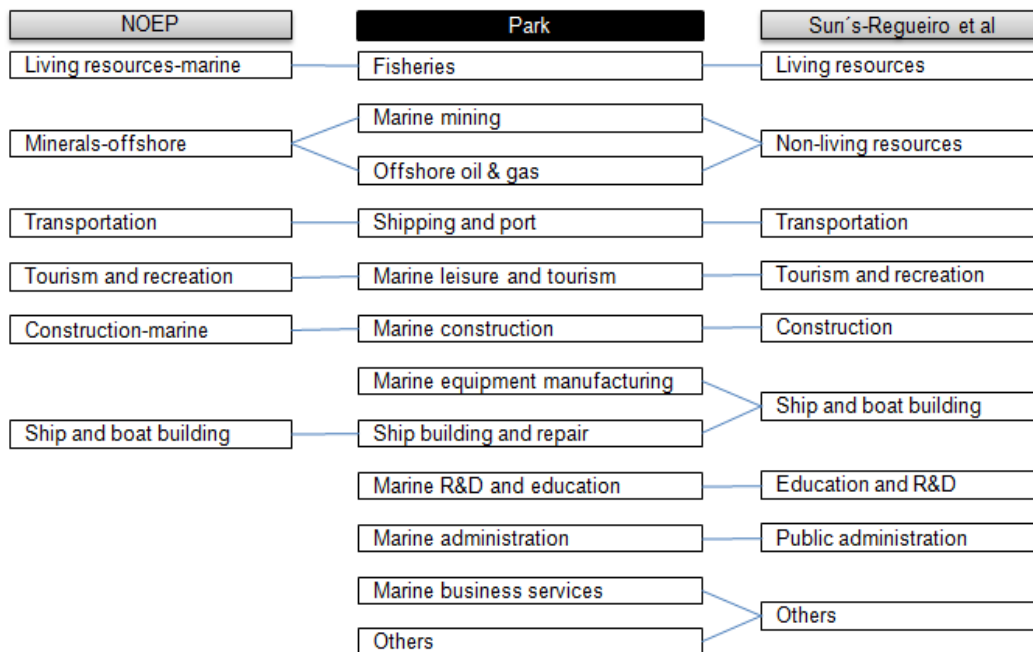


Figure 6. Comparison of the scope of the ocean economy among the three studies

5.2.2. Redefining Sectors and Establishing Underlying Categories

As seen in Table 13, each sector proposed by the new classification standard can be defined and categorized as follows. First, ‘Fisheries’ can be defined as the economic activity related to the production, processing and distribution of seafood, while the scope of fisheries consists of the categories of fishing, aquaculture, seafood processing, seafood distribution and sale. Although marine bio industry uses living marine things, it is excluded from fisheries because this industry’s purpose differs from that of fisheries.

‘Marine mining’ is the economic activity related to the production, extraction and processing of non-living resources in seabed or seawater. The sub-sectors in marine mining are marine aggregates such as limestone, sand and gravel, seabed resources, salt and seawater dissolved minerals extraction. Nonetheless, it doesn’t include offshore oil & gas because most countries separate this from marine mining.

‘Offshore oil & gas’ is the economic activity related to the exploration and production of offshore oil and gas, and includes the operation and maintenance of

related equipment. It only includes the activity related to oil and gas E&P and offshore service business. Thus, the building of facilities for oil and gas E&P, such as offshore platforms and OSVs, is excluded from this scope in keeping with the countries' classification standards. They are instead included in the ship and boat building industry.

'Shipping and port' refers to the economic activity related to the transportation of freight and passengers on oceans and rivers, as well as the economic activity related to the O&M of port. In particular, the port industry is included in the shipping industry in light of the countries' classification standards. However, it does not include the building and repair of vessels. Three sub-sectors under shipping are passenger transportation, freight transportation and shipping business services. The port industry includes port development to O&M such as storage, loading and unloading, etc.

'Marine leisure and tourism' is defined as the economic activity related to marine and coastal leisure and tourism, which includes eating and drinking places, hotels and lodging, marinas, marine sporting goods retailers, zoos, aquariums, recreational vehicle parks and campgrounds, and so on. Fishing for amusement (or "recreational fishing") is also included in this sector. The sub-sectors of marine leisure and tourism include all the tangible facilities (such as hotel, marina, aquarium) and (or) intangible activities (such as marine sports and leisure, marine festival). Generally, to be classified as a part of marine leisure and tourism, the activities or facilities should take place or be located near the coast.

'Marine construction' refers to economic sea-related construction taking place in the ocean. It can be divided into the sub-sectors of marine construction (seabed cable, pipeline, waterway, etc.) and marine-related construction (ports, bridges, etc.). Like marine leisure and tourism, it is important for marine construction to take place on or near the coast to meet the geographical criterion.

'Marine equipment manufacturing' is the representative industry that provides goods to multi sectors. It can be defined as the economic activity which includes the manufacturing of marine equipment and materials, such as various types of machinery, valves, cables, sensors, ship materials and so on. However, it does not include the building, repair and/or conversion and supply of services. It is difficult to decide what to include in or exclude from marine equipment due to the variety of equipment.

‘Ship building and repair’ is the economic activity related to the building, repair, and maintenance of ships, boats, offshore platforms and OSVs. Offshore platforms are the facilities that explore and develop oil and gas resources in the ocean, such as FPSO, fixed platform, spars, TLPs, and so on. OSVs, which support offshore oil and gas E&P are included in this sector both because offshore platforms are indeed similar to ships and OSVs themselves are a kind of ship. Moreover, such facilities are manufactured by shipbuilders.

‘Marine business services’ are the economic activities related to services that support the ocean industry. Such services feature the sub-sectors of marine insurance and finance, marine consulting, rental, technical services, inspection and survey, S/W services, labor supply services and others related to this activity.

‘Marine R&D and education’ includes the economic activities related to research and development, education and training. Despite their differences, R&D and education are combined into a single sector because they are generally performed by the same organizations, e.g. universities or research institutes.

‘Marine administration’ refers to the economic activities related to defense, the Coast Guard, security, navigation and safety, and coastal and marine environmental protection by government and public or private organization.

‘Others’ refers to the economic activities not classified elsewhere. It also includes economic activity related to the development of the ocean resources of renewable ocean energy, marine living resources, seawater and ocean spatial. These industries are usually found in the early stages of development.

Table 12. Rebuilding the Classification System of the Ocean Economy

Sectors	Definition	Categories
1. Fisheries	The economic activity related to the production, processing and distribution of seafood.	1) Fishing 2) Aquaculture 3) Seafood processing 4) Seafood distribution and wholesale
2. Marine mining	The economic activity related to the production, extraction and processing of non-living resources in the seabed or seawater. But it doesn't include offshore oil & gas.	1) Marine aggregates (limestone, sand, gravel) 2) Seabed resources 3) Salt 4) Seawater dissolved minerals extraction
3. Offshore oil & gas	The economic activity related to the exploration and production of offshore oil and gas, includes operating and maintaining equipment related to this activity. It doesn't include building offshore platforms, equipment, and OSVs.	1) Oil and gas E&P 2) Offshore supply services
4. Shipping and Port	The economic activity related to the transportation of freight and passengers through the ocean and river, and related to operation and management of ports.	1) Passenger transportation 2) Freight transportation 3) Shipping business services 4) Port development 5) Port O&M (storage, load and unload, trucking, etc.)
5. Marine leisure & tourism	The economic activity related to marine and coastal leisure and tourism, which includes eating & drinking places, hotels & lodging places, marinas, marine sporting goods retailers, zoos, aquariums, recreational vehicle parks & campgrounds.	1) Eating & drinking places 2) Hotels & lodging places 3) Marinas, marine sporting goods retailers, zoos, aquarium, recreational vehicle parks & campgrounds 4) Marine festival, etc.
6. Marine construction	The economic activity which includes construction in the ocean and related to the sea.	1) Marine construction (seabed cable, pipeline) 2) Marine related to construction (ports, bridges, etc.)

7. Marine equipment manufacturing	The economic activity which includes manufacturing of marine equipment and materials, such as various machinery, valve, cable, sensor, ship materials and so on (no building, repair and/or conversion and supply services).	<ol style="list-style-type: none"> 1) Machinery, valve, cable, sensor, ship components 2) Research equipment 3) Others
8. Shipbuilding & repair	The economic activity related to the building, repair and maintenance of ships, boats, offshore platforms, and OSVs.	<ol style="list-style-type: none"> 1) Ship & boat building 2) Ship & boat repair and maintenance 3) Offshore platform & OSV building 4) Offshore platform & OSV repair and maintenance
9. Marine business services	The economic activity related to services to support ocean industry like finance, consulting, technical services, and so on.	<ol style="list-style-type: none"> 1) Finance & Insurance, marine consulting 2) Rental 3) Technical services 4) Inspection 5) Ocean engineering, S/W service 6) Labor supply services 7) Others
10. Marine R&D and education	The economic activity which is related to research and development, education, and training.	<ol style="list-style-type: none"> 1) Research and development 2) Education and training
11. Marine administration	The economic activity related to defense, coast guard, security, navigation and safety, coastal & marine environmental protection by government and public or private organization.	<ol style="list-style-type: none"> 1) Defense, coast guard, security 2) Navigation and safety 3) Coastal & marine environmental protection 4) Organization (government, public organization, NGO)
12. Others	The economic activity which is not classified elsewhere. It also includes economic activity related to development of the ocean resources, which are ocean renewable energy, marine living resources, seawater and spatial, but just enter into the early commercial stage.	<ol style="list-style-type: none"> 1) Ocean energy (tidal, wave, OTEC, offshore wind) industry 2) Marine bio industry 3) Seawater desalination 4) Marine CCS 5) Others which are not classified elsewhere

6. CONCLUSION

6.1 Summary

Ocean-related economic activities are developing significantly around the world. However, as Kildow and McIlgorm (2010) pointed out, in studies by other countries, different definitions or delimitations of the ocean economy or industry can arise. As seen in Sections 2 and 3, classification standards and scope as well as terminology and definition vary from country to country. Consequently, it is difficult to compare the ocean economy among countries, though such comparisons are important for ocean policy decision-makers. In light of this, this study has aimed to make concrete practical proposals for the definition, classification standards and scope of the ocean economy. To this end, we have redefined the ocean economy, extracting characteristics from the ocean countries. Furthermore, we have analyzed the classification standards and the scope of the ocean economy for each country. For terminology, this article considers ‘ocean economy’ to be the most representative choice. Though ‘ocean’ can be replaced with ‘marine’, ‘economy’ cannot be used interchangeably with ‘industry’ because the former includes much more than the latter. Only when the ocean economy deals solely with the private sector and excludes the public sector, is it suitable to use the term “ocean Industry.” Moreover, non-market value is excluded from the ocean economy in this article despite its important role in the ocean economy. Regarding the definition of the ocean economy, common words are extracted from each country’s classification efforts, and a combination of industrial and geographical perspectives is considered. As a result, the ocean economy is defined as follows: (a) the economic activities that take place in the ocean, receive outputs from the ocean and provide goods and services to the ocean, or (b) the economic activities that directly or indirectly take place in the ocean, use the ocean’s outputs and contribute inputs to the ocean’s activities.

To determine the scope of the ocean economy, nearly 50 common words are extracted from the classifications of 10 ocean countries, and three characteristics of the scope of the ocean economy are inferred from them. These are ‘in the ocean’, ‘from the ocean’, and ‘to the ocean’. Supply chain and the relationships within the ocean economies are also considered on a per country basis. According to the newly proposed classification standard, 12 sectors of the ocean economy are reestablished and linked to common words.

6.2 Limits and Suggestions

This study has two limits. First, there is no trial to enable comparison among countries, because this study is solely focused on reestablishing the definition, classification standard and scope of the ocean economy. Ideally, a follow-up study would be conducted. Second, even though non-market value must be included in the ocean economy, it is excluded from this article for ease of evaluation. This also requires a follow-up study.

Furthermore, we should consider the methodology of estimating the ocean economy. Most countries have no statistical classification system for the ocean economy as a distinct category of the economy. To estimate the size of the ocean economy, these countries usually use Standard Industrial Classification (SIC) or input-output tables produced by the country's own statistical bureaus. Therefore, one might consider linking to the U.N. International Standard Industrial Classification (ISIC) Most countries adopt the ISIC as a national statistical system. If each country used the ISIC to classify its ocean economy, it would be easier to make cross-country comparisons.

Although this study aims to provide concrete practical proposals for the definition, classification standard and scope of the ocean economy, its results are likely to elicit differing opinions. Therefore, the topic should be more widely discussed and standardized at the international level.

REFERENCES

- Allen Consulting Group, The economic contribution of Australia's marine industries 19996 to 2002-03, June 2004.
- Cesar, H.J.S., Burke, L., and Pet-Soede, L., The economics of worldwide coral reef degradation, Cesar Environmental Economics Consulting, Arnhem, and WWF-Netherlands, Zeist, The Netherlands, 2003.
- China Marine Information Economic Network, Statistical bulletin of China's ocean economy 2012, January 2013.
- Chul-Oh Shin and Seung-Hoon Yoo, Economic contribution of the marine industry to RO Korea's national economy using the input-output analysis, Tropical Coasts, PEMSEA, 2009.
- Colgan CS. Measurement of the ocean and coastal economy: theory and methods. National Ocean Economics Project, USA; December 2003.
- Colgan CS. A guide to the measurement of the market data for the ocean and coastal economy in the National Ocean Economics Program, USA, January 2007.
- Crown Estate et al., Socio-economic indicators of marine-related activities in the UK economy, Project OSR 07-04 Final Report, March 2008.
- Gardner Pinfold, Economic impact of ocean activities in Canada, 2009.
- Innovamar, cuantificación económica del sector marítimo y su desagregación sectorial, Fundación Instituto Tecnológico para el Desarrollo de las Industrias Marítimas, Spain, Febrero 2011.
- J. T. Kildow and A. McIlgorm, The importance of estimating the contribution of the oceans to national economies, *Marine Policy* 34, 367–374, 2010.
- Juan C. Suris-Regueiro et al, Marine economy: A proposal for its definition in the European Union, *Marine Policy* 42, 111–124, 2013.
- K.H Hwang et al., Assessment of gross ocean products in Korea, Korea Institute of Marine Science and Technology Promotion, 2011.
- Korea Maritime Institute, The strategy of development the ocean based new national wealth, 2009.
- Kwak SJ, Yoo SH and Chang JI, The role of the maritime industry in the Korean national economy: An input–output analysis, *Marine Policy* 29(3), 371–383, 2005.
- National Ocean Economics Program, State of the U.S. ocean and coastal economies, 2014.
- Nomura Research Institute, The report on of Japan's marine industry, March 2009.
- Pontecorvo GM et al, Contribution of the ocean sector to the US economy, *Science* 208:1000–1006, 1980.
- Pontecorvo GM, Contribution of the ocean sector to the US economy: estimated values for 1987 — a technical note, *Mar Technol Soc J* 23(2): 7–14, 1988.
- Régis Kalaydjian et al., French marine economic data, Ifremer, 2010.
- Rui Zhao et al., Defining and quantifying China's ocean economy. *Marine Policy* Volume 43, 164–173, January 2014.
- Socio-Economic Marine Research Unit. 2010. Ireland's ocean economy.
- Southeast England Development Agency, International trade and global marine opportunities, MareNet, February 2009.
- Statistics New Zealand's Environmental Statistics, New Zealand's marine economy 1997–2002, June 2003.