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Development of Ocean Economy Satellite Account in Korea

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1. INTRODUCTION

The oceans provide numerous economic benefits to the coastal societies. Consequently, the measurement of ocean economic activities has become an essential task to examine the potential for innovation in ocean industries and to establish strategies for the ocean economy. The definition of the ocean economy used in this study is “the economic activities that take place in the ocean, receive outputs from the ocean and provide goods and services to the ocean, or 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” (Park and Kildow, 2014). The ocean economy is a large industry group that includes primary industries (fishing and aquaculture), secondary industries (shipbuilding, equipment manufacturing, fishery product processing, marine construction), and tertiary industries (shipping, marine leisure tourism, ocean-related services, etc.). However, apart from some individual industries such as fisheries, shipping, and shipbuilding, the ocean economy cannot be independently identified within the national account system and central statistic industrial classifications. There have therefore been difficulties in analyzing industrial activities related to the ocean economy within the national accounts system.

To identify the broad range of contributions made by the ocean economy, a satellite account may be created that reflects the characteristics of the ocean economic activities while maintaining consistency with the national accounts. Moreover, an assessment of the ocean economy in terms of its gross output, value added, and employment compared with the national economy is important to estimate the degree to which the ocean economy contributes to the national economy. Satellite accounts can be used to identify and present defined aspects of the ocean economy that are not otherwise visible in the standard presentation of national accounts. Supply-use tables within the national accounting framework and form the foundation on which ocean economy statistics can be developed (Statistics Portugal, 2016, 2016; OECD, 2019; BEA, 2020; OECD, 2021).

A satellite account is a statistical framework that focuses on a certain field, economic, or industrial aspect in the context of national accounts. The measurement of the ocean economy by country has been mainly based on survey statistics of related industries or estimated using economic models. To develop a sustainable ocean economy, evidence-based policies with accompanying data and analysis have become the most fundamental tasks to be implemented (OECD, 2019; Korea Maritime Institute (KMI), 2019e). However, some issues remain to be resolved, such as unified concepts and evaluation methods for the ocean economy, comparability between the national economy and the ocean economy, and the connection between global and national assessments. In this respect, the OECD (2021) and the Global Ocean Accounts Partnership (GOAP) (2021) have recently highlighted the need for guidelines on standardized ocean economy satellite accounts and ocean accounts, attempting to develop pilot guidelines and accounts. Standardized international guidelines for understanding the ocean economy will play a key role in establishing policies to drive ocean-

based growth. This study demonstrates how Korean attempts to develop ocean satellite accounts can assist with the establishment of such international guidelines.

Since the ocean economy is comprised of various complex industries, it is necessary to establish policies based on an objective analysis of economic indicators. If an appropriate measurement system could be established to objectively measure the ocean economy, it would be possible to identify the impact of external economic volatility on the ocean economy and prepare appropriate responses. Measurement of Korea's ocean economy, has been actively conducted since the 2000s, starting with Kwak et al. (2005) who evaluated gross output and value added of ocean economic activities based on input-output (I-O) tables (KIMST and KMI, 2011, KMI 2019a, 2019b, 2019c, 2019d, 2021). Among them, shipbuilding, shipping, and the port sectors, which are sensitive to global economic conditions, account for a high proportion, 38.4% in 2017 of Korea's ocean economy (KMI, 2021).

Although I-O tables contain industrial activities by detailed sector, they have a time lag of more than three years and are based on a product classification system. This means there are some limitations to accurately estimate the contribution of the ocean economy as an industrial classification in its own right. Therefore, it is necessary to establish a satellite account system, which can boost the timeliness, integrity and comparability of the ocean economy account with national accounts. It is crucial to perform periodic and continual assessments and analyses to understand the ocean economy on a national scale. Moreover, accurately diagnosing the present state can contribute significantly to planning mid- to long-term development goals for the ocean economy five or ten years into the future.

In what follows, this study first reviews the literature on ocean economy satellite accounts. The structure of Korea's ocean economy satellite accounts, the principles for constructing accounts and the basic data used for value coefficient estimation is highlighted in section 3. Pilot results for several components of the ocean economy are presented in section 4 while section 5 discusses remaining challenges for the future refinement of the system of ocean accounts in Republic of Korea.

2. LITERATURE REVIEW

There have been a number of studies conducted on the ocean economy over the past 10 years as the importance of the oceans contribution to societies has become better understood (Foley et al., 2014; Hynes and Colgan, 2021). Analyses have been conducted on the importance of estimating the ocean economy (Kildow and McIlgorm, 2010; Foley et al., 2014), on the classification system of the ocean economy (Park and Kildow, 2014; OECD, 2021), on the size of global ocean economy (OECD, 2016), and on the contribution of ocean (or marine) economy to national economies (Statistics Portugal, 2016; BEA, 2020; European Commission, 2019; O'Donoghue et al. 2021).

Focusing on the importance of ocean economy and the potential of ocean-based economic

growth, major maritime countries and international organizations have endeavored to measure the sizes of ocean economies objectively. Results of an analysis conducted by the OECD (2016) on ocean-based industries show that oil and gas (34%) and leisure and tourism (26%) account for the largest shares of the total value. The United Nations Conference on Trade and Development (UNCTAD, 2021) analyzed the trade structure of ocean-based industries. Major maritime countries including the United States, Australia, Ireland, Korea, China, Portugal and France also publish ocean economy reports to figure out the value added and size of their respective ocean economies.

The ocean economies of major maritime countries, when measured by value added, are different in sizes and industrial structures (Park and Kildow, 2014). This is due to the fact that different countries have different resources and ocean environments and consequently have different ways of classifying ocean economy. They also have different ways of classifying ocean-based industries and estimating the aggregate value of the ocean economy, making it difficult to compare ocean economies directly. Furthermore, while there has been much discussion on the issues, there remains no standardized definitions, scope, and classification system of the ocean economy across recent ocean economy studies. The EU have a standardized ocean economy framework for EU coastal member states (European Commission, 2021) but this is not comparable to ocean economy studies outside the EU jurisdiction.

The UN System of National Accounts (SNA, 2008) is an international standard system of national accounts, and countries compile national accounts statistics based on 2008 SNA. Macroeconomic statistics generated based on the SNA can be compared internationally. The SNA offers the flexibility of the use of satellite accounts, which are supplementary statistics that allow a focused analysis on a particular aspect of the economy, such as spending on tourism or healthcare. Indeed, the SNA allows the use of satellite accounts and addresses them at a high level, but if international comparison are to be made for satellite accounts compiled by individual countries, it is necessary to apply standardized guidelines on the use of satellite accounts for particular aspects of the economy. For example, the UN World Tourism Organization (UNWTO) announced a statistical framework for constructing tourism satellite accounts (TSA) (UN, 2010) while the OECD, Eurostat and WHO jointly announced a manual for constructing health satellite accounts (OECD, 2017).

In order to produce detailed ocean economy statistics to be used in developing effective ocean economy policies, the OECD (2021) proposed a blueprint for isolating ocean-based economic activities from the national account supply and use tables (SUTs). As discussed by Lequiller and Blades (2014), SUTs are the accounting mechanism used to estimate key indicators of economic performance including gross domestic product (GDP) in a balanced manner. Some countries have recently started to develop a satellite account for economic activities in the seas. Portugal has been one of the first to produce statistics using an ocean satellite account (Statistics Portugal, 2020). The Portuguese Satellite Account for the Sea (SAS) was produced within the national account framework in Portugal. According to the recent Portuguese SAS, the ocean economy accounted for 3.9% of the Gross Value Added over 2016-2018 (Statistics Portugal, 2020). The USA has also developed prototype satellite

statistics in the form of its Ocean Economy Satellite Account (OESA) (BEA, 2020). According to the OESA statistics of the United States, the ocean economy accounted for 1.8% of national GDP in 2018 (BEA, 2020). Both Portugal and the USA produced their respective satellite accounts of the ocean economy using the SUT framework. In the meantime, the GOAP is developing technical guidance on ocean accounting in line with the SNA by referencing the UN System of Environmental Economic Accounting (SEEA) framework (GOAP, 2021). Ocean accounts include not only ocean economy but also the stocks and changes in stocks of environmental assets (natural capital) that provide benefits to people. This study describes the process and methodology in detail that was used to construct the Korean satellite account for the ocean economy in line with its system of national accounts.

KMI (2019e) initiated a basic structure and preparation system to establish an ocean economy satellite account and worked out a pilot project on the fisheries production industry. Subsequently, the Ministry of Oceans and Fisheries (MOF) and KMI conducted a pilot project on the shipping and port sections during its research on the groundwork to establish an ocean economy satellite account (MOF and KMI, 2020). Over the three years from 2020 to 2022, the MOF will continue to set up pilot accounts for each industry of the ocean economy. From 2023 onwards, the MOF will prepare and announce an ocean economy satellite account.

The tourism, health, and environmental sectors have created and announced their own satellite accounts in Republic of Korea. The health account and environmental expenditure accounts, and satellite accounts in other sectors in Republic of Korea, are mainly focused on the demand side. The TSA was created by joining the supply and demand sides. However, the ocean economy satellite account was created based on industrial activities and is focused on the supply side.

3. PROPOSED SYSTEM FOR AN OCEAN ECONOMY SATELLITE ACCOUNT IN KOREA

3.1 The Scope and Purpose of and Ocean Economy Satellite Account for Korea

The 2008 System of National Accounts (SNA) classifies satellite accounts into two types (EC *et al.*, 2008). The first type maintains the concepts of the SNA but “rearranges the classification of the central system and introduces some possible complementary elements (2008 SNA chapter 29).” The second type is an alternative concept to the SNA in which concepts such as production, consumption, and capital are extended to generate for example satellite accounts for the environment or for human resources. The Korean ocean economy satellite falls under the first type. The purpose of Korea’s ocean economy satellite account is, above all, to set up a fundamental economic indicator measurement system for the ocean economy by establishing a satellite account that corresponds to the national account

framework. Second, by providing a system that can measure the economic activities of the ocean economy, the satellite account contributes to the establishment of development goals and aids in the preparation of industrial policies for the ocean economy.

To create an ocean economy satellite account in accordance with the national account, it is necessary to establish a clear scope of the ocean-based industry. In Korea, the Marine and Fisheries Industry Special Classification System is the officially approved classification system used by Statistics Korea. The ocean sectors defined in the Marine and Fisheries Industry Special Classification System include activities related to outputs and inputs regarding the use of marine resources in the ocean space. In the system, the ocean sector consists of nine industries and is subdivided into 29 divisions, 68 groups, and 143 classes (The satellite account is however based on 10 industries as the shipping/port industry is divided up into shipping and port industries).

Table 1. The Industrial Scope of Ocean Economy Satellite Accounts

Industry		Industry
Marine resources development and construction		Fisheries processing
Shipping		Fisheries distribution
Port		Marine leisure and tourism
Vessel and offshore plant construction and maintenance		Marine and fisheries equipment manufacturing
Fisheries production	0	Marine fisheries services

3.2 THE MAIN ELEMENTS OF OCEAN ECONOMY SATELLITE ACCOUNTS

To prepare a satellite account for the ocean economy comparable with the national account statistics, the statistical elements must correspond with those in the national accounts. As shown in figure 1 the basic ocean economy account, coincides with the elements contained in the national account: a production account, income account, capital account, and overseas transaction account, with an added employment account.

Figure 1 Comparison Between the National Account and the Ocean Economy Satellite Account.

Source : Korea Maritime Institute, 2019e, p.xv

Note: Statistical data other than the National Account Statistics of the Bank of Korea are also used to create the ocean economy satellite account.

3.2.1. Production Account

The main variables included in the production account in the national account system are gross output, intermediate inputs, and value added. Gross output is the sum total of goods and services produced over a certain period at the market price (Bank of Korea, 2015). Gross output is evaluated with basic prices, but in cases where it is difficult to evaluate with basic prices, it is assessed with producer prices as an auxiliary.¹ Intermediate inputs refer to the value of consumed goods and services that have been input into the production process for output. The value added can also be measured as the sum of the compensation of employees, gross operating surplus, consumption of fixed capital, and other net production taxes (Bank of Korea, 2014).

3.2.2. Income Account

The main variables that make up the income account of the national account include

¹ The basic price = producer prices - taxes on products + product subsidies

employee remuneration, operating surplus, production taxes and subsidies, and final consumption expenditures. Employee compensation is a remuneration, either monetary or in kind, paid by employers to employees in return for their work during a set period. Operating surplus is the surplus generated from production, calculated before taking account of any express or implied interest, rent, or other property income on financial assets, land, and other tangible productive assets necessary for production activities (Bank of Korea, 2019). Taxes on production are taxes levied on producers concerning the production, sale, or use of goods and services.

Subsidies are the amount that the government has paid for part of the production cost of producers, for policy purposes. Subsidies are treated as deductible from value added amounts. Finally, final consumption expenditure refers to the amount spent by consumers on goods and services.

The main variables of the capital account prepared in the national account include gross fixed capital formation and fixed capital consumption. Gross fixed capital formation refers to purchasing capital goods for the replacement or expansion of production facilities.

Consumption of fixed capital refers to the decrease in the value of fixed assets due to physical wear and tear caused by the use of fixed assets owned by producers for production during the accounting period, obsolescence of the ordinary ratio, or daily losses (Bank of Korea, 2019).

3.2.3. Overseas Transaction Account

In an open economy, goods and services produced in a country are either used domestically or exported abroad. Among domestically produced goods and services, those exported abroad are referred to as exports of goods and services, and goods and services produced abroad that are imported and used in the country are called imports of goods and services. Goods and services consumed by foreigners or foreign institutions in Korea are included in exports, while foreign goods and services consumed by Korean citizens on overseas travel and overseas expenditures by government agencies are included in imports. The trade balance can be measured using statistics on exports and imports of goods and services.

3.2.4. Employment Account

The employment account covered in this study can be created based on employed persons and employees². Employed persons include employees, self-employed and unpaid family workers, and employees are workers earning a wage. In general, the number of employed persons or employees refers to the total amount of labor input for production activities in one year.

By synthesizing the content discussed so far, the basic structure of Korea's ocean economy satellite accounts prepared within the framework of the national accounts for the

² The number of employed persons and the number of employees are measured on the full-time equivalent basis.

ocean economy can be represented as shown in figure 2 below.

Figure 2. The Framework of Korea's Ocean Economy Satellite Account. Source : Korea Maritime Institute, 2019e, p.50

Note: Net other taxes on production is obtained by subtracting other production subsidies from other taxes on production.

3.3 Account Creation Steps

Currently, there is no international recommendation for the creation of an ocean economy satellite account. However, the 2008 SNA, which is the standard for each country's national account system, reveals the basic framework for creating satellite accounts. In other words, satellite accounts can be created by rearranging the central classifications of national accounts and introducing complementary elements. The 2008 SNA presents TSA and SEEA as representative satellite accounts based on the concept discussed above. Therefore, this study examines whether a national account-oriented rearrangement of classification is necessary for the creation of a satellite account for the ocean economy and examines what supplementary elements are required for each ocean sector.

The basic preparation procedure for creating a satellite account for Korea's ocean economy is presented in eight steps. It can be divided into a procedure to identify the relevant industry statistics and product statistics (step 1), a procedure for preparing industry statistics (step 2-step 5), and a procedure for preparing product statistics (step 6-step 8).

First, the compatibility of both industry and product statistics with the national account is reviewed to determine the subject and elements of the satellite account (step 1). After that, each classification system is reviewed for industry statistics and product statistics (step 2 and step 6 respectively). Following that, three steps are taken: statistics collection (step 3 and step 7 for industry statistics and product statistics, respectively), deduction of the weight for segmentation, and statistical calculation (step 4 and step 8 for industry statistics and product statistics, respectively). However, in the case of industrial statistics, employment statistics are also calculated (step 5). Each of the steps are reviewed in figure 3.

Figure 3. The Process for Constructing the Ocean Economy Satellite Account. Source : Korea Maritime Institute, 2019e, p.xvii

3.3.1. Classification Review of Industry and Product (step 2 and step 6)

The goal of this study is to create an ocean economy satellite account that is consistent with various statistics of Korea's national account system. Therefore, the various statistics of the ocean economy satellite accounts derived by the preparation procedure presented above

should be linked with the industry classification system that the national account system complies with.

In this study, the Marine and Fisheries Industry Special Classification System and the Korean Classification of Economic Activities for National Accounts (KCEAN) were linked through the Korea Standard Industry Code (KSIC). As shown in figure 4, product classification was also linked to the classification system of the Bank of Korea's I-O table using KSIC.

Figure 4. The Marine and Fisheries Industry Special Classification System-KSIC-KCEAN Connection Diagram (Industry and Product). Source: Korea Maritime Institute, 2019e, p.xvi

3.3.2. Gathering Industry and Product Statistics (step 3 and step 7)

To create an ocean economy satellite account, researchers review and collect industry and product statistics data. As shown in table 2, the industrial statistics needed for the Republic of Korean ocean economy satellite account can be collected from the Bank of Korea, Korea Statistics, the Ministry of Oceans and Fisheries, and other related organizations. Where there are no related statistics, separate sample surveys can be conducted.

Table 2. Statistics Related to the Ocean Economy

Classification	Usage Statistics (example)	The Producing Institution
Utilizing the existing statistics	Supply and use table, employment table, national income statistics, balance of payments, supply amount table by product item (supplementary table of I-O, about 3000 items)	The Bank of Korea
	Korea's economic census, the national business survey, the transportation survey, the wholesale and retail survey	Statistics Korea
	Marine and fisheries industry statistics	The Ministry of Oceans and Fishery
	Other sectional statistics in the marine and fisheries industry	Other statistics different institutions by statistics
Separate survey and statistics	Self-reported surveys and statistics	-

The Bank of Korea provides statistics on I-O tables, SUT, employment tables, national income statistics, and the international balance of payments. The SUT is mainly used to prepare the ocean economy satellite account because the value added by economic activities in the national income statistics corresponds to the value added for each industry in the use table as the industrial standard value added.

Statistics related to the ocean economy can be collected from the survey statistics of Korea Statistics, Republic of Korea's central statistics agency. These surveys include the economic census, the nationwide business survey, the transport industry survey, and the wholesale and retail survey. In addition, statistics that can be collected from the Ministry of Oceans and Fisheries include statistical surveys of the ocean sectors. If it is difficult to identify the ocean industry using existing statistics, a separate investigation into the relevant section of the ocean economy is required. In the case of product statistics, the Bank of Korea's supply amount table by product item, while Statistics Korea provide additional product information through its Economic Census and Industrial Manufacturing Survey. Table 3 below highlights the difficulties in collecting data by ocean economy sub-sectors

using a traffic light system where red indicates difficult to obtain the required data and green means the necessary data is readily available. Statistics collection difficulties are lower for shipping, vessel and offshore plant construction and maintenance, and fisheries processing industries as they can be identified directly from the available national I-O Tables or Supplementary Tables. As for port and fisheries distribution industries, various industry-related statistics, such as the transportation industry survey, the services industry survey and the marine and fisheries statistical survey are utilized. On the other hand, marine resources development and construction, and marine fisheries services industries pose difficulty in terms of data collection as they have a wide range of product level detail, many of which are not identifiable directly from existing statistics. Marine and fisheries equipment manufacturing has few statistics to determine the coefficient of each sub-sector; therefore, rates of intermediate demand from the SUT are used instead.

Table 3. Indicator of Difficulty in Obtaining Statistics by Marine and Fisheries Industry

	Industry	Difficulty in Obtaining
	Marine resources development and construction	Red
	Shipping	Green
	Port	Yellow
	Vessel and offshore plant construction and maintenance	Green
	Fisheries production	Green
	Fisheries processing	Green
	Fisheries distribution	Yellow
	Marine leisure and tourism	Red
	Marine and fisheries equipment manufacturing	Red
0	Marine fisheries services	Red

Note: In the difficulty indicator, red means difficult to obtain, yellow means normal, and green means easy to obtain.

3.3.3 Industry and Product Statistics (step 4 and step 8)

Industrial statistics and product statistics for each industry in the ocean economy are derived based on the SUTs. Based on previously collected statistics, the proportions for subdividing the ocean economy industries from their parent industry classifications are calculated and the industry and product statistics are derived based on this. Table 4 shows the industry data sources for Republic of Korea's Ocean Economy Satellite Accounts while figure 5 demonstrates how the source product data is used to segment out the ocean industries in the SUTs.

Table 4. Reference Data for Korea's Ocean Economy Satellite Accounts

Industries	Reference data
Fisheries	Sub low-level SUT, supplementary tables of I-O tables, wholesale and retail trade survey
Shipping	Sub low-level SUT, economic census
Port	Sub low-level SUT, OE statistics survey, economic census
Vessel & offshore plant construction and repair	Sub low-level SUT, supplementary tables of I-O tables
Marine & fisheries equipment manufacturing	Sub low-level SUT
Marine resources development and construction	Sub low-level SUT, supplementary tables of I-O tables, economic census
Marine leisure and tourism	Sub low-level SUT, Korean comprehensive survey of culture facilities
Marine & fisheries services	Sub low-level SUT, Economic Census, OE Statistics Survey

Note: The classification of SUT consist of 4 stages; high-level, mid-level, low-level and sub-low level. Sub-low level means sub-classification of low level

Figure 5. The Subdivided Conceptual Diagram for the Identification of Ocean Industries.

Source : Korea Maritime Institute, 2019e, p.61, p.67

Employment statistics (step 5) derive employment for each ocean industry based on the employment table of the Bank of Korea. In the employment table, the number of employed persons and the number of employees are based on the KCEAN Accounts sub-classification standard. Therefore, for sectors where the ocean industry contribution cannot be identified at the sub-classification level, it is necessary to apply the ratio for subdividing the ocean industry, as previously mentioned. Representative statistics that can be used for subdividing employment statistics include Statistics Korea's economic census (every five-year survey) and the national business survey (annual survey). However, ocean industries that lack available employment statistical data are identified by applying the output weight ratio or by carrying out a separate survey.

3.4. Method of Estimating Value Coefficients

3.4.1. One-To-One Connection

If the Marine and Fisheries Industry Special Classification and the industry groups of the national level I-O Table (based on the 381 industries from the Korean Classification of Economic Activities for National Accounts) are matched one-to-one, the ratio should be 1.

3.4.2. Utilizing the Supplementary Table of I-O tables (Supply Amount Table by Product Item)

If the ocean industry classifications in the Marine and Fisheries Industry Special Classification System do not connect one-to-one with the industries of the national level I-O tables, the ratio is calculated by associating the classification in the supply amount table by industry and by product item. The supply amount tables are annexed to the national I-O tables. These supply amount tables contain the supply amount for more detailed sub-categories of products (more than 3,000) than what is available for the basic industry groups in the I-O tables.

3.4.3. Utilizing the Ratio of Sales Survey Statistics

When the groups and categories of the Marine and Fisheries Industry Special Classification System and the Supply Amount table by industry cannot be linked one-to-one, a survey statistic authorized by Statistics Korea is used to calculate the proportion of sales. Economic census microdata sales are used as the denominator, and the marine and fisheries industry statistical surveys and relevant industrial statistics sales are used as the numerator.

3.4.4. Utilizing Statistics Other than Sales

When calculating the value coefficient ratio of the ocean industry based on sales revenue is difficult, the ratio of the ocean industry is calculated utilizing statistics other than sales revenue. For example, the ratio of visitors to marine and coastal parks among all domestic natural parks is utilized for marine leisure and tourism, and the ratio of sea aggregate volume collection out of the total amount of domestic aggregate collection is utilized for marine resources and construction (aggregate mining).

3.4.5. Utilizing the Intermediate Demand Rate

In some categories of the marine and fisheries equipment manufacturing industry and the marine and fisheries service industry, the demand for equipment (service) from the ocean industries becomes a numerator and the total intermediate demand for equipment as the denominator.

4. TRIAL CALCULATION RESULTS ON SHIPPING AND PORT

Previously, a method for linking the Marine and Fisheries Industry Special Classification System and the Bank of Korea's KCEAN through the KSIC was explained. The results of linking the classification system for the shipping and port industries are presented in Table 5 below. The shipping industry is linked to the five relevant industries of the Bank of Korea: outbound transportation, coastal and inland water transportation, other transportation-related services, equipment and supplies rental, and water transportation support services.

Table 5. Linkage of the Shipping Industry's Marine and Fisheries Industry Special Classification System - KSIC - Bank of Korea Classification. Source : Ministry of Oceans and Fisheries and Korea Maritime Institute, 2020, p.100

Marine and Fisheries Industry Special Classification System						The 10th Korea Standard Industry Classification		The Bank of Korea (KCEAN)	
code	division	code	group	code	class	code	sub-class	code	Basic Industry
21	Shipping industry	211	Passenger transportation	2111	International passenger water transportation	50111	Sea passenger water transport	5010	Sea transportation industry
				2112	Domestic passenger water transportation	50121	Coastal passenger water transport	5020	Coastal and inland water transport
				2119	Other passenger transportation	50201	Inland passenger and freight transport	5020	Coastal and inland water transport
						50202	Harbor passenger transport	5020	Coastal and inland water transport
		212	Freight transportation	2121	Sea freight transport	50112	Sea freight transport	5010	Sea water transport
				2122	Inland freight transport	50122	Coastal freight transport	5020	Coastal and inland water transport
		219	Other shipping service	2191	Tugboat operation	50130	Other sea and coastal water transport	5020	Coastal and inland water transport
						50209	Other inland water transport	5020	Coastal and inland water transport

			2192	Marine transportation brokerage services	52991	Activities of customs agents and related services	5290	Other transport-related services
					52992	Activities of freight forwarders and cargo agents and related services	5290	Other transport-related services
					52999	Other supporting transport services n.e.c.	5290	Other transport-related services
			2193		76190	Renting of other transport equipment	7700	Renting and leasing equipment and tangible goods
			2194	Vessel management services	52929	Other service activities incidental to water transportation	5212	Supporting services for water transport

The trial calculation of the satellite account for the shipping and port industries, resulted in a figure for the total output of the shipping industry of 31.9 trillion KRW, and for the port industry of 6.1 trillion KRW. As shown in table 6, the gross value added of the shipping industry was 6.7 trillion KRW, accounting for 0.44% of the total industry value added, and the port industry's value added was 2.8 trillion KRW, accounting for 0.19% of the total industry value added. A more detailed breakdown of the value added across these industries is shown in figure 6. The total number of full-time equivalent employed persons in the shipping industry was 44,000, and the number of employed persons in the port industry was 45,000.

Table 6. Satellite Account Trial Calculation Results in the Shipping and Port Sectors (Units: Trillion KRW, 10 thousand persons, %). Source : Ministry of Oceans and Fisheries and Korea Maritime Institute, 2020, p.171

As of 2015	Shipping Industry		Port Industry		Total	
	Total amount in Shipping Industry	Percentage to National Account	Total amount in port industry	Percentage to national account	Total amount	Percentage to national account

Production account	gross output	31.9	0.86	6.1	0.16	38.0	1.02
	intermediate input	25.2	1.14	3.3	0.15	28.5	1.29
	added value	6.7	0.44	2.8	0.19	9.5	0.62
Employment account	The number of employed persons	4.0	0.23	4.1	0.24	8.0	0.47

Figure 6. Details of value added in the port industry and shipping industry

5. CONCLUSIONS

The use of ocean economy satellite accounts in Republic of Korea presented in this study can serve as an important example in defining a framework and principles for international efforts to measure the global ocean economy as well as to encourage use of ocean economy satellite accounts that allow for international comparison. It also has the following marine policy implications. Firstly, the development of an ocean economy satellite account provides solid grounds for establishing mid-to long-term goals, including the Republic of Korean ‘*Basic Plan for the Development of Oceans and Fisheries*’, as well as establishing policy goals for each industry of the ocean economy. Secondly, industry-based statistics produced in connection with national accounts can serve as the most complete basic data for forecasting the national ocean economy. Thirdly, the satellite account can be utilized to evaluate the

effects of governmental policies optimized for the ocean economy. Fourthly, the satellite accounts presented in this study are based on Korea's SNA, which means that it facilitates direct comparison with other industries in the SNA. Lastly, this study boosts public awareness of the extent to which the ocean economy contributes to the national economy. However, the ocean economy satellite account process being promoted currently has limitations in that the accuracy or timeliness of account statistics compilation may be insufficient to a certain extent if detailed statistics required to determine the shares of ocean industry are not readily available. This could be partly improved through more elaborate linkage of a broad range of individual ocean industry survey statistics, gradual expansion of official survey statistics in related fields specializing in the ocean economy and the application of time-series extension techniques.

For future research, additional accounts should be produced, from the demand perspective for Korea's ocean economy satellite accounts. For instance, the fisheries industry and the marine leisure and tourism industry provide final consumption products to consumers, but have been underestimated in the national economy. Once the construction and production of the ocean economy satellite account by sector stabilizes, it is essential to consider expanding into and connecting with regional-level statistics. It would also be beneficial to expand into an 'Ocean Environmental Satellite Account', which would analyze marine ecosystem services and natural capital used in the economic activities of the ocean industries. This would be in line with the aforementioned UN System of Environmental Economic Accounting coordinated by the UN Statistical Division.

What is needed the most from an international perspective is smooth linkage between ocean economy satellite accounts on a national level and international ocean economy satellite accounts to be developed in the future. This is because it can be difficult to include the specific and regional characteristics of each country into the scope of the classification of maritime economic activities covered by international satellite accounts. Therefore, it is proposed to create mapping tables for comparison between ISIC-based international satellite accounts and satellite account classifications developed by individual coastal countries.

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