

Ocean Governance with Data and Information Management

~Collection, use and integration of ocean data and the prospect of Asia-Pacific region~

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Abstract—This paper shows the results of studies focusing on interaction between ocean governance and ocean-related data & information. This will include, first of all, the international comparison of the integrated marine information system (clearing house, and Marine Cadastre or Marine Spatial Data Infrastructure: MSDI), marine policy, and Marine Spatial Planning (MSP), as an effective decision making tool or process for science-based marine management and governance. This paper also shows the results of study on the needs of ocean survey conducted for emerging countries mainly in the Asia and Pacific region which are trying to expand ocean-related activities and demanding the ocean management or “governance” capabilities. The results showed the great needs for conducting ocean survey as the first step to understand their oceans, as well as the needs for the database management (e.g. integrated marine information system), application (including the interest in Marine Spatial Planning: MSP), and capacity building in marine-related government agencies/research institutions. Upon all these analysis on the dynamics of how the scientific tools (i.e. ocean survey and integrated information system) are linked to the decision making mechanism (i.e. MSP) which could ultimately assist the possible legislation necessary for the ocean administration, this paper illustrates the possible ways to strengthen the “ocean governance” capabilities to manage the sustainable exploitation, development, and conservation of our oceans by the ocean-related data & information management, especially focusing on Japan and Asia and Pacific region.

Keywords— *ocean governance; integrated marine information system; marine spatial planning (MSP)*

I. INTRODUCTION

Ocean is international and interdisciplinary/multi-sector world, as represented by international shipping, global/regional environmental phenomena, movement/migration of marine species, disaster management (such as tsunami), and climate change issue, as well as security and defense issues. Beyond the terrestrial seas and exclusive economic zones (EEZ), activities/exploration in global commons such as high seas and deep seas are emerging, and issues have been raised how to sustainably manage and exploit these common goods under the international framework upon the principal of the United Nations Convention on Law of the Sea (UNCLOS) [1]. Especially in emerging countries which are expanding activities in and beyond the oceans, proper management or “governance” of ocean and ocean-related activities need to be

strengthened in each nation or in regional level for sustainable and peaceful use of the oceans.

For governing and managing ocean and ocean activities, understanding and monitoring ocean domain with objective and reliable data & information play important roles. As oceans are connected globally and across borders, data & information exchange across countries is very important. In order to facilitate such data & information sharing, various international exchange frameworks/systems have already developed based on each objective as represented by Global Ocean Observing System (GOOS), Global Earth Observation System of Systems (GEOSS), International Oceanographic Data and Information Exchange (IODE), Ocean Biogeographic Information System (OBIS), World Meteorological Organization Information System (WIS), Maritime Safety and Security Information System (MSSIS) to share the real-time Automatic Identification System (AIS) data from around the world, or other various regional frameworks/systems on each agreement basis for each purpose or issues of concern. However at the same time, we have also observed the challenges: such as difficulties of inter-agency/cross-sectoral cooperation in exchanging data & information at national level; developing capabilities of collecting, managing, and applying such data & information for managing ocean activities; and difficulties of trans-national/trans-boundary cooperation in exchanging data & information, including the issues of sensitivity and interoperability of data. In this sense, we see the “ocean governance” capabilities in utilizing ocean data & information are still weak nationally and internationally, especially in developing countries, high seas and deep seas where activities/explorations are emerging [2].

Upon this recognition, this paper shows the results of studies focusing on the interaction between ocean governance and data & information: 1) comparative study of the integrated marine information system, marine policy, and marine spatial planning (MSP) of each country; and 2) the study on needs for ocean survey conducted for emerging countries mainly in the Asia and Pacific region. Upon all these analysis, this paper illustrates the possible ways to strengthen the “ocean governance” capabilities to manage the sustainable exploitation, development, and conservation of our oceans by the ocean-related data & information management, especially focusing on Japan and Asia and Pacific region.

II. INTEGRATED MARINE INFORMATION SYSTEM, MARINE POLICY, AND MARINE SPATIAL PLANNING

A. Major countries (U.S., Germany, UK, Canada, Australia)

The first study was conducted for analyzing the development and interaction among the integrated marine information system (clearing house, and Marine Cadastre or Marine Spatial Data Infrastructure: MSDI), marine policy, and Marine Spatial Planning (MSP) in each country. TABLE I shows the list of international comparison of these instruments by the U.S., Germany, UK, Canada, and Australia. In this comparison, following findings and observations were made:

- The integrated marine information systems have been developed to provide ocean data to stakeholders (users) in planning and decision making process. These systems have been made by single agency or under the coordinating body in cooperation with other agencies and data custodians, agreeing on data policy, data & metadata standardization and interoperability etc. The purposes of the information system could be specific missions or for multi-purpose oriented including MSP.
- In order to facilitate the efficient data exchange among stakeholder agencies, some cases have been observed to create single marine management Agency (e.g. Marine Management Organisation (MMO) of UK) or the coordinating body (e.g. National Ocean Council (NOC) of the U.S., Australian Ocean Data Centre Joint Facility (AODCJF)).
- In order to facilitate the development of the integrated marine information system and single agency/body for coordination, national ocean policy which provides the consistent shared goal for ocean development and management. Legal backups may also be followed in order to underpin the effective implementation of such policy. For example, in UK, Marine Policy Statement (MPS) provides the principle and vision for managing whole UK ocean. Marine Plan process is implemented in accordance with this national level policy, managed by MMO as a single national ocean management agency. All of them were developed upon the Marine and Coastal Access Act (MCAA) enacted in 2009.
- Spatially visualized information of all related ocean activities as well as non-spatial data (such as legislations and regulations) were effective to facilitate the better understanding and make agreements among stakeholders, while there were some differences among each system based on each purpose, interests, and the scale of the oceans to be managed: e.g., European counties with comparatively small EEZs tend to focus on ocean zoning to manage the congested marine activities including increasing ocean wind farms, while the U.S. adopts Coastal and Marine Spatial Planning (CMSP) divided into regions based on Large Marine Ecosystems (LMEs).

TABLE I. COMPARISON OF MARINE SPATIAL PLANNING (MSP) AND INTEGRATED MARINE INFORMATION SYSTEM IN MAJOR COUNTRIES (USA, GERMANY, UK, CANADA, AND AUSTRALIA)

Country	MSP	Agency	Background /Objective	Information System
USA	“Coastal and Marine Spatial Planning” (CMSP)	National Ocean Council (NOC) & 9 Regional Planning Bodies	CMSP by 9 regional planning bodies based on Large Marine Ecosystems (LMEs) is one of priorities of the National Ocean Policy.	“Multipurpose Marine Cadastre” (MMC) by NOAA & BOEM. Also developing information system for CMSP.
Germany	“Maritime Spatial Planning” (North Sea and Baltic Sea)	Federal Maritime and Hydrographic Agency (BSH)	Legally mandated zoning for ocean wind farm; natural conservation zone (Natura2000 site); maritime / shipping control etc.	“Continental Shelf Information System” (CONTIS): for MSP. “GeoSeaPortal” as marine data integrated search & discovery portal
UK	“Marine Planning”	Marine Management Organisation (MMO)	MMO was established as a single national marine administration agency. Marine Planning for ocean wind farm, natural conservation zone etc.	“Marine Planning Portal”: for Marine Planning and other MMO’s activities and operations (licensing etc.)
Canada	“Large Ocean Management Areas” (LOMAs)	Department of Fisheries and Oceans (DFO)	5 LOMAs are selected (e.g. ESSIM) LOMA in ESSIM is implemented mainly for Marine Protected Areas (MPA)	Data Visualization tool (GIS) for identifying MPA in designated area such as “ESSIM Data Tool” DFO is also developing “Marine Geospatial Data Infrastructure” (MGDI)
Australia	“Marine Bioregional Planning” (MBP)	Department of Environment	Setting Marine Protected Areas (MPA) based on “Bioregion”	Integrated into “Australian Marine Spatial Information System” (AMSIS) by Geoscience Australia (GA)

B. Others (Japan and Asian countries)

Japan has developed the clearing house and the integrated marine spatial information system (or “Marine Cadastre”) lead by the Japan Coast Guard (JCG) under the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), however, Japan hasn’t introduced the mechanism of MSP at national level. Some Japanese local autonomies have introduced a kind of zoning system as a part of Integrated Coastal Management (ICM), however, they are not linked to the integrated marine information system nor science-based/eco-system based management in many cases.

In other Asian countries, some local coastal cities have employed zoning systems as a tool for ICM for conserving marine environment and species under the cooperation of the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), although they are not the MSP for whole terrestrial sea or EEZ. For these cases, the integrated marine information system have not been developed and the necessary ocean data themselves were insufficient and need to be collected.

III. NEEDS FOR OCEAN SURVEY BY EMERGING COUNTRIES

A. Outline of the survey

The second study was conducted to analyze the needs of ocean survey by emerging countries such as in the Asia and Pacific region which are trying to expand ocean-related activities and demanding ocean governance capabilities. As observed in the first study above, ocean data & information play essential role in marine planning process, and such mechanisms have been worked especially in Europe and North American countries. However, we have also observed the gaps between necessary ocean data themselves and the lacks of ocean survey capabilities to collect such data especially in emerging and developing countries such as Asia-Pacific region.

Upon this recognition, we have conducted the questionnaire and interview survey to analyze the needs for ocean survey by emerging and developing countries, with the aim to identify the possible way of cooperation to strengthen the ocean governance capabilities of the countries, which could contribute to the sustainable development of our oceans. The questionnaire survey was conducted from 1st November until 31st December, 2013 by e-mail, and some interview surveys were followed based on the questionnaire survey. The survey was made for ocean related government and academic agencies of emerging and developing countries, and we have received the answers from 22 agencies in 12 countries in total: in Asia-Pacific (Indonesia, Thailand, Philippines, Brunei, Malaysia, Bangladesh), Pacific (Papua New Guinea, Kiribati, Cook Islands), Latin America (Ecuador, Belize), and Africa (South Africa). The interview surveys were conducted for Cook Islands, Applied Geoscience and Technology Division of the Secretariat of the Pacific Community (SPC/SOPAC) to see the comprehensive needs for ocean survey of Pacific Islands countries, and Indonesia. Please see TABLE II and Fig.1 for the details of the survey.

TABLE II. OUTLINE OF THE QUESTIONNAIRE FOR OCEAN SURVEY NEEDS

Duration	1 st November ~ 31 st December, 2013
Methodology	E-mail & Interview Survey
Target	Ocean related agencies of emerging and developing countries in Asia-Pacific, Africa, and Latin America (answers from 22 agencies in 12 countries in total). - Asia (11 agencies in 6 countries): Indonesia (environment, fishery), Thailand (environment (university), meteorology & oceanology), Philippines (environment (3 universities)), Brunei (hydrography), Malaysia (environment (university)), Bangladesh (water resources, water resources (university)) - Pacific (8 agencies in 3 countries): Papua New Guinea (hydrography), Kiribati (ocean resources), Cook Islands (environment, ocean resources, continental shelf, meteorology & oceanology, disaster management, fishery) - Latin America (2 agencies in 2 countries): Ecuador (hydrography), Belize (coastal management) - Africa (1 agency in 1 country): South Africa (fishery)

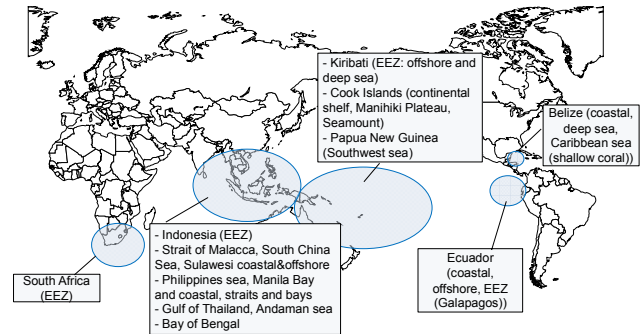
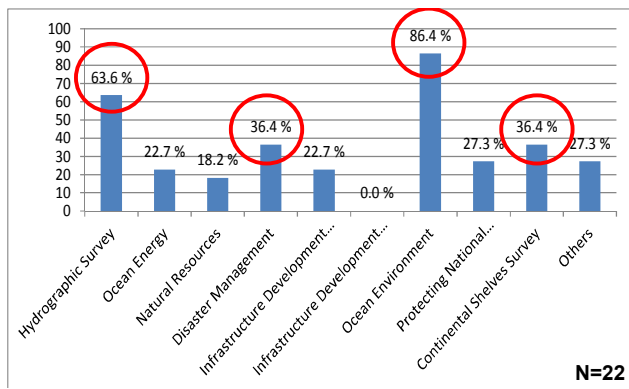


Fig. 1. Geographical areas where needs for ocean survey were observed

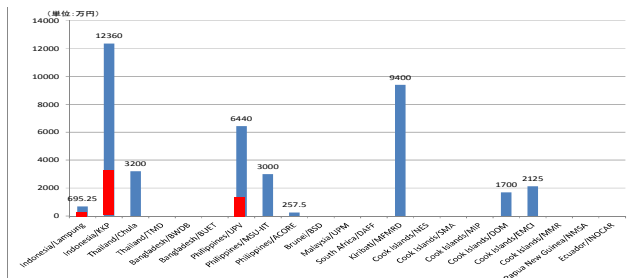
B. Results of the survey

The results of the survey showed the great needs for conducting ocean survey as the first step to understand their oceans, as well as the needs for the database management (e.g. integrated marine information system), application (including the interest in Marine Spatial Planning: MSP), and capacity building in marine-related government agencies/research institutions. Followings are the major findings of the survey:

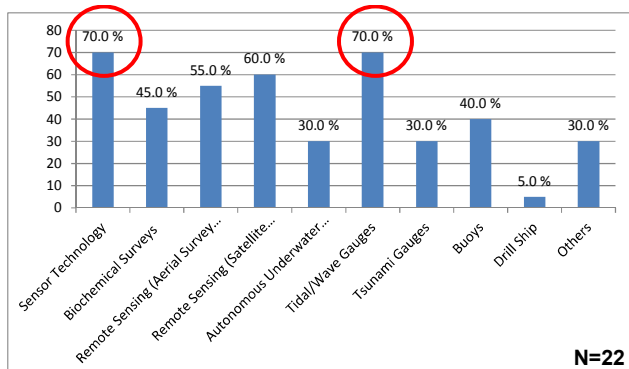
- Needs for surveying ocean environment (scientific survey, environmental impact assessment, conservation etc.) is the largest (86.4%). The second largest needs is hydrographic survey (63.6%). This needs are not limited to hydrographic agency, but also from other agencies such as ocean environment, ocean resources, and disaster management. The needs for disaster management (monitoring tsunami, high tides) and surveying continental shelves are also strong (See Fig.2).



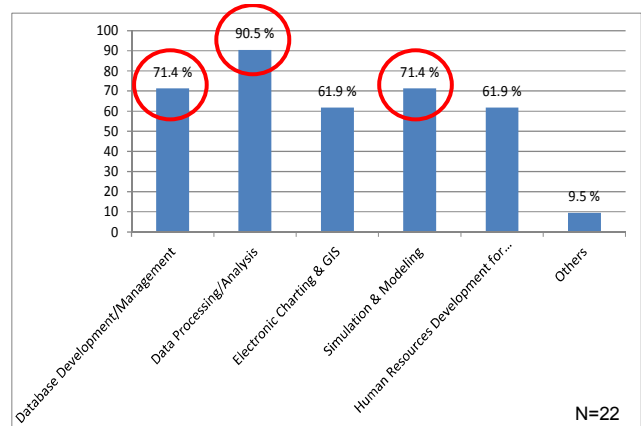
- Estimation of the necessary budget for conducting ocean survey itself is not yet done in many countries, although these countries have shown great needs for ocean survey (feasibility study itself may be insufficient). Some countries have done precise cost estimation, however, sufficient budget is not ensured (See Fig.3).



- Needs for sensor technology (multi-beaming) and tidal/wave gauges are the largest (70% for each). Needs for satellite remote sensing (60%) and air-borne remote sensing (55%) are followed. Needs for Remotely Operated Vehicle (ROV) and Autonomous Unmanned Vehicle (AUV) are also emerging (30%) for continental shelf and natural resources exploration, as represented by the needs for deep sea survey by Kiribati for 400-6000 meters depth (See Fig.4).



- Not just the needs for surveying itself, but the needs for supporting data processing & analysis (90.5%), database development & management (71.4%) are strong. The needs for capacity building were also identified (See Fig.5).



In the following survey conducted for Cook Islands, SPC/SOPAC and Indonesia, we have also recognized the needs for developing the integrated marine information system/platform of all the social, environmental, and scientific information & data (both spatial & non-spatial) related to ocean activities for decision makings. These needs are also coupled with the needs for implementing ocean zoning or MSP to declare the Marine Protected Areas (MPAs) or sustainable ocean resources exploitation and development.

Ocean data & information play essential role in marine planning process, and such mechanisms have been worked especially in Europe and North American countries. However, we have also observed the gaps between necessary ocean data themselves and the lacks of ocean survey capabilities to collect such data especially in emerging and developing countries such as Asia-Pacific region.

We have also observed the great needs for conducting ocean survey as the first step to understand their oceans, as well as the needs for the database management (e.g. integrated marine information system), application (including the interest in Marine Spatial Planning: MSP), and capacity building in marine-related government agencies/research institutions

Upon this, we could conclude that the cooperation in developing ocean survey capabilities could contribute to the ocean governance capabilities of emerging countries such as Asia and Pacific region by combining the assistance for the integrated marine information system and MSP that are effective for sustainable ocean development. Strengthening these capabilities would work effectively to tackle the issues such as balancing deep sea exploration and environmental conservation, mitigating disaster management and climate change impacts etc. based on the scientific data & information.

etc. that would enable the smooth implementation of “ocean governance” by emerging countries.

ACKNOWLEDGMENT

This paper is made based on the surveys and report I made at the 2nd Marine Information Forum hosted by the Ministry of Land, Infrastructure, Transportation and Tourism (MLIT), adding the additional analysis and observations. I deeply appreciate MLIT for providing the basics for this study.

I would also like to thank all the cooperation made for these studies, especially for respondents to the questionnaire, and interviewees including the staff of the agencies of Cook Islands, SPC/SOPAC, and Indonesia.

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