



Progress in the Industry-University-Institute Cooperative Use of Research Vessels

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Abstract

With the support of the Ministry of Oceans and Fisheries of Korea, the Korea Institute of Ocean Science and Technology (KIOST) promoted ‘The study for the industry-university-institute cooperative use of research vessels’, which was an opportunity to advance domestic ocean research to the next level, in line with the launch of the R/V Isabu in 2017. A brief history in relation to the project is described in Lee (Ocean Sci J 57(2), 2022) in this issue. Celebrating the 5th year of the project, KIOST (Marine scientists on a boat, Korea Institute of Ocean Science and Technology, Busan, 2021) has published a resource book on the progress of the project excluding scientific papers. In this special issue, some of the scientific results from the project are grouped together and introduced. The joint use of research vessels started with large research vessels and gradually expanded to small research vessels. Thus, the target area of the study also included from the open ocean to the coastal waters (KIOST, in Marine scientists on a boat, KIOST Korea Institute of Ocean Science and Technology, Busan, 2021) as shown in the papers featured in this issue.

Keywords Research vessel · Industry-university-institute cooperation

1 Intangible Achievements

As a result of the project, the intangible achievements shown so far are, above all, the diversification of domestic ocean research and the expansion of the research target area. Most of them are in line with the use of advanced observation equipment. Ocean research and research areas have been expanded to the far seas of the Indian Ocean and Pacific Ocean, and various research topics and ideas have been raised. Observations in the palaeoclimatic field have been markedly expanded. The project provided an opportunity for professors related to oceanography, who had been maintaining a low profile because they did not have the chance to use a research vessel, to come out and engage in the field of academic exchange. Furthermore, the experience of conducting ocean surveys on board by graduate students who want to pursue academic careers provided a unique learning motivation that they did not feel in the classroom or laboratory. The positive responses of the students who participated in

the expedition on board the vessel are more valuable as the expected effect of the project than the publication of papers. As the basis for judging that the project is being carried out successfully, it can be suggested that necessary conditions were provided and that there were various important factors.

2 Necessary Conditions for Project’s Success

Earth science research, especially oceanography, is done based on observational data. In terms of language, oceanography is a study that records information related to the ocean (‘*ocean*’) on maps (‘*graphy*’), and the production of ocean survey data is one of the starting points for research. Ships are the best way to get ocean information necessary for research. Although unmanned ocean surveys using satellites, unmanned vehicles, unmanned platforms, mooring observation equipment, and floats are on the rise, ships will not relinquish their status as the primary means of conducting comprehensive ocean surveys.

KIOST has been leading the development of domestic oceanography in Korea by developing and operating large-scale observation infrastructure such as a research fleet,

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ocean observation bases, and ocean observation satellites, and boasts experts in the field of observation technology. In particular, the ocean research fleet, which currently consists of five research vessels, is a key infrastructure for ocean research. The history of KIOST's pure ocean research ship began with the now retired R/V Banwol, launched in 1980. In 1992, the R/Vs Ieodo and Onnuri were launched, laying the foundation for research with regard to waters surrounding Korea. The small research vessels Jangmok 1 and Jangmok 2, which are suitable for inland and coastal ocean surveys, are contributing to coastal ocean survey research. In 2016, the launch of the large R/V Isabu laid the foundation for raising the level of ocean research capabilities and oceanography research.

In addition to KIOST's research fleet, research vessels with special functions or for the purpose of investigations focusing on specific fields such as fisheries, waterways, meteorology, geophysics and polar oceans are operated by the National Institute of Fisheries Science, the Korea Hydrographic and Oceanographic Agency, the National Institute of Meteorological Sciences, the Korea Institute of Geoscience and Mineral Resources, and the Korea Polar Research Institute.

Domestic universities have training ships and survey ships, but there are limitations to observation-based ocean research due to spatial and temporal constraints and the lack of specialized technical manpower and equipment used for pure ocean surveys. In view of the demand for using ships, it is more difficult for the industry to utilize research vessels. In this situation, KIOST prepared the necessary conditions to expand the scope of ocean research in Korea by providing opportunities to utilize research vessels. In particular, the launch of the R/V Isabu generated a lot of interest and feedback from oceanography majors who need to engage in observational activities/studies. The fact that the research fund was supported along with the opportunity to use the research vessel is another reason why it received a lot of attention.

3 Important Factors for the Project's Success

Considering the aspect regarding the quality of ocean survey research, the following three points also became important background factors for the project's success along with the diversification of research topics. First, the R/V Isabu is equipped with a dynamic positioning system that automatically controls the position and direction of the vessel. This increases the success rate of mooring and coring operations. Another advantage is that there are fewer errors in the data observed at a fixed location. Second, the research vessel is equipped with the latest state-of-the-art ocean survey equipment. Here are some examples: the Giant piston corer

system is capable of sampling sedimentary layers up to 30 m from the seafloor. This is where palaeoclimatic researchers benefit greatly. The Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS) can control plankton collection and environmental data measurement at multiple specific depths in real time. Research efficiency in the field of plankton research has improved, and the research spectrum has been broadened, so the MOCNESS is also used in paleoclimate research. The R/V Isabu is equipped with a variety of acoustic observation instruments that enables studies of subsea stratum structures, sediment conditions, and identification of biomass communities in the water column. In addition, it is possible to collect a variety of information such as the structure related to physical processes in the water column. Ultra clean sampling system literally consists of a clean laboratory with special equipment designed to prevent contamination of seawater during the collection process. It is greatly desired by researchers in the field of marine biogeochemistry because it enables the precise measurement of trace elements and isotopes. Third, the strength of human infrastructure. Specialized observers and crew members with accumulated experience and in-depth work skills in ocean surveys serve as the finishing touch for successful ocean research.

4 Remarks

Oceanographic observations essential to understanding, using and conserving the oceans from a global perspective are still lacking in quantitative and qualitative terms. For example, in the case of ocean depth, most of the knowledge pertaining to current bottom topography is only indirectly derived based on satellite observation data rather than actual measurements. It lags behind observing the appearance of the moon and Mars. That's why bottom topography is at the forefront of the list of challenges facing oceanography. This is just one example of how much work and research remains to be done with regard to ocean surveys. In terms of exploration, the ocean is mostly an unexplored world. Prominent physical oceanographer Henry Stommel said in his keynote speech at the inaugural meeting of the Oceanography Society that there are more discoveries than predictions from the point of view of ocean phenomenology. (Stommel 1989). It is true that even 30 years later, there are still many things that oceanographers do not know about the ocean. This is an important background supporting the need for continuous ocean observation.

In the 2020s, the external environment surrounding ocean research is changing. The declaration of the launch of the UN Decade of Ocean Science (the Ocean Decade, 2021–2030, <https://www.oceandecade.org>) in February 2021 signifies that the purpose of global ocean research is not to

achieve the research goal itself, but to utilize the research results. The goal is to ensure that the ocean is in good shape in 10 years, and can be passed on to future generations. If ocean research so far has been aimed at achieving the researcher's goal, it now means that we are currently unveiling a novel organizational framework to achieve all user-centered outcomes with regard to the ocean. From a different perspective, it also means that a platform has been created that guarantees the justification of continuous ocean research and related research. In the next decade, the UN Ocean Decade will be the rudder in policymaking and the development of research programs related to the ocean and will be cloaked in this term. 'The study for the industry-university-institute cooperative use of research vessels' project should be actively supported so that it can continuously become a driving force for ocean research in Korea and contribute to the UN Ocean Decade.

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