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The public value of building large oil spill response vessels in Korea

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ABSTRACT

As Korea imports most of the oil consumed in the country from abroad using oil supertankers, it is always at risk of offshore oil spill accidents. However, Korea has only small- and medium-sized oil spill response vessels (OSRVs), the size of which is less 2000 tons and has a difficulty in coping with large-scale oil spill accidents. The Korean government is considering the construction of two large OSRVs to enable prompt reduction of the pollution caused by large-scale oil spill accidents. This article aims to assess the public value of building these two large OSRVs. To this end, a survey of 1000 Korean people was conducted using the contingent valuation technique, eliciting Korean people's willingness to pay (WTP) for constructing the OSRVs. The mean yearly WTP for the construction is calculated to be KRW 3721 (USD 3.18) per household. When the sample is expanded to the whole country, it is worth KRW 71.8 billion (USD 61.3 million) per annum. Therefore, constructing the two large OSRVs will contribute to the Korean people's utility and can be done with public support.

1. Introduction

Due to the frequent passage of oil and hazardous cargo vessels in Korean waters, the possibility of large-scale marine pollution accidents is high. In particular, an unprecedented offshore oil spill occurred off the coast of Taean, Korea, in December 2007. Two tugboats (Samsung T-5 and Samho T-3) working offshore Taean were sailing alongside the maritime crane boats Samsung No. 1 in parallel. The Hong Kong-registered Hebei Spirit, a 14,868-ton tanker, collided with these. A total of 12,547 kl of oil was spilled into the sea. Since the Hebei Spirit was a single hull tanker, the damage caused by the oil spill was even greater. The damage to the marine environment caused by an oil spill in such an accident is very serious because it damages the coastal ecosystem [1–3]. Oil spills are environmental disasters that often lead to negative and long-term impacts on the environment [4]. Large oil spill incidents result in a much longer decontamination period and a much greater decontamination cost than smaller oil spills.

The oil storage facilities in Yeosu, Ulsan, and Daesan are concentrated in an area comprising around 90% of the total facilities, and damage could occur if the proper response cannot be made in the event of an accident. The blowout of the Macondo well (also referred to as the Deepwater Horizon oil spill) began on 20 April 2010, in the Gulf of Mexico on the BP-operated Macondo Prospect. Eleven workers on the Deepwater Horizon drilling rig lost their lives and sixteen workers were seriously injured. The flow continued for nearly 3 months before the well could be completely killed, during which time, nearly 5 million barrels of oil spilled into the Gulf of Mexico [5].

In June 2011, more than 500 tons of oil was leaked from Penglai 19-3 oilfield in Bohai Bay, China, contaminating five times the area of Hong Kong [6]. If a massive outflow such as that of the Macondo spill occurs in an offshore oil field in the Yellow Sea, Korea will be affected directly or indirectly, which will lead to serious economic and environmental damage.

In spite of these hazards, Korea has no large oil spill response vessels (OSRVs) of a size in excess of 2000 tons to provide an immediate response in the event of a large offshore oil spill accident. The United States has twenty nine vessels over 1000 tons which is includes sixteen vessels of 1000–3000 tons, five vessels of 3000–5000 tons, and eight vessels of 5000 tons. Japan has three multi purpose large OSRV over 4000 tons which are located so as to arrive at the scene of an accident within 24 h. China has five response vessels including one of 500 tons and four of 2000 tons, with plans to build additional response vessels. The European Maritime Safety Agency has sixty five vessels over 1500 tons including twelve OSRV over 4000 tons.

According to Article 31 of the Enforcement Regulations of the Maritime Safety Law of Korea, vessels of less than 250 tons cannot depart from the port when the storm warning system comes into force. During the 72 h after the Hebei Spirit accident, the failure to respond to initial movements due to bad weather and the lack of large OSRVs resulted in widespread contamination and increased cost of damage because of difficulties in controlling the spill. Understanding how oil is distributed on the sea surface and in the water column is crucial for the

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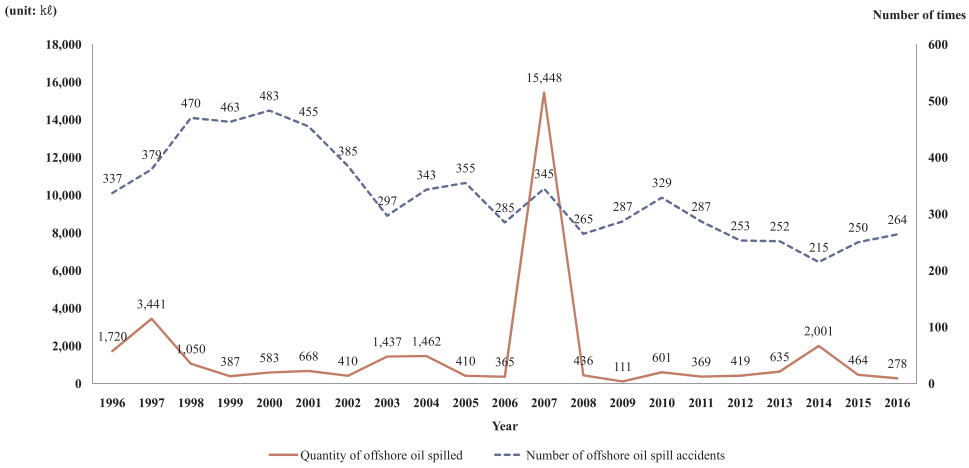

Fig. 1. Trend of the offshore oil spill accidents in Korea.

development of a number of aspects of oil spill response systems [7,8].

In addition to the weather advantage, one large OSRV has several other advantages over a few smaller vessels. First, the cost of building and operating a large OSRV is smaller than that of building and operating several smaller vessels. This is because economies of scale will occur in removing the pollution caused by large-scale oil spill accidents. Second, in a coastal area several smaller vessels that can surround and deal with the spill from different positions can be better than a large OSRV, but in an offshore area a large OSRV will be more effective in promptly coping with a large-scale oil spill accident than several smaller vessels. Third, in the case of strong tidal currents a large OSRV can clean up oil spilled when smaller vessels cannot be operated. According to Korea Ministry of Maritime Affairs and Fisheries, smaller vessels are unable to operate for 142 days per year because of strong tidal currents. Fourth, a large OSRV can remove more oil spilled from the sea surface and retain it on board than several smaller vessels. Thus a large OSRV can promptly deal with oil recovery, its retention on board, carriage and subsequent unloading better than several smaller vessels. Therefore, the Korean government is seeking to build two large OSRVs to enable prompt reduction of pollution caused by large-scale oil spill accidents and reduce the cost of damage to the marine environment. Each of the OSRVs will be 5000 tons.

Currently both policymakers and the public are demanding information on the public value of building the two large OSRVs. Policymakers need information to make an informed decision about whether and how to invest in the construction. The public, who will pay national taxes to carry out the construction, want to know how well their tax revenue is being spent. Since there will be a financial burden if the construction proceeds, Korean public support will be necessary to carry it out successfully. As it is vital to obtaining public agreement for this major investment, the public's acceptance of the construction should be examined.

The task of determining the public value of building two large OSRVs falls to researchers. The literature shows that such tasks have been conducted using stated preference techniques, including contingent valuation (CV) (e.g., see [9,10]) and choice experiments (e.g., [11]). These two techniques usually elicit people's willingness to pay (WTP) for the construction concerned, either directly or indirectly. This study thus seeks to examine the public value of constructing two large OSRVs using the CV approach. Because no research has specifically examined the public acceptability of such work in the literature, public preference can be used as an appropriate and important reference point for a more detailed discussion.

Of course, as an alternative approach to the CV approach one can assess the damage that may be caused by spills and the inability to clean-up without the OSRVs in monetary units. For example, according to the Korea Coast Guard, oil spill clean-up and damage costs of the Hebei Spirit accident were respectively KRW 97.2 billion and KRW 2382 billion. These values reflect damage from an oil spill accident that took place in the past. However, the focus of this study is to measure the public value of building two OSRVs to prevent damage from an oil spill accident that may take place in the future.

The prime purpose of the study is thus to determine the Korean public's WTP for building two large OSRVs. The research was undertaken using a CV survey of 1000 Korean households. The rest of this article comprises four sections. Section 2 explains the methodology employed in the study. Section 3 presents the WTP model. Section 4 provides and discusses the results. The final section reports conclusions and policy implications.

2. Methodology

2.1. Object to be investigated

The object to be investigated in this study is the government's plan to build two 5000-ton OSRVs to prevent damage from offshore oil spill accidents in Korea. The expected effects of the plan implementation, explained in detail to the respondents in the CV survey using visual aids such as color pictures and tables, are summarized as follows. First, the quality of the sea water is effectively preserved with immediate response and a shorter process. Second, the damage from oil spill accidents can be curtailed, aiding the residents and ecosystem in the impacted area.

The information on the quantity of offshore oil spilled and the number of offshore oil spill accidents and some explanations about the information were also conveyed to the respondents to help them to understand the object. Fig. 1 presents the trend of the offshore oil spill accidents in Korea during last twenty years (1996–2016). The maximum number of offshore oil spill accidents was 483 in 2000. With the help of the efforts of the government and ship owners, the number of offshore oil spill accidents has not exceeded 300 since 2010. It appears that overall the number of offshore oil spill incidents has decreased over the period. In spite of that, big oil spill accidents have sometimes taken place. The accident that happened in 2007 already mentioned spilled 12,547 kl oil, which is about 2670 times more that the average quantity of offshore oil spilled over the period 1996–2016 (4.7 kl).

Although the government and shipowners have paid closer attention to preventing oil spill incidents since the accident, there also occurred a big oil spill accident in 2014. In this accident, 899 kl oil was spilled [12]. In particular, Korea, the 8th largest oil consumer in the world, relies on foreign imports for most of its crude oil. Because tankers carrying crude oil visit frequently, the risk of marine oil spill accidents is increasing. However, it is quite difficult to cope promptly with large-scale oil spill accidents with small OSRVs. Thus, large OSRVs are