

SOCIO-ECOLOGICAL RESILIENCE OF OIL SPILL: FOCUSING ON THE HEBEI SPIRIT OIL SPILL ON THE WEST COAST OF KOREA

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Abstract:

Purpose of this paper: The purpose of this study is to examine the relationship between the socio-ecological impacts and resilience of the Hebei Spirit Oil Spill (HSOS). This study analyzes the ecological and social impacts and social and ecological resilience of HSOS from the perspective of the Ecological Impacts (oil spill itself, physical environment of the marine, and marine biology), Social Impacts (disaster management, economy, compensation), and Social and Ecological Resilience (human health and community resilience, policy and decision).

Design/methodology/approach: In order to examine the socio-ecological impacts, this study conducts a comprehensive literature review, which includes government and industry papers and reports related to oil spills and their environmental and societal consequences. The literature consists largely of case studies, the Ministry of Land, Transport and Maritime Affairs' Hebei Spirit oil spill white papers, reports on inspection ruling from Seosan local court concerning HSOS compensation by area and type of business, and secondary statistics from published academic journals. In addition, we also conducted an interview in 2008 near the damaged area regarding conflicts between resident groups and communities.

Findings: This study presents several suggestions on methods to restore damage caused by an oil spill. First, it is necessary to establish long- and mid-term strategies to restore the ecosystem. Second, not only do governments and local societies need to put effort into revitalizing the affected local economy but also focus more on social and ecological resilience. Third, since Taean is at a risk of experiencing another oil spill at any time, it is necessary to establish a strict compensation system of the IOPC, laws and systems relating to compensations for damage and loss, and a system that will resolve local conflicts in the case of a disaster.

What is original/value of paper: From the perspective of the socio-ecological system (SES), the ecological system and social system are closely linked with one another. Accordingly, looking into both the social and ecological aspects of the HSOS as a whole would be more meaningful than examining ecological and social influences separately. This study supplements the limitations

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of previous literature by focusing on the relationship between social and ecological impacts and resilience of the HSOS from a socio-ecological standpoint.

Keywords: Resilience, Social-ecological System, Hebei Spirit Oil Spill, Marine, Disasters

1. INTRODUCTION

Human populations are concentrated along coasts, and consequently coastal ecosystems are some of the most impacted and altered worldwide. These areas are also sensitive to many hazards and risks, from floods to oil spill. Therefore, we need to explore how a better understanding of the linkages between ecosystems and human societies can help to reduce vulnerability and enhance resilience of these linked systems in coastal areas. By resilience, we mean the capacity of linked social-ecological systems to absorb recurrent disturbances such as hurricanes or floods so as to retain essential structures, processes, and feedbacks (Holling, 1973; Walker et. al., 2004). Resilience reflects the degree to which a complex adaptive system is capable of self-organization and the degree to which the system can build capacity for learning and adaptation (Adger et. al., 2005; Carpenter et. al., 2001).

Scholars and practitioners have reached a consensus that an oil spill is one of the most difficult ocean pollution accidents to recover. Among many hazards in coastal areas, an oil spill from a vessel is one the largest causes of pollution. Furthermore, the number of oil pollution accidents has recently surged in both the U.S. and Korea along with the increasing dependence on crude oil. The United States suffered massive economic, social and ecological damages due to the Deepwater Horizon Oil Spill Accident (April 20, 2010) and the Exxon Valdez Oil Spill Accident (March 24, 1989). Korea has also undergone major oil spill accidents including the Captain Vangelis Oil Spill Accident (February 15, 2014), Wu Yi San Oil Spill Accident (January 31, 2014), Hebei Spirit Oil Spill Accident (December 7, 2007), and Sea Prince Oil Spill Accident (July 23, 1995).

The purpose of this study is to examine the relationship between the socio-ecological impacts and resilience of the Hebei Spirit Oil Spill (HSOS). This study analyzes the ecological and social impacts and social and ecological resilience of HSOS based on the theoretical research framework in Table 1. In order to examine the socio-ecological impacts, this study conducts a comprehensive literature review including government and industry papers and reports related to oil spills and their environmental and societal consequences. The literature consists largely of event case studies and the Ministry of Land, Transport and Maritime Affairs' Hebei Spirit oil spill white papers (2008, 2012), the reports on inspection ruling from the Seosan local court concerning HSOS compensation by area and type of business (Seosan Local Court, 2013), and secondary statistics of published academic journals. In addition, we also conducted an interview in 2008 near the damaged area regarding conflicts between resident groups and communities. Previous studies related to

HSOS accidents have focused on the effects of oil spill on ecology and communities (Chang et. al., 2014).

This study contributes to previous literature by extending the restoration of HSOS into socio-ecological resilience. Lee et. al., (2010, p. 49) state that social-ecological impacts progress more slowly than natural environment devastation and economic damages, but they are more difficult to restore and take more time. Therefore, it is critical to develop a restoration strategy based on an understanding of economic, ecological, and social systems to prepare for any oil spill accidents that may occur in the future. Until now, the South Korean government has been intent on restoring primary economic damage, and has failed to attend to long-term restoration efforts relating to affected local communities and their social and ecological aspects. Oil spill accidents in the past have proven that ecological resilience after an oil spill accident has taken more than twenties years to recover. However, the restoration of the HSOS accident in 2007 was finalized within ten months focusing on only the removal of oil and emergency cleanup, without considering social and ecological resilience. Accordingly, this study focuses on the importance of social and ecological resilience after an oil spill accident.

Table 1
Framework: oil spill impacts and socio-ecological resilience

<i>Sector</i>	<i>Definition</i>	<i>Oil spill impacts (Key analytic variables)</i>
Ecological Resilience	Ecological system is conferred by biological legacies that persist after disturbance, including mobile species and propagules that colonize and reorganize disturbed sites and refuges that support such legacies and mobile links.	oil spill, marine physical environment, marine biology
Social Resilience	Social system comes from the diversity of individuals and institutions that draw on reservoirs of practices, knowledge, values, and worldviews and is crucial for preparing the system for change, building resilience, and for coping with surprises.	disaster management, economic, compensation of oil spill
Socio-ecological Resilience	Socio-ecological system is an ecological system intricately linked with and affected by one or more social systems.	short-term and long-term impact and recovery – human health and community resilience – policy and decision

2. THEORETICAL BACKGROUND

Oil Spill and Socio-ecological Resilience

Resilience comes from the Latin, 'resilire', which means 'to spring back'. Resilience is the capacity of a system to absorb disturbance and reorganize while undergoing

change so as to still retain essentially the same function, structure, identity, and feedbacks (Walker et. al., 2004). After catastrophic change, remnants of the former system become growth points for renewal and reorganization of the socio-ecological system (Berkes et. al., 2008). Managing for socio-ecological resilience recognizes that a process of uncertain change is underway, and it aims to support the ability of the environment and dependent human communities to absorb shock, regenerate and reorganize to maintain vital functions and processes. Importantly, socio-ecological resilience explicitly considers that social and ecological systems are intrinsically linked and that the resilience of each component of the system is related to its linkages to other components (Schuttenberg and Marshall, 2005). Resilient social-ecological systems incorporate diverse mechanisms for coping with change and crisis (Berkes et. al., 2008; Gunderson et. al., 2002). Social and ecological systems contain units that interact interdependently and each may contain interactive subsystems as well. When social and ecological systems are so linked, the overall SES is a complex, adaptive system involving multiple subsystems, as well as being embedded in multiple larger systems (Anderies et. al., 2004).

The social and ecological impacts caused by oil spill accidents are closely related to the level of damage exposure levels (Lee, 2009, pp. 127-128). If the level of damage exposure gets higher, the affected residents tend to suffer from more serious economic consequences such as a loss of and jobs, and are subject to deterioration of social relations and suffer from severe physical and mental stress. In addition, damage is heavily concentrated on the socially underprivileged, those who are almost defenseless against such impacts. In the case of Hebei Spirit Oil Spill Accident, fishermen who engage in fishing without gears, and aqua farms are forced to do fishing in limited areas, and need more time to recover from the damage. While local residents actually wanted to return to their original places of livelihood by quickly restoring the marine ecological system, more investment was put into engineering works or the building of factories. This proves the importance and urgency of community resilience from a social and ecological aspect. Despite this, the government's response measures are mostly limited to economic damage compensation instead of concentrating on social and ecological approaches for community resilience.

3. CASE STUDY OF HEBEI SPIRIT OIL SPILL (HSOS)

3.1. Ecological Impacts of HSOS

3.1.1. Specificity of HSOS: Oil Spill Itself

The specificity of HSOS is related to the variable oil spill itself. In terms of the safety of vessels, double-hulled ships have a lower chance of causing an oil spill

than single-hulled ships. However, when 12,547 kl of crude oil was spilt by the collision between a crane barge from Samsung Heavy Industries and a large crude oil carrier of Hebei Spirit in December 2007, both were single-hulled vessels. After this accident, the government legislated regulations for the prevention of pollution by ships on January 31, 2008 and banned single-hulled vessels from coming to port. Second, a strong northwesterly wind carried the oil from Hebei Spirit to the coast of Gureumpo, Euihang-ri, Sowon-myeon, Taeangun County at 21:10 pm on the day of accident.

On the fourth day after the accident, the 35 km-long coastal area from Hakampo to Padori was polluted by a thick layer of oil. Soon after, oil lumps arrived at Nam-myeon and island areas. Some of the oil turned into oil/water emulsions or tar balls, which were carried by the sea currents through the coast of Jeolla Province and island areas and finally reached the coast of Daryeodo Island in Jocheon-eup, Jeju City on the 31st day after the accident (January 6, 2008) (MLTM, 2009, p. 2).

During the early stage of the accident, most of the oil spill reached the coasts. Taean area, which was under direct influence of the accident, was coated with liquefied crude oil, while the coast of Jeolla Province and its island areas were polluted with tar balls. It was reported that some of the spilt oil remaining in the intertidal zone after the emergency control and clean-up became bio-degraded by indigenous microorganisms, and some remained under the surface area as a result of precipitation or sedimentation depending on composition of sediment quality. In the case of Garumi area, which is scattered with cobblestones, spilt oil remained under the rock mass due to a lack of early-stage oil spill clean-up efforts right after the accident. As a result, the clean-up continued until the summer of 2009 (MLTM, 2011, p. 965).

3.1.2. Physical Environment of the Marine

The areas affected by the HSOS are the eastern Yellow Sea and the central West Sea of Korea. The Yellow Sea is shallow with an average depth of 50 meters with very strong tides. Incheon Harbor, which is located approximately 50 km north of the accident has a max tidal range of about 10 meters, while the Taean peninsula has a tidal range of 8.7 meters. Gunsan, which is approximately 100 km from the accident, and Shinan about 250 km away have tidal ranges of 5 meters and 4 meters respectively, displaying a drop in tidal ranges from an average of 8 meters to 4 meters from north to south. The submarine topography of the coastline is featured by the fact that the main waterways are developed from northeast to southwest, which is the main direction of the flow of tides, and the depth of the waterway is approximately 20 meters. The submarine sedimentation is mostly represented by sand sedimentation in and around the waterways, but there is a clear sms mud-belt in the offshore of Muan.

3.1.3. *Marine Biology*

The influence of a certain substance on living creatures may vary depending on its toxicity and exposure levels. Oil pollution can affect marine plants and animals including marine mammals, sea birds, fish, invertebrate animals, etc. Invertebrate animals living in intertidal zones can die of suffocation as their skin is coated in oil or due to behavioral or foraging disorders. A high concentration of oil may delay spawning and reduce the growth rate (MLTM, 2011).

Right after the Hebei Spirit oil spill, a weekly, monthly and seasonal investigation were conducted with its focus on the intertidal zone, and the details are as follows. First, the total petroleum hydrocarbon (TPH) levels measured during the first investigation conducted in December 2007 showed that most of the 72 test sites were under direct influence due to influences of local environmental characteristics, clean-up status, and re-influx of the remaining spilled oil. The TPH levels continued going up and down repeatedly until April 2008 (MLTM, 2011, p. 963). After June 2008, the TPH levels decreased constantly, and in 2009, most of the test sites showed TPH levels below the sea water quality standard of 10 ppb, but some test sites around the coastal areas of Mallipo and Sogeeunri had TPH levels slightly higher than the sea water quality standard. Especially when excavators were mobilized for an intensive cleanup work in Garumi, the TPH level was measured at 523 ppb, which was almost similar to that measured in February 2008 during the early stage of the oil spill. Since September 2009, all affected coastal areas have shown TPH levels below the sea water quality standard.

The polycyclic aromatic hydrocarbons (PAHs) level in the intertidal zone was measured at 5,170 ng/L at an early stage of the accident, which is considered a high concentration level. One month following the accident in January 2008, the concentration dropped remarkably, showing PAHs levels below 100 ng/L. After experiencing a steady decline until May 2008, the PAHs levels of all affected coastal areas have repeatedly been going up and down the level of a normal coastal area or brackish water zone.

The analysis results of the sediment in the intertidal zone at the early stage of the accident show that the zone was not directly affected by the oil spill with Total Petroleum Hydrocarbon (TPH) with the highest level at 1,630 ppm, 16 kinds of PAHs with the highest level at 3,350 ppb, and Alkyl-PAHs with the highest level of 66,430 ppb. Oil pollution level in the sediment of the intertidal zone started declining one month after the spill, but unlike sea water or living creatures, the concentration of contaminants did not decrease by a significant level over the lapse of time.

3.2. Social Impacts of HSOS

3.2.1. Disaster Management

Efforts to prevent a further spread of oil and cleanup projects began in accordance with the Marine Environment Management Act. Article 65 (Measures when there are concerns of pollutant leaks) of this Act prescribes that in the event that there are concerns of ships or marine facilities discharging pollutants due to accidents such as hitting rocks, collision, sinking or fires of the ship or marine facility, the owner or captain of the ship or the owner of the marine facilities must take measures to prevent the discharge of pollutants. The oil pollutant control hierarchy is made up of the main department of the MLTM (currently the Ministry of Oceans and Fisheries), main agency of the Korea Coast Guard, the Korea Marine Environment Management Corporation, which is a half-government half-private institute, and the relevant local autonomous entity, military, civil disaster control companies, local residents and volunteers. The biggest difference of the HSOS cleanup activity with past cases is that over 1.22 million participated as volunteers. The number of voluntary workers added up to about half a million until December 2007, and the official number increased to a total of 1,226,730 volunteers by the end of the work. During the emergency cleanup, cleanup organizations, military, communities and volunteers actively took part to restore the coastlines that were severely affected, in particular, the Taean peninsula coastlines. The 10-month (including emergency cleanup) long-term cleanup following the accident was focused on the island coastlines rather than the mainland. This was to remove of tar-type oil on the rock coasts and concave coastline topography for the 59 islands of South Chung cheong Province and the 42 islands in North Jeolla Province. The cleanup activities ended on October 10, 2008 and a total of 2.13 million people had been mobilized. Given its seriousness, the Hebei Spirit oil spill accident grabbed much public attention. From the second day of the accident, people came from across the country to help prevent further contamination. As of December 2007, the average daily number of volunteers stood at 16,300 individuals, with the highest daily turnout at 36,029 (MLTM, 2009, p. 4).

3.2.2. Economy

The total area size affected by Hebei Spirit oil spill accident stood at 34,703.5ha (Chungnam: 25,104.5ha, Jeonnam: 6,049ha, Jeonbuk: 3,550ha), while the percentage of damaged fisheries accounted for about 13.5% of the total fishery area. The affected coastal line spanned a distance of 375km (Chungnam-Jeonnam, 101 islands), and 15 beaches including Mallipo Beach in Chungnam were found to be contaminated (MLTM, 2010, p. 26).

This produced a negative impact on the GRDP of the region, and industries including agriculture, forestry and fishery, wholesale and retail trade, and accommodations and restaurants took the full brunt of the accident. The GRDP of Taean County, which suffered the most damage, was recorded at USD 1,153 million (KRW 1,384 billion) in 2005, USD 1,156 million (KRW 1,388 billion) in 2006, and USD 1,218 million (KRW 1,461 billion) in 2007, but plummeted to USD 990 million (KRW 1,188 billion) in 2008, a 18.7% decrease from the previous year. The reason for the increase in GRDP in 2007 when the oil spill accident occurred was due to the influx of cleanup workers including volunteers leading to an increase in wholesale and retail trade, and accommodations and hotels, in addition to the government's active support.

Specifically speaking, the contributions of the agriculture, forestry and fisheries to the GRDP was estimated at USD 161 million (KRW 193 billion) in 2005 and USD 153 million (KRW 184 billion) in 2006, but declined to USD 124 million (KRW 149 billion) in 2007, a 19.0% decrease from the previous year. Furthermore, the contributions stood at 129 million (KRW 155 billion) in 2008, a 3.9% decrease from the previous year, equivalent to 80.2% of the contributions to the GRDP in 2005. This shows that the industry's contribution to the GRDP in 2008 was not restored to the pre-accident level a year after the oil spill. Damage to agriculture, forestry and fisheries was recovered to the pre-accident level in 2009, with its contribution to the GRDP recorded at USD 166 million (KRW 199 billion) (Korean Statistics Information Services, 2013).

The output trend of accommodations and restaurants in Taean County was estimated at USD 46 million (KRW 56 billion), a 12.2% increase from the previous year's USD 41 million (KRW 49 billion), due to the momentary influx of cleanup workers including volunteers to the region. In 2008, as the number of tourists and cleanup staff left, the industry's output dropped to USD 41 million (KRW 50 billion), equivalent to 89% of the previous year.

Table 2
Breakdown of GRDP of Taean County
(Unit: KRW in billion, USD in million/1\$ = 1200.0 won)

<i>Economic Activity</i>	<i>GRDP by Year</i>									
	2005		2006		2007		2008		2009	
	<i>KRW</i>	<i>USD</i>	<i>KRW</i>	<i>USD</i>	<i>KRW</i>	<i>USD</i>	<i>KRW</i>	<i>USD</i>	<i>KRW</i>	<i>USD</i>
GRDP(market price)	1,384	1,153	1,388	1,156	1,461	1,218	1,188	990	1,516	1,236
Agriculture & Forestry	193	161	184	153	149	124	155	129	199	166
Whole & Retail Sale	45	38	51	43	55	46	42	35	40	33
Accommodations & Restaurants	47	40	49	41	56	46	50	41	46	39

Source: Korean Statistics Information Services 2013.

Other affected regions (Boryeong, Seosan, Dangjin, Hongseong, Seocheon and Gunsan) saw the number of incoming tourists recover to the pre-accident level after October 2008, but the local tourism industry of Taean County which boasts 30 scenic beaches, suffered a heavy loss. The number of tourists visiting Taean County plummeted to 23% of the level in 2007, and was thereafter restored to 70% of the pre-accident level. However, the number declined again to 57% of the pre-accident level in 2010 and to 38% in 2011. In contrast, the total number of tourists for the entire country increased at a steady pace after 2007, and rose dramatically in 2010 by 16% from the previous year, which shows the severity of the decline in tourism industry within Taean County after the oil spill (MLTM, 2011, p. 719).

Table 3
Tourist

<i>Tourist</i>	2005	2006	2007	2008	2009	2010	2011
Whole Country	668,611	679,271	686,825	721,393	734,101	796,201	851,983
Chung Nam	84,260	84,632	85,631	74,290	88,456	103,835	98,778
Taean	19,689	20,627	20,880	4,854	14,704	11,912	7,878

Source: Tourism Information System 2013.

3.2.3. *Compensation for Damages Caused by Hebei Spirit Oil Spill*

The compensation for damages caused by the oil spill accident of Hebei Spirit, a Hong Kong-flagged oil tanker, off Taean, Chungnam Province in December 2007, was determined at USD 611.75 million (KRW 734.1 billion) by the local court. The Second Civil Part of Daejeon District Court's Seosan branch ruled on January 16, 2013 that the total compensation for damages caused by the oil spill should be USD 611.75 million (KRW 734.1 billion). This included compensations for damages suffered by the affected residents, clean-up costs, and bonds issued by the central and local governments. The amount was four times higher than a preliminary assessment of USD 152 million (KRW 182.4 billion) by the International Oil Pollution Compensation Funds, but far lower than the compensation (USD 3,522.583 million/KRW 4,227.1 billion) demanded by people affected by the disaster. Out of the total compensations, USD 344.833 million (KRW 413.8 billion), USD 306.333 million (KRW 367.6 billion) was allocated as the compensation for damage to the fishery sector, while USD 38.417 million (KRW 46.1 billion) was provided for damage to the non-fishery sector including the tourism industry. Registered fishermen including those who engage in fishing without gear were compensated with USD 198 million (KRW 237.6 billion). The court decided that USD 266.917 million (KRW 320.3 billion) should be given as a combined compensation for clean-up costs (USD 85.75 million/KRW 102.9 billion) and for maritime restoration project costs financed by the bonds issued by the central and municipal governments (USD 181.167 million/KRW 217.4 billion).

The compensation determined by the court was used as the yardstick for future compensation of residents' loss and damage. Out of the determined compensation, USD 125 million (KRW 150 billion) was provided by the Hebei Spirit, while USD 4.667 million (KRW 5.6 billion) was provided by Samsung Heavy Industries. In addition, 247.833 million (KRW 329.8 billion) was paid by the International Oil Pollution Compensation Funds (IOPC Fund). The remaining USD 207.25 million (KRW 248.7 billion) was given by the central and municipal governments in accordance with the 'Special Act for the Support of Residents Affected by the Hebei Spirit Oil Spill Incident and Restoration, etc. of the Marine Ecosystem' (Daejeon District Court's Seosan branch, 2013).

Table 4
Court Decisions on Compensations for Damages Caused by Hebei Spirit Oil Spill¹
(Unit: USD in million (KRW in billion))

Compensation requested by residents	Compensation ruled by court	Responsible parties				Compensation beneficiaries			
		The Hebei Spirit	Samsung Heavy Industries	IOPC	Government (Special Act)	Resident' damage		Bonds issued by central and local governments	Cleanup costs
						Fishery	Non-fishery		
3,522.583 (4,227.1) (127,471 cases)	611.75 (734.1)	125 (150)	4.667 (5.6)	247.833 (329.8)	207.25 (248.7)	344.833 (413.8)	38.417 (46.1)	266.917 (320.3)	85.75 (102.9)

¹ An assessment hearing is not an official judgment but a preliminary judgment, which determined an applicant's eligibility for compensation and the appropriateness of compensation amount. The assessment hearing involved the affected residents and all responsible parties including the Hebei Spirit and the IOPC, and if one of the concerned parties raises an objection to the ruling, the civil lawsuit will start from the first trial. Given this, the compensation determined by the assessment hearing is not final nor binding, but it is meaningful that it will serve as an important guideline for assessing damage caused by the Hebei Spirit oil spill accident.

Source: Daejeon District Court's Seosan branch (2013).

3.3 Social and Ecological Resilience of HSOS

3.3.1. Human Health and Community Resilience

Two months after the Hebei Spirit oil spill accident, stress levels of the affected residents reached 70.6%. Eight months after the accident, the stress levels dropped significantly but still remained at 57.9%, indicating that they were suffering far higher levels of stress than normal people, almost equal to post-traumatic stress disorder (PTSD) level (Kim et. al., 2009). Psychological stress of the affected residents could be prolonged, and therefore attention by the government and local community is crucial (Lee & Kim, 2011, pp. 281-283).

The Taean Environment and Health Center (2011) conducted its first long-term health impact investigation from January 2009 to July 2010. The results showed that the residents around the coast of Taean had an average index of damage to generic materials caused by PAHs--designated as one of priority contaminants by the US Environmental Protection Agency (EPA) – at 4.46, almost four times higher than a normal person’s at 1.18. Furthermore, the results of biological exposure of residents who experienced a prolonged cleanup displayed a significantly higher level of oxidative damage to genetic material in cells and lipid. Students around the coastal area, in particular, had a higher incidence of asthma by 2.5 times than their inland counterparts, and by 2-4 times than students in industrially complex areas. Those residents with high exposure levels were found to be highly likely to suffer from chronic PTSD and depression.

In addition to these issues, many different kinds of conflicts between resident groups arose during the cleanup. The first was the conflict over the allocation of contingency aids for livelihood between resident groups, and also between residents and local governments. After the accident, the means of livelihood changed from fishing to temporary cleanup because fishery was no longer possible due to contamination of the waters. As a result, a conflict broke out over the allocation of cleanup labor costs, or the allocation of limited resources. When the cleanup work entered a stabilization phase, another conflict over the methods and deadline of the cleanup came to the surface. When compensations were discussed, various kinds of conflicts ensued over the period of ban on fishing and the recognition of damage the assessment of damages by the IOPC caused by differences between the compensation manual of the International Oil Pollution Compensation Funds and local fishing practices, local projects implemented in partnership with Samsung Heavy Industries between villages and between residents, and lastly integration with the Damage Rehabilitation Committee (Park, 2013, p. 191).

3.3.2. Policy and Decision

In accordance with the designation of the affected regions as a special disaster zone and the legislation of a special law after the Hebei Spirit oil spill accident, the central and local governments developed and implemented various kinds of support policies, including financing, tax reliefs, and student loans. On December 11, 2007, 4 days after the occurrence of the accident, the government declared six cities and counties in Chungnam (Taean, Boryeong, Hongseong, Seocheon, Dangjin, Seosan) as special disaster areas. After that, however, the affected areas spread to Jeonnam and Jeonbuk Provinces, and the government added Younggwang, Muan and Shinan in Jeonnam to the list. After the regions were designated as special disaster zones, the central government provided partial funding for administrative, financial, banking and medical support required by municipal governments, including

cleanup projects and residents' compensation for damage, laying the ground for the national government's support for affected residents and regions.

The Special Act for the Support of Residents Affected by the Hebei Spirit Oil Spill Incident and Restoration, etc. of the Marine Ecosystem came into force upon its promulgation on March 14, 2008 with the purpose to accelerate the recovery of local residents and marine ecosystem damaged by the incident on December 7, 2007 by establishing and implementing prompt and appropriate patch-up and recovery measures. The Special Act was designed to speed up the response to the Hebei Spirit Oil Spill (HSOS), and its gist included support for damage compensation to victims, restoration of marine ecosystem, and support for the affected areas, which were implemented as supplementary measures for a delay of compensation or damage compensation limits. In terms of the decision making structure, the committee that consisted of 15 heads of the related ministries and local governments was established under the Prime Minister, who was appointed the chairman of the committee. An organization for the affected local resident might be formed, and its representative could hear the opinions of the committee.

The provision for support for damage compensation to victims is based on the exercise of subrogation rights by the government to make partial payment to claimants in advance. In addition, the government could provide interest-free loans in accordance with the provision. The support for damage compensation to victims spent the total budget equivalent to USD 75.360 million (KRW 90.432 billion) from 2008 to 2012 as advance payments for tourism and cleanup or as loans for fishing without gear and boat fishing (MLTM, 2012).

However, after the cleanup work of the oil spill was finished as of October 10, 2008, the political circle and the public's interest and support for restoration of marine environment dwindled. Also, the international oil pollution fund defined the compensation for environmental damages as "being limited to actual costs required by measures taken or to be taken to restore losses and damages caused by environmental damages," and clarified that the compensation for damage to the environment itself is limited only to costs for environmental restoration measures (MLTM, 2009).

The support for economic revitalization of the affected areas was conducted as a local development project. There were projects requested from the local residents, which included an economic revitalization business and an image-improvement business through infrastructure renovation of the affected areas. A total of USD 569.929 million (KRW 683.915 billion) was spent from 2008 to 2012 for the project (MLTM, 2012). As the project for economic revitalization of the affected areas, a yearly average of 20 projects were conducted for reinforcement of infrastructure, but the allocated budget for the undergoing infrastructure projects was frontloaded under the name of economic revitalization of the affected areas. Due to such nature

of the project, although a total of USD 471.758 million (KRW 566.110 billion) was spent for economic revitalization of the affected areas, most of the related projects had already been planned by related ministries and implemented in advance in the form of the special act, provoking the public’s outrage. Upon request from local residents, the government was forced to additionally implement the resident-centric projects through collection of public opinions. The resident-centric projects or the ones requested by local citizens were additionally implemented after the government reflected residents’ opinions that the local economic revitalization project failed to have a tangible effect on restoration of the local economy. However, only USD 98.171 million (KRW 117.805 billion) was allocated as the budget for the project. In addition, image improvement projects for affected areas were also carried out as one-time events, including beach festive events, sports events, and fishing contests. A total of 27 projects were carried out over a 4-year period from 2008 to 2012 with a total budget of 0.958 million (KRW 1.149 billion).

However, a total of USD 407.613 million (KRW 489.135 billion) was earmarked for contingency aids for livelihood and the local development fund. Contingency plans were financed by the central government (USD 65.601 million/KRW 78.721 billion), local government (USD 12.813 million/KRW 15.376 billion), and the national donation (USD 21.697 million/KRW 26.036 billion). Furthermore, Samsung Heavy Industries, the party responsible for the oil spill, contributed 300 million (KRW 360 billion) as a local development fund in early December, 2013. The details of the support programs for the Hebei Spirit oil spill are summarized in Table 5.

Table 5
Supplementary economic supports deployed during 2008-2012 by the HSOS Special Law.
The grand total summed up to approximately KRW 1.26 trillion (USD 1.05 billion)
which consists of 3 sections shown below
(Unit: KRW in billion, USD in million)

<i>Provisional compensation for economic loss</i>	<i>Financial support by regional economic facilitation projects</i>						<i>Contingency aids for urgent subsistence</i>	
			<i>Improvement of infrastructure</i>		<i>Projects requested from local residents</i>			
	KRW(10 ⁶)	USD(10 ³)	KRW(10 ⁶)	USD(10 ³)	KRW(10 ⁶)	USD(10 ³)	KRW(10 ⁶)	USD(10 ³)
Sub-total	90,432	75,360	566,110	471,758	117,805	98,171	489,135	407,613
Total	1,263,483	1,052,903						

Source: MLTM (2010, 2012).

4. DISCUSSION AND CONCLUSION

The investigation results of the Ministry of Land, Transport and Maritime Affairs on the social-ecological resilience of the affected areas of the HSOS accident completed in June 2008 shows that items which had recovered accounted for only 4%, while 88%

were not restored. According to the results of the second investigation completed in September 2009 or 22 months after the accident, 15% of the responses said they had recovered, while 45% said they were not. Given this, it seemed that social resilience of the local community took place over time after the HSOS accident, but not to a satisfactory degree (MLTM, 2011).

The HSOS inflicted a severe damage on the social ecosystem by destroying the marine ecosystem, devastating the social and economic foundation of the local community heavily dependent on natural resources, tarnishing the image of the local community, and provoking various kinds of conflicts among residents. The HSOS accident dealt a heavy blow to the local community and also to the inshore ecosystem. Despite the completion of the yearlong clean-up work and an increase in tourists and fish catches, the devastated and disturbed local community and inshore ecosystem did not recover as hoped. Ecological resilience should be conducted together with the restoration of the local community. The Taean area, which took the full brunt of the HSOS accident, witnessed a decline in its GRDP and suffered severe damage to fishery and tourism industries, which did not fully recover until 2012. In addition, as the issue on compensation for damage and loss dragged on, conflicts between residents, Samsung Heavy Industries and Government, and between residents continued to break out.

Therefore, the following efforts should be made in order to restore the collapse of the local community, caused by ecological devastation, disintegration of local economy, tarnished image of local community, deteriorating health of local residents, and various kinds of local conflicts after the HSOS accident.

First, it is necessary to establish a long- and mid-term strategy to restore the ecosystem. Even 20 years after the Exxon Valdez oil spill accident in 1989, marine pollution in the affected area was not fully removed (Carson et. al., 1992; Rodgers et. al., 2005; Perry, 2010). It may take more than 20 years for the ecosystem in Taean to recover to the pre-accident level. Given the characteristics of Taean where the local economy and the livelihood of residents are closely related with the sea, an early recovery of the marine ecosystem is a crucial survival strategy. Therefore, the government must pursue the social and ecological resilience of the local community based on long- and mid-term restoration plans by imposing comprehensive and scientific research and investigations.

Second, concerted efforts of the government and the local society are needed for the revitalization of the local economy. The assessment hearing on compensation for damages and loss and the liability limitation procedure was finalized on January 16, 2013. The court's ruled compensation exceeded a preliminary assessment amount of the international fund, but fell far short of the residents' request of USD 3,552 million (KRW 4,227 billion). As conflicts over the issue of compensation for damages and loss are expected to prolong, the government is required to make more active efforts to solve the problem.

Third, it is necessary to work on the issues that came to the surface during the process of responding to the HSOS accident. These issues include the shortcomings, which were revealed due to a strict compensation system of the IOPC, a lack of laws and systems relating to compensation for damage and loss, and an absence of a local conflict resolution system in the case of a disaster. These efforts will likely alleviate the economic loss of residents and promote a healthy local development if a similar disaster occurs in the future. Given the country's economic structure with a heavy dependence on imported crude oil, South Korea may experience a similar oil spill from an oil tanker like Hebei Spirit at any time.

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