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ENVIRONMENTAL IMPACT ASSESSMENT IN AGRICULTURE: THE *SIHWA* PROJECT CASE OF KOREA

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Key words: environment, assessment, EIA, reclamation

ABSTRACT

This paper outlined the environment impact assessment (EIA) in the Sihwa project, and raised some issues. After EIA process, some key changes were introduced in the area; for example, more than six hundred hectares are newly allotted for wetland to help conserve natural ecosystem. The most salient contribution of EIA is its clear indication that the sustainable agriculture should be the way of farming on the newly created agricultural lands. However, it is argued that a new comprehensive environmental impact assessment is necessary which incorporates all development plans and projects in the Sihwa area. The environment impact statement was prepared under the assumption that the project would be implemented, without seriously considering no-action alternative. The project should be validated socially and economically, by implementing social impact assessment.

Ⅰ. Introduction

The *Sihwa* project of Korea has come to be widely known since late 1990s when the water quality of *Sihwa* Lake deteriorated drastically just after tide embankment was finished. A large area

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was planned to be used as agricultural land after reclamation, which provoked considerable protests from environmentalists, in particular. "Environment" has been an important keyword since then regarding the project. It is no wonder that the environmental impact assessment (EIA) is a very crucial procedure, particularly for the project. This paper aims to outline the EIA in Korea and the *Sihwa* project, to describe what the EIA can contribute to the establishment of agricultural activities suitable to this area, and to raise some issues and problems in applying the EIA in the project.

II. Environmental Impact Assessment in Korea

Environmental impact assessment in Korea was first introduced in the late 1970s, and the full-scale application to the developmental projects began in 1981 when the Environment Conservation Act was amended. Korean government has extended the scope and range of applied projects since then. In 1993, the Korean National Assembly passed the Environmental Impact Assessment Act (EIAA), enforcing mandatory public explanatory meeting or hearing on the environmental impact statement (EIS) draft. The EIAA was amended in 1997, and, in 2001, a new Environmental, Traffic, and Disaster Impact Assessment Act (ETDA) replaced previous acts and provisions regarding environmental, traffic, and disaster impact assessments. Through new legislation, developers do not need to pass those three impact assessments separately.

The ETDA defines the EIA as an assessment which "predicts and analyzes the effects of a project that will be implemented on natural, living, and social and economic environments, and devises appropriated measures to mitigate them."

Since its enforcement, more than 2,000 environmental impact statements have been made. The ETDA stipulates those projects which are required to go through the EIA procedure: city or industrial site development, energy or water resource development, port, airport, road, railroad, or tourist resort

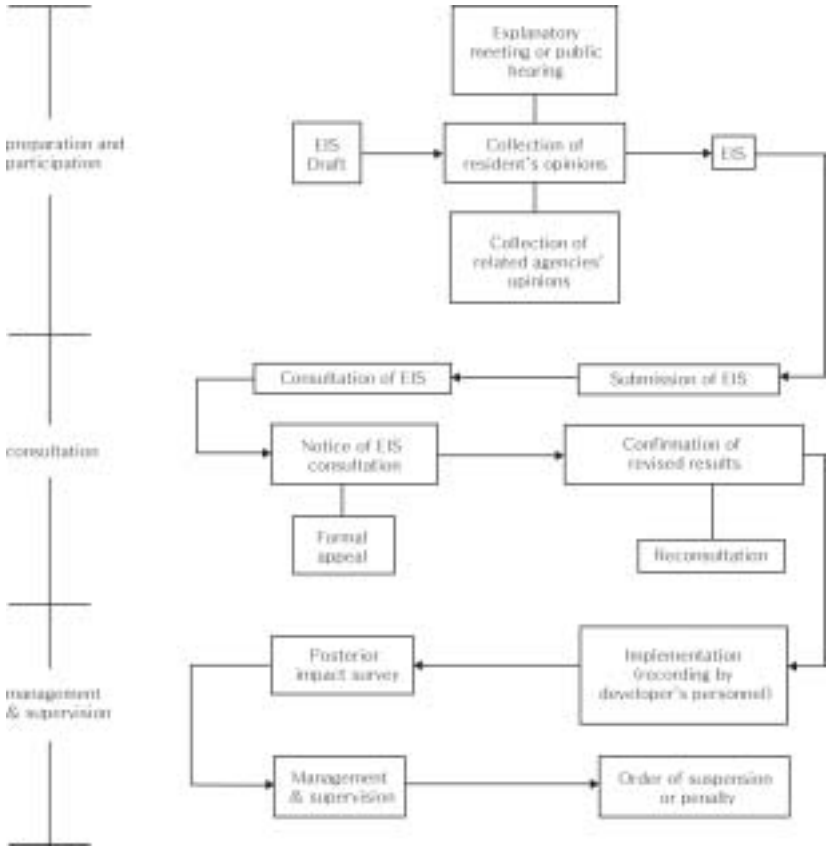
construction, river work, reclamation, forest development, physical training or waste disposal facilities, national defense facilities, and quarrying of soil and stones. It also stipulates the scale of each project; for instance, a reclamation project needs to undergo EIA if the planned area exceeds 300,000m^2. For smaller projects, there is a legal process, called "prior review of environmental impacts." It requires that ministries concerned should deliberate on the project before final decision about a certain developmental project is made.

Developers in most cases make contracts with vicarious agents to make EIS. EIS should contain the following subjects:

- Outline of the project
- Determination of the area to be covered by the EIA
- Investigation results
- Impact analyses and assessments of alternatives
- Measures for unavoidable environmental impacts

In assessing the environmental impacts, developers need to include 23 items about ecological, living, and socio-economic environments. Since the 1997 amendment of EIAA, developers have been allowed only to focus upon some selected "priority assessment" items that are thought to be crucial in assessing the impacts of the project rather than assessing all items. Figure 1 shows the current EIA procedure in Korea.

FIGURE 1. Procedure of EIA



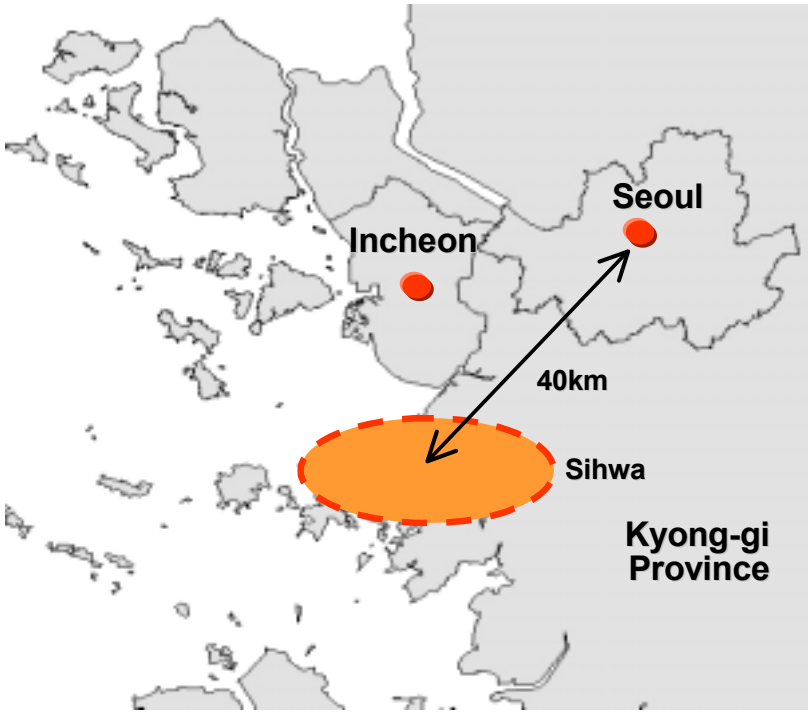
Ⅲ. The *Sihwa* project

Historical Background of *Sihwa* Project

The *Sihwa* area is not only located at a very well-developed, shallow rias coast at the city of Ansan and the Hwasung County, but also it is very close to Seoul, the capital city－at a distance of about 40km－and Incheon, the fourth largest city in Korea. Thanks to its topological and geographical conditions, developers have long asserted that the *Sihwa* area was a perfect place to satisfy both the industrial and agricultural demands on land, as well as that the project would revitalize the domestic construction industry. In mid-1980s, the state formally started the *Sihwa* project. It had designed the plan to implement the project in two stages: first, the northern side of the lake for urban and industrial uses, and second, the southern part for agricultural uses. At a very short distance from the northern part are located big industrial complexes with almost two thousand small- and medium-level factories, mostly metalworking, machine, petrochemical, and textile industries. The second stage plan was later changed after fossilized dinosaur eggs had been found－only about 40% of southern tideland would be used for agricultural land and the rest was designated as a reserve area. The construction of tide embankment was included in the first stage.

The tide embankment is about 13km long, and it stops the worldly known high tides of *Yellow Sea*. Exploiting the topographical features, in mid-1980s, the state decided to build an artificial lake and reclaim the tidelands which are about 200km2 in area. Originally, the state planned that the *Sihwa* Lake, which would be an inland lake by the tide embankment, would contain freshwater for industry, agriculture, houses, and so on. Immediately after the tide embankment had closed the seawater and been ready to contain freshwater. The quality of water rapidly deteriorated. The surface water quality had been 0.4-2.8mg/ℓ in chemical oxygen demand (COD) in 1980, but it

FIGURE 2. Location of *Sihwa* Area



was 10.4-30.9mg/ℓ in 1997. It was due to excessive influx of polluted water from the nearby factories and houses, the early completion of the tide embankment before the construction of basic waste treatment facilities, the fault connections of sewage pipes, and other factors. The state finally determined to give up the plan to make the *Sihwa* Lake a freshwater lake, and let the seawater freely flow in and out of the lake by opening the sluice gates twice a day. Partly thanks to it, the water quality of *Sihwa* Lake is improving, showing 2.9-12.8mg/ℓ in COD in 1998. Since July 2001, research projects are on the way to make a comprehensive plan for land uses of the area.

The plan on the land use of *Sihwa* area is not finalized yet, and still there is a vast amount of land undecided on its utilization. Ministries and local governments are in discussions about land uses; for instance, the Ministry of Construction and Transportation plans to develop industrial and urban lands, and the Ministry of Marine and Fishery is trying to build a port and tide power plant, while local governments want to develop marine natural-ecological tourist sites. However, about 40% of the southern tideland has already been agreed by governmental ministries to be used as agricultural land after reclamation. Table 2 shows the allotment of the area for different land uses.

TABLE 1. History of *Sihwa* Agricultural Land Development Project

Month, Year	*Development*
1982-84	Basic investigation of the *Sihwa* area
1987-94	Construction of tide embankment
1996-97	Lake water quality deteriorated after closing, the sluice gates decided to be open for seawater flow in and out of the lake
Jul. 1998	Size of reclaimed agricultural land area resettled by the Office for Government Policy Coordination
Dec. 1998	Permission of reclamation to create agricultural land
Nov. 99-Jun. 00	Public explanation meeting and hearing on agricultural EIS draft
Jan. 2001	*Sihwa* Lake decided to be a saltwater lake
Aug. 2001	All EIA procedures finished

Source: Korea Agricultural & Rural Infrastructure Corporation (KARICO) (2000).

TABLE 2. Allotment of *Sihwa* Project Area

	Area (ha)	Proportion (%)
Total	18,364	100
Seawater lake (*Sihwa* Lake)	4,235	23
Industrial complex	2,453	13
Northern tideland	1,207	7
Reserved southern tideland	6,073	33
Southern tideland for agricultural use	4,396	24

Outline of the project

A. Objectives of the reclamation for agricultural land
   - Creation of large agricultural land of high-quality
   - Increase of farm incomes and creation of good living conditions
   - Improvement of land transportation and irrigation for neighboring areas

B. Project period and total investment in agricultural land reclamation
   - The reclamation has just begun in fall 2001, and all agricultural development projects will be finished in 2012. Complete desalination for farming will take about 4 to 8 years depending on the natural conditions.
   - About 444 billion won (about 342 million dollars) will be invested.

C. Other benefits of the project
   - Employment during development: 2 million people per year
   - Production of agricultural products: 30 thousand tons per year
   - Transportation improvement: Using the dike will save about 22km

D. Water supply plan
   - Freshwater lake inside the reclamation area, *Tando* Lake, is planned to supply fresh water for agricultural activities. In case there is water shortage, in particular in the busy farming season, water will be directed from another freshwater, *Woojung* Lake, located outside of the *Sihwa* area.

FIGURE 3. Development Plan of *Sihwa* Area

1: *Sihwa* Industrial Complex
2: Banwol Industrial Complex
3: Waste disposal facility (planned)
4: Industrial complex (planned)
5: Agricultural land (planned)

Ⅳ. EIA Results

In August 2001, the Korea Agricultural & Rural Infrastructure Corporation (KARICO) finished the procedures of environmental impact assessment. The area covered by the EIA was 5,064ha, constituted of the reclaimed area (3,636ha), freshwater lake (760ha), and neighboring area affected by the development (668ha). These areas are within an 8km radius of the center of project area.

Nine items were selected as subjects of priority assessment in three parts:

- topography and geological features, water uses, marine

environment, and fauna and flora (natural environment)
- land uses, water quality, and waste disposal (living environment)
- population and cultural properties (social and economic environment)

Besides, a few items were included to understand the current situations of the area, such as climate, air quality, noise and vibration, landscape, and housing. The rest—public sanitation, jamming, obstacle to sunlight, offensive odor, etc. were dropped.

The EIS draft was publicly shown for sixty days, and an explanatory meeting and a public hearing were held in 1999 and 2000. The original agricultural land use plan was changed after collecting public opinions on the draft. Key feature of the change was the serious consideration of the protection of agricultural environment. Table 3 shows the changes in the plan of agricultural land use.

TABLE 3. Comparison of Agricultural Land Use Plans between Before and After the EIA

	Before EIA		*After EIA*	
	Area	*%*	*Area*	*%*
Total Reclamation	4,396	100.0	4,396	100.0
Mechanized farming	3,528	80.2	2,891	65.8
Paddy	3,444	78.3	2,831	64.4
Management	75	1.7	34	0.8
Public facilities	9	0.2	26	0.2
Model & experimental farm	56	1.3	137	3.1
Tourist farm	32	0.7		
Recreation complex for farmers	20	0.5		
Wetland conservation area			608	13.8
Natural wetland			473	10.8
Waterweed reservoir			65	1.5
Natural space			70	1.6
Freshwater lake (*Tando* Lake)	760	17.3	760	17.3

The EIS presented measures to mitigate or reduce environmentally negative effects of the project. The followings are a few crucial measures among others.

A. Natural environment
- Total area size is unchanged but the paddy area is shrunken. 608ha are newly allotted for wetland to help conserve natural ecosystem.
- During construction works, buffer zones or temporary facilities will be built to minimize destruction of ecosystem.
- Transformation of landscape and destruction of some habitats of wild animals are unavoidable effects.

B. Living environment
- To protect the water quality of the *Tando* Lake－the freshwater lake to be formed inside of the reclaimed area for agricultural water use－, environment-friendly agricultural techniques will be adopted
- To help purify wastewater flows naturally which into the Tando Lake, wetland conservation area are newly allotted and algae elimination facilities are to be installed.
- Excluding the model & experimental farm area, all wastewater from agricultural lands will be drained to the Tando Lake, not to the *Sihwa* Lake. The model & experimental farm will have sewage disposal facilities.

C. Social and economic environments
- The population increase of farmers will be limited to 1,000.
- Any cultural properties found during land development will be notified to the competent authorities so that proper measures are taken.

D. Post assessment of environmental impacts
- Until 5 years after completion of the project, post environmental impacts will be monitored and assessed.

Ⅴ. Contributions of EIA to Agricultural Development: Promotion of Sustainable Agriculture

The most salient (potential) contribution of EIA in agricultural project in *Sihwa* area may be its promotion of environment-friendly agriculture. The conventional agricultural land use may do harm to environment by adding heavy amounts of chemicals. The EIS applied to the *Sihwa* area clearly indicated that the sustainable agriculture should be the way of farming on the newly created agricultural lands. This indication is justifiable in the following senses.

First, the *Sihwa* project is known as a representative case of "environmental calamity," since, as introduced above, the dike caused the *Sihwa* Lake to be substantially polluted, and so the state had to give up creating a freshwater lake. Under heavy criticisms, including the objection to the reclamation itself which would destroy the tideland, environment-friendly farming was thought to be a way out of those harsh criticisms on the part of the state. In the same manner, KARICO could not but deny such pollution-creating farming as livestock and horticulture in its land use plan at least for now.

Second, the wastewater from the agricultural land is designed to flow into the Tando Lake and, eventually, to the outer sea of Jebu Island located outside of *Sihwa* area. Waste lake water with chemical components may do harm to the coastal fishery, and cause conflicts there. It means that any out-flowing water needs to be completely purified before reaching the sea, and the low-input agriculture will be an excellent method.

Last, it is predicted that the price of rice will substantially fall in Korea due to high productivity, decreasing consumption, prospective increase of imports from abroad, and so forth. Under the circumstances, rice production on the vast reclaimed area with conventional methods of high-input agriculture is becoming less acceptable while more consumers will demand foods produced in sustainable and safe ways.

Ⅵ. Issues and Problems in EIA Application in *Sihwa* Project

1. Lack of Comprehensive Assessment

Many environmental movement organizations and some residents argue that a new comprehensive environmental impact assessment is necessary which incorporates all development plans and projects in the *Sihwa* area (Daily *The Hankyoreh*, Feb. 14, 2001; Daily *Dong-a Ilbo*, Apr. 1, 2000). This argument is reasonable in the sense that the *Sihwa* Lake development project is constituted of diverse developmental projects－industrial complexes, tourist sites, tidal plants, ports construction, etc., and agricultural development is a part of the whole *Sihwa* project. EIA in agriculture alone cannot completely assess the effects from land uses, and, therefore, it is necessary to assess the integrated environmental impacts. In actuality, however, assessments of environmental impacts from neighboring areas were discarded because they were out of the geographical range of EIA in agriculture.

However, it is also true that the state cannot proceed with a comprehensive EIA until it hammers out an agreed plan by concerned governmental departments. As said above, the plan on the land use of *Sihwa* area is not yet finalized, and still there is a vast amount of land undecided on its utilization. For now, only agricultural land use is planned, although not in the detailed form, and the KARICO implemented the EIA only for the agricultural plan.

2. Indulgence for Developers

The KARICO performed the EIA *after* they had advanced implementation plan rather than at the earlier stage of establishing a basic development idea. EIA is a formal set of procedures, which is used to assess and predict the environmental

consequences of proposed developmental projects and to discover alternatives that would function to mitigate or prevent negative impacts. It provides politicians with concrete and relevant scientific information, who then consider it pragmatically from within a context of political conflicts and make informed decisions (Heo 1997).

In case of *Sihwa* project, however, the EIA came to be just a "procedural obligation" rather than a "substantive obligation" (Ortolando and Shepherd, 1995), losing the role of a critical method to achieve a balance between the environmental conservation and development. The *Sihwa* EIS was prepared under the certain assumption that the project would *be* implemented, and it did not seriously consider any no-action alternative from the outset. What the vicarious agent of EIS, Research Institute of Environment and Pollution at the Yonsei University, has considered as alternatives are:

- Alternative I: "Before EIA" in Table 3 (no wetland conservation area)
- Alternative II: "After EIA" in Table 3 (wetland conservation area added and model & experimental farm increased)
- Alternative III: Alternative I plus increased volume to *Tando* freshwater lake.

Also, under the circumstance that the vicarious agent wrote the EIS on behalf of the developer, KARICO, it would be almost impossible for the agent to take the no-action alternative into serious consideration. This problem renders the criticisms on the EIA that it is merely a kind of indulgence for developers (Daily *Kookmin Ilbo*, Jan. 15, 2001).

Therefore, the EIA may be most effectively performed at the stage in which the initial basic-level plan is made, and thus it may be integrated into the planning process. This integration is argued to have many strong points (Ortolano and Shepherd, 1995):

- It has the potential to prevent environmentally harmful activities from becoming concretized.
- It gives more opportunities for coordination among agencies.
- It improves efficiency because any number of similar projects within the boundary of a basic plan or program need not repeat EIA procedures.

It is necessary to make the EIA a substantive measure to properly evaluate and assess the impacts on the environment of the projects. One of the crucial tasks is to do EIA at the earliest stage possible so that plausible environmental impacts are importantly taken into consideration at the decision-making process. Recently, the Ministry of Environment is trying to introduce "strategic environmental assessment (SEA)" which will play such a role (Nam et al. 1998). Rather than focusing upon each individual project, SEA is more concerned with basic policy, plan, or program which will to a various degree affect environment, such as basic urban development plan, or national land development plan.

3. The Need of Social Impact Assessment

The social impact assessment (SIA) is currently included in the EIA having seven assessment items under the section "social and economic environment"—population, housing, jobs, public facilities, education facilities, transportation, and cultural properties. This part has always been too broadly dealt with, compared to other ones. In *Sihwa* EIA, mere two items—population and cultural properties—among seven were selected as priority assessment ones, and only 40 pages were used to assess the social and economic environmental impacts, compared to 188 pages for natural environment and 173 pages for living environment.

Social (and economic) impact assessment is important in that short-term effect consideration should be complemented by long-term socio-economic impact consideration. The importance of

full-scale EIA cannot be overemphasized because developmental impacts on environment are irreversible. Also, proper impact assessment will make it possible to prevent the social community from being dissolved, to strike out social agreements on the development, and to overcome the shortcoming of present EIA－fragmented assessment－through comprehensive social and economic assessments (Nam et al., 1998). But, as Freudenburg and Keating (1985: 582) put it, "the words 'social impact' seem to mean the impact *of* people *on* service agencies, rather than the impact of new technologies on humans and social systems; most social impact assessments have very little to do with the ways in which human beings are reacting to the changes being wrought."

In *Sihwa* case, although KARICO compensated the residents for their fishery rights, many people there are not satisfied. They are still working at traditional fishery－so-called "bare hands fishery" such as collecting shells, which is no longer legal in *Sihwa* Lake area. It is because of the low amount of compensation for living after quitting the fishery, few chances and incapacity to be engaged in other jobs than fishery due to their lack of skills and/or old age, etc. Further, surrounding the allocation of compensation money, people were divided and quarreling, spoiling the community solidarity, because it was the fishery organizations which had been compensated for the fishery rights and the organizations distributed the money among their members. Some residents have begun growing grapes or mushrooms, but, due to the salt dust generated from the dry tideland, it is common that they have come to be infertile (Han et al. 1998).

Large-scale projects, including agricultural one, may affect vast area and those who have lived there for generations. They may need to relocate from the planned site or to be retrained for new jobs or to change their ways of living to adapt themselves to new environments. These all will take much time, sometimes many years. The lack of fair consideration of social impacts would not only cause social problems like dissolution of village communities, but also hinder further large-scale developments of

similar sorts in the future.

To implement the SIA effectively, it is necessary that the project should be validated socially and economically. Social survey, which is administered not only to the residents but also, if needed, to the general public, will be a good idea to know the social acceptability of the project. Crucially, one needs to calculate non-market environmental values, for instance, the economic value of waste purification by tideland, as well as market ones in evaluating benefits and costs.

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