

# Practice of Strategic Environmental Assessment in Coastal Zone, China

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*The mistakes made in the decision-making process would result in more serious environmental problems than in the project process. How to reduce or avoid the negative environmental impacts that may be created in the decision-making process, and push the decision-making towards sustainability, strategic environmental assessment (SEA) was considered one of the most effective approaches and tools. Although SEA has been in existence for over ten years, it should be noted that there are still some shortcomings involving the framework, methodology, procedure and review methods. Based upon three SEA case studies in the coastal zone of Xiamen, China, this paper systematically compares and analyzes targets, contents, methodologies, and effects of SEA. The results showed that the higher the level of the target, the larger the effect of SEA ; and the earlier SEA is involved in the decision-making process, the more effective SEA is in influencing decision-making. The conceptual framework for environmental protection principles proposed at the beginning of the decision-making process was developed. It was proven a very efficacious methodology for SEA.*

**Key words** Strategic environmental assessment, Practice, China

## Introduction

Strategic Environmental Assessment (SEA) is a systematic and comprehensive process of evaluating the environmental consequences of proposed policies, plans or programs (PPPs) and their alternatives in order to ensure they are fully included and appropriately addressed at the earliest suitable stage of the decision-making process<sup>[1,2]</sup>. The contribution of SEA

towards sustainability stems from several points: (1) SEA ensures the consideration of environmental issues from the beginning of the decision-making process; (2) provides a framework for the chain of action; (3) contributes to integrated policy making, planning, and programming; and (4) can detect potential environmental impacts at an early stage, even before the projects are designed<sup>[3]</sup>.

The regulatory basis for SEA began with the USA National Environmental Policy Act (NEPA) in 1969, which requires that all federal agencies prepare a "detailed statement" on the environmental impacts of "every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment". In subsequent years, however, the environmental impact assessment (EIA) process has focused primarily on individual projects, rather than on PPPs. The traditional EIA has played an important role in pollution control and environmental protection. Because of its limitation at project levels, EIA has revealed many shortcomings including passive reactions, cumulative impact issues, alternatives and little actual effect on the decision-making process. In the late 1980s, the USA and Canada began to shift towards more SEA-related issues, particularly in the cumulative impact analysis<sup>[4]</sup>. With the requirement of implementing a sustainable development strategy in the 1990s, many countries, including the USA, Canada, Netherlands, etc., introduced and applied SEA methodologies with great success<sup>[4,5]</sup>. SEA is now a well-accepted environmental assessment and decision support tool. The EU in 1992 and 2001, and Canada in 1999 enacted the directives for SEA development and implementation<sup>[6,7]</sup>.

SEA was introduced to China in the mid 1990s. However, most subsequent research has been focused on the introduction of SEA concepts, theories and

methods since then. Only a limited number of case studies are available<sup>[8]</sup> because of the nature of the political and management systems in developing countries. The Environmental Impact Assessment Act of People's Republic of China (EIAA) was enacted by the National People's Congress of China on October 28, 2002, and enforced on September 1, 2003. Although EIAA only focuses on planning assessment of SEA and does not involve policy and program levels of decision-making, its enforcement will drive the development and practice of SEA in China.

This paper briefly introduces three case studies of SEA practices in Xiamen which is located in the southeast coast of China. We were fortunate in obtaining the support from several international organizations to conduct SEA. The experience and lessons derived from the case studies would be useful to EIAA enforcement in China, and improve the link between decision-making and sustainability, especially for the decentralization of government functions in developing countries<sup>[2]</sup>.

## 1 Methods and Results

### 1.1 Ecological and Socioeconomic Impact Assessment of Xiamen Economic Development

In 1994, the Global Environmental Facility (GEF), United Nations Development Programme (UNDP) and the International Maritime Organization (IMO) launched a 5-year (1994—1999) regional programme for the Re-

gional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas. The programme is to demonstrate the applicability of the Integrated Coastal Management (ICM) approach in addressing marine pollution problems at the two demonstration sites located in Xiamen, China and Batangas Bay, Philippines<sup>[9]</sup>. The Ecological and Socioeconomic Impact Assessment of Xiamen Economic Development (SEA-1) is one of the subprojects to address the impact of regional socio-economic development on the marine environment and is being conducted by Xiamen University. In addition to the assessment of the current state of the marine environment, SEA-1 is also focused on assessing the impact on both the marine and socio-economic environment after the implementation of the regional planning of Xiamen City. It is, therefore, a SEA project.

The SEA-1 was conducted in 1995—1996 and the assessment scope of SEA-1 is shown in Fig. 1 including the entire seas and coastal area of Xiamen City. The assessment addressed issues including natural marine resources, marine environmental quality and ecosystem issues, the impact of major human and economic activities on the marine environment and ecosystem, the impact of marine environmental change on society and the economy, the primary problems of Xiamen's coastal environment, management guidelines for ICM, and the case studies of the environmental economic analysis for pollution control in Yuandang Lake and the project involved in the opening of the Maluan Seawall<sup>[10]</sup>.

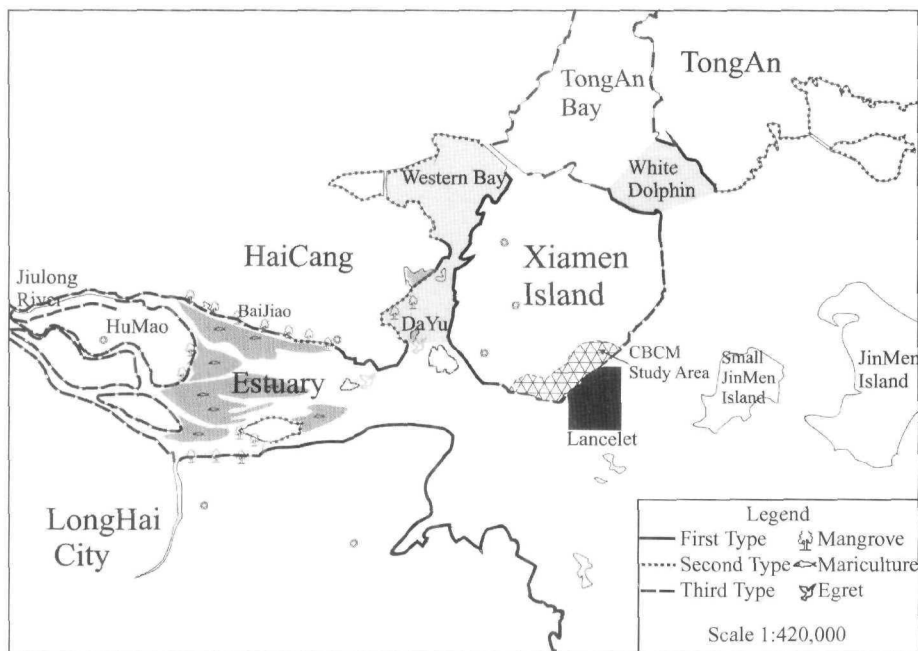


Fig. 1 Map of Demonstration Site.

The issues found in SEA-1 were:

- (1) Conflicts in the utilization of marine and coastline resources;
- (2) Impact of coastal projects on the marine ecosystem and environment, and;
- (3) Possibility of near-term seawater quality degradation in TongAn Bay.

The results concluded that the development of Xiamen would not be sustainable if the issues mentioned above could not be resolved. The guidelines for the decision makers were proposed as follows:

- (1) Legislation for marine and coastal area and marine function zoning;
- (2) Creation of ICM mechanism in Xiamen;
- (3) Prohibition on marine reclamation, and re-planning of coastline utilization;
- (4) Adjustment in the industrial distribution surrounding TongAn Bay and the construction of a sewage treatment plant in TongAn District;
- (5) Construction of a conservation area for rare and endangered marine species. Restoration of mangrove area;
- (6) Formulation of comprehensive mari-culture plan, and;
- (7) Opening of the Maluan Seawall to increase tidal income.

Most of the suggestions have been adopted and implemented facilitating both excellent effects and a long term impact<sup>[9]</sup>.

## 1.2 Strategic Environmental Assessment of the Development Planning of the Southeast Coast of Xiamen Island

The Canadian International Development Agency (CIDA) sponsored a 5-year (1998—2003) international cooperation project, named Community-Based Conservation Management (CBCM). Seven universities from Canada, China and Vietnam participated this Project. The main efforts of CBCM are to drive public involvement in decision-making, maintain natural conservation and ecosystem health, and promote capacity building of CBCM in developing countries.

The Strategic Environmental Assessment of the Development Planning of the Southeast Coast (DPSC) of Xiamen Island (SEA-2, 1999—2001) was the Pilot Project of CBCM in Xiamen. The study area of SEA-2 was the Southeast Coast of Xiamen Island, called Golden Beach (Fig. 1). It is a potential area for the tourism development, and would be developed

in 2000 after the new road around the Island was built. The DPSC was just drafted, and did not submit to be reviewed in 1999.

As a pilot project, SEA-2 focused on the assessing the impact of the DPSC, emphasized CBCM Core Concepts and main SEA principles<sup>[4,6,7]</sup>, aimed at the resource and ecosystem conservation and sustainability, used the resource-oriented principle, and kept public involvement throughout the whole SEA process. The stakeholders included local citizens, villagers, government officers, congressman, developers, scientists, teachers and students, and some NGOs. The assessment approaches included<sup>[11]</sup>:

- (1) Screening: Identifying the socio-economic and ecological issues during the developing process by experts and public involvement;
- (2) Scoping: Determining the assessment factors by combining impact factors caused by development planning and the environmental factors of concern by the public;
- (3) Tourist Resource Value: Using travel cost methods, contingent value methods and willingness to pay methods by public questionnaire;
- (4) Assessment: Impact of DPSC on the regional environment, society and economy;
- (5) Alternatives: Optimizing the appropriate utilization of regional resources by the opportunity cost method, public involvement and environmental economic benefit/cost analysis, and assessing the environmental impact of the alternatives;
- (6) Planning: Evaluating the regional tourist capacity and proposing a conceptual planning framework for eco-tourism to guide in the revision of the DPSC, and;
- (7) Public feedback and hearing forum.

The main results and achievements included:

- (1) The revision of the DPSC;
- (2) The adjustment of the construction plan of the new road which moved to the inland to protect the coastal shelterbelt and sand beach (conservation management);
- (3) The improvement of public awareness and public involvement mechanisms to drive decision-making towards CBCM. The scientists acted as a bridge to communicate between the government and public;
- (4) The measures made by the government to restore the coastal ecosystem such as re-planting a coastal shelterbelt and regional greenbelt, removing

the buildings constructed on the beach, etc. , and;

(5) The employment opportunities for local villagers offered by the government.

### 1.3 Strategic Environmental Assessment of the General Harbor Planning of Xiamen Seas

In order to develop and use the deep coastline resources of Xiamen more effectively, Fujian Provincial Government proposed to formulate General Harbor Planning of Xiamen Seas (GHPXS). To consider the impact of development planning on the marine environment systematically and comprehensively, reduce mistakes in the decision-making process, and mitigate negative impacts in the development of the harbor, the Strategic Environmental Assessment of the GHPXS (SEA-3, 2000—2002) was conducted by Xiamen University in cooperation with the Third Institute of State Oceanic Administration.

The assessment target was the GHPXS. The scope included the entire sea region and related coastal area around Xiamen Seas (Fig. 1). SEA-3 was involved at the beginning of GHPXS, and conducted with the GHPXS synchronously. The procedure and contents of SEA-3 were shown as follows:

(1) Scoping: Based on the GHPXS Outline, initial investigation and public involvement;

(2) Conceptual Framework of Environmental Protection Principle (CFEPP): Proposed according to local resource and environmental characteristics to assist in GHPXS creation;

(3) Assessment: Focused on the integrated and cumulative environmental impact caused by all planning alternatives, and;

(4) Alternatives: Based on the public involvement, Precautionary Principle and environmental economic benefit/cost analysis.

SEA-3 was not the assessment after the formation of the planning, but the internal element of planning and an auxiliary tool of decision-making. The CFEPP was proposed to determine three types of coastlines based upon their usage attributes: The first type could be planned for harbor construction; the second was somewhat more environmentally sensitive and required much additional attention to in the planning process; and the third was too sensitive for use as a potential harbor (Fig. 1). SEA-3 was concurrently conducted with GHPXS, especially the proposal of CFEPP before the planning drafting, guided and assisted in the formulation of the planning to avoid

the mistakes during the decision-making process. This effort minimized the conflict between the formulation of the planning and the environmental assessment. SEA-3 progressed significantly not only in the environmental cumulative assessment, public involvement and the application of Precautionary Principle, but also in the integrated assessment of the optimum benefit between the socio-economic, environmental and sustainability factors<sup>[12]</sup>. The achievements included:

(1) Advancing CFEPP to lead and assist in the formation of the planning, and to minimize the mistakes in environmental issues during the decision-making process;

(2) Assessing the cumulative impact of harbor planning on seawater and marine ecosystem health, and;

(3) Proposing alternatives such as the protection of Mangrove Conservation by public involvement, the alternatives of Baijiao mangrove using eco-restoration principles, the removal of the hidden dam plan in the HuMao Bank by implementing the Precautionary Principle, and the reservation of the deep coastline resources in the Egret Conservation area of DaYu Island by Sustainable Development Principles; and the environmental economic benefit/cost analysis of these alternatives.

## 2 Discussion

The lessons learned from three cases mentioned above were discussed as follows.

### 2.1 Assessment Target of SEA

For the assessment targets in the three SEA cases, SEA-1 was at the highest level, and was the Master Planning for all of Xiamen City. SEA-3 was the second and was the planning for special industry, harbor transportation. The lowest was SEA-2 which was the planning for small areas. The results showed that the higher the level of the target, the larger the effect of SEA. For instance, the SEA-1 accelerated the formation of the regulations related to marine environment including the Marine Function Zoning, the creation of the ICM mechanism, the establishment of a conservation area for rare and dangerous marine animals, and the adjustment of the industrial distribution around TongAn Bay and Western Bay. These issues were all critical decisions for Xiamen City. SEA-3 has

had an essential impact on the decisions involving critical environmental issues such as the reservation of the deep coastline resources of DaYu Island and the cancellation of reclamation in the Mangrove Conservation area. SEA-2, however, only influenced the planning of small area.

## 2.2 Stage of SEA Involvement

The results of implementing SEA practices showed that the earlier SEA is involved in the decision-making process, the more effective SEA is in influencing decision-making.

SEA-1 conducted after the formulation and implementation of the planning. It was very difficult to amend the planning unless powerful evidence was provided in the assessment results.

SEA-2 conducted during the drafting of the planning, but prior to implementation, promoted more revision of the planning and amended some new concepts and SEA results, such as the Precautionary Principles and Ecosystem Health, into the planning. Similar to SEA-1, however, SEA-2 was difficult to put the concepts and results, which were hard to be evidenced such as eco-tourism and tourist capacity, into the planning.

Fortunately, SEA-3 was involved before the planning formulation and concurrently steered the development of the planning. Because the CFEP proposal is included at the beginning of the planning phase, SEA became an intrinsic factor to assist in planning formulation, and was not an assessment made after the fact. Therefore, the remediation process of the mitigation measures for environmental impact is minimized. It takes SEA from a reactive to a more proactive approach to conservation management and sustainable development in the decision-making process<sup>[2,6,13]</sup>.

## 2.3 Assessment Contents and Methods

Although there is no single "best" methodology, and hard to find a universal guideline or approach for SEA<sup>[5,7,14]</sup> due to the differences of targets, magnitudes, scopes, and natural and social conditions in wide PPPs, there were some lessons and experience obtained from the practices of SEA, which need to be emphasized:

- (1) Scoping is a key step to succeed in SEA<sup>[5]</sup>;
- (2) Public participation is a necessary process to avoid the mistakes in the early stage of the decision-

making process toward sustainable development<sup>[5-7]</sup>. Public participation plays an important role in scoping, alternatives and decision transparency. We are far from community-based system for developing countries, but need to progress from public involvement to public participation in the SEA process;

(3) Social and economic impact assessment plays an important role in SEA<sup>[7,15]</sup>. It gives more direct answer to the public and decision-makers, and makes it possible to combine the results of SEA to the decision-making process, especially in the link between science and decision-making, and;

(4) The use of Precautionary Principle in SEA process is necessary<sup>[6]</sup> because of the difficulties in understanding most environmental issues and uncertainties. It will avoid or reduce the mistakes in decision-making<sup>[16,17]</sup>.

## 2.4 Alternatives and Mitigations

Alternative and mitigation measures are the main objectives of SEA<sup>[5]</sup>. It was found that the higher the level of SEA target is and the earlier that SEA is involved, the better the efficiency of the alternatives and mitigations would be. Only if SEA is involved in the early stage of decision-making process could it help find inherent alternative and mitigation measures to resolve environmental issues and eliminate the need for remedial measures after the fact.

## 2.5 Conceptual Framework of Environmental Protection Principle for Decision-Making

The CFEP has proven to be a significant factor in the planning/decision-making process. According to applicable environmental regulations and regional resource and environmental conditions, the CFEP has become the principle basis of environmental protection and sustainability for planning formulation. It proposes a series of principles and requirements to guide decision-making process toward sustainability and ecological conservation.

Hedo & Bina<sup>[15]</sup> used the Reference Framework in the SEA of the Hydrological and Irrigation Plan in the Duero Basin, Spain, and found it was important. The Reference Framework they used, however, was the general overview of the important socio-economic and environmental issues related to water management. The Reference Framework could facilitate to identify the environmental issues, but was difficult to influence decision-making directly. The

CFEPP is not just the issues identified, but the principle based on the issues to require decision-making to be followed. It forces SEA to integrate into the decision-making process indeed and become the assistance and an internal element of the decision-making. CFEPP proposed at the beginning of decision-making is an important instrument to enhance SEA validity.

### 3 Conclusion

The three case studies introduced above were examples of only a few SEA practices in China. Fortunately, we received support from international organizations to conduct SEA in China. The lessons and experience learned from the case studies in the application of SEA principle will facilitate SEA practices, and drive decentralization toward sustainability in developing countries.

The case studies showed that the SEA process could raise awareness, improve the understanding of the interaction between natural resources, the environment and the developmental decision<sup>[175]</sup>, and enhance the transparency and validity of decision-making. Scientists in the SEA process acted as a bridge to communicate between the public and decision makers.

It was proven that the conceptual framework of environmental protection principle (CFEPP) proposed at the beginning of the decision-making process was a very efficacious methodology for SEA involvement in the decision-making process. The development of CFEPP as the first step in the SEA approach will enhance SEA validity.

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### References

- [1] Lee N., Walsh F. Strategic Environmental assessment: An overview. *Project Appraisal*, 1992, 7:126—136
- [2] World Bank. Environment Strategy Papers: Strategic Environmental Assessment in World Bank Operations. World Bank Report No. 24759. Oslo: Olav Kjørven and Henrik Lindhjem, 2002
- [3] Arce P., Gullon N. The application of strategic environmental assessment to sustainability assessment of infrastructure development. *Environ. Impact Assess Rev*, 2000, 20: 393—402.
- [4] Therivel R., Systems of strategic environmental assessment. *Environ. Impact Assess. Rev.*, 1993, 13: 145—168.
- [5] von Seht H. Requirements of a comprehensive strategic environmental assessment system *Landscape and Urban Planning*, 1999, 45: 1 — 14.
- [6] EU. European directive on strategic environmental assessment. *J. of Environ Law.*, 2002, 14: 131—140
- [7] Canadian Environmental Assessment Agency Strategic Environmental Assessment: The 1999 Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals. Quebec: Her Majesty the Queen in Right of Canada, 2000.
- [8] Che X., Shang J., Wang J. Strategic environmental assessment and its development in China. *Environ. Impact Assess. Rev.*, 2002, 22: 101—109
- [9] Cha T. E. Lessons learned from practicing integrated coastal management in Southeast Asia *Ambio*, 1998, 28: 599—610.
- [10] Hong H. S., Xue X. Z., Zhang L. P. Ecological and socio-economic impact assessment of the economic development of Xiamen. In: *Integrated Coastal Management in Xiamen*. Chapter XV: XV 1-129. Beijing: Oceanic Press, 1998.
- [11] Liu Y, Zhang L. P., Hong H. S. Basic principles and methods of strategic environmental assessment (SEA) on the developing planning of Eastern Coastal Zone of Xiamen Island. *J Xiamen University (Natural Science)*, 2002, 41: 786—790.
- [12] Chen B., Zhang L. P. Practice of strategic environmental assessment for harbor planning. *Shanghai Environ Sci.*, 2003, 22: 1013—1016
- [13] Shepherd A., Ortolano L. Strategic environmental assessment for sustainable urban development. *Environ Impact Assess Rev.*, 1996, 16: 321—335.
- [14] Partidario M. R. Elements of an SEA framework—improving the added-value of SEA. *Environ Impact Assess Rev.*, 2000, 20: 647—663.
- [15] Hedo D., Bina O. Strategic environmental assessment of hydrological and irrigation plans in Castilla y Leon, Spain *Environ. Impact Assess Rev.*, 1999, 19:259—273.
- [16] deFur P. L., Kaszuba M. Implementing the precautionary principle. *Sci. Total Environ.*, 2002, 288: 155—165
- [17] Sand P. H. The precautionary principle: A European perspective. *Human Ecol. Risk Assess.*, 2000, 6: 445—458.