

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR SUSTAINABLE DEVELOPMENT IN URBANIZATION PROCESS IN CHINA

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ABSTRACT: This paper reviewed the development of Strategic Environmental Assessment (SEA) in China, expounded its functions and regional characteristics, and discussed the targets of SEA in the process of urbanization, and the main assessment indicators, procedures, techniques and methodologies of SEA. It concluded that SEA could be improved by the following recommendations: incorporating SEA in decision-making process, selecting experimental units for SEA trial run, and developing strategic evaluation tools and techniques. SEA can provide appropriate and up-to-date information on the impact of human activity on environment in the process of urbanization, and develop a plan of action targeting implementation of intervention for the rehabilitation and preservation of the ecological stability of a city. Therefore, SEA can be a supporting tool for decision-making toward achieving sustainable development.

KEY WORDS: Strategic Environmental Assessment; urbanization; sustainable development; environmental decision-making

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1 INTRODUCTION

Since the implementation of economic reform and the opening up to the world, economy has been grown quickly and steadily, and urbanization has undergone a rapid development in China. Urbanization of China had increased from 17.9% in 1978 to 30.9% in 1999, with an average annual growth rate of 0.63%, which was the double of the average of the world at the same time. However, compared with the average urbanization of the world (40%–60%), Chinese urbanization is still delayed severely. Cities are a focus of environmental concern throughout the world. They are places of intensely growing economic activities, therefore, the urbanization is an unavoidable phenomenon in China. In consequence, urban population is rapidly growing. It is estimated that nearly 43% and 52% of Chinese population will live in the towns and cities in 2010 and 2020, respectively (LI and YANG, 2000). This is a measure of the benefits offered by urbanization. The success of urbanization, however, has to some extent been overshadowed by environmental problems: air and water pollu-

tion, loss of amenity, soil contamination, and urban wastes; land resources are becoming more and more smaller; and resources consumption and its pressure on the environment are rising. Meeting the need of people and the development of the economy on the one hand, while protecting the fragile environment and limited natural resources on the other hand, is becoming more difficult.

It is an essential component in sustainable development to take society, economy and environment into account in the earliest appropriate stage of decision-making. Strategic Environmental Assessment (SEA) can support this process by providing appropriate environmental information (THERIVEL *et al.*, 1992). Therefore, SEA is required to assist the Government in formulating future development strategies (including policies, plans and programs) in the urbanization process of China.

2 DEVELOPMENT PROCESS OF SEA IN CHINA

Environment Impact Assessment (EIA) was legislated by the Regulation on Promoting Previous Work of Ba-

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sic Construction Project, which became law when the Environmental Protection Act of the People's Republic of China was enacted in 1979. EIA procedures at the project level were mandated, and this became an important cornerstone of feasibility studies of capital construction projects.

In the subsequent 20 years, project EIA has grown, and regional environmental assessment (REA) has also developed in China (LI, 1996). In recent years, however, the inherent limitations of conventional project EIA have become apparent, particularly in its failure to suggest alternative projects and alternative sites. SEA can compensate for some of this deficiency. This has been recognized by the Chinese government, which has subsequently come to attach more and more importance to SEA.

Agenda 21 in China states the need for objectives-led planning and broadening the appraisal process to encompass the whole range of sustainability. Not just environmental appraisal criteria, but the application of SEA in actual policies and statutes is important in promoting sustainable development. *Agenda 21 in China* brought China the "sustainable development statutes and policies" system, which stresses the coordination between economic development and environmental protection, and contends that environment assessment should take more accounts than just environmental effects, i.e., social and economic effects of policies and programs.

Moreover, in 1996 the National Environmental Protection Five-year Development Program for 1995–2000 and the Long-term Targets for the Year 2010 showed that it was essential to improve the application of EIA and to extend EIA from just projects to the planning/programming level, e.g., EIA of natural-resources development and other economic development.

As approved by the State Council in December 1998, the Environmental Protection Management Ordinance for Construction Projects prescribes an EIA for regional development. REA also was explicitly stipulated for the first time in the regulation with the intent of extending the EIA system from projects to higher levels. REA, with respect to its content, basic procedures, techniques and methods, is very similar to SEA (XU *et al.*, 2000; MA *et al.*, 2000).

After a period of investigation, research and discussion, the Environmental and Resources Protection Committee of the National People's Congress concluded that SEA is necessary in legislation procedures and drafted an "EIA Act of the People's Republic of Chi-

na". EIA act calls for expanding the scope of EIA in China, not only at the project level but also at higher levels (planning and programming level) to cover all relevant areas of consideration. On October 28, 2002, the Ninth Session of National People's Congress Standing Committee (NPCSC) held discussions on the bill and finalized a manuscript of SEA. Subsequently, SEA was required legally on September 1, 2003 in China.

3 FRAMEWORK OF SEA IN URBANIZATION

SEA systems are often linked to urban environmental planning/programming that have a main goal of improving the quality of the urban environment. The appraisal framework is designed to provide a clear step-by-step guide toward the identification of the best practicable environmental option for the city that requires great improvement in their development strategies. Essentially, it comprises a series of more detailed research methods that will supply decision-makers with enough information to compare the possible alternatives and consequently to identify the best practicable environmental option for each strategy. However, until now, China has no obligatory procedure for SEA. Based on previous researches (SHANG and BAO, 2000; CHE *et al.*, 2001) and foreign SEA experiences, following procedures can be adopted in SEA (Fig. 1).

- (1) Set the scene for a sustainable development system.
- (2) Identify the environmental quality of a city. A suite of social and environmental components for the city should be referred to a checklist of potential components that provide guidance to find the appropriate information.
- (3) Determine assessment criteria. On the basis of analysis of the character and function of the city, assessment criteria should be established.
- (4) Select development indicators. To confirm the objective of SEA, firstly we should make sure the natural environment, dimensions and structure of a city, and then select indicators according to the characteristics of natural environment, economic structure, population, urban structure and other factors that determine the urban environmental quality.
- (5) Make an urban development scenario.
- (6) Test the indicators.
- (7) Raise mitigation measures or if necessary modify the strategies.

To be able to create a scenario for the urban development system we start from discussing the concept "sus-

tainability". Urban environment consists of natural, economic and social environments. Its quality refers to the quality of the comprehensive environment of residential living and social and economic development. Sustainable development needs to consider both the economic and social benefits in environmental policy-making. As a second step we studied the environmental goals on the national and the regional scales and the SEA methods for the review of the regional plan. The third step is to develop indicators for the environmental quality assessment. The fourth step is to develop urban scenario and policy option that do not violate the environmental quality at present and still is able to reach the environmental goals in the future.

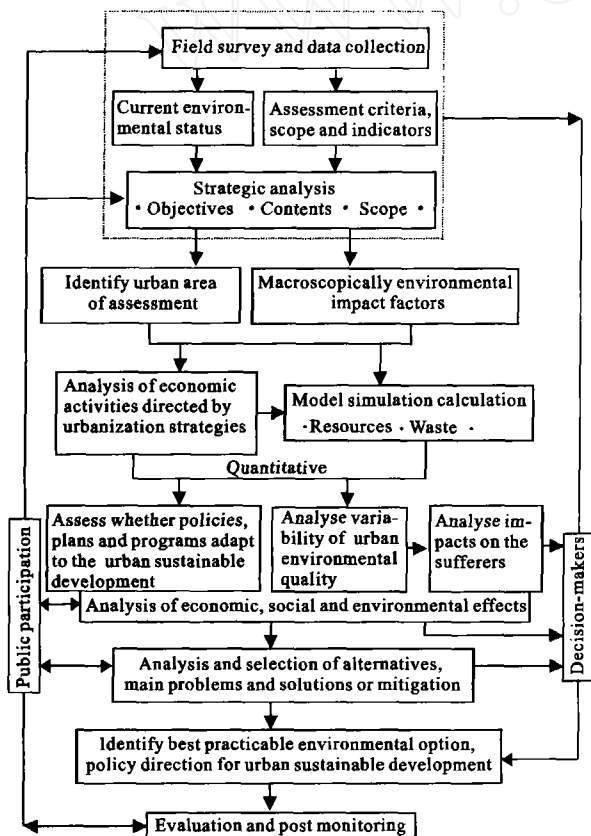


Fig. 1 Framework or procedure of SEA for urbanization process (CHE *et al.*, 2001)

Such a framework for environmental assessment would allow the principle of sustainability to be carried out from policies to projects. SEA can therefore be considered as an essential mechanism for the attainment of sustainable development. The main outline or framework for a "sustainability led" approach to SEA includes following steps: 1) Commitment to sustainability; 2) Determination of parameters, application of international standards; 3) SEA of all relevant PPPs

(policies, plans and programs) and alternatives; 4) Public participation procedure; 5) Procedures integrating the findings of SEA into decision-making; 6) Monitoring programme (iterative feedback into preceding steps except step (1)).

In practice, the industry, or developers concerned with projects warranting SEA, would be expected to provide as much relevant information as possible. This provision could be carried out in accordance with the guidelines issued by government department, which would detail the relevant urban ecological criteria.

It should be stressed that this procedure is not intended to guide detailed project EIA, but to improve the effectiveness and efficiency of the environmental appraisal process. The results will be used during more detailed environmental investigation of each best practicable environmental option that is identified. The emphasis of the framework is very much on the user to adapt the requirements for their own particular situation.

4 INDICATORS FOR SEA IN URBANIZATION

The indicators for SEA is formulated with relative goals and recommended to be able to be accurately and comprehensively described in environments of residential living and social and economic sustainable development. Of course, those indicators must be of comparability between various natural conditions, and functional levels of economic and technical developments in different cities. In general, the indicators for SEA of comprehensive urban environment are classified into three parts (WANG and LU, 1999).

The substantial part of the indicators should include the criteria reflecting the state of the environment in terms of their immediate impact on human health, physical and psychical conditions, as well as on sustainability of non-human communities: air pollution and emission; water contamination, soil deterioration and presence of harmful substances; noise level; negative scent impacts; vibration; radiation; production and management of all categories of waste; and use and management of land. Needless to emphasize that most of the key indicators represent the elements building sustainability paradigms for cities as they protect and develop the values indispensable for the sound community and for biosphere at large.

The second part of the indicators should be connected with purely ecological constituents of urban structures: vegetation coverage and greenery; presence, specific qualities and size of local, regional and super re-

gional systems of ecological stability (skeleton of ecological stability); presence and size of especially protected natural areas; size and conditions of ecosystem in terms of the urban environmental values and functions; specific spatial needs of non-human communities and entities; values of natural landscape in the city.

The third part of the indicators should be defined as physical constituents of urban environment resulting from human activities. Those include environmental improvement and economic development. All selected indicators are listed in Table 1 (WSSDI, 1997).

5 RECOMMENDATIONS FOR IMPROVING SEA

(1) Incorporating SEA into decision-making process. Today, the most EIAs are in relation to specific construction projects in China. And only a limited number of alternatives can be considered at this stage. The concept of SEA was adopted more than 10 years ago in Hong Kong to support high-level decision-making. And SEA has become an essential part of major studies on development plans and strategies (VICTOR and LAU, 2000). However, in China's mainland work on the case studies of SEA has been done only in re-

Table 1 Indicators for Strategic Environmental Assessment of urbanization process

| Classified indicator (I) | Classified indicator (II) | Detailed indicator |
|--------------------------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental status | Air pollution and emission | SO ₂ , NO _x , TSP, pH of precipitation |
| | Water contamination | DO, permanganate index, BOD ₅ , non-ion ammonia, volatile phenols, cyanide, petroleum products, anionics (anionic surface active agent), chlorophyll-a, benthonic animals, total coliform bacteria |
| | Solid waste | Land occupation, residents affected, volume |
| | Noise level | Average noise values in different functional areas: 1) residential area; 2) mixed area; 3) industrial area; 4) road side |
| Ecological constituents of urban structure | | Vegetation coverage and greenery; presence, specific qualities and size of local, regional and super regional systems of ecological stability; presence and size of especially protected natural areas; size and condition of ecosystem in terms of the urban environmental values and functions etc. |
| Urban communities' evolution | Environmental improvement | Up to standard emission ratio; SO ₂ emission per person; up to standard waste water ratio; up to standard drinking water ratio; industrial waste water per 10000 yuan (RMB) product; recycling/reuse of industrial solid wastes; disposition rate of industrial solid wastes; clearance of domestic solid waste; environmental protection investment in proportion to GDP; public green area per capita; acreage of conversion area; recondition of soil-erosion; vegetation coverage ratio |
| | Economic development | GDP per capita; economic growth rate; economic structure etc. |
| | Social progress | Population density; communication: telephones per 10000 residents; medicine and health: hospital beds per 10000 residents; education: highly educated/total population etc. |

cent years. It is evident that if relatively small engineering projects are subject to EIA, then other actions such as policies, plans, and programs which have a much wider scope should also be screened for adverse environmental impacts. After a period of investigation, research and discussion, it has been recognized that SEA is necessary in legislation procedures and an "EIA Act of the People's Republic of China" has been drafted. The key for the EIA Act to bring in effect is to really incorporate SEA into decision-making process during the process of urbanization.

(2) Developing strategic evaluation tools and techniques (CHE and SHANG, 2002). Based on international experiences and studies, some EIA methods, such as checklists, matrices, life cycle analysis or multi-criteria analysis can be applied in SEA. However, for the SEA of plans and programmes covers such a wide variety of topics and issues, and has great differ-

ence regarding as the significance of impacts, it is crucial to develop appropriate methods and techniques for improvement and facilitation of the SEA process. Although only a limited number of case studies have been done in China, the techniques and tools used for SEA at the strategic level have been gradually improved. For example, meta-synthesis (LI and XU, 2000) and multi-criteria analysis (LIU *et al.*, 2001) approaches have been adopted in the recent SEAs. If possible, case studies should be used to illustrate the effectiveness of the specific methods. Experience exchange could stimulate the development process.

(3) Encouraging public participation. Wide consultation on policies and strategic proposals and their SEAs can help achieve sustainable development. Involving the public in the setting of policies and strategies can raise public awareness of strategic environmental issues that affect the long-term environmental sustainability

(CHE and SHANG, 2002).

(4) Organizing educational programs. SEA can work only when administrators and initiators believe in the potential of the instrument. Many administrators, decision-makers and project developers fear SEA. They perceive it as a threat to their authority, or they think it is a tool developed by environmental groups to stop further development. It is feared that SEA would lead to delays and difficulties in providing additional benefits. Therefore, SEA can benefit from educational programs, which would teach interest groups how to deal with the SEA process (CHE and SHANG, 2002).

(5) Selecting experimental units for SEA trial run. We recommend selecting experimental units for SEA trial run in some cities, such as southeast coastal cities. Contrasted with the others, experimental units have superior scientific and economic conditions, and this will fully contribute to the development of methods for raising the quality of SEA. SEA trial run not only lends SEA itself to check the validity of existing procedures and methodologies and to demonstrate their feasibility, but also raises awareness by enhancing the exchange of information and communication between the key actors involved in the decision-making processes. Furthermore, the future direction of SEA can be pointed out through the trial run. As a result, SEA is increasingly and comprehensively being carried out in practice in China (CHEN and SHANG, 2002).

6 CONCLUSIONS

SEA is an effective environmental management and decision-making tool, especially at the beginning of new millennium when the development of the Chinese urbanization has come into a critical point. Urban areas are increasingly a focus of environmental concern. Therefore, as an instrument for environmental protection, SEA provides a means of helping to clarify objectives and principles of urban environmental plan, possibly within an integrated policy framework for addressing socio-economic and environmental issues. Then, SEA can be a supporting tool for decision-makers to ensure urban sustainable development. However, SEA is a frontier subject in the field of EIA, only a very limited number of case studies have been discussed in China. Therefore, there is a lot of work needed to be done on SEA in China. Mechanisms, which ensure SEA to be implemented effectively and really incorporated into decision-making process in the

course of urbanization, are worthy of researching, and it is essential for us to carry out experimental unit of SEA for urbanization process in China, and to promote application of new approaches such as GIS in SEA.

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