Reformed Environmental Impact Assessment in China: An Evaluation of Its Effectiveness

Yang Yang

Doctoral Program in Global Environmental Studies
Kyoto University, Graduate School of Global Environmental Studies (GSGES)
Laboratory of Global Environmental Policy
Under the supervision of Makoto Usami, Professor

Defended on February 7th, 2022.

Reformed Environmental Impact Assessment in China: An Evaluation of Its Effectiveness

Yang Yang

With the rapid economic development and urbanization in China, there engender new requirements for the environmental impact assessment (EIA) in the new era. In 2015, a "reform storm" of EIA opened up. A set of reforms were carried out to streamline administration, delegate more powers, improve regulation and provide better service. This dissertation tries to answer the question of how effective the reformed EIA system is. Following the classification of the EIA system in China, the effectiveness evaluation was conducted with Project EIA and strategic environmental assessment (SEA), respectively.

First, Ahmed and Wood's model is revised to evaluate the effectiveness of the EIA system in terms of systematic measures, including legislative provisions, administrative set-up, and EIA process, as well as foundation measures. The results demonstrate that the revised laws and regulations are more stringent than their predecessors. The process of Project EIA came to be simplified, and its coordination with the pollutant discharge permit system is further promoted. The interim and post-event supervision is currently more robust, and the penalties are more severe than before. However, the hierarchical position of the Environmental Protection Law is not high enough, and the coordination of different government departments is still challenging.

Second, a meta-analysis is conducted to broaden the SEA interpretation in China. 68 academic papers published from 2009 to 2019 are scrutinized, with 41 articles related to the international context and 27 to China. The analysis followed an integration model of Bond's sustainability assessment model and J. Arts's conceptual model. After figuring out the number of times each criterion being mentioned, a comparison of adoption frequency is made between Chinese and world-wide backgrounds. The result shows that criteria adopted in studies on China's SEA are largely accordant with international cases. Both of them discuss more on procedural and contextual effectiveness; and the distribution of substantive and normative effectiveness resembles the most. However, the significant differences lie in assessment methods and communication criteria, which suggest the drawbacks influencing SEA implementation in China.

Last, the effectiveness of SEA is overviewed against the identified well-acknowledged evaluation criteria. The results show a relatively good procedural effectiveness, albeit lacking regulations on some key issues. The late integration of SEA impedes the realization of substantive objectives. Although SEA reduces environmental impacts to a certain extent, it fails to achieve the normative objective of sustainable development. Insufficient cooperation and communication hinder the knowledge transfer and learning process. Pluralist effectiveness discusses the causes of inadequate public participation. Contextual factors, including governance style and decision-making culture, are examined to illustrate the SEA ineffectiveness in some issues. All of the effectiveness dimensions are not independent; their interrelation and mutual influence have also expatiated.

Key words: *environmental impact assessment; strategic impact assessment; effectiveness evaluation; meta-analysis*

Contents

Figures

Tables

Abbreviations

CIA	Cumulative Impact Assessment
EA	Environmental Assessment
EEPB	Ecological and Environmental Protection Bureau
EIS	Environmental Impact Statement
EIA Law	Environmental Impact Assessment Law
EIR	Environmental Impact Report
EIRF	Environmental Impact Registration Form
EIF	Environmental Impact Form
EPL	Environmental Protection Law
EPB	Environmental Protection Bureau
ERA	Environmental Risk Assessment
LCA	Life Cycle Assessment
IAIA	International Association for Impact Assessment
MARA	Ministry of Agriculture and Rural Affairs
MEE	Ministry of Ecology and Environment
MEP	Ministry of Environmental Protection
MWR	Ministry of Water Resources
PDP	Pollutant discharge permit
PEIA	Planning Environmental Impact Assessment
PPPs	Policies, Plans, and Programs
REIA	Regional Environmental Impact Assessment
RPEIA	Regulations on Planning Environmental Impact Assessment
SEA	Strategic Environmental Assessment
SIA	Social Impact Assessment
TG	Technical Guideline
UNECE	United Nations Economic Commission for Europe

Acknowledgments

Throughout my PhD journey, I have received a great deal of support from many people.

First of all, I would like to profoundly thank my supervisor, Prof. Makoto Usami, whose expertise was invaluable in formulating the research questions and methodology. Your insightful feedback and meticulous advice pushed me to polish my thinking and elevated my work to a higher level. Besides, I have always been impressed by your noble character and great enthusiasm for research. I am proud to have studied under your supervision.

I am immensely grateful to my vice-supervisor, Associate Prof. Akira Yoshino for all your critical comments and guidance, which substantially helped refine my research. I sincerely appreciate your time and effort in reviewing my dissertation.

I would also like to extend my sincere gratitude to Assistant Prof. Yumiko Takema for your encouragement and wise suggestions on my research. Your elegant manners and responsible attitudes towards life also impressed me remarkably.

In addition, I would like to acknowledge Prof. Abe Ken-ichi, who gave me a valuable opportunity to conduct an internship at Research Institute for Humanity and Nature (RIHN). I am thankful to all the researchers and staffs in the Communication Department of RIHN: Daniel Niles, Yutaka Mimura, Katsuya Soda, Nahoko Shimada, and Masako Kuroda. All of your warm-hearted support facilitated me to have a wonderful and fruitful internship period.

I cannot forget to thank all my fellow colleagues at the Laboratory of Global Environmental Policy. I gained significant knowledge on different topics and research models during the lab seminars and informal tutorial meetings. The multi-national background of my colleagues provided a good channel to understand cultures of different countries. In particular, I want to thank Dr. Laÿna Droz-dit-Busset, Phuong Lan Nguyen, Kumie Hattori, Dinita Setyawati, Masako Ichihara, Bahareh Ghafouri, Lilia Shahar Griffin, Undrakh Batkhuyag and Tshering Ongmu Sherpa, who always listened to my confusion patiently and provided useful suggestions about manuscript forming, writing skills and grammar checking, etc. Our friendship also helped me overcome many low phases.

I am indebted to the Chinese Scholarship Council, who offered me financial aid. The funding released me from the economic pressure that enabled me to devote all my time to research. The Consulate-General of China in Osaka also provided Chinese students like me with a safe and secure environment to study abroad. I am thankful for the love showered by my motherland.

At last, but by no means least, I want to give my deepest thanks to my family members. You are the source of my strength and my motivation to work harder. My husband, Dr. Zhang Jintong, it is you who accompanied me all the time and provided stimulating discussions as well as happy distractions to take a break from research and rejuvenate myself. My dearest parents, you both are my backbone. I cannot thank you enough for taking much responsibility of looking after my daughter. My baby Zhang Xianwen, you are the best gift sent from heaven. Thank you for choosing me as your mom and giving me the patience to learn how to be a good mother.

Once again, a heartfelt thank you for all your support, inspiration and encouragement!

Chapter 1. Introduction

Over the last several decades, human activities have altered natural cycles and systems on an unprecedented scale (Sadler, 1996). Serious environmental problems, such as the greenhouse effect, acid rain, land desertification and species vanishing, occur and are exacerbated due to rapid global urbanization and population growth. Many reputable scientists consider that the impact of human activities on the biosphere is reaching critical thresholds, with the consequent threat of ecological breakdown and social conflict. The risks and impacts are significant than ever before. Environmental Impact Assessment (EIA) has been emerging in this context, which is the process of estimating and evaluating the significant effects of a program or project on the quality of its location's environment beforehand (Li & Zhao, 2015).

On January 1, 1970, EIA was firstly introduced in Environmental Policy Act in the U.S.A. Since then, it has been adopted worldwide as an environmental management instrument firmly embedded in domestic and international environmental laws. Till now, 191 of the 193 member nations of the United Nations have enacted national laws or have signed some forms of international legal instruments that refer to EIA use (Shakil & Ananya, 2014). The question is whether EIA can remain an effective tool to realize its anticipatory objectives as it is designed. This dissertation tries to answer this question by evaluating the EIA system's effectiveness.

1.1 The EIA system

1.1.1 Definition and goals of EIA

Although the worldwide application of EIA, its characteristics differ in different countries due to their diverse political systems, economic development levels and cultural traditions. EIA is institutionalized as a separate formal process under various legal and institutional arrangements. It is also taken forward informally through other development planning and resource management systems (Sadler, 1996). There are many changes in EIA's object, scope, procedure, and assessment method among those countries (M. Wang, 2016). Nevertheless, EIAs worldwide share similar principles and goals.

Definitions of EIA are abounding (Glasson, Therivel, & Chadwick, 2005). The oft-quoted definition is from R.E. Munn (1979), which refers to the need "to identify and predict the impact on the environment and man's health and well-being of legislative proposals, policies, programs, projects and operational procedures, and to interpret and communicate information about the impacts". The Department of Environment in the UK (1989) gives its narrow operational definition: "the term 'environmental assessment' describes a technique and a process by which information about the environmental effects of a project is collected, both by the developer and from other sources, and taken into account by the planning authority in forming their judgments on whether the development should go ahead." The United Nations Economic Commission for Europe (UNECE) provides a more succinct and pithy definition: "an assessment of the impact of a planned activity on the environment". In 1994, the International Association for Impact Assessment (IAIA) defined EIA as the systematic process of identifying the future consequences of current or proposed action. All these definitions share three basic concepts: EIA is a process, EIA is part of project planning, and EIA is a proactive way of addressing environmental concerns (Ram B., Stefan, Ananda R., Shailendra, & Ajay B., 2013).

It is important to note that the definitions above may have different interpretations and patterns in different countries. Broadly speaking, EIA is a general designation that includes Environmental Assessment (EA), Project EIA, Planning EIA, Strategic Environmental Assessment (SEA), Social Impact Assessment (SIA), Environmental Risk Assessment (ERA), Cumulative Impact Assessment (CIA), Life Cycle Assessment (LCA), and other forms of impact assessment. Some countries often use these terms interchangeably, in particular, EA and EIA. Narrowly speaking, EIA only includes Project EIA of construction projects and SEA of policies, plans, and programs (PPP)[1]. China's EIA is mainly in a narrow sense according to its legal definition.

EIA is a systematic approach to analyzing, predicting and evaluating the positive and negative impacts on components of the environment that may arise from the planning and construction projects, and then putting forward the preventive measures to mitigate the adverse environmental impact.

(Article 2, the EIA Law of China)

Compared with the internationally agreed tiered system among PPP, China's SEA hierarchy is incomplete (as shown in **Figure 1.1.**). The EIA for plans was institutionalized in 2003, and since then, "Planning EIA" has been the Chinese name for SEA, and some researchers use the two terms interchangeably (Gao, Christensen, & Kørnøv, 2014). In the Chinese context, a policy (zhèng cè) is typically described as a principle or rule to guide decisions and achieve rational outcomes, such as the reform and opening-up policy; a plan (guī huà) is a strategic program for the long term (five to ten years), such as the 12th national economic and social development five-year plan; and a program (jì huà) is similar to a plan, but it is more detailed and short term, such as the 2012 program for national economic and social development (Yang, 2012).

The discussion in this dissertation is based on a narrow concept. EIA is a general form, and Project EIA refers to the assessment of construction projects. In general, SEA refers to the assessment of PPPs, while in the Chinese context, SEA specifically is Planning EIA; they are used exchangeably.

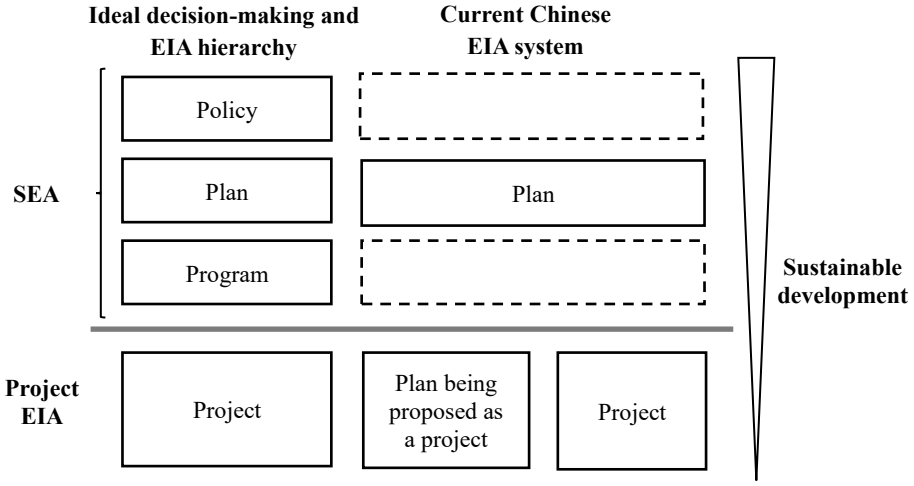


Figure 1.1. Hierarchy of the EIA system in China (Source: Zhou and Sheate, 2011)

[1] The definition of SEA is discussed in detail in Chapter 3.

In essence, EIA is the systematic process that examines the environmental consequences of development actions in advance. The EIA processes are defined in different ways in different countries[2] (Ram B. et al., 2013). Although details of assessment procedures are different, they have the same generic stages: screening, scoping, assessment, mitigation, report review, decision-making, follow-up, public participation and alternative consideration. As illustrated in **Table 1.1.**, these stages can be divided into three major phases: a preliminary assessment, detailed assessment, and follow-up to decision making (Sadler, 1996). Public participation is involved in the whole process.

Table 1.1. Generic EIA stages
（Source: Sadler, 1996）

EIA stages	Descripment
Preliminary assessment	• Screening to establish whether EIA is required and the likely extent of process application. • Scoping to identify the key issues and impacts that need to be addressed and prepare terms of reference.
Detailed assessment	• Impact analysis to identify, predict, and evaluate the potential significance of risks and effects. • Mitigation to specify measures to prevent, minimize, and offset or compensate for environmental damage. • Reporting to document the results of EIA, including recommended terms and conditions. • Report review to ensure the report meets terms of reference and standards of good practice. • Decision-making to approve (or not) a proposal and establish terms and conditions.
Follow-up	• Monitoring to check if actions comply with terms if impacts are within predicted ranges. • Management to address unforeseen events or unanticipated impacts. • Audit/evaluation to document results, learn from experience, and improve EIA and project planning.

Internationally, EIA is well-recognized as a multi-purpose process[3]. Glasson et al. (2005) state three functions of EIA: aid to the decision-making, assistance to formulate development actions, and instrument for sustainable development. EIA can help decision-makers systematically examine the environmental implications of a proposed action or alternatives in advance, clarify some of the trade-offs associated with developing a planned activity, and finally lead to more rational and structured decision-making. Since EIA is implemented before various activities, it is helpful to the formulation of development actions. For example, it indicates areas where a project can be modified to minimize or eliminate its adverse impacts on the environment and to integrate environmental consciousness into the early planning stage. By preventing pollution, EIA aims at ultimately achieving sustainable development: development that does not excessively cost the Earth.

Sadler (1996) considers the purposes of EIA to be twofold: the immediate aim is to facilitate decision-making, and the ultimate goals are environmental protection and sustainable development. The result of an EIA is one of a number of factors taken into account in political and administrative decision-making. Typically, these decisions involve a series of trade-offs among economic, environmental, social and other criteria. Striking a balance among these factors lies at the heart of integrated decision-making for sustainable development.

[2] The process of Project EIA and SEA in China is clarified in Chapter 2 and Chapter 3, respectively.
[3] The argument of EIA effectiveness by scholars is also an inquiry into the EIA objectives. The purposes of EIA are expounded in the following effectiveness discussion. This part is here to provide a general introduction.

The EIA law of China also explicitly stipulates the short-term purpose of preventing adverse effects and the long-term aim of realizing sustainable development.

> *This Law is formulated to implement a sustainable development strategy, prevent the adverse effects on the environment after implementing planning and construction projects, and promote the coordinated development of the economy, society, and environment.*
>
> *(Article 1, EIA law of China)*

Apart from the above apparent objectives, there is a set of supporting and secondary aims: improving coordination among participating agencies and actions, fostering better designed and planned development projects, empowering community development, building local capacity through public participation, and instilling environmental values and accountabilities across a range of institutions (Sadler, 1996).

1.1.2 Historical development in China

The beginning of EIA development in China can be traced back to the early 1970s. Its evolution over the following decades can be divided into three phases: preparatory phase (1973-1978), establishment and implementation phase (1979-1990), and intensification and consolidation phase (1991 to date) (Y. Wang, Morgan, & Cashmore, 2003; Zhao, 2018). Over these years, a package of laws and regulations have been issued. The development history of EIA in China and the time axis of the EIA storms and reforms is illustrated in **Figure 1.2**.

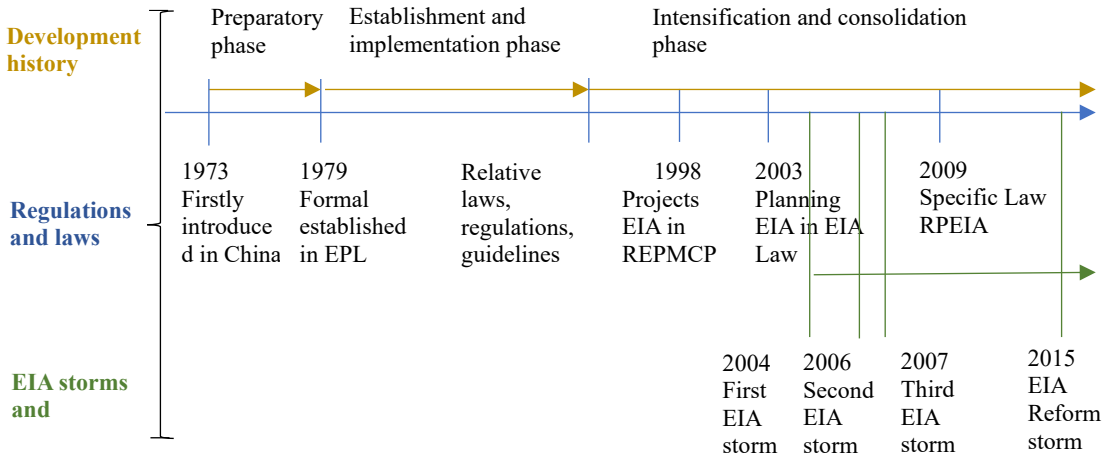


Figure 1.2. The development history of EIA in China and the time axis of EIA storms and reforms (Source: adapted from Y. Wang, Morgan, & Cashmore, 2003 et al., 2003; and Zhao, 2018)

Preparatory phase: 1973-1978

The concept of EIA was first introduced to China in 1973 during the First Conference for National Environmental Protection and then trialed through the Environmental Quality Assessment program, which was designed specifically to tackle serious industrial pollution issues (sān fèi): liquid, solid and gaseous industrial waste (Y. Wang, Morgan, & Cashmore, 2003). In 1974, the Environmental Protection Office (EPO) was established to draft an Environmental Protection Law (EPL), including EIA provisions. A little earlier than EIA, the "Three Simultaneities" (3Ss) system was adopted in 1972. As the earliest environmental management instrument, the 3Ss system is put forward based on China's socialist system and construction experience and is an original-creation effective environmental protection measure with Chinese characteristics. This concept requires the

environmental protection measures must be designed, constructed and operated simultaneously with the project's main components to prevent or control pollution. After EIA was introduced, the 3Ss management system was integrated into the EIA process, mainly in the area of mitigating impacts and subsequent impact monitoring.

Establishment and implementation phase: 1979-1990

Y. Wang et al. (2003) further divide this phase into the early EIA phase (1979–1985) and the main implementation phase (1986–1990). In 1979, the trial version of Environmental Protection Law (EPL) was promulgated, marking EIA's formal introduction into China[4]. The EPL (trial) set out the conditions under which an EIA would be required but did not prescribe how it should be conducted. Later, the Management for Environmental Protection of Capital Construction Projects (MEPCP) provided detailed guidance on how EIAs were to be carried out. In 1984, the EPO was expanded, renamed the National Environmental Protection Bureau (NEPB). NEPB is primarily responsible for the holistic management of environmental protection. The Environmental Protection Bureaus (EPBs) in provincial, county and city levels implement the national environmental protection policies and procedures, as set out by the NEPB. However, they were under the control of local authorities and funded from the local rather than the national level, which raised several problems.

The first official EIA was carried out for a copper mine in 1979. The main implementation phase started in 1986 when an EIA Licensing System (EIALS) for impact assessment practitioners was introduced. The EIALS can revoke licenses if the EIA practitioners, mainly research institutes, were not performing to an adequate level of competence or provide guidance for NEPB and EPBs to review assessment standards. During this period, communication between China and international agencies was set up, and political support for the EIA process was obtained. The EIA was widely applied. Concerns began to emerge in the late 1980s, both in the EPBs and among developers, about the quality of environmental impact reports (EIRs) and the overall cost of EIA. The government responded by issuing some regulations and circulars at national and local levels. After a 10-year trial period, the EPL was revised and formally enacted in 1989.

Intensification and consolidation phase: 1991 to date

During the intensification period (1991-1995), the economy grew rapidly, and national concern about economic growth hampered the implementation of impact assessment procedures. The assessments were generally poor, and mitigation or abatement measures often lacked due to the lack of specific legal provisions. To improve the situation, the government issued more regulations and ordinances, including the Circular to Strengthen the Environmental Protection of the Construction Projects Supported by Overseas Investment in 1992 and the Technical Guidelines for Environmental Impact Assessment in 1993 (TGEIA). The Category Management was also introduced, construction projects were categorized depending on which type of document they require to prepare, a full Environmental Impact Report (EIR), a less detailed Environmental Impact Form (EIF) or a basic Environmental Impact Registration Form (EIRF). In addition, a process for Regional Environmental Impact Assessment (REIA) was introduced in 1993 so that EIA could be extended from individual projects to wider development zones.

[4] Article 2 of the EPL describes its function as being: "to ensure.. . rational use of natural environment, prevention and elimination ofenvironmental pollution and damage to ecosystems, in order to create a clean and favourable living and working environment, protect the health of the people and promote economic development."

Since 1996, EIA has been further enhanced as the main regulatory instrument for environmental protection. In 1998, the Regulations on Environmental Protection Management of Construction Projects (REPCP) was formally approved, and EIA was made compulsory for all sizes of construction projects. The EIA Law was enacted in October 2002 and came into force in September 2003. In Part 2, Articles 7 to 15, Planning EIA was officially regulated. Nevertheless, more emphasis was still given to Project EIA in the following years. Given its superiority in effect on the initial phase of decision-making, a great effort was made to strengthen the implementation of Planning EIA. Finally, in 2009, the Regulation on Planning Environmental Impact Assessment was issued.

1.1.3 Current implementation

Since 2003 when the EIA law was promulgated, EIA has developed tremendously. By the end of 2007, there were already 1.17 million projects in total that got EIA approvals; the country's cumulative SO_2 emissions have been reduced by 2,500 tons, and COD emissions were decreased by 14.06 million tons, which promoted the completion of the "11^{th} Five-Year" restrictive targets for environmental protection (Z. Bao, 2015). According to the data from the "Market strategic planning and supply and demand strategy analysis report for China's EIA industry for 2020-2026" released by Zhiyan Consulting, the market scale of China's EIA industry in 2015 was 7.45 billion yuan, which increased to 19.84 billion yuan in 2019. **Figure 1.3.** revealed the constantly increasing market scale of EIA from 2015 to 2019, demonstrating the increasing demand for EIA in recent years.

Nevertheless, EIA's implementation and actual enforcement have lagged far behind (X. Ren, 2013). **Figure 1.4.** lists some examples of the low implementation rates of Project EIA. While official statistics of the MEP boasted more than 95% of projects having undertaken EIA over the past decade, its investigation of selected sectors in 2004 showed a different situation. Among the mining projects built from 1994 to 2004, only 30% to 40% of projects did EIA as required. Investigating the small hydropower stations built in Yong Zhou prefecture by 2010, only about 10% of them have EIA undertook as requested.

In addition, the implementation of Planning EIA is also low (C. Bao & Wen, 2019). In 2008, the National People's Congress carried out a five-year enforcement inspection of EIA Law, and the results showed that the implementation rate of the Planning EIA from 2003 to 2008 was only less than 10%. From January 2009 to June 2013, a total of more than 3,700 Planning EIA was conducted, which is greatly less than the estimated number of about 2000 items per year. Besides, the implementation of EIA in the 14 types of plans stipulated in EIA Law is very different. As illustrated in **Figure 1.5.**, the type of planning that carries out more environmental assessments is industrial parks (about 75%), following by the planning in transportation (6%), river basin water conservancy and hydropower (5%), energy and mineral resource development (4%), urban and rural planning (3%), and tourism planning (3%). Some of the remaining plans have no records of performing EIA.

In one special inspection activity in 2009 organized by the Environmental Supervision Bureau of MEP, 313 projects were examined, and 19.8% were found illegal problems in implementing EIA Law. Except for the national-level large-scale construction projects reported by the MEP, some other projects at the local level have also been found violating the EIA Law. For example, 73 construction projects were notified disregarding EIA law by the EPB of Taiyuan city in 2010. Investigating 852 industrial projects from 2006 to 2010 in Linfen city, 106 were found not having the EIA approvals (Z. Bao, 2015). As is announced by the MEP, 201 administrative penalties were given to 132 agencies in 2016, while above 36 agencies were given penalties higher than twice, which shows that there still exist serious problems in the EIA agencies.

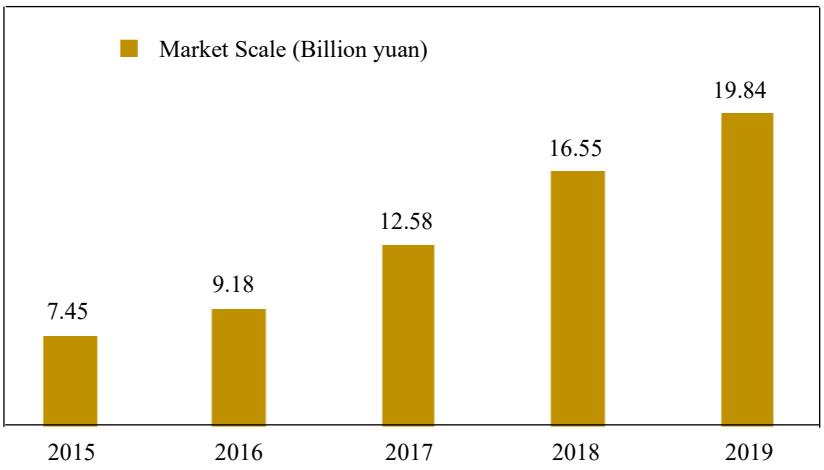


Figure 1.3. Industry market scale of China' EIA from 2015-2019 (Billion)
(Source: https://www.chyxx.com/industry/202005/868961.html.)

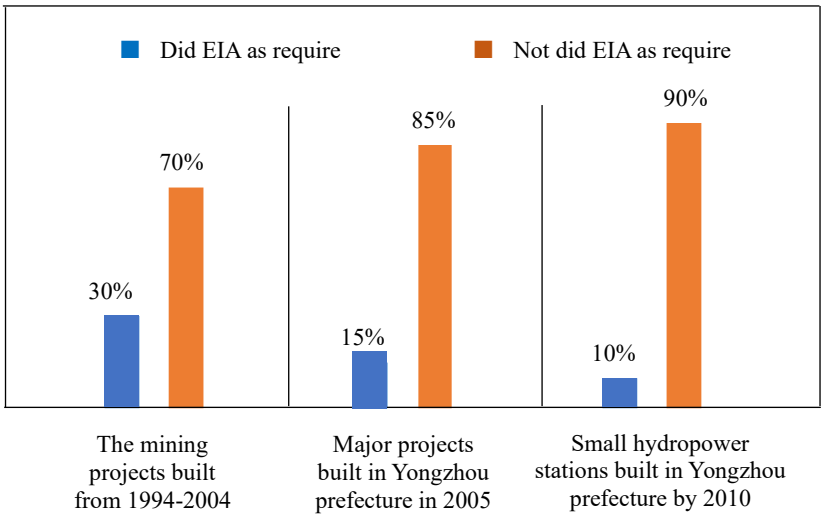


Figure 1.4. The implementation rate of Project EIA
(Source: X. Ren, 2013)

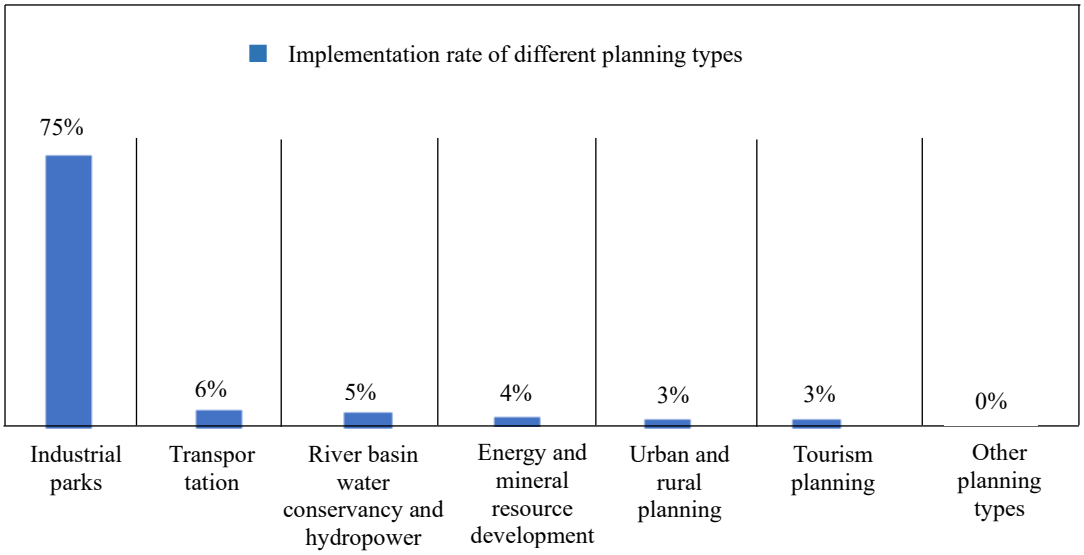


Figure 1.5. The implementation rate of Planning EIA
(Source: C. Bao & Wen, 2019)

1.2 Rectifications and reforms on EIA system

1.2.1 Three rectifications

Regarding the low implementation rate of EIA and repeated exposure of protects violating the EIA Law, the central government frequently conducted selected inspections and rectification activities. Three famous ones carried out in 2004, 2006 and 2007 were called “rectification storms” (People, 2015b). As listed in **Table 1.2.**, some representative large-scale high-polluted projects, which illegally proceeded to construction before getting EIA approvals, or whose constructions were not compliant with the EIA requirements, were suspended or shut down. The legal basis of the three rectifications was all EIA Law; nevertheless, the goals of each rectification were different. They were not the simple continuation of the last action but an improvement (Sohu, 2006).

The rectification in 2005 aimed to crack down on procedural violations and establish an effective environmental impact assessment system for construction projects. In 2004, 30 projects in the Power industry, including the famous Jinsha River Xiluodu Hydropower Station and Three Gorges Underground Power Station, were suspended because their EIA reports were unqualified. The total investment was as huge as 14 billion dollars. Besides, the State Environmental Protection Administration examined 198 1st grade and 728 2nd EIA agencies at the end of 2004. 68 agencies were found unqualified and severely dealt with, 8 institutions’ certificates were revoked; 4 institutions’ evaluation scopes were narrowed; 11 agencies’ certificates were suspended and were required to rectify within a limited time; 16 companies have been notified and criticized; and 29 companies have been suspended for issuing certifications (Sohu, 2005).

In November 2005, the Songhua River Water Pollution Incident happened. An explosion occurred in the first workshop of the Benzene Plant of Jilin Petrochemical Company, with which about 100 tons of benzene flowed into the Songhua River, causing serious river water pollution and affecting the lives of millions of residents along the coast. Later, major environmental incidents have occurred one after another across the country, and most of the companies involved were petrochemical and chemical companies located in the river’s waters. Thus, another rectification started in early 2006 sought to implement the Planning EIA. 10 projects in the Chemical Petrochemical industry with a total investment of about 4 billion dollars were suspended (Sohu, 2006). Its focus was to clean up environmentally sensitive areas, mainly on the layout and structural environmental risks of rivers and waters. Establishing a Planning EIA system for high-risk industries was helpful to curb the frequent occurrence of environmental accidents.

In 2007, the government started implementing the punishment measure of “regional restriction”, which means freezing EIA approval of all new projects in an administrative region that failed to meet regional environmental quality targets. 82 projects with a total investment of about 15 billion dollars were involved (People, 2015b). The purpose of this measure is to suppress the blind expansion of high-polluting industries. The first punishment was given to four cities, namely Tangshan, Lvliang, Laiwu, Liupanshuiand, and four power companies, including Guodian Group.

Despite the drastic movement, the outcomes of these rectifications are still doubtful. Local governments show much more interest in economic development than environmental protection. Since the mode of economic growth has not been fundamentally changed, investment in fixed assets is still too high, and a large part of it is high-energy-consuming and high-polluting industries. A thoroughgoing improvement of EIA implementation would require a comprehensive examination of its effectiveness and a series of reforms on the EIA system.

Table 1.2. Comparison between three EIA rectifications

Year	The projects being stopped or suspended	Significance
2004	30 projects in the Power industry with a total investment of 14 billion dollars, including the famous Jinsha River Xiluodu Hydropower Station and Three Gorges Underground Power Station; Punishes 68 unqualified EIA agencies.	Prevents illegal procedures and constructs an effective Project EIA system (Sohu, 2005).
2006	10 projects in the Chemical Petrochemical industry with a total investment of about 4 billion dollars.	Cleans up environmentally sensitive areas and pushes Planning EIA (Sohu, 2006).
2007	82 projects with a total investment of about 15 billion dollars; First gives punishment of "regional restriction" to 4 administrative regions and 4 power groups.	Starts the punishment measure of "regional restriction," which means freezing EIA approval of all new projects in an administrative region which are failing to meet regional environmental quality targets (People, 2015b).

1.2.2 Reform storm

In 2015, the central government carried out an inspection and the third team pointed out six severe problems in the EIA system, which include: (1) some developers proceed construction projects before getting EIA approval; (2) some leading cadres and their relatives illegally intervene in the EIA approval process or set up agencies to undertake EIA task; (3) a large number of EIA agencies are "Red Roofs Intermediary Agency", which means those agencies practically belong to governmental sectors and play a dual role of both evaluators and reviewers; (4) some EIA agencies get licenses through bribes; (5) some government departments give EIA approval leniently or neglect the post-event supervision; and (6) some local environmental protection departments are prone to corruption during the EIA approval process (People, 2015a). Subsequently, an EIA "reform storm" opened up, and a series of reforms took place.

Under the guidance of "Implementation Plan for the Reform of EIA in 13th Five-year Plan (2015-2020)", reforms have been carried out aiming to streamline administration, delegate more powers, improve regulation and provide better service (C. Bao, 2015). In March 2015, the Ministry of Environmental Protection (MEP) issued the "Plan for Decoupling of EIA Agencies from Environmental Protection Department" and started to abolish the "Government-affiliated Intermediary Agency". All those EIA agencies are required to change to companies or withdraw from the EIA service market by the end of 2016. From January 2017, the EIA approval for the Environmental Impact Registration Form (EIRF), which is required to be compiled by those projects causing little environmental impacts, has been canceled and only needs to complete the online registration. With this change, it is expected to reduce the cost of EIA approval and increase its efficiency. In December 2018, the qualification management for EIA agencies was canceled (REPMCP, 2017). The agencies were not classified into the 1st, 2nd or 3rd grade, and a certain number of EIA engineers in each agency were not indispensable anymore, which was expected to reduce the chaos of certificate borrowing and attachment. Afterward, the Ministry of Ecology and Environment (MEE) was established. The MEE, replacing the former MEP, takes the overall responsibility for environmental management and ecological protection and opens a new era of "super-ministry" (Ma & Liu, 2018). The list of reforms is summarized in **Table 1.3**. It seems that how those reforms influence the EIA system in China deserves to be examined, and the effectiveness of the reformed EIA system needs to be evaluated.

Table 1.3. The list of reforms on EIA since 2015

EIA reforms	EIA system		Start of the reform	Influenced EIA components
	Before reform	After reform		
Administrative set-up				
Establishment of MEE	● The environmental protection duties are dispersed in different departments.	● MEE oversees and coordinates the environmental protection work nationwide. The EIA and Emission Management Department in MEE is responsible for the implementation of EIA.	2018.4.16	Review authorities
Vertical management reform of environmental monitoring and enforcement departments below the provincial level	● The environmental protection authorities are under the management of local municipal governments.	● The management of environmental protection authorities belongs to higher-level environmental protection authorities. The supervision responsibility belongs to the provincial level. The responsibility of law enforcement decentralized to the city and county level.	2016 Guidance for pilot work of vertical management reform	Supervision authorities
Decoupling of EIA agencies from the Environmental Protection Department	● Exists "Government-affiliated Intermediary Agency"	● All the "Government-affiliated Intermediary Agencies" change to enterprises or withdraw from the EIA service market.	2015.3.25 Plan for decoupling of EIA agencies	Preparation of EIS
Canceling the qualification management of EIA agencies	● The EIA agencies are classified into three grades, which require a different number of engineers.	● Grade management is canceled. The government does not issue a certificate to EIA agencies. Companies can prepare EISs.	2016.7.2 EIA law (2018)	Preparation of EIS
EIA process				
Canceling the preconditions of EIA review	● For the project related to soil and water conservation, the conservation methods should be reviewed firstly by the industrial authorities.	● The preconditions have been canceled.	2017.10.1 REPMCP	Review
Simplifying the EIA approval process	● EIRF is required to be reviewed by EPBs.	● EIRF only needs to do online registration. The required documents of some projects are simplified from complete EIR to simplified EIF or from EIF to EIRF.	Catalog of Project EIA	Scoping; Review

		The review jurisdiction of some projects which have little environmental consequences is delegated to lower levels.		
Increasing penalties for violations	● The cost of breaking the law is low.	● The fine for proceeding to construction before getting approval increases as high as 1%-5% of the gross investment. Implements the double-penalty system.	2016.7.2 EIA law (2018)	Penalties
Enhancing interim and post-event supervision	● Pays most attention to the EIA review.	● Adopts online and offline supervision methods. Creates the "intelligence EIA" system. Conducts the periodic selective examination of EISs. Adopts a lifelong responsibility system and social credit management system.	2018.1.25 Advice on strengthening the interim and post-event supervision	Supervision
Increasing public participation	● Three publicities. Requires to publicize the brief version of EIR. Mainly uses government websites, newspapers and posters.	● The publicity covers the whole EIA process. Six publicity and above are required. The contents of each publicity are enriched, and the whole EIR requires to be exposed. It also recommends the use of social media platforms such as WeChat and Weibo.	2019.1.1 MPPEIA	Public participation

Source: regulations and laws; policy interpretations.

1.3 Effectiveness researches

1.3.1 Definition of effectiveness

To better guide EIA reforms, the central government issued "Implementation plan for environmental impact assessment's reform in the 13th five-year plan (2015-2020)", which stipulates that the reforms should comprehensively improve the EIA effectiveness while improving the environmental quality is seen as the core. However, there is no authoritative definition of "effectiveness" in the law. In 1993, at the Shanghai meeting of the International Association for Impact Assessment (IAIA), the International Study of the Effectiveness of Environmental Assessment was launched. Later, Sadler (1996, p.37) firstly defined effectiveness simply as "whether something works as intended and meets the purposes for which it was designed". "Something" in this dissertation means the "environmental assessment process", which includes EIA and SEA.

Chanchitpricha and Bond (2013) summarize the definitions of 'effectiveness' based on many relevant studies. **Table 1.4.** illustrates a wide variety of perspectives that encompass understandings of the term 'effectiveness'. There is a similarity between the definitions of effectiveness in different impact assessment fields. Effectiveness has been defined based on: the process of the impact assessment, the required resources, namely, staff, time and cost, the purposes of the impact assessment, the involved actors/stakeholders, the values/interests of decision-makers, its contribution to policy development, the learning gained from the process, the changing of perspectives through gained knowledge, and the expectations of interested/involved parties/or stakeholders. Thus, it is clear that the effectiveness of the impact assessment process depends on the context and the role(s) of key participating actors and stakeholders (Chanchitpricha & Bond, 2013).

Table 1.4. Effectiveness definitions regarding impact assessment processes (Source: Chanchitpricha & Bond, 2013)

Type	Definition of effectiveness in impact assessment processes
EIA	"How well something works or whether it works as intended and meets the purposes for which it is designed" (Sadler, 1996, p.37). "The potential outcome of a goal-directed process" (Elling, 2009, p.129).
SEA	"How well something works or whether it works as intended and meets the purposes for which it is designed" (Sadler, 1996, p.37). "A function of the extent it influences, and adds value, to decision making" (Partidário, 2000, p.647). The impact of SEA is "the extent to which SEA recommendations were in line with the values and interests of the main decision-makers" (Runhaar and Driessen, 2007, p.12). "The contribution of SEA to the selection of the most sustainable, environmentally-friendly planning option" (Van Buuren and Nooteboom, 2009, p.146). "A function of design, procedure, substance, as well as transaction, influenced by political issues" (Theophilou et al., 2010, p.136).

1.3.2 Dimensions of effectiveness evaluation

Over the past decades, there has been great debate over the effectiveness and evaluation dimensions. Sadler (1996, p.37) first proposes three effectiveness dimensions: procedural effectiveness to examine how the policy was applied or what procedures were used, substantive effectiveness to evaluate to what extent the objectives were met, and transactiveness effectiveness to assess the financial and temporal costs of conducting the EIA. Based on his research, Baker and

McLelland (2003) introduce the normative effectiveness to examine the extent to which the policy meets its ideal purpose, such as sustainable development and the transparent, democratic and participatory environmental assessment process. In addition to those four main effectiveness perspectives, A. Bond, Morrison-Saunders, & Pope (2012) suggest a sustainability assessment framework. They incorporate two more perspectives: pluralism to examine whether assessment takes different stakeholders' views and knowledge and learning to inspect whether the assessment process facilitates knowledge sharing. Since then, the above seven effectiveness dimensions are well-acknowledged by researchers worldwide and have been widely used by researchers in different countries with various clarification (Geißler et al., 2019). Different evaluation criteria are developed under each effectiveness dimension considering EIA's context-specific characteristic. **Table 1.5.** list the descriptions of these effectiveness perspectives mentioned in past literature.

Table 1.5. Effectiveness dimensions and descriptions in past literature (Source: Chanchitpricha and Bond, 2013; Veronez, Aparecida Veronez, & Montaño, 2015)

Effectiveness dimensions	Description
Procedural effectiveness	"Does the EA (environmental assessment) process conform to established provisions and principles?" (Sadler, 1996, p.39). "Examination of the practice involves finding out how the policy was applied or what procedures were used" (Baker and McLelland, 2003, p.585). The process is related to "The framing of SEA's methodological dimension in response to the perceived limitation in EIA practice, and the growing emphasis on process versus technique" (Bina, 2007, p.587). "As an input to decisions about strategic actions, the effective SEA must provide decision-makers with robust, clearly presented information about the environmental impacts of their plan and the rights" (Therivel, 2010, p.39).
Substantive effectiveness	"Does the EA process achieve the objectives set, e.g., well-informed support decision-making and result in environmental protection?" (Sadler, 1996, p.39). "Examination of performance involves finding out what objectives were met as a result of the application (the practice)" (Baker and McLelland, 2003, p.586). The output is related to "The strategic dimension of SEA, originally linked to the paucity of environmental type assessments of policies, plans and programs (PPPs)" (Bina, 2007, p.587). "Does it answer whether integrated environmental decision-making is achieved? And does it refer to performance?" (Theophilou et al., 2010, p.139).
Transactive effectiveness	"Does the EA process deliver these outcome(s) at least cost in the minimum time possible, i.e., is it effective and efficient?" (Sadler, 1996, p.39). "Examination of proficiency involves finding out how resources were used in achieving objectives" (Baker and McLelland, 2003, p.586). "Does it answer whether efficiency is achieved, and does it refer to proficiency?" (Theophilou et al., 2010, p.139).
Normative effectiveness	"Examination of the purpose involves finding out what normative goals are realized" (Baker and McLelland, 2003, p.586). "Normative goals are those which are derived from a combination of social and individual norms" (Bond and Morrison-Saunders, 2013, p.45). "The contribution of EIA to consent and design decisions can be viewed resolutely as one component of incremental changes in institutions, organizations, philosophy, science and culture" (Cashmore et al., 2004, p.306). The output related to "The purpose of SEA and the increased reference to the contribution to sustainable development" (Bina, 2007, p.587).
Pluralism	Examines how and to what extent there was public participation in the process (O'Faircheallaigh 2010).
Knowledge and learning	Identification of repositories of knowledge (Sánchez & Morrison-Saunders 2011).

1.3.3 Overall research trends

Researches in the international context

The past several decades witnessed a great expansion of EIA effectiveness studies[5]. Loomis and Dziedzic (2018) review 59 relative articles from 1996 to 2016 to show effectiveness studies' state of the art. It can be found that the effectiveness studies have been conducted worldwide. As seen in **Figure 1.6.**, Europe and Asia dominate, and surprisingly, few studies originate in the birthplace of EIA, North America. As illustrated in **Figure 1.7.**, procedural effectiveness attracts the most attention among the four basic evaluation dimensions. In sequence, the next ones are the substantive, transactive and normative effectiveness. Promisingly, multidimensional studies are becoming more common that highlight linkages among these dimensions. W. Li and Zhao (2015) conduct a bibliometric analysis of global environmental assessment research from 1993 to 2012. The frequently used keywords analysis shows that the priority in assessment gradually change from Project EIA to SEA. The h-index analysis used to evaluate the research quality worldwide reveals that improving developing countries' EIA systems is becoming a popular research topic.

Fischer and Onyango (2012) conducted a content analysis of 263 peer-reviewed SEA-related papers published from 1992 to 2011, with 626 authors associated with 439 institutions across 38 countries being involved, representing all continents. The three most preeminent international refereed English language journals are identified for SEA: Environmental Impact Assessment Review, Impact Assessment and Project Appraisal and Journal of Environmental Assessment Policy and Management. A geographical bias of SEA research activities is found. The geographical distribution of publications shows that most papers were written by authors from developed countries. The publications from China and other Asian countries significantly increased from 2009 to 2012, while about 90% collaborated with authors from developed countries. This result is the same as W. Li and Zhao's (2015) statement that the internationally collaborated articles are prevalent, and increasing international collaboration would lead to more powerful articles due to the sharing of ideas and workloads. With the analysis of 50 questionnaires, 82.3% insist that more research into SEA effectiveness evaluation is needed (Fischer & Onyango, 2012).

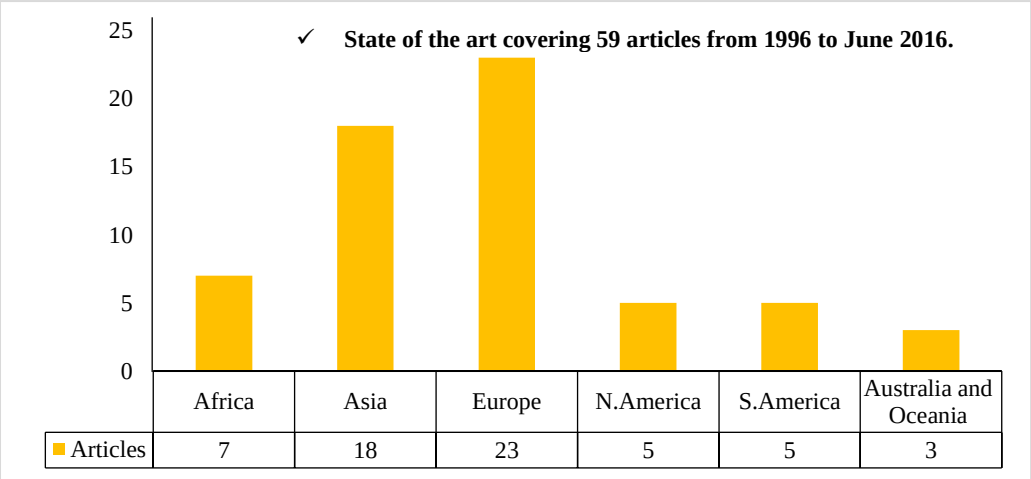
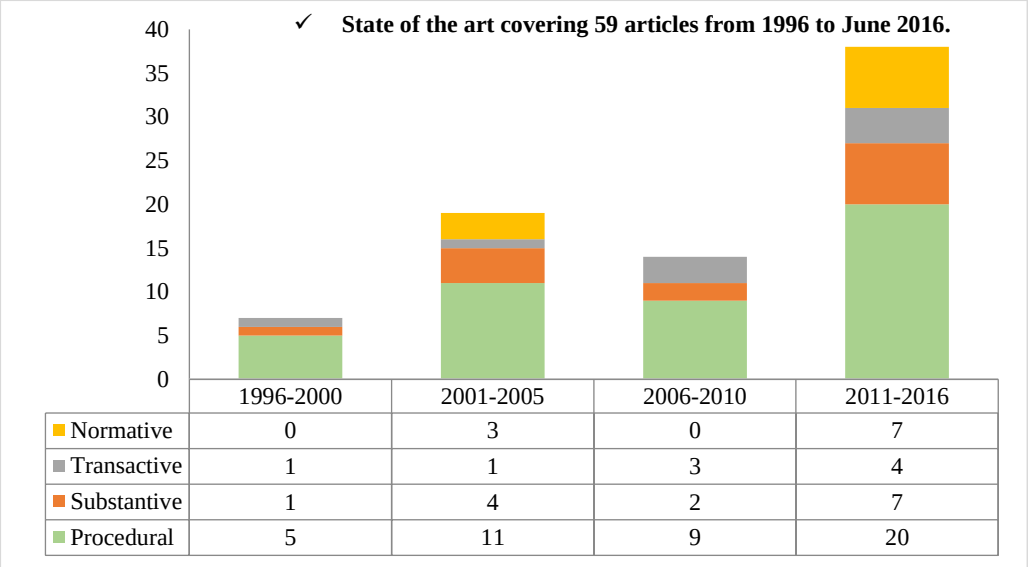


Figure 1.6. Region distribution of effectiveness studies in the international context (Source: Loomis and Dziedzic, 2018)

[5] The researches discussing the Project EIA and SEA effectiveness in the international and Chinese context is listed and analyzed in Chapters 2. and 3., respectively. The discussion in this part mainly focuses on their overall situation and general trends.



	1996-2000	2001-2005	2006-2010	2011-2016
Normative	0	3	0	7
Transactive	1	1	3	4
Substantive	1	4	2	7
Procedural	5	11	9	20

Figure 1.7. Trend's analysis of effectiveness studies in the international context (Source: Loomis and Dziedzic, 2018)

Researches in the Chinese context

Apart from the English database, the Chinese database is also indispensable to grasp the overall research trends of China's EIA effectiveness. The China Academic Journals Full-text Database (CJFD) and China doctoral/Master's Theses Database (CDMD) are searched, respectively, with the topic of "EIA and effectiveness". As shown in **Figure 1.8.**, 77 journal papers were published from 2009 to 2018. 51% of them discuss the effectiveness of public participation, which is one of the most important components in the EIA process. 22% articles study the SEA / Planning EIA effectiveness. Only 5 papers examine Project EIA's effectiveness using case studies of the specific construction industry. The scholarly dissertations show the same trend with peer-reviewed articles, as indicated in **Figure 1.9**. Most of the master's thesis focus on improving public participation in the EIA process. It should be noticed that there was only one doctoral dissertation study. Chen (2010) constructs an effective public participation management model for EIA by adopting Thomas's public participation effective decision-making model and combining expert interviews, questionnaire surveys, and statistical analysis.

Table 1.6. lists some typical literature discussing China's EIA system. Three research perspectives can be classified. Environmental Impact Statement (EIS), as the direct outcome of EIA, is an indicator of the performance of the EIA systems and attracts great attention. Y. Zhang (2002) analyze the quality of 36 EIA reports within 1991-2000 in Shanghai, M. Yin (2004) evaluate the performance of 80 EIA reports written between 1995-2002 in Shenzhen, and G. Jin (2017) review the 1163 EIA reports within 2010-2015 in Jilin province. By evaluating EIA reports' quality, the effectiveness of EIA system can also be reflected. Besides, comparative case studies are conducted. The EIA system in China is compared with different countries, including the United States, Canada, Japan and Korea (Zhao, 2018; F. Chen, 2017; X. Zhang, 2010; L. Wu, 2016). The deficiencies may be found through checklist comparison, and lessons can be learned from these countries' practices. As to the studies related to effectiveness evaluation, some researchers examine the perception of experts and government officials (J. Wu, Sun, Cunkuan, Fan, & Dahe, 2011; O. Bina, Jing, Brown, & Partidário, 2011); some researchers retrospect the development of EIA (S. Wang, Liu, Ren, Zhang, & Wang, 2009; J. Wu, Chang, Bina, Lam, & Xu, 2011); some researchers conduct case studies, and

some researchers use checklist method to examine the effectiveness of EIA in China (Aung, Fischer, & Shengji, 2020).

Wang, Morgan and Cashmore (2003) assess the likely prospects of the EIA Law on project-level EIA by establishing the historical context of the EIA process, considering the main concerns relating to the institutional and procedural arrangements, and discussing the practical implementation of the EIA process. Lv (2006) tries to apply the circular economy principle to EIA to improve its effectiveness. The concept of circular economy can be incorporated into EIA by revising the institutional provisions, constructing a circular economy indicator system, and revising the EIA Guidelines. In addition, it is necessary to adjust the evaluation objectives, assessment contents, and evaluation method. L. Zhang (2007) optimizes the prediction and evaluation process of highway noise to improve assessment accuracy. Sun (2008) attempts to establish an evaluation system by studying the influencing factors of the effectiveness of PEIA. Through examining the implementation of the "Technical Guidelines for Planning Environmental Impact Assessment (Trial)" and reviewing EIA reports, the problems of implementing China's PEIA are analyzed, and the countermeasures to improve its effectiveness are put forward. Ran (2013) studies the effectiveness of EIA based on the "State-Structure-Performance" (SSP) pattern. The analysis shows that the performance of EIA system leans to the government and the owner which are minorities in society, but the environmental rights and interests of public which is majority in society are insured formally not virtually and eventually lead to a departure from the system design and system goals. Z. Tan (2010) proposes the effectiveness evaluation indicators for Project EIA and SEA, respectively, and recommends incorporating the environmental health indicator. H. Wang (2014) discusses SEA effectiveness's conceptual connotation and characteristics and builds the conceptual models, including procedural effectiveness and action effectiveness. The Fuzzy Comprehensive Evaluation method is also used to evaluate the SEA effectiveness of Tianjin Binhai New Area. Guo (2017) identifies the influence factors of PEIA's effectiveness and constructs an evaluation system by adopting the Analytic Hierarchy Process - Fuzzy Comprehensive Evaluation (AHP-FCE) method; the effectiveness of Overall Planning EIA for the development of Nanyang new district is evaluated using this system.

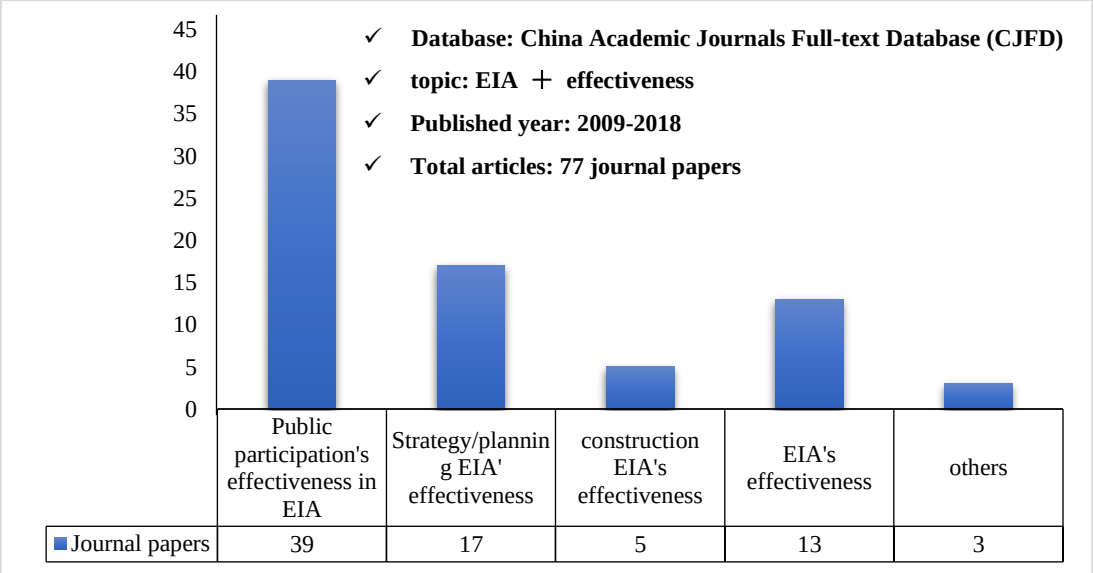


Figure 1.8. EIA effectiveness-related journal articles in China Academic Journals Full-text Database (CJFD)

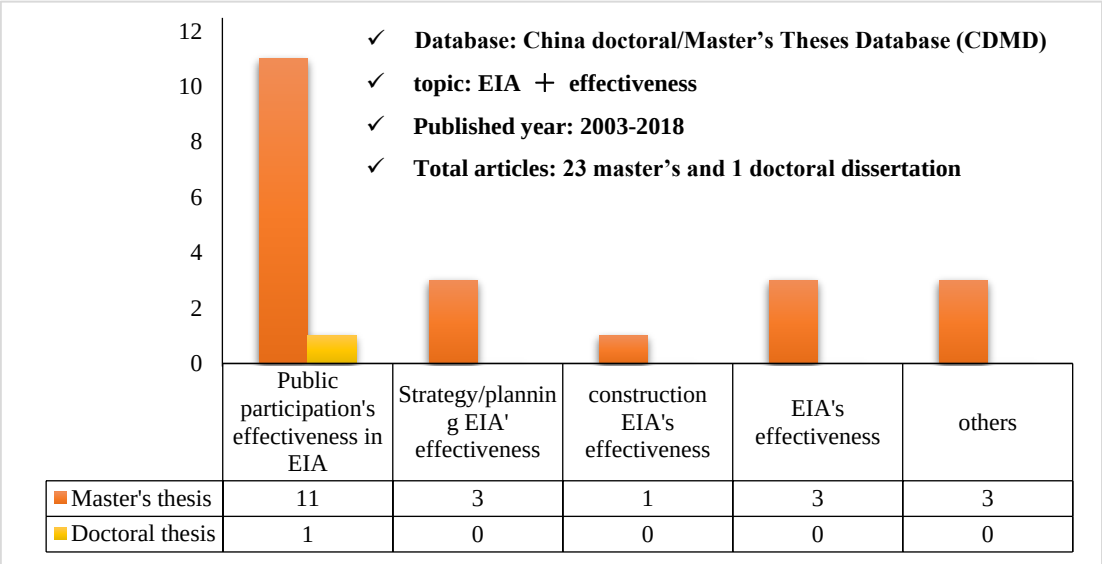


Figure 1.9. EIA effectiveness-related dissertations in China doctoral/Master's Theses Database (CDMD)

Table 1.6. Researches on China's EIA system

Classification	Author	Topic	Language	Type
Comparative studies	Kultip (2016)	China, Japan, Thailand	English	Journal paper
	X.B. Zhang (2010)	China, Japan	Chinese	Mater's dissertation
	Y. Li (2017)	China, Canada	Chinese	Mater's dissertation
	G.L. Liu (2016)	China, England	Chinese	Mater's dissertation
	L.L. Wu (2016)	China, Korea	Chinese	Mater's dissertation
	Q. Zhao (2016)	U.S.A, German, Korea	Chinese	Mater's dissertation
	Fan. Chen (2017)	U.S.A, Canada	Chinese	Mater's dissertation
Quality of EIA Report	Y. Zhang (2002)	36 EIA reports within 1991-2000 (Shanghai)	Chinese	Journal paper
	M. Yin (2004)	80 EIA reports within 1995-2002 (Shenzhen)	Chinese	Journal paper
	G.H. Jin (2017)	1163 EIA reports within 2010-2015 (Jilin)	Chinese	Journal paper
Effectiveness evaluation ✓ **Case study** ✓ **Retrospect** ✓ **Perception investigation**	H.Z. Wang (2012)	Measurement indicators and evaluation of SEA effectiveness	English	Journal paper
	T. Aung (2020)	EIA's system effectiveness in the countries along with the belt and road initiatives	English	Journal paper
	O. Bina (2011)	An inquiry into the concept of SEA effectiveness	English	Journal paper
	Y. Wang (2003)	The effectiveness of Project EIA	English	Journal paper
	J. He (2011)	Experts' perspective on the performance of Chinese technical guidelines for Plan EIA	English	Journal paper
	S.J. Wang (2009)	The development and practices of SEA in Shandong Province, China	English	Journal paper
	J. Wu (2011)	SEA in China —Five-year review and prospects	English	Journal paper

Literature gaps

After the thoroughgoing literature review, the main research perspectives have been understood, and past research achievements have been summarized. However, several literature gaps can be found.

First, the research on the effectiveness evaluation in China is still limited. Compared with the developed countries, the number of studies on EIA effectiveness in China lags. Especially, the discussion on the term "effectiveness" is not enough. Most studies try to give suggestions to the EIA system in China by comparing the EIA system with other countries. With the implementation of a series of reforms on EIA, improving the effectiveness is seen as an important goal. Therefore, it is significant to evaluate the effectiveness of reformed EIA.

Second, the discussion on the evaluation model in China's context is lacking. Some researchers use the AHP method to evaluate the effectiveness of Planning EIA. Nevertheless, the evaluation model has seldom been used. Instead, some studies propose the influence factors or evaluation criteria. There is little discussion on to what extent it is vital in China's context and on the mechanism of how it is revised. The statistical study is also limited. Thus, the criteria are necessary to be revised to fit the reformed EIA, taking into consideration of each reform's objective.

Third, although achieving sustainable development is seen as the final objective of EIA, there is no article examining to what extent China's EIA system embraces sustainability. The researches on procedural effectiveness occupy the most. Discussion on some other dimensions, especially on normative effectiveness, is insufficient. The international-acknowledged performance indicators have not been statistically discussed, and the research gap between China and the international context has not been explored. Under the extraordinary period to transfer the emphasis from Project EIA to SEA, it is significant to evaluate the effectiveness of SEA/Planning EIA.

1.4 Objectives and framework of the dissertation

According to the research gaps mentioned above, three objectives are put forward in this dissertation.

First, an effectiveness evaluation system appropriate to China's context is constructed. The evaluation models proposed by past researchers are adopted and further revised. The revised model can be used to examine the current status of EIA in China and can be borrowed by other countries, especially for countries with very similar EIA systems.

Second, the effectiveness of reformed Project EIA and SEA/Planning EIA can be evaluated, respectively. The achievements of a series of reforms on EIA are identified, and the inadequacies are also pointed out. The extent to which China's EIA complies with the international-acknowledged principle is examined, and to which the reforms realize the objective of "streamlining administration, delegating more powers, improving regulation and providing better service" is discussed.

Third, the specific improvement measures are specifically put forward, and the EIA system can be optimized. It is helpful to realize the transition from Project EIA to SEA. By improving EIA's effectiveness, it is beneficial to increase EIA efficiency, reduce EIA expense, mitigate environmental pollution, and realize sustainable development.

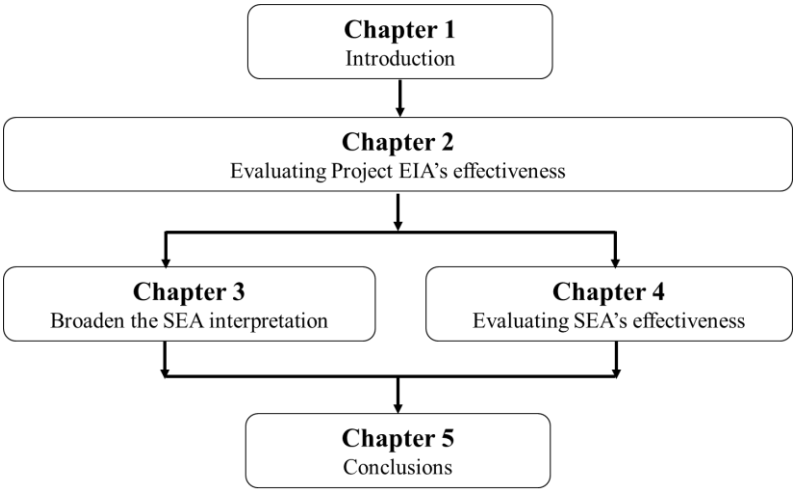


Figure 1.10. The structure of dissertation

The structure of this dissertation is depicted in **Figure 1.10**. Chapter 2 describes the effectiveness evaluation for Project EIA, and Chapter 3 and Chapter 4 for SEA. All the evaluations contain three steps: propose the evaluation model, revise the evaluation criteria and evaluate the effectiveness. The evaluation is all descriptive assessment. The advantages of EIA in China are described, and the inadequacies are also pointed out. For Project EIA, Ahmed and Wood's model (2002) has been adopted, including systematic measures and foundation measures. Document analysis and interviews with experts are used to revise the evaluation criteria. For SEA, Baker and McLelland's effectiveness evaluation model (2003), Bond's sustainability assessment model (2012) and J. Arts's conceptual model (2012) are integrated, which involves seven effectiveness dimensions: procedural, substantive, transactive, normative, contextual, knowledge and learning, and pluralist effectiveness. A meta-analysis of 68 papers from 2009 to 2019 is conducted to analyze each dimension's evaluation criteria statistically.

Chapter 2. Evaluating Project EIA's Effectiveness

In 2015, at the beginning of the 13th Five-year Plan (2015-2020), six severe problems in China's EIA system were pointed out by the inspection team. Then, an EIA "reform storm" opened up[6]. To improve the effectiveness of EIA is seen as the mainline. Under the guidance of the implementation plan, EIA reforms have been carried out to streamline administration, delegate more powers, improve regulation and provide better service. Especially, these reforms influenced almost all the phases of Project EIA, such as adjusting project catalogs requiring conducting EIA, facilitating the preparation of Environmental Impact Statement (EIS), simplifying the review process, shortening the approval time, enhancing public participation, reinforcing supervision and aggravating penalties. Hence, it is of great significance to evaluate the effectiveness of reformed Project EIA. This chapter tries to evaluate its procedural effectiveness, which is helpful to analyze the institutional reforms on EIA and lay the foundation for future studies on some other effectiveness dimensions.

2.1 Research purpose and framework

2.1.1 Previous studies on Project EIA's effectiveness

Once the EIA Law (2002) was promulgated, Wang, Morgan and Cashmore (2003) evaluated the effectiveness of Project EIA and pointed out that despite the new law, the EIA in China still faces the old problems. X. Ren (2013) analyzed the main reasons for weak EIA enforcement and implementation: the political system and incentive mechanisms, institutional arrangements, and regulatory and methodological shortcomings. Jia et al. (2011) compared the technical guidelines for Plan EIA between old and new versions. Z. Tan (2010) reviewed the effectiveness of China's EIA. He combined the past research progress and the problems existing in Project EIA to propose an effectiveness evaluation indicator system, including the first-class index of the EIA report, the realization degree of EIA, environmental management, and public participation. However, since 2015, when the "reform storm" started, the development of EIA in China and the comparison before and after reforms have not been sufficiently discussed by past researches. The most important, no evaluation model appropriate for the reformed EIA system is proposed yet.

Loomis and Dziedzic (2018) reviewed 59 relative articles from 1996 to 2016 and summarized the methods used in procedural effectiveness studies, which are listed in **Figure 2.1**. It can be revealed that national case studies (both single and comparative) dominate while subnational case studies are few. Some researchers examine the EIA system by using history-tracing to expatiate the evolution of the EIA system and explain the strengths and failings (Gibson, 2002). Some studies use an environmental statement review package to analyze EIS content (Lee, 1999). Some papers evaluate the EIA performance employing the checklist, including some criteria based on the effectiveness dimension (Gallardo and Bond, 2011). The most popular method for evaluating EIA systems procedurally has been the 14 criteria of an ideal EIA system established by Wood (1995) that subsequent authors have adopted for comparing EIA systems. Over time, it has been validated because authors have expanded and adapted these criteria to examine both developing and developed countries. Many studies conduct documental analysis and interview surveys. Some studies also adopt qualitative methods, such as qualitative comparative analysis (Befani and Sager, 2006), realistic evaluation (Pawson and Tilley, 2008); and quantitative methods, for example, statistics.

[6] The list of reforms is shown in **Part 1.2.2.**, **Table 1.3.** The list of reforms on EIA since 2015.

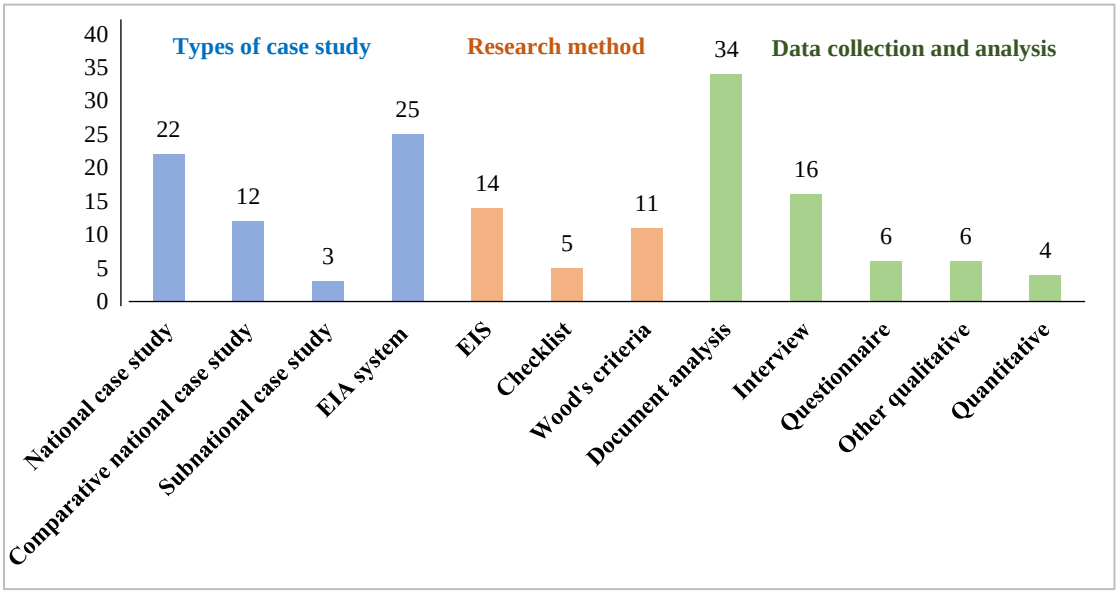


Figure 2.1. Methods used in procedural effectiveness studies

(Source: John J., 2018)

2.1.2 Research purpose and method

In this chapter, the EIA system before and after reforms is compared firstly. Then, Ahmed and Wood's model is revised to make it appropriate for the Chinese context. At last, the effectiveness of the reformed Project EIA system is evaluated against the proposed criteria. The research framework is depicted in **Figure 2.2**. The legislation and regulations, official policy interpretations, academic articles and news reports in the past ten years are extensively reviewed. The formal official documents show well the reform intentions and actions of the government. At the same time, the news reports can speak out the comments of experts, the complaints of the public and NGOs, and the suggestions of EIA engineers. As a supplement, the in-depth semi-structured interviews are conducted with six senior EIA engineers who have many years of work experience.

To revise the evaluation criteria, the important notions mentioned many times by the literature review and interviews are identified, then the in-related sub-criteria are deleted, the important ones are added, and the criteria are reclassified. To conduct the descriptive evaluation, the documents and past researchers' comments are analyzed, which is supplemented with the opinions of interviewees. The interview questions cover all evaluation criteria and the problems being found in the literature review. To guarantee an unbiased survey, the interviews use opening questions, for example: "How do you think about…?" In the following discussion, the interviewees are represented by a simple code to preserve their anonymity.

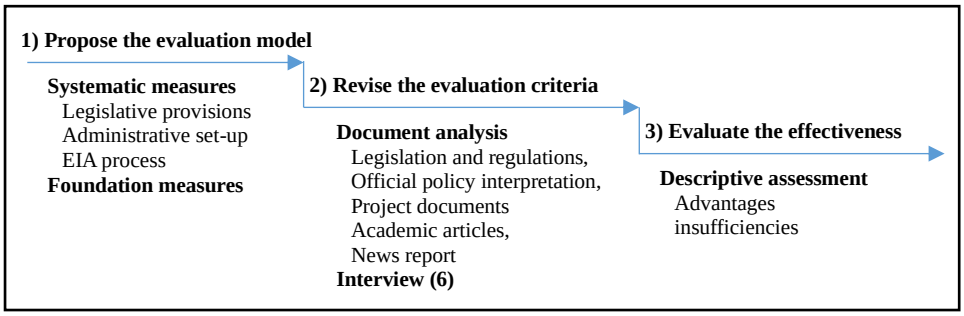


Figure 2.2. Framework for evaluating the effectiveness of the reformed Project EIA

2.2 Institutional arrangements for Project EIA

2.2.1 Legislative provisions

The Environmental Protection Law (EPL) is the backbone of environmental legislation, which is complemented by several specific laws related to environmental elements such as atmospheric, water and noise pollution prevention and control (Y. Wang et al., 2003). Besides, a package of laws and regulations describes how EIA should be carried out. Commonly referred to as "one law and two regulations", the most relevant ones are the EIA Law, Regulations on Environmental Protection Management of Construction Projects (REPMCP) and Regulations on Planning EIA (RPEIA) (C. Bao, 2015).

The REPMCP (Ning, Wang, & Whitney, 1988) was issued in 1998 and stipulated the environmental protection tool, including "Three Simultaneities (3Ss)" and "EIA". 3Ss requires the environmental protection facilities to be designed, constructed and operated simultaneously with projects, while EIA is responsible for giving approval before the construction of projects. The EIA Law was implemented in 2003 and mentioned the importance of EIA for regional or inter-regional Planning. However, in the following years, most attention was focused on Project EIA. To reinforce the Planning EIA, the specific law, RPEIA, was issued in 2009. As a result, the EIA system of "one law and two regulations" was officially established. With economic growth and social development, reforms were carried out to streamline administration and strengthen supervision (Liu, 2019). The EIA Law was revised in 2016 and 2018. Accordingly, the RACPEP was revised in 2017.

2.2.2 Administrative setup

The Ministry of Ecology and Environment of the People's Republic of China (MEE), being established in March 2018, takes the overall responsibility for environmental management and protection in China and opens a new era of "super-ministry" (Ma & Liu, 2018). In the past, the environmental protection duties were dispersed in many different departments such as Ministry of Environmental Protection (MEP), National Development and Reform Commission (NDRC), Ministry of Water Resources (MWR), and Ministry of Agriculture and Rural Affairs (MARA). To speak of the awkward fragmented situation of environmental protection, the former minister Zhou (2013) said that "Even the emission of carbon monoxide (CO) and carbon dioxide (CO_2) is managed by two different departments". MEP is responsible for "CO", which represents air pollution, while NDRC is in charge of "CO_2", the metaphor for all the causes of the greenhouse effect. Nowadays, MEE integrates the scattered environmental protection responsibilities together and mostly helps to avoid the overlap of management responsibilities, the possible disputing over trifles between different departments and the high cost of coordination.

The Department of Environmental Impact Assessment and Emission Management within MEE is mainly in charge of overseeing and coordinating the implementation of EIA and emission permit (EP) nationwide, reviewing the Strategic and Planning EIA, technically re-reviewing the Project EIA and conducting the work of post-EIA (MEE website, accessed on 2018.10.8)[7]. It is set up with five offices, with each office manages different issues. The general office is responsible for the overall coordination work, formulating and implementing the relevant regulations and standards related to EIA and EP. Office of strategy and Planning EIA regulates not only the work of Planning EIA, but also the implementation of newly-set environmental protection methods for EIA system called "three lines and one list" that is "red line of ecological protection, the bottom line of

[7] http://www.mee.gov.cn/xxgk2018/xxgk/zjjg/jgsz/201810/t20181008_644811.html, accessed on 2018.10.8.

environmental quality, the up line of resource utilization, and negative list of environmental admittance". Office 1 and office 2 of EIA and EP for stationary pollution source is in charge of the industries mainly affecting ambient air and water quality, while the office of resource development and infrastructure EIA (abstracted as ecological EIA) reviews the EISs focusing on the ecological environment. The arrangement is in accordance with the principle of reform that strengthening the connection between EIA and EP, which are mutually complementary. EIA analyzes and forecasts pollutant emission based on the facilities and technologies that might be quipped by the project before construction. At the same time, after the operation, the EP can help monitor the pollutants' emissions and inspect the operation of environmental protection facilities (Chang, Wang, Wu, Sun, & Hu, 2018).

The Appraisal Centre for Environment and Engineering, established in 1992 and now subordinated under MEE, is responsible for providing technical support for MEE, conducting EIA technical reviews and training for EIA agencies and Ecological and Environmental Protection Bureaus (EEPBs) (Appraisal center website, accessed on 2020.3.20)[8]. The EEPBs are responsible for ecological and environmental protection within their jurisdictions.

2.2.3 Project EIA process

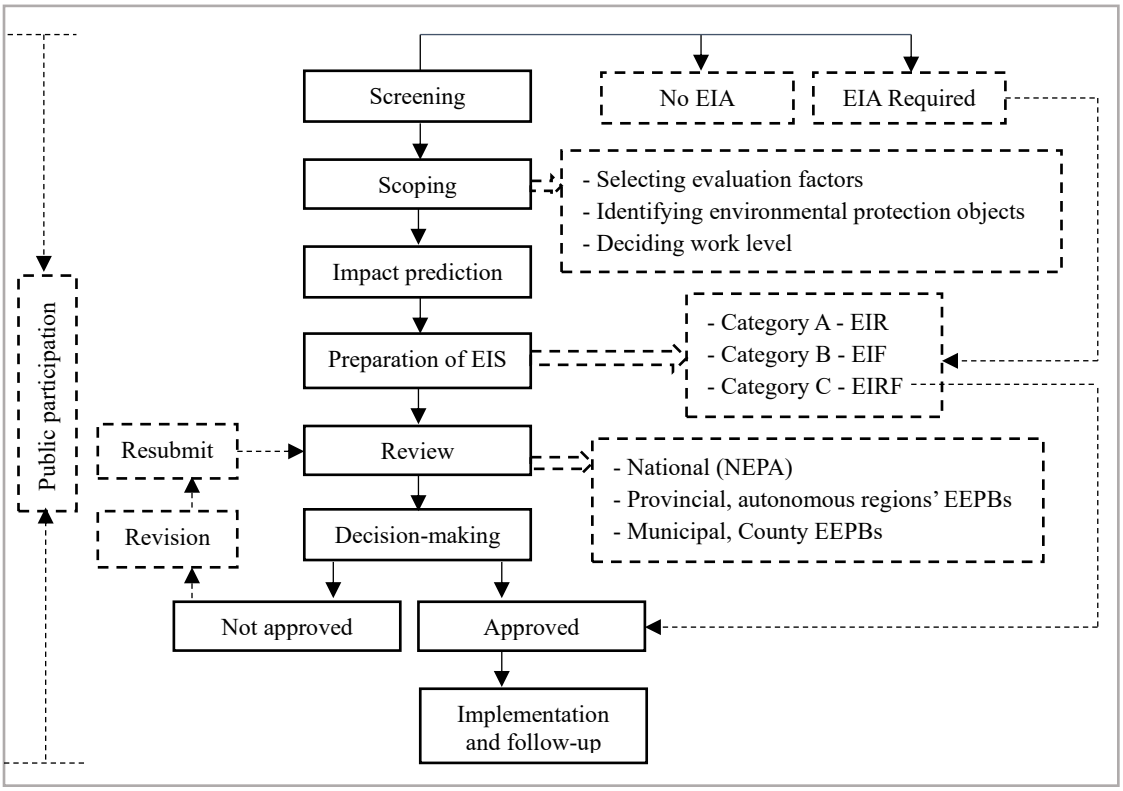


Figure 2.3. Project EIA Process in China (Source: TGs)

Screening

As shown in **Figure 2.3.**, the process of Project EIA in China is fully compatible with the generic steps that are followed internationally. The EIA process starts with a screening process using list and threshold approaches. An EIA categorized management is conducted. Whether a project is necessary to conduct EIA refers to a Catalog, which elaborates a list of projects belonging to three

[8] http://www.china-eia.com/zxjj/, accessed on 2020.3.20.

categories. (Article 16 of EIAL, 2016; Y. Wang et al., 2003; Suwanteep, Murayama, & Nishikizawa, 2016):

Category A: Projects requiring an Environmental Impact Report (EIR), which are likely to cause a significant environmental impact.

Category B: Projects requiring preparation of an Environmental Impact Form (EIF), which are likely to cause some environmental impacts.

Category C: Projects requiring submission of an Environmental Impact Registration Form (EIRF), which are not expected to cause significant environmental impacts.

To measure the magnitude of environmental impacts, a threshold method is used, which takes into account the project's features such as its scale, output and pollutants' emission volume and location's environmental sensitivity such as its ecological, archaeological and cultural value. The Catalog is issued by MEE at the national level and complemented by provincial regulations. For example, Shanxi Province stipulates the regulation measures for the projects which are not listed in the Directory in 2016.

The project categories subject to the Project EIA involve light industry, chemical industry, metallurgy, construction material, agriculture, mining, nuclear and transportation. And the transportation sector can be further divided into six small sectors: highway, railway, subway, airport, seaport, and channel. Xu, Murayama and Nishikizawa (2016) analyzed the EIA reports in 2014 and found that the transportation sector was represented with the greatest percentage (34%) in the total number of EIA reports, followed by the nuclear industry (18%), construction material sector (16%), mining sector (13%), and agriculture sector (12%). The percentage of project category is illustrated in **Figure 2.4**.

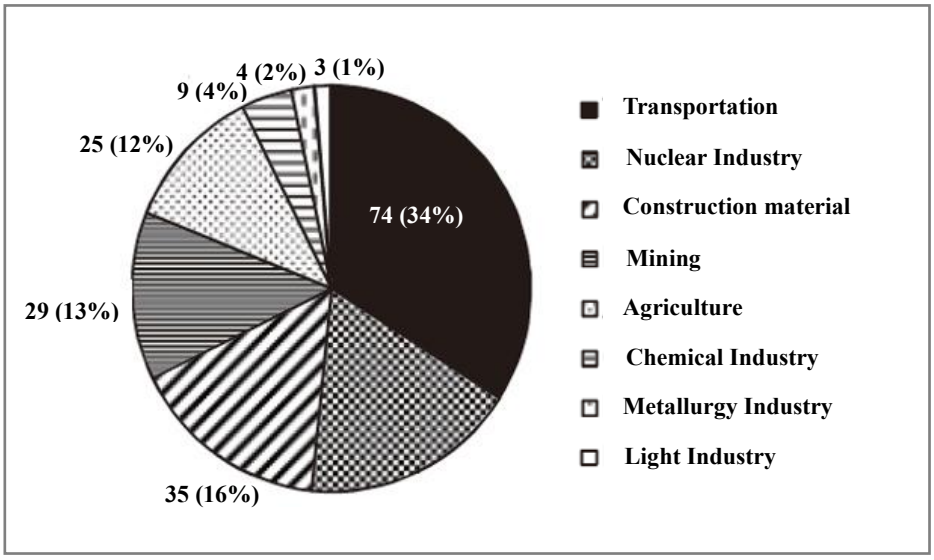


Figure 2.4. Percentage of project category in 2014
(Source: Xu, Murayama and Nishikizawa, 2016)

Scoping

Scoping, in the EIA process, is a necessary procedure for subsequent evaluation and assessment. EIA engineers should complete the action outline in this scoping period. Through the preliminary analysis of engineering projects and baseline analysis of the existing environmental status quo, the environmental impacts should be identified and the evaluation factors should be selected. Then, working levels I- III, in descending sequence of the severity and sensitivity of impacts, are identified,

referring to the relevant laws, regulations and technical guidelines (TGs). Corresponding to each working level, the evaluation scope and ambient standards can also be proposed. The ambient standard and emission standards with which construction projects must comply corresponds to the environmental zoning where projects are located (X. Ren, 2013). Also, environmental protection targets need to be listed, such as the environmental sensitive zones, the name and function of the protection targets, their location relationship with the projects, the corresponding environmental requirements (TG, 2016).

Impacts prediction and evaluation

Following the above action outline and working levels, EIA engineers further conduct the impact prediction procedure. Two parts of analysis are included, namely the monitoring and evaluation of environmental status and the engineering analysis of the project (TG, 2016). The emphasis is that engineers predict possible changes in environmental components caused by construction projects using the appropriate prediction methods and techniques provided by TG. The examinations for pollution-producing projects and ecology-influencing projects are different. The former needs to clarify each pollution-producing node in production technics, while the latter mainly discuss the ecological impacts during construction, operation and decommissioning phases. Then, specific environmental protection measures should be proposed, following which cost-benefit analysis is required to evaluate its monetary value to coordinate economic cost and environmental protection (Y. Wang et al., 2003). Based on all the analyses, EIA engineers assess whether the construction project meets the environmental standards or not.

Preparation of Environmental Impact Statement (EIS)

The EISs are compiled from all the above analyses. For low-impact C-category projects, developers can compile registration forms (EIRF) by themselves and, thanks to the reform, simply submit them online. For B-category projects, simplified forms (EIF) are sufficient, but detailed reports (EIR) are required for high-impact A-category projects. Before the reform, developers had to contract EIA agencies to compile EIF and EIR. From 2018, developers are also allowed to do it themselves, but the main compilers are required to be qualified engineers (revised EIAL). The EIA Law (2016) prescribes the content of EIR, which includes baseline analysis, impact prediction, evaluation, mitigation and conclusion.

Review of EIS

EEPB is in charge of reviewing EIR and EIF. Jurisdiction for approving an EIR and EIF is split across three tiers: (1) national environmental protection authority (NEPA), (2) provincial, autonomous regions or municipal EEPBs, (3) county EEPBs (Y. Wang et al., 2003). Typically, the catalogs of construction projects EIA at the national and provincial levels precisely stipulate what types of projects are to be examined at what level. For types of projects that are not listed in the catalogs, the provincial EEPB decides whether they are required to do EIA or not. After the reform called “streamline administration and delegate more powers”, some types of projects previously reviewed by higher authority are delegated to lower bureaus. For example, the thermal power plants, which required national review before 2015, now get approval directly at the provincial level.

Decision-making

After reviewing the EIS, the NEPA and EEPBs decide as to whether to grant permission to a construction project (Y. Wang et al., 2003). For EIR, this decision should be given within 60 days, while 30 days for EIF. EIRF does not need to get approval from EEPBs and only needs to finish online registration since 2016. To make a decision, the EEPBs organize a technical review meeting

which includes EIA experts, relative industry experts, EEPBs representatives, EIA engineers and developers. After document discussion and field investigation in the meeting, the negative or positive comments are given. According to the comments, the EIS needs to be revised and resubmitted to EEPBs. Then, the EEPBs decide whether or not to give approval to developers. Usually, the EEPBs tend to organize the review meeting again when negative comments are given. The developers cannot conduct construction before getting EIA approval (EIA Law, article 25).

2.3 Ahmed and Wood's model

2.3.1 Description of the model

In 1995, Wood established 14 criteria of an ideal EIA system to test the performance of eight EIA systems, including those of the United States, the Netherlands and Canada. Ahmad and Wood (2002), additionally added ten criteria and classified them into systemic measures and foundation measures. The systemic measures are defined as "features of EIA systems that are designed to deliver quality assurance in the practice and administration of EIA". They aim at evaluating the performance of EIA system attributes, including legislative provisions, administrative setup and EIA process. Foundation measures are described as "features which promote good practice and underpin the successful application of the systemic approaches", such as training and capacity building. Afterward, Ahmed and Wood's criteria have been extensively used in many countries, including the Middle East and North African countries, India and Iran (Naser, 2012; Khosravi, Jha-Thakur, & Fischer, 2019), as shown in **Table 2.1**. Thanks to the inclusion of foundation measures, Ahmed and Wood's ideal evaluation criteria are appropriate for evaluating the reformed EIA system in China, which tends to pay more attention to supervision and penalties.

Table 2.1. Extensively application of Wood's criteria in procedural dimension (Source: K. Fatemeh, 2019)

authors	Criteria	EIA system	Source of data		
			Literature review	Document analysis	Interview
Wood (1995)	Wood (1995)	International context	●		
Annandale (2001)	Modified Wood (1995)	Maldives EIA system	●		
Ahmad and Ferdausi (2016)	Annandale (2001)	Bangladesh EIA system	●		
Aung (2017)	Annandale (2001)	Myanmar EIA system	●		●
Ahmed and Wood (2002)	Ahmed and Wood (2002)	Egypt, Turkey, and Tunisia			●
Badr (2009)	Ahmed and Wood (2002)	Egypt EIA system			●
Wayakone and Makoto (2012)	Ahmed and Wood (2002)	Lao EIA system	●		
Moradi (2009)	Ahmed and Wood (2002)	Iran EIA system	●	●	
Nadeem and Hameed (2008)	Adapted Wood (1995), Ahmed and Wood (2002), Fuller (1999)	Pakistan EIA system	●		●
Khosravi (2019)	Nadeem and Hameed (2008)	Iran EIA system	●	●	●

2.3.2 Revision of evaluation criteria

Through document analysis and in-depth interviews with experts, the frequently mentioned notion can be identified, according to which some irrelated evaluation criteria are deleted, some important criteria are newly proposed and then reclassified them into different evaluation dimensions. The revised model is shown in **Table 2.2**. The newly proposed criteria are marked with circles, and the criteria covered by reforms are marked with triangles. By comparing the criteria with reforms, it can be demonstrated that this revised model is appropriate to evaluate the effectiveness of the EIA system in China because all the reforms can be examined. Especially, the reforms are greatly related to all the legislative measures, including the sufficiency of EIA legal basis, operability of legislation and regulations, adequacy of technical guidelines, guidance for EIA implementation at the local level, and formal provisions for SEA; and most of the foundation measures, including systematic supervision measures, effective warning and deterrent of penalties, the existence of legislative provisions for appeals, existence of training of various stakeholders, strict quality control system in EIA agencies, and coordination with other pollution control measures, for example, cleaner production audit, three simultaneities system.

Table 2.2. EIA evaluation criteria: systemic and foundation measures (Source: Adapted from Ahmad and Wood, 2002)

Criteria	Sub criteria	Newly proposed	Covered by the reforms
Systemic measures			
1 Legislative provisions	1.1 Sufficiency of EIA legal basis		▲
	1.2 Operability of legislation and regulations	●	▲
	1.3 Adequacy of technical Guidelines		▲
	1.4 Guidance for EIA implementation at the local level	●	▲
	1.5 Formal provisions for SEA		▲
2 Administrative set-up	2.1 specified EIA review body		▲
	2.2 Existence of supervision authority	●	▲
	2.3 Specification of industry authorities' responsibility		
3 EIA process	3.1 Specified screening categories		▲
	3.2 Systematic scoping approach		
	3.3 Requirement for impacts prediction		
	3.4 Specified EIS content		▲
	3.5 Systematic decision-making approach		▲
	3.6 Requirement for monitoring		
	3.7 Public participation in the EIA process		▲
	3.8 Requirement to consider alternatives		
	3.9 Requirement for EIA follow-up		
foundation measures	4.1 Systematic supervision measures		▲
	4.2 Effective warning and deterrent of penalties	●	▲
	4.3 Existence of legislative provisions for appeals	●	
	4.4 Existence of training of various stakeholders		▲
	4.5 Strict quality control system in EIA agencies	●	▲
	4.6 Coordination with other pollution control measures	●	▲

●: Sub criteria developed by the author.

▲: Sub criteria that are either explicitly mentioned or practically covered by the EIA reform storm in China.

2.4 Evaluation of Project EIA's effectiveness

2.4.1 Legislative provisions

The evaluation from systemic measures is shown in **Table 2.3**. In the past, China paid the most attention to Project EIA, which only reject the construction of a single project while not influence the initial decision and layout. Nowadays, the Strategic EIA (SEA), which refers to EIA for policies, plans and programs (PPP), has been given more emphasis, aiming to incorporate environmental protection into the decision-making process (Shujun Wang et al., 2009). Generally, a tiered system exists among PPP that starts with policy formulation at the upper level, followed by the plan at the second stage, and the program at the end (Wood & Dejeddour, 1992). However, the SEA hierarchy in China is incomplete.

SEA in China only covers "plan," called Planning (guī huà) EIA (RPEIA). As is required, the Project EIA should be accordant with the local Planning EIA. However, its implementation is low, and many projects still do not have Planning EIA to follow (interviewee #2, 2019). As to "policy," although Article 14 of EPL (2015) mentions 'the governments need to take the environment into consideration when they formulate economic and technological policies,' there are no corresponding regulations to stipulate and guide the implementation of Policy EIA. As to "program," it is missing in Chinese characters (K. Y. Zhou & Sheate, 2011). The actions meeting the definition of "program" made by Wood and Dejeddour (1992) is, in practice, subject to Project EIA, which makes their EIA measures and technologies inappropriate.

Besides, the revised EPL came into force in 2015 and was regarded as the ever-strictest. However, the hierarchical position of EPL is not high enough to ensure the force of law. EPL has the same hierarchical position as other specific laws, such as Water Law and Forestry Law. That is, the specific laws do not have to be entirely in accordance with EPL(Chang, 2014). This may lead to a possible conflict between them and give the developers an excuse to comply with specific laws other than EPL. As a result, the strict legal provisions of EPL easily become empty talk.

2.4.2 Administrative measures

With the implementation of the vertical management reform for EEPBs under the provincial level since 2016, the administrative setup is more efficient and effective. The relationship between local governments and environmental protection departments changed. The management of EEPBs altered from local governments to higher-level of environmental protection authorities. The provincial EEPB is in charge of municipal EEPBs, who is supervising counties' EEPBs. Besides, the supervision of environmental protection is retrieved to provincial EEPB, and the right of law enforcement is decentralized to municipal and county levels. After the reform, the local government is not responsible for the establishment, personnel and funding of EEPBs anymore, but the higher-level EEPBs (MEE, 2016). As a result, the intervention from the local government decreased.

X. Tan et al (2018) pointed out that this reform is still at the initial stage, and there are still several problems to tackle. For example, how to guarantee the implementation of environmental responsibility of local governments after they lose control of local EEPBs, how to coordinate the relationship between EEPBs with other local environmental protection departments, and how to strengthen the supervision of local EEPBs. Indeed, this vertical management reform needs to be improved. It is undeniably an excellent attempt to reduce the interference of local governments on EEPBs and strengthen the overall management of environmental protection in the whole province.

1

Table 2.3. The evaluation from systemic measures

Criteria and Sub-criteria	Performance of Reformed EIA	
	Advantages	**Inadequacies**
1. Legislative provisions		
1.1 Sufficiency of EIA legal basis	● EPL is supplemented with specific laws on environmental components and typical industry; EIA Law is supplemented with specific laws of Projects EIA and Planning EIA.	● Lacks specific laws for Policy EIA.
1.2 Operability of legislation and regulations	● The regulations at national levels are general; The ones at local levels are specific.	● The hierarchical position of EPL is not high enough; Some legal terms are too general, easily result in different interpretations.
1.3 Adequacy of technical guidelines	● General TG is supplemented with specific guidelines for all environmental components and some industries.	● Too inflexible, result in unnecessary work.
1.4 Guidance for EIA implementation at the local level	● Exists regulations at the provincial level.	● Needs to be revised frequently.
1.5 Formal provisions for SEA	● Regulations on Planning EIA was issued in 2009.	● Lacks supporting laws to guide the implementation of Planning EIA.
2. Administrative set up		
2.1 Specified EIA review body	● For EIR and EIF: (1) state environmental protection authority (MEE), (2) provincial, autonomous regions' EPBs, (3) municipal, county EEPBs. For EIRF, online registration is required.	/
2.2 Existence of supervision authority	● MEE and EEPBs at different levels	● Vertical management reform of environmental monitoring and law enforcement departments under improving.
2.3 Specification of industry authorities' responsibility	● The pre-review of EIR for some industries was canceled since 2017.	/

Criteria and Sub-criteria	Performance of Reformed EIA	
	Advantages	**Inadequacies**
3. EIA process		
3.1 Specified screening categories	● List and threshold approaches. Projects are classified into three categories: A, B and C, according to their projects' features.	● Although the assessment methodologies are more specific, some regulations are too inflexible. It may lead to unnecessary work.
3.2 Systematic scoping approach	● Identifies the evaluation factors and working levelsI-III following TGs, which decides the evaluation scope and ambient standard.	● Too inflexible
3.3 Requirement for impacts prediction	● Evaluation of environmental status and project engineering analysis Analyzes each pollution-producing node in production techniques and ecological impacts; Evaluates the monetary value of environmental protection measures cost-benefit analysis.	● Too inflexible
3.4 Specified EIS content	● Required in article 17 of EIA Law.	● Too inflexible
3.5 Systematic decision-making approach	● Adopts technical review meetings. Article 11 of REPMCP lists the conditions of not giving EIA approval.	
3.6 Requirement for monitoring	● Randomly on-site investigation of projects, periodically selective examination of EISs and real-time monitoring of pollutant emission	
3.7 Public participation in the EIA process	● Public participation almost covers the whole EIA process.	● Not explicitly declare the environmental right of citizens.
3.8 Requirement to consider alternatives	● Focuses on technical options.	● No consideration of "without project" or "delay the project".
3.9 Requirement for EIA follow-up	● Article 27 of EIA Law If the construction and operation of projects are inconsistent with EIA requirements, the EIA follow-up needs to be conducted.	/

Source: Adapted from Ahmad and Wood (2002).

Table 2.4. The evaluation from foundation measures

Criteria and Sub-criteria	Performance of Reformed EIA	
	Advantages	**Inadequacies**
Foundation measures		
4.1 Systematic supervise measures	● The interim and post-event supervision has been strengthened.	
4.2 Effective warning and deterrent of penalties	● The penalties are more severe than before.	● Exists problems at implementation.
4.3 Existence of legislative provisions for appeals	● The Law of Executive Accusation is suitable for EIA appeal.	● The amount of lawsuit is low. ● The percentage of developers or public winning the lawsuit is low.
4.4 Existence of training of various stakeholders	● The training for EIA engineers is conducted regularly at a national level. ● Provincial EEPBs also conduct training for government officials and developers. ● Citizens can also get the information of EIA through media such as posters and news.	● The training for engineers is not compulsory and the minimum study time is not required.
4.5 Strict quality control system in EIA agencies	● The three-level review system inside EIA agencies are adopted.	● Lacks control of small projects
4.6 Coordination with other pollution control measures	● The coordination of EIA, three simultaneous system, and discharge permission system are strengthened.	

Source: Adapted from Ahmad and Wood (2002).

2.4.3 EIA process

Screening

The MEE periodically updates the catalog in response to knowledge, experience and lessons learned over time (X. Ren, 2013). With the progress of science and technology, some projects produce fewer environmental impacts than before and can then be moved from Category A to Category B or from Category B to Category C. For example, the tobacco production factories with an annual output above 300,000 boxes belonged to Category A are now classified into Category B, according to the catalog issued in 2018 (MEE, 2018b). As announced by MEE, in the first half of 2018, the number of projects compiling EIRF represents 80% of the whole EISs. Among the rest of the projects, only 8% of them compile the EIRs (MEE, 2018a). Compiling EIRF is more time and cost-efficient than EIR. In short, with the decentralization and adjusting of the projects list, the workload for the central and provincial governments decreased significantly.

Scoping

With social development and economic growth, pollution control technology, pollutant discharge standards, and environmental assessment technology have significantly changed. Thus, the Technical Guidelines (TGs) of general program, atmospheric environment, surface water, groundwater and soil, have been revised in recent years. The exposure drafts of TGs of sound and ecological impact have also been issued in 2019 (MEE, 2020). The new TGs adjusted the method of identifying working levels, amended the assessment content of each working level and updated the technology of assessment. Overall, the scientific rigor of the assessment increases. Interviewee #1 said: “the environmental standards are much stricter than before”. However, some terms are still ambiguous, and the different experts may have different interpretations, which makes the engineers confusing (Interviewee #3). Some TG regulations are too inflexible. The small projects are also required to cover some unnecessary content, leading to needless work (Interviewee #4).

Impacts prediction

As is required by TGs (2016), all the possible pollution impacts and ecological impacts should be analyzed, be it positive or negative, long-term or short-term, reversible or irreversible, direct or indirect, cumulative or non-cumulative. The literature increasingly recognizes that mitigation approaches should adopt a more holistic approach looking at broader landscape-scale impacts, cumulative impacts, as well as impact mitigation regarding ecosystem services and climate change (Pediaditi, Banias, Sartzetakis, & Lampridi, 2018). However, the EIA in China still gives priority to air, water, noise and solid waste and provides them with detailed guidance on appropriate prediction methods and criteria. For cumulative impacts, especially the non-pollution type, there remains a significant gap to be filled (Y. Wang et al., 2003; X. Ren, 2013).

Quality of EIS

Environmental impact statement (EIS), as the direct output of EIA, is often examined to show the effectiveness of the EIA system. Through evaluating the quality of 1163 EISs from 2011 to 2015 in Jilin Province, Jin et al. (G. Jin, 2017) found that the quality of EISs is gradually increasing. However, with the examination of selected EISs, the central government inspection teams pointed out many problems, as exemplified by the 201 administrative penalties given to 132 EIA agencies in 2016. Among them, above 36 agencies were given penalties more than twice. Reasons for penalties are various: some EISs’ qualities are too low; some agencies do not submit the inspection materials as required, and some EIA agencies’ quality control systems of EISs are not sufficient

(MEE, 2017). Generally speaking, the quality of EISs indeed increased, while there is still improvement space.

Review of EIS

With the implementation of the decentralization policy, the review efficiency has been dramatically improved. In the 2018 fiscal year, the number of construction projects conducting EIA is 91,686 in total, among which only 22 projects got approval from MEE at the national level. Besides, around 80% of construction projects do not need to be reviewed and are only required to do online registration because of the canceling of the review of EIRF (MEE, 2018a). However, local governments, driven by the desire of economic development, tend to give the EIA approvals to polluting industries leniently. In March and April of 2015, two low thermal coal power generation projects were rejected by the national environmental protection authorities for several reasons, including insufficient pollutant treatment technology and utilities and the excessive regional overcapacity of pollutant discharge. With the delegation of review responsibility of the thermal power industry from the national level to the provincial level since May 2015, these projects got the EIA approval from EEPB of Shanxi Province. Later in the same year, Shanxi province also gave EIA approvals to 21 similar projects within three months. The total installed capacity of those projects is significantly excessive (NGO, 2015). Therefore, the balance between regulation and centralization is hard to achieve. The catalogs need to be continually adjusted.

Decision-making

An EEPB gives the EIA approval to developers and reports to a higher level. However, the technical capacity of government officials is often limited, that they usually tend to consult with the EIA experts at the review meeting. Thus, the experts' interpretations of EIA legislative provisions substantially impact the quality of EISs. Most of the interviewees claimed that "The technical decision of whether giving EIA approval is in practically left to those experts' judgments, which is subjective" (Interviewees #2, # 3, #5). Some researchers also worry that the experts are under pressure to follow local governments' interests who tend to take economic development as the first priority (X. Ren, 2013). Therefore, sufficient supervision is essential to ensure the independence and impartiality of decision-making.

Monitoring

The follow-up monitoring measures are diverse and comprehensive, which is essential to ensure the concrete implementation of EIA. They cover both the construction and operation phases of projects. The developers are required to submit the results of monitoring during the construction phase to obtain operational approval from EPBs (Y. Wang et al., 2003). The environmental protection acceptance (EPA) is adopted to supplement the EIA. The EPA report is to examine and record the big changes of projects' nature, scale, location, production techniques, pollution control measures, or ecology protection methods, the monitoring of the environmental impacts during the construction phase, and the implementation situation of 3S systems (MEP, 2017).

In December 2017, the administrative examination and approval of EPA by EPB was canceled, and the developers are required to complete the online EPA by themselves and take the whole responsibility for the result (REPMCP). The developers can compile the EPA reports by themselves or contract the agencies to help them, then invite the relevant experts and government officials to give comments. As a result, the responsibility changed to the developers. The excellent point is that it encourages developers to pay more attention to environmental protection on their initiatives, not being compelled by the government. The problem lies in the insufficient capacity of developers.

Interviewees #1 and #5 said that "The developers always feel confused about the EPA process; they still invite the experts and government officials to give comments".

Public participation

Public participation is obligatory during the whole EIA process. The revised MPPEIA (2018) declares a broader scope of public participation that includes the citizens, legal representatives and other organizations being influenced within the EIA scope. The ways of information disclosure are various that are defined as networks, newspapers and posting announcements. The content of the disclosure is much more detailed. Besides, the penalties are more severe; if any deception is found in the collection of public opinions, the information on construction projects, their legal representatives, and the EIA engineers may be disclosed to the public. Overall, the new MPPEIA makes public participation in China much more implementable. With the increasing awareness of environmental and civil rights, public participation is improving (Interviewees #4 and #5).

Consideration of alternatives

Consideration of alternatives lies at the heart of EIA while it is inadequately carried out in many countries (Gałaś et al., 2015). Although the General TG (2011) requires all EIAs to consider project alternatives (Article 14, TG), the alternatives considered only technical options such as variation of the project site, alignment, size, production process, environmental impacts and carrying capacity of the local environment. However, the strategic alternatives such as "without project" or "delay the project" are not mentioned (X. Ren, 2013; Ruan, 2016). Interviewees #4, #5, and #6 agreed that before conducting the Project EIA, there is an acquiescent condition that this project will finally be constructed; the only thing EIA needs to do is just setting the requirements it should comply.

2.4.4 Foundation measures

Supervision

The evaluation from foundation measures is shown in **Table 2.4**. In 2018, NEPA promulgated the Implementation Opinions on Strengthening the Interim and Post-Event Supervision of Construction EIA. The Opinions claim that it is time to relax the pre-construction approval with social development and economic growth while strengthening the interim and post-event supervision. It explicitly requires that the interim supervision includes the legality and validity of the EIA review, the professionality of technical review organizations, the facticity of EISs, the compliance of developers, and the involvement of public participants. The post-event supervision includes the monitoring of three simultaneous (3Ss) by EEPBs, the selective examination and recheck of EISs and the implementation of EIR by developers (MEP, n.d.). At the same time of simplifying EIA approval, the coordination of EIA, three simultaneous system, and discharge permission system are strengthened (Interviews #1, #4 and #5).

Online and offline supervision methods are adopted. The "Intelligence EIA" system integrates the online EIA review system with some other environmental management systems such as EPA system and EIRF record system. While realizing online management, the EIA data are also collected. Using the provided data, the supervision departments can further conduct supervision through on-site inspection, remote sensing check, and satellite verification. In 2018, the MEE began to conduct selective examines every three months. The results of the examinations are publicized on the government website.

To further ensure the quality of the EIS, the lifelong responsibility system and credit management system were also adopted. The EIA engineers compiling one EIS need to be responsible

for the quality of this EIS in their whole life. Whenever severe quality problems of EIS have been found, the related engineers are held accountable (EPL, RPEIA, IDMRAE (trial)). Besides, the relevant information of developers, projects and EIA agencies and engineers is required to publicize to the public on the online credit management system. For EIA agencies and engineers, their credit files are required to be established, and the penalties mentioned in EIA Law are also reflected in their credit score. Because of all these supervision methods, the engineers feel enormous pressure and try to ensure the quality of EISs (Interviewees # 1, #2 and #6).

Penalties

The fourth chapters of the EIA Law and REPMCP titled "Legal Liability" describe the penalties for violations to environmental authorities, agencies, developers and related personnel. For developers, who were found conducting illegal construction and operation, can remedially apply for the EIA approval after paying fines. However, the fines were much lower than the profits of developers' illegal operations. Thus, many developers prefer to pay fines rather than obey the legal process. In 2015, the EIA Law was revised, and this remedial measure was abolished. The fines have been increased as high as 1%-5% of the gross investment (Article 31, EIA Law 2016). It means that for the projects whose investment is above a hundred million, the fine can be significantly high. For those projects who illegally discharge pollutants and fail to rectify them within 30 days, the daily accumulated fines may be charged from the day they are required to rectify (Article 59, EPL 2014).

As to EIA agencies, the double-penalty system is adopted, which means that if the EISs are found having severe quality problems, both related organizations and personnel are punished (Article 31 and 32, EIA Law 2016). Besides, if any corruption is found during the EIA review process, the responsible environmental authorities may be given administrative or criminal penalties (Article 34, EIA Law 2016). Indeed, after these reforms, penalties became more severe, and the legal force much more robust.

Appeal

Under the Administrative Litigation Law, the administrative decisions made by EPBs at all steps of the process of Project EIA, such as administrative penalties, examination, information disclosure, neglect of statutory duty and compensation, can all be challenged in courts (ALL, 2017). However, Planning is still not subject to judicial review. From 2000 to 2014, even though the overall number remained low, the number of lawsuits grew gradually (Z. Jin, 2015). However, EPBs were overwhelmingly successful in the challenges under EIA law. In almost 80% of cases, EPBs defendants were cleared of charges. Among them, some court decisions did the judges of sustaining EPB's EIA decisions, while in most cases, the judges simply rejected the lawsuits or overruled the plaintiff's claims. It can be found that the judges tend to be highly self-restrained and deferential in reviewing EPBs' EIA decisions (Z. Jin, 2015). Thus, it is essential to avoid the complicated trade-offs and balances under the judicial review and further protect the right of action of developers, residents, and environmental groups.

Capacity building

The capacity of government officials in China remains limited. To give the final approval to developers, EEPBs usually consult with EIA experts' comments in the review meetings. Particularly, with the delegation of review authority to the county level, the local EEPB officials even do not know how to conduct the EIA review process (Interviewee #1, #2 and #6). For the last several years, more provincial EEPBs have begun to organize EIA experts to give policy interpretations for government officials and developers, which is helpful to improve their understanding of the EIA policy and review process.

As to EISs engineers, the Environmental Engineering Assessment Centre of MEE regularly conducts training courses about different professional skills. The unregistered and registered EIA engineers can selectively attend. Except for the training courses, they can also take the online study course (GCBCPEIA (trial), 2019). However, the attendance of training is not compulsory, and the minimum study time is not required. Interview #3 said that "some engineers escape from the courses for saving training expenses." It is still difficult to guarantee their competency and capacity.

2.5 Summary

This chapter elaborates on the reforms on EIA in China carried out since 2015 and evaluates the effectiveness of the reformed EIA system using revised Ahmed and Wood's (2002) model. Based on document analysis and literature review, supplemented with in-depth interviews, the advantages and inadequacies of reforms are pointed out, and several recommendations are put forward. Four main criteria are covered, among which legislative provisions, administrative setup and EIA process are concerning to systematic measures, the methods aiming at promoting successful application belong to foundation measures.

With the implementation of reforms, a set of corresponding laws and regulations were issued or amended. The revised EIA Law and TGs are more stringent than the old versions. The revised EPL was regarded as the ever-strictest. However, EPL has the same hierarchical position as other specific laws, which makes the strict legal provisions of EPL easily become empty talk. Although SEA has been paid increasing attention, there still lack specific laws for Policy EIA and supporting laws to guide the implementation of Planning EIA.

As to the administrative setup, government management is more efficient and effective. The establishment of the MEE in 2018 opened a new era of "super-ministry". It takes the overall responsibility for environmental management and ecological protection. Besides, the vertical management reform on environmental monitoring and enforcement departments was widely conducted below the provincial level. It is expected to realize the overall management of environmental protection at the national and provincial levels. However, what the overall management explicitly entails and how to realize it remains unclear. The coordination of different local government departments is also challenging.

To respond to the reforming principle of "streamline administration, delegate more powers, improve regulation and provide better service", the EIA process is greatly simplified. For example, the pre-reviews of EIS by industrial authorities are canceled, the review of the EIA registration form is simplified as online registration, and some projects previously reviewed by higher authorities are delegated to lower levels. The EIA approval is more efficient than before.

While relaxing the pre-construction approval, the interim and post-event supervision activities are strengthened, and penalties are more severe. The coordination between EIA and pollutants discharge permit systems is promoted. The "Intelligence EIA" system is adopted to conduct online supervision. The offline examinations of EISs are conducted regularly. The credit management and lifelong responsibility systems are adopted to constrain the EIA agencies and engineers. Besides, training courses are launched to improve the capacity of officials and engineers. All these measures make the engineers feel pressure to ensure the quality of EISs.

Overall, despite the problems occurring at the initial phase of the reforms, the effectiveness of the reformed EIA system is significantly improved. China simplifies the approval of Project EIA

while strengthening the post-event supervision and its coordination with the pollutants discharge permit system. In the foreseeable future, the role of Project EIA will be weakened, while the implementation of SEA will be improved. Given the identified insufficiencies in the reformed EIA system, several recommendations are put forward.

(1) The Strategic EIA should be further developed, and the EIA for Policy, Plan & Programme (PPP) need to be integrated into the early stages of the strategic-decision process. Subsequently, the construction projects should be in accordance with the regional planning and macroscale policy processes.

(2) The hierarchical position of EPL should be improved to ensure its concrete implementation. The relationship between EPL and specific laws should be coordinated, and supporting policies should also be issued.

(3) Vertical management reform on environmental monitoring and law enforcement department below the provincial level needs to be deepened. The responsibility list of environmental protection departments should be explicit.

(4) The initiative, activity and responsibility of local government officials should be further stressed to ensure the concrete interim and post-event supervision of EIA.

(5) The environmental right of citizens should be explicitly declared. Also, their right of appeal should be guaranteed.

(6) The relative provisions for consideration of alternatives should be considered.

Chapter 3. Broadening the SEA Interpretation

Strategic environmental assessment (SEA), as a decision support tool for predicting and evaluating the potential environmental impact of policies, plans, and programs (PPPs), has been used in more than 60 countries worldwide (Cape et al., 2018). The SEA was institutionalized in China in 2003 by the Environmental Impact Assessment Law (EIA Law; Yang, 2012), which required EIA for both construction projects and plans. Since then, SEA has been known in China as Planning EIA, and researchers in China use the two terms interchangeably (Gao et al., 2014). Nevertheless, compared with the internationally agreed tiered system among PPPs, China's SEA hierarchy is incomplete (Zhou & Sheate, 2011). By integrating the environmental consideration at the earliest appropriate decision-making stage, SEA promotes sustainable development (Hegazy, 2014). Given the superiority of Planning EIA, China is emphasizing it more than before.

In the period 2009–2019, many reforms were made to strengthen Planning EIA, and a set of regulations has been promulgated. The Regulation on Planning EIA was promulgated in 2009 (Decree of the State Council of the People's Republic of China [2009] No. 559). The Opinions for Strengthening the Linkage Between Project EIA and Planning EIA were issued in 2016 (Ministry of Environmental Protection, Environment [2015] No. 178), 2021). The Guidance for Compiling the Ecological Conservation Redline, Environmental Quality Bottom Line, Resource Utilization Upper Limit Line, and List for Environmental Permits (three lines and one list; trial) was published in 2017 (Ministry of Environmental Protection [2017] No. 99). In 2019, the Technical Guideline for Planning EIA (HJ130-2019) was revised to integrate "three lines and one list." In addition, the strategic-level EIA, which focuses on coordinating regional or cross-regional development and environmental issues, was emphasized and expected to provide a foundation for Planning EIA (Implementation Plan for the Reform of EIA in the 13th Five-Year, 2016). Overall, China is making an effort to construct a comprehensive SEA hierarchy that embraces the generally agreed international SEA principles and standards (Bina et al., 2009). This chapter aims to learn some lessons from the international SEA practices and broaden the SEA interpretation in China.

3.1 The SEA system

3.1.1 Definition and goals

The application of EIA at the project level is constrained by several well-documented deficiencies (Ram B. et al., 2013). For example, Project EIA is self-limiting (reactive), not forward-looking (proactive), and is ineffective in tackling the current scale and rate of global ecological deterioration; there are difficulties in assessing cumulative impacts; there is a lack of flexibility in considering alternatives and mitigation measures; and the impact of non-project actions such as fiscal policy, trade, and privatization cannot be assessed through an EIA. To address environmental issues at higher levels of decision, EIA is being applied under the name of SEA. However, it is still a relatively new concept, and its use is restricted mainly to developed countries.

SEA literature has insistently drawn attention to the lack of a precise definition for SEA and its objectives (Jiliberto, 2011). The conceptual evolution of SEA and the schemes or models that aim to classify the applications are changing through time and continue to evolve. The earliest definitions of SEA were strongly rooted in the concepts of project EIA, which defines the SEA as the systemic process of studying and anticipating the environmental consequences of proposed initiatives at high-level decision-making. As time went by, researchers started to move the key of the SEA concept

from environmental impact or consequences to a tool to mainstream environmental considerations into decision-making. Now, the world-acknowledged definition of SEA is: "a systematic process for evaluating the environmental consequences of a proposed policy, plan or program (PPP) initiative to ensure they are fully included and appropriately addressed at the earliest appropriate stage of decision-making". Later SEA definitions have gradually stressed that the aim of SEA is neither exclusively nor primarily to incorporate the consequences of decisions into decision-making processes, but to improve those processes themselves, clearly from an environmental perspective.

3.1.2 Its evolution process

Xiong and Mei et al. (2018) divide the development of Planning EIA in China into three phases: trial phase (The early eighties - 2003), propulsion phase (2003-2010), and promotion stage (2011 - now).

Trial phase:

Since the mid-1980s, along with China's reform and opening, there have been many regional development projects, such as economic and technological development areas, high and new technology industrial development zones, tourist resorts, tariff-free zones, and border-trade development areas. These areas are characterized as having many construction projects implemented in one area within a short period. Due to the nature of EIA for construction projects, it is difficult to predict the cumulative environmental impacts that result from all construction projects within one area. Therefore, the regional environmental assessment (REA) was developed.

In January 1993, Circular on Strengthening the Management of Environmental Protection of the Construction Projects was issued and regulated that the government has the responsibility to actively participate in the decision-making processes related to economic development areas and that REA should be performed and approved before the construction of economic (industrial) development areas. In 1994, China's Agenda 21 stated that the country must include provisions for a system of sustainable development impact assessments in legislation and require government agencies to consider potential impacts on sustainable development when formulating policies and plans and approving construction projects. In 1996, the Rules Related to Some Environmental Protection Issues was promulgated and stipulated that "… the economic, social and environmental benefits should be considered equally together…" and "EIA should be conducted while formulating economic construction and social development decisions, such as regional and resource development plans, and urban and sector development plans".

In 1998, the Ordinance of Environmental Management for Construction Projects explicitly stipulated that: "EIA should be performed while preparing the construction plans for regional development such as watershed development, construction of development areas, construction of new urban areas and construction and renovation of old urban areas". During the first trial phase, many important REA has been carried out and have been seen as the preliminary trial of Planning EIA, for example, the revision of the general plan of the west area of Kunming Dianchi National Tourist Resort, the EIA of Tianjin Municipal Wastewater Resource Recovery Policy, Guangxi Beibu Gulf Economic Zone Development, Taizhou Chemical Raw Material Export Base in Zhejiang Province and Shanghai Chemical Industry Development Zone.

Propulsion phase:

The first EIA Law in China was issued in 2002 and came into force in 2003. Part 1 is the general principles; Part 2 regulates the requirements for Planning EIA, and Part 3 for construction projects; Part 4 lists the legal liability. A list of integrated plans and specific plans are required to conduct

Planning EIA. From 2003 to 2005, several laws and regulations were developed, including Technical Guideline for Planning EIA (trial, HJ/T130-2003), Review Measures for the Environmental Impact Report of Specific Plans, Temporal Measures for Public Participation in Environmental Impact Assessment. Especially, the Specific Scope of the Plans Requiring the Environmental Impact Report (trial), and the Specific Scope of the Plans Requiring the Environmental Impact Chapters or Descriptions (trial) ([2004] No.98) clearly state the plans requiring Planning EIA as "One land, three areas and ten specific plans": plans for land use; development of regions, drainage areas and marine areas; and specific plans for the industry, agriculture, animal husbandry, forestry, energy, water management, transportation, urban construction and tourism and nature resources development.

Since 2005, Planning EIA has gradually obtained attention from local governments. Twenty-seven pilot Planning EIAs were carried out for specific administrative regions, key industries, and important special plans. In 2005, the "Planning EIA for Wenchuan's Post-Earthquake Reconstruction" and the "Planning EIA for Adding 100 Billion Catties of Grain" were conducted by the Ministry of Environmental Protection. Besides, the EIA for Liaoning coastal economic belt, the coastal areas of Jiangsu and the key development areas of Hengqin were implemented. The Planning EIAs for rail transit were also launched in 30 key cities, including Shanghai. In 2009, the Regulation on Planning Environmental Impact Assessment was promulgated and implemented. The subject, procedures, and contents were stipulated in the form of a Decree of the State Council.

Promotion stage:

In 2011, the Ministry of Environmental Protection issued the Notice on Strengthening the Planning Environmental Impact Assessment of Industrial Parks ([2011] No.14) and emphasized that Planning EIA should be performed when the parks are newly built, renovated, and upgraded. In 2014, the Technical Guidelines for Planning EIA - General Principles (HJ130—2014) came into force, replacing the trial version (HJ/T130-2003). The guidance for the evaluation process has been improved. The new Environmental Protection Law was promulgated in 2014 and came into force in 2015, seen as the ever-strictest version. Article 19 stipulates that "when preparing the development and utilization plans and constructing the projects producing adverse environmental impacts, the EIA has to be carried out. The plans without Planning EIA cannot be implemented, and the projects without Projects EIA cannot be constructed."

In addition, the Opinions for strengthening the linkage between Project EIA and Planning EIA ([2015] No.178) was published in 2015 by the MEP. It is required to strengthen the guidance and constraints of the Planning EIA to construction projects. In 2016, the revised EPL further regulated the legal liability for the planning agencies who have not conducted the EIA for proposals and resulting in serious inaccuracy. In 2006, the Implementation Plan for EIA reform in "13th Five-Year" stated that the strategic-level EIA, which focuses on coordinating the regional or cross-regional development and environmental issues, is emphasized and expected to provide a foundation for Planning EIA. Later, the Guidance for Compiling the Ecological Conservation Redline, Environmental Quality Bottom Line, Resource Utilization Upper Limit Line, and List for Environmental Permits (three lines and one list) (Trial) was published in 2017 (Ministry of Environmental Protection [2017] No.99). The Technical Guideline for Planning EIA (HJ130-2019) was revised in 2019 to integrate "three lines and one list".

Through continuous efforts, China's planning environmental assessment laws and regulations have been improved, and some successful experiences have been obtained. However, there are still problems in institutional improvement, practical implementation, and evaluation technologies.

3.1.3 SEA process

Table 3.1. Requirement for different planning types (source: T. Zhu et al., 2005)

	Integrated Plans	**Specific Plans**
Proponent authority	The relevant authorized department under the State Council, the People's Governments at or above the city level and other relevant governmental departments	
Type of plan	Plans for land use and regional development, development of drainage areas and marine	Specific plans for the industry, agriculture, animal husbandry, forestry, energy, water management, transportation, urban construction, tourism and the development of natural resources
EIA requirements	Prepare and include a chapter or statement on environmental impacts as part of the overall plan. There is no need to prepare a separate EIS	Prepare a separate EIS
Content of EIA	Analysis, forecasting and evaluation of possible negative environmental impacts after plan implementation. Provide countermeasures to prevent or mitigate negative environmental impacts	1) Analysis, forecasting and evaluation of possible negative environmental impacts resulting after plan implementation 2) Countermeasures and steps to prevent or mitigate negative environmental impacts 3) Conclusion of EIA
Timing	During the plan preparation process (for integrated/guidance plans, the SEA and the plan should be conducted simultaneously)	After the plan draft is prepared and before it is submitted for review and approval
Solicitation of comments on draft EIS from associated units, specialists and the general public	Not required	For those specific plans Comments that are predicted to induce negative environmental impacts and directly affect the public interest, the proponent authority for these plans must hold discussion meetings, public hearings or some other forum to solicit comments on draft EIS from associated work units, specialists and the public before submitting draft plans for review and approval. However, classified plans under national security regulations are excluded.
Review of EIS	Not required	Written comments should be provided by the EIS review team

Screening

The screening process is to determine if a plan is necessary to carry out EIA. Article 2 of Planning EIA law (2009) and Article 7 and 8 of EIA Law (2016) stipulate the plans subjects to EIA. Plans prepared by the relevant authorized departments under the State Council, by the People's Government at or above the city level and all relevant authorized departments are involved, including two categories: integrated plans for land use and development of regions, drainage areas

and marine areas; and specific plans for industry, agriculture, animal husbandry, forestry, energy, water management, transportation, urban construction and tourism and nature resources development. The Requirements for different planning types are summarized in **Table 3.1**.

Scoping

Scoping is a key stage to establish environmental goals and evaluation indicator systems. With planning contents analysis and status-quo investigation, the resource utilization status is examined, the evaluation region's environmental quality is analyzed, the ecological system's importance and sensitivity are evaluated, and the area's ecological environment is retrospected. Combining all the analysis with requirements of "three lines and one list", the proposed plan's resource-, ecological, and environmental constraints are proposed (Part 6, TG HJ130-2019). The environmental goals and evaluation indicator system are then established based on the identified constraints.

Assessment

Regarding the identified resources-, ecological, and environmental elements, multi-scenario impact prediction and evaluation are carried out, including the forecast scenario setting, the ecological environment pressure analysis on planning implementation, the forecasting and assessment on environmentally sensitive areas and key ecological function areas, the environmental quality and ecological function impact prediction and evaluation, the environmental risk prediction and evaluation, the resources and environmental carrying capacity evaluation. The resource and environmental carrying capacity is evaluated by combining the environmental quality, ecological function, and resource utilization status in affected areas. A conclusion is given if the implemented planning meets the environmental objectives.

Environmental Impact Statement

Legal EIA requirements for these two types of plans are different due to their different characteristics (T. Zhu et al., 2005). For integrated plans, EIA needs to be performed during the planning preparation phase. EIA-related chapter or illustration is conducted and included as one part of the plan. A separate EIS is not required. Two main contents are demanded: analyzing, forecasting, and evaluating possible adverse environmental impacts after plan implementation; and proposing countermeasures to prevent or mitigate negative environmental impacts. For specific plans, EIA is carried out after the plan draft has been prepared. A separate EIS is required before submitting the proposal for review and approval. Apart from the contents included in the EIA chapters or descriptions, the conclusion of EIA is also obligatory, including the environmental rationality and feasibility of the draft plan, the rationality and effectiveness of preventive measures, and adjustment suggestions of the draft plan.

Review

There is no requirement for EIS review for integrated plans because the EIA chapter or description is part of the plan and can be examined while conducting the plan review. A separate reviewing process of EIA is, therefore, unnecessary. However, for specific plans, before the approval of the plan, the authorized department is required to appoint an environmental protection bureau or other relevant departments to organize a review team, including department representatives, experts and specialists. The review team is responsible for appraising the EIS of the Plan and providing a written review comment. The assessment from six aspects are contained: 1) the authenticity of the basic information and data; 2) the appropriateness of the evaluation method; 3) the reliability of environmental impact analysis, prediction and assessment; 4) the rationality and effectiveness of countermeasures and measures to prevent or reduce adverse environmental impacts; 5) the rationality of the acceptance and non-admission of public opinions and the explanation of the

reasons; 6) the scientificalness of the environmental impact assessment conclusions.

Public participation

For integrated plans, public participation is not required. With an internal EIA, the related experts, specialists and officials are consulted while not revealed to the general public. For specific plans, public participation is a compulsory process. Before the draft plan is submitted for approval, the opinions of relevant units, experts, and the public needs to be publicly solicited through various methods, such as questionnaires, symposiums, argumentation meetings, and hearings. The adoption situation of the public opinions and reason descriptions should also be submitted together with the EIS to the environmental protection authorities.

Follow-up evaluation

A follow-up evaluation is necessary for the plans that significantly impact the environment after implementation. Four subjects are included: the comparative analysis between the actual environmental influences after the plan's implementation and the possible impacts predicted by the environmental impact assessment document; the effectiveness evaluation of the preventive and mitigation measures adopted during the plan's execution; the collection of public opinions after the plan is carried out; and the conclusion of the follow-up evaluation.

3.1.4 SEA technical flow chart

The technical flow chart of Planning EIA is shown in **Figure 3.1**. It presents the evaluation workflow, clarifies the designated tasks of each stage, and demonstrates the significant roles of "three lines and one list". For an integrated plan, the Planning EIA should be integrated into the early stage of planning preparation and fully interact with key processes such as planning preparation, argument, and review.

At the early planning stage, the planning environmental assessment work is expected to be carried out simultaneously. After analyzing the planning content, the planning-related laws, regulations and environmental policies are found out; and the upper-level planning, the SEA of the planning area, and the achievements of "three lines and one list" are collected. Besides, an on-site survey is conducted of the planning areas and possible affected areas. The basic data are collected; the environmentally sensitive areas are preliminarily investigated; the main environmental impacts after implementing plans are identified; and then the resource-, ecological, and environmental constraints of planning implementation are put forward.

At the planning preparation stage, the status-quo investigation and evaluation are conducted, the evaluation indicator system is proposed, the resource-, ecological, and environmental constraints of the proposed plan are analyzed, predicted, and assessed. The evaluation result and conclusion are then fed back to the planning authority as a reference and basis for alternative comparison and optimization.

At the planning review and approval stage, the environmental rationality of alternatives is further argued, and the optimization and adjustment suggestions are put forward. In addition, the environmental impact mitigation measures are proposed, and the follow-up evaluation plan is presented. The EIA report is finally completed.

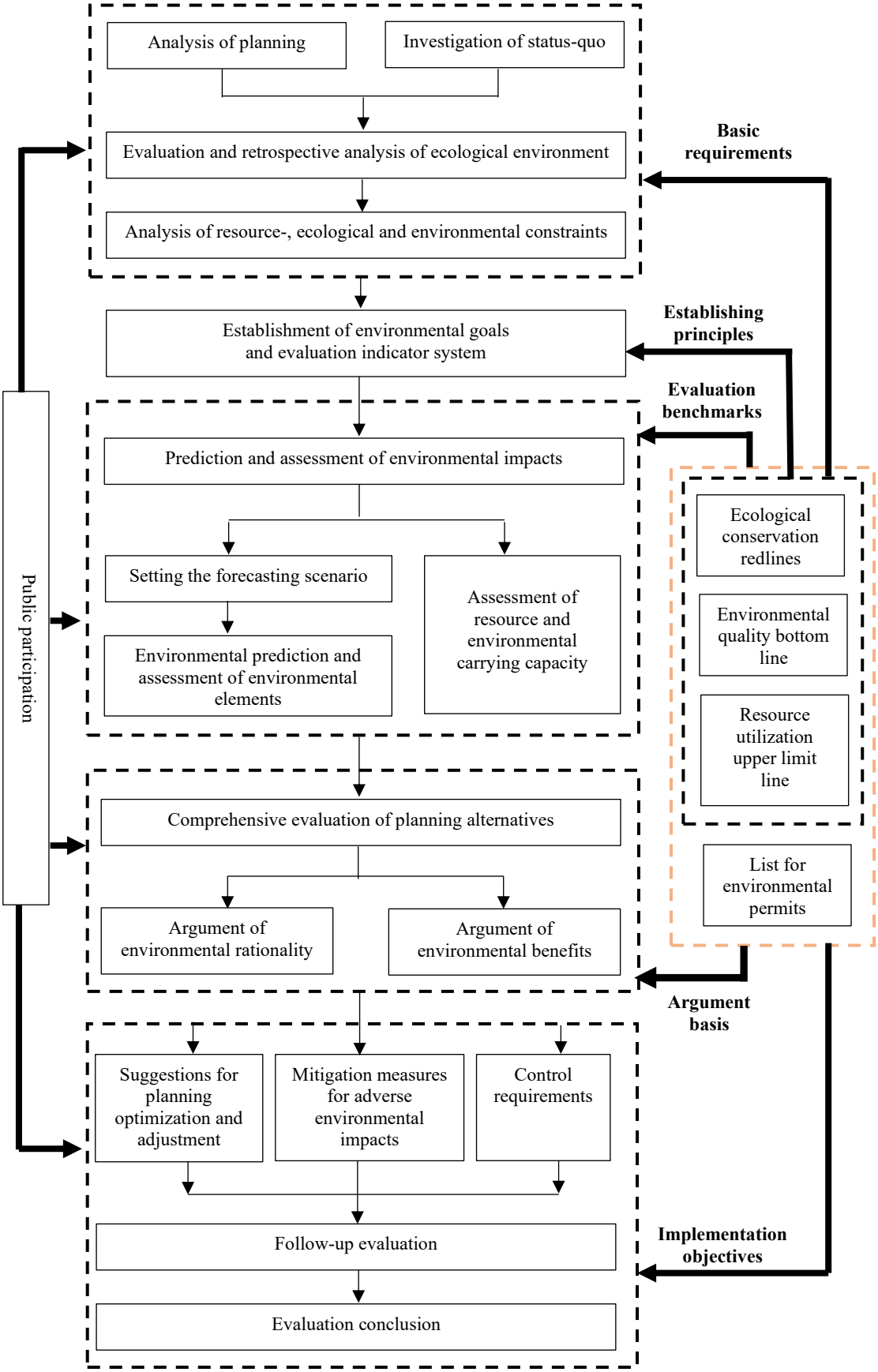


Figure 3.1. Technical flow chart of Planning EIA (source: TG HJ 130—2019)

3.2 Research purpose and framework

3.2.1 Previous studies on SEA's effectiveness

The past decades witnessed a great expansion of SEA practice and its theoretical framework (Hegazy, 2014). Studies on effectiveness are the basis of much discussion, asking whether the SEA achieves its objectives (Theophilou, Bond, & Cashmore, 2010). A series of principles on effectiveness have already been developed to guide the practice at both the international and Chinese levels. However, due to the complexity and context-specificity of SEA, the evaluation criteria are not equally valid for every SEA (Fischer, 2002). Researchers have given different interpretations when adopting the proposed effectiveness principles. Till now, there has been no consensus about the goals assigned to SEA, which has led to considerable debate over its effectiveness (Runhaar, Gommers, Verhaegen, Cooman, & Corens, 2019). Therefore, it is meaningful to conduct the meta-analysis to scrutinize the criteria and sub-criteria adopted by past scholars. The most cited and important criteria can be identified by statistically analyzing each criterion's adoption frequency. Comparing the SEA effectiveness criteria used in the Chinese and international contexts can help find the research gaps and make Planning EIA interpretation broader. In addition, the meta-review of China's SEA effectiveness studies can statistically analyze the existing problems.

Researchers usually revise and make the evaluation criteria appropriate to their studies when adopting the proposed effectiveness models and dimensions. Interviews and questionnaire surveys are used extensively to investigate different stakeholder views toward the expected and realized value of SEA (Cape et al., 2018). Hanna and Noble (2015) use a Delphi study to identify effectiveness criteria by consulting with diverse experts. The fuzzy analytic hierarchy process (fuzzy AHP) is adopted to better understand the weights of indicators and sub-indicators. Experts are also requested to give numerical values based on their knowledge and expertise. However, human judgment is always subjective and, thus, imprecise (H. Wang, 2012).

The literature review, which reports the state of art of the effectiveness studies, can shed light on the possible important criteria in past research in a statistical manner. The broad inclusion of studies may afford the greatest understanding of the phenomenon and significantly remove the possible bias of personal judgment. Fischer and Gazzola (2006) scrutinize 45 key SEA-related books and conference proceedings up to 2002 and summarize effectiveness criteria in the literature, while no classification by effectiveness dimensions. Chanchitpricha and Bond (2013) conceptualize the effectiveness of impact assessment processes through a literature-based framework. Their study established four effectiveness categories: procedural, substantive, transactive and normative, each containing several criteria. Loomis and Dziedzic (2018) reviewed 64 studies published over 20 years following the four effectiveness dimensions. Although these studies' concepts and methods used to evaluate the effectiveness are summarized, there is no discussion on the evaluation criteria and sub-criteria. Zhang, Christensen and Kørnøv (2013) examined 33 refereed journal articles and identified 203 notions of critical factors for EIA implementation. The paper focuses on the links between different critical factors and how they relate to EIA stages, thus influencing decision-making. However, it has not been discussed what effectiveness dimensions are proposed, how many evaluation criteria are included in each dimension, and how frequently each criterion is adopted.

3.2.2 Research purpose

This chapter avoids repeating the effectiveness evaluation studies based on practices and does not retell the SEA effectiveness statement by other scholars. Instead, it mainly focuses on quantitatively depicting the distribution of evaluation criteria. A meta-analysis is conducted with 68

academic papers published from 2009 to 2019, which witnessed the great expansion of effectiveness studies. The meta-review is helpful to afford the greatest understanding of the effectiveness evaluation criteria and remove the possible bias of personal judgment or single case studies.

Three objectives are achieved. The present study first recognizes the effectiveness dimensions, identifies their evaluation criteria, and calculates each criterion's frequency. Next, it compares the adopted effectiveness criteria in China with the international ones, points out the gaps between them, and sheds light on future research. Finally, it examines China's effectiveness evaluation studies, discovers the problems of China's SEA system stated by past scholars and reveals their discussion frequencies.

3.2.3 Meta-analysis

Collecting papers related to SEA effectiveness studies

Meta-analysis is a technique to identify, analyze and quantify the frequency of certain concepts or words within a large number of documents (Geißler et al., 2019). This study used different methods to collect articles. Through searching in Google Scholar by the keywords "Strategic environmental assessment (SEA) evaluation OR performance OR effectiveness", three most frequently cited SEA-related preeminent English language journals were identified, including Environmental Impact Assessment Review (EIA Review), Impact Assessment and Project Appraisal (IAPA) and Journal of Environmental Assessment Policy and Management (JEAPM). The three journals were also acknowledged by Fischer and Onyango (2012) in their review article. Next, the papers related to SEA effectiveness evaluation were searched in the three journal's websites, respectively. Besides, the snowball method was used starting from six review papers' references (Fischer and Gazzola., 2006; Fischer and Onyango., 2012; Fundingsland Tetlow and Hanusch., 2012; Zhang, Kørnøv, et al., 2013; Loomis and Dziedzic., 2018; Geißler et al., 2019). The Chinese journal called Environmental Impact Assessment (huán jìng yǐng xiǎng píng jià) was also examined to get more information about the SEA situation in China.

Following the paper collection, the abstract was examined one by one to screen out the studies discussing SEA effectiveness evaluation. Finally, 41 articles were found related to the international context, while 27 to China's, among which 16 were written in English and 11 were in Chinese. **Table 3.2.** lists the studies on SEA effectiveness in the international context. **Table 3.3.** lists the studies on SEA effectiveness in the Chinese context. All the authors were compared with the well-known researchers summarized by Caschili et al. (2014) in their quantitative literature review analysis of SEA research to verify the broad inclusion of the collected papers. **Figure 3.2.** shows the Tag-cloud visualization of the network of co-authorship on SEA-related research. As a result, leading researchers' names were covered. It demonstrates that their important viewpoints were included; the meta-analysis of collected papers can show the representative statements of major scholars.

Identifying the effectiveness evaluation criteria adopted by collected papers

During the meta-review process, the criteria adopted to evaluate the effectiveness of SEA were identified article by article. The criteria herein refer to the standards or principles for evaluating the effectiveness. Besides, synonymous terms such as "principle", "constraint", and "factors" were also identified. They all influence the effectiveness, performance and implementation of SEA.

Statistically calculating the adoption frequency of each criterion

The identified criteria were then classified into several effectiveness categories. It is undeniable

that different scholars may approach the same meaning using different words or classify similar criteria into different categories. This study followed the principle that each criterion's name should be neither too abstract nor too specific; preferentially should be most frequently mentioned in the articles (Zhang, Kørnøv, & Christensen., 2013). Then, the number of times the collected studies adopted every criterion was counted. The adoption frequency of each criterion is equal to the ratio of the number of papers adopting one criterion to the total number of papers (41 for international contexts and 27 for Chinese).

Depicting the frequency distribution of the adopted criteria

The frequency distribution of evaluation criteria in different effectiveness perspectives was depicted as a radar photo. In **Figure 3.4.**, the situations in Chinese and international-related studies were compared. In the present study, a higher adoption frequency represents more attention and discussion. Besides, the similar frequency distribution demonstrates that Chinese scholars and international scholars share similar ideas towards the importance of specific criteria. The differences in adoption frequency reveal the Chinese-characteristic issues, problems or inadequacies.

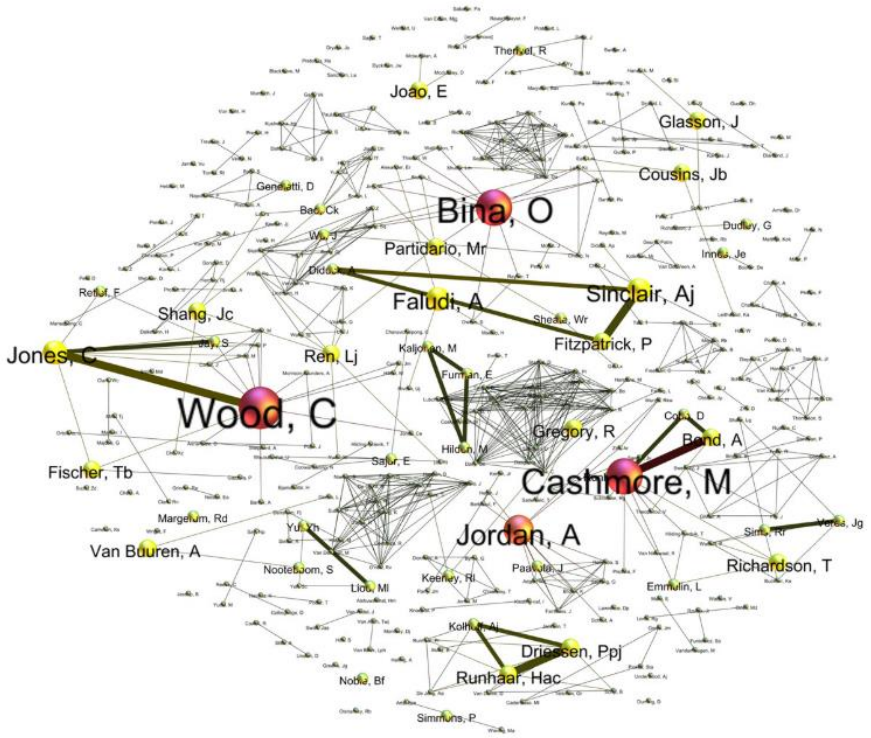


Figure 3.2. The Tag-cloud visualization of the network of co-authorship on SEA-related researches (source: Caschili *et al.*, 2014)

Table 3.2. Studies on SEA effectiveness in the international context

	Paper	Context	Type	Method
1	(Geißler *et al.*, 2019) Effectiveness of SEA in Germany	Germany	Meta-review	Document analysis; Literature review
2	(González *et al.*, 2019) Towards a better understanding of SEA effectiveness in Ireland	Ireland	Case study	Interviews with stakeholders
3	(Therivel, 2019) Effectiveness of English local plan SEAs	England	Case study	Interviews; Questionnaire survey

4	(Tokarczyk-Dorociak *et al.*, 2019) Effectiveness of SEA in Poland	Poland	National level	Online questionnaire survey
5	(Musil and Smutný, 2019) Effectiveness of SEA in the Czech Republic	Czech Republic	National level	The small-scale survey with SEA practitioners
6	(Runhaar *et al.*, 2019) The effectiveness of EA in Flanders: An analysis of practitioner perspectives	Flanders	National level; Comparative study	Online questionnaire survey
7	(Noble *et al.*, 2019) Effectiveness of SEA in Canada under directive-based and informal practice	Canada	Case study	Document analysis
8	(Therivel and González, 2019) Introducing SEA effectiveness	Austria, Brazil, Canada, the Czech Republic, England, Estonia, Germany, Ireland, Poland, Portugal, Romania, Scotland, Spain, Slovenia and Thailand.	Snapshot review, Comparative study	Literature review
9	(Peterson and Vahtrus, 2019) Factors affecting SEA effectiveness in Estonia	Estonia	National level	Semi-structured interview
10	(McLauchlan and João, 2019) Recognising 'learning' as an uncertain source of SEA effectiveness	Scotland	National level	Document analysis; Interview with stakeholders,
11	(Cepuš *et al.*, 2019) The effectiveness of the SEA process in Slovenia	Slovenia	National level	Online questionnaire survey
12	(Malvestio and Montaño, 2019) How flexible SEA may be	Brazil	the state-of-practice	Analyzes the SEA reports; Interview
13	(Arce-Ruiz, Soria-Lara and González-Del-Campo, 2019) SEA effectiveness in Spain: insights from practice	Spain	National level	Online questionnaire survey
14	(Chanchitpricha, Morrison-Saunders and Bond, 2019) Investigating the effectiveness of SEA in Thailand	Thailand	Case study	Analyzes the SEA reports; Document analysis
15	(Loomis and Dziedzic, 2018) Evaluating EIA systems' effectiveness: A state of the art	-	Review	Reviews 64 studies over 20 years
16	(Monteiro, Partidário and Meuleman, 2018) A comparative analysis on how different governance contexts may influence SEA	China, Vietnam, Chile, Portugal, Denmark, Netherlands	National level Comparative analysis	Literature review
17	(Rega, Singer and Geneletti, 2018) Investigating the substantive effectiveness of SEA of urban planning: Evidence from Italy and Spain	Italy, Spain	Case study	Review the urban plans SEA reports; Document analysis
18	(Cape *et al.*, 2018) Different stakeholder views of the expected and realised value of SEA	South Africa	Embed a case study	Document analysis; Interview; Focus group meeting
19	(Tshibangu, 2018) An analysis of SEA legislation and regulations in African Countries	African Countries	National level Comparative study	Literature review; Content analysis
20	(Pope *et al.*, 2018) Are current effectiveness criteria	Western Australia	Case study	Document review; Involved in the first-

	fit for purpose? Using a controversial SEA as a test case			hand experience of two of the authors who were involved in the case study
21	(Rehhausen *et al.*, 2018) Quality of federal level SEA– A case study analysis in Germany	Germany	Case study	Document analysis; Focus group discussion
22	(Lyhne *et al.*, 2017) Theorising EIA effectiveness: A contribution based on the Danish system	Denmark	National level	Literature review; Interviews with stakeholders nationwide
23	(King and Smith, 2016) Evaluating the Benefits and Limitations of SEA for the Koshi River Basin	-	Case study	Document review; Interviews with key stakeholders
24	(Phylip-Jones and Fischer, 2015) SEA for wind energy planning: Lessons from the United Kingdom and Germany	United Kingdom, Germany	Specific planning type	Reviews of the SEA report; Interview
25	(Hanna and Noble, 2015) Using a Delphi study to identify effectiveness criteria for environmental assessment	-	-	Delphi study
26	(De Montis *et al.*, 2014) SEA effectiveness for landscape and master planning: An investigation in Sardinia	Italy	Specific planning type	Online questionnaire survey
27	(Acharibasam and Noble, 2014) Assessing the impact of SEA	Canada	-	Literature review; Online survey with practitioners
28	(Malvestio and Montaño, 2013) Effectiveness of SEA applied to renewable energy in Brazil	Brazil	Specific planning type	Analysis of 9 SEAs, Document analysis
29	(Zhang, Christensen and Kørnøv, 2013) Review of critical factors for SEA implementation	-	Literature review	Literature review
30	(Chanchitpricha and Bond, 2013) Conceptualising the effectiveness of impact assessment processes	-	Literature review	Literature review
31	(Fundingsland Tetlow and Hanusch, 2012) Strategic environmental assessment: the state of the art	-	Literature review	Literature review
32	(van Doren *et al.*, 2012) Evaluating the substantive effectiveness of SEA: Towards a better understanding	Dutch	Case studies	Document analysis
33	(Morrison-Saunders and Retief, 2012) Walking the sustainability assessment talk — Progressing the practice of EIA	South Africa	National level	Literature review
34	(Arts *et al.*, 2012) Reflecting on 25 Years of EIA Practice in the Netherlands and the UK	The Netherlands, the UK	National level	Semi-structured interview with stakeholders
35	(Stoeglehner, 2010) Enhancing SEA effectiveness: lessons learnt from Austrian experiences in spatial planning	Austria	Specific planning type	Literature survey; Document analysis, analysis of SEA reports
36	(Theophilou, Bond and Cashmore, 2010) Application of the SEA Directive to EU structural funds: Perspectives on effectiveness	EU	Case study	Interviews with stakeholders
37	(Stoeglehner, Brown and Kørnøv,	-	-	Others

	2009) Ownership of SEA by the planners is the key to its effectiveness			
38	(Runhaar, 2009) A discourse perspective on how SEA contributes to decision-making	The Netherlands	National level	Discourse analytical approach
39	(Jha-Thakur et al., 2009) Effectiveness of SEA: the significance of learning	Germany, Italy and the UK	Case study Comparitive study	Interviews with stakeholders
40	(van Buuren and Nooteboom, 2009) Evaluating SEA in the Netherlands: content, process and procedure as indissoluble criteria for effectiveness	The Netherlands	Case study	Interviews with stakeholders
41	(Soderman and Kallio, 2009) SEA in Finland: an Evaluation of the SEA Act Application	Finland	Case study	Interviews with stakeholders

Table 3.3. Studies on SEA effectiveness in the Chinese context

	Paper	Context	Type	Method
	Written in English			
1	(Li et al., 2016) Strategic environmental assessment performance factors and their interaction: An empirical study	China	National level	Questionnaire survey; Semi-structured interviews; Structural Equation Model (SEM)
2	(Gao, Christensen and Kørnøv, 2014) The changing Chinese SEA indicator guidelines: Top-down or bottom-up?	China	National level	Document analysis; Interviews with stakeholders
3	(Gao, Kørnøv and Christensen, 2013) Do indicators influence communication in SEA	China	Case study (2 urban planning SEA)	Online questionnaire survey; Interview
4	(Wang, 2012) Measurement indicators and an evaluation approach for assessing SEA effectiveness	China	Case study	Literature review; Fuzzy AHP evaluation;
5	(Yang, 2012) Reasons for the slow establishment of provincial SEA system in China	China	Provincial-level	Document analysis
6	(Zhu et al., 2011) An inquiry into the potential of scenario analysis for dealing with uncertainty in SEA in China	China	Case study	Document analysis
7	(Jia et al., 2011) Experts' perspective on the performance of Chinese technical guidelines for Plan EIA	China	National level	Questionnaire survey
8	(Bina et al., 2011) An inquiry into the concept of SEA effectiveness	China	National level	Literature review
9	(Zhou and Sheate, 2011) Case studies: Application of SEA in provincial level expressway infrastructure network planning in China	China	Case study	Document analysis
10	(Wu et al., 2011) Strategic environmental assessment implementation in China — Five-year	China	National level	Literature review; Questionnaire

	review and prospects			survey
11	(Che et al., 2011) Integrating planning and assessment during the preparation of Shenzhen's Master Urban Plan	China	Case study	Document analysis
12	(Zhou and Sheate, 2009) EIA application in China's expressway infrastructure	China	Case study	Document analysis; Literature review
13	(Fischer and He, 2009) Differences in perceptions of effective SEA in the UK and China	China	National level; Comparative study	Questionnaire Survey
14	(Bina, Ausra and Zhang, 2009) Transition from Plan EIA to SEA	China	National level	Literature review
15	(Wang et al., 2009) The development and practices of SEA in Shandong Province	China	Provincial-level	Literature review; Document analysis
16	(Lam, Chen and Wu, 2009) SEA in China: opportunities, issues, and challenges	China	National level	Literature review; Document analysis
	Written in Chinese			
17	(Wang et al., 2019) Study on the Effectiveness and Countermeasures of Inland Port Planning EIA in the Yangtze River Economic Zone	China	Case study	Document analysis
18	(He, Liang and Feng, 2019) Discussion on Effective Linkage between Planning EIA and Project EIA	China	Provincial-level	Document analysis: review of SEA 40 reports
19	(Bao and Wen, 2019) Upgrading of Planning EIA for the Reform of Planning System	China	National level	Literature review
20	(Geng, 2019) Thoughts About SEA in China in New Era	China	National level	Literature review
21	(Xiong and Mei, 2018) The Planning EIA in China: the problems and improvement measures	China	National level	Literature review
22	(Fan, 2017) Study on Effectiveness of Planning EIA based on AHP - fuzzy Synthetic Evaluation Method	China	Case study	AHP - fuzzy Synthetic Evaluation Method
23	(Chen, 2016) Analysis on the effectiveness of Planning EIA	China	National level	Literature review
24	(Geng, 2016) The Development Direction of China's SEA from the Characteristics of Foreign SEA	China	National level; Comparative study	Literature review
25	(Tu, 2014) From Ideal to Reality: The Status, Problems and Countermeasures of China's SEA	China	National level	Literature review
26	(Bao, Zhou and Zeng, 2014) Thinking about potential help of PEIA to the new urbanization construction	China	National level	Literature review
27	(Wang, 2014) Conceptual model and evaluation method of SEA effectiveness	China	Case study	Fuzzy AHP Evaluation

3.2.4 Proposition of integrated evaluation model

Over the past decades, there has been great debate over the effectiveness and evaluation dimensions. **Table 3.4.** shows the SEA performance criteria proposed by IAIA in 2001. Sadler (1996, p.37) first defined effectiveness simply as "whether something works as intended and meets the purposes for which it was designed". He proposes three effectiveness dimensions: procedural effectiveness to examine how the policy was applied or what procedures were used, substantive effectiveness to evaluate to what extent the objectives were met, and transactiveness effectiveness to assess the financial and temporal costs of conducting the EIA. Based on his research, Baker and McLelland (2003) further introduced the normative effectiveness to examine the extent to which the policy meets its ideal purpose, for example, sustainable development and transparent, democratic and participatory environmental assessment process.

In addition to those four main effectiveness perspectives, Bond et al. (2012) suggested a framework for sustainability assessment and incorporated two more perspectives: pluralism to examine whether assessment takes different views of stakeholders and knowledge and learning to inspect whether the assessment process facilitates knowledge sharing. Besides, Fischer and Gazzola (2006) stated that the contextual dimension is essential because the performance criteria are not equally valid for every SEA. Arts et al. (2012) proposed a conceptual model and identified four contextual factors: the characteristic of assessment results, the course of EIA procedure, the characteristic of actors, and the decision-making context. Since then, the above seven effectiveness dimensions are well-acknowledged by researchers worldwide and have been widely used by researchers in different countries with various clarification (Geißler et al., 2019). This chapter adopts an integrated effectiveness evaluation model of SEA, as shown in **Figure 3.3**, incorporating Bond's sustainability model (2012) and Arts' conception model (2012). During the meta-analysis, the identified criteria are classified under the integrated framework of seven effectiveness dimensions.

Table 3.4. SEA performance criteria (IAIA, 2001)

Criterion	Description
Integrated	Ensures an appropriate environmental assessment of all strategic decisions relevant for the achievement of sustainable development.
	Addresses the interrelationships of biophysical, social and economic aspects. Is tiered to policies in relevant sectors and (transboundary) regions and, where appropriate, to project EIA and decision making.
Sustainability-led	Facilitates identification of development options and alternative proposals that are more sustainable (i.e., that contributes to the overall sustainable development strategy as laid down in Rio 1992 and defined in the specific policies or values of a country).
Focused	Provides sufficient, reliable and usable information for development planning and decision making.
	Concentrates on key issues of sustainable development. Is customised to the characteristics of the decision-making process. Is cost- and time-effective.
Accountable	Is the responsibility of the leading agencies for the strategic decision to be taken. Is carried out with professionalism, rigor, fairness, impartiality and balance. Is subject to independent checks and verification.
	Documents and justifies how sustainability issues were taken into account in decision making.
Participative	Informs and involves interested and affected public and government bodies throughout the decision-making process. Explicitly addresses their inputs and concerns in documentation and decision making. Has clear, easily-understood information requirements and ensures sufficient access to all relevant information.
Interactive	Ensures availability of the assessment results early enough to influence the decision-making process and inspire future planning. Provides sufficient information on the actual impacts of implementing a strategic decision to judge whether this decision should be amended and to provide a basis for future decisions.

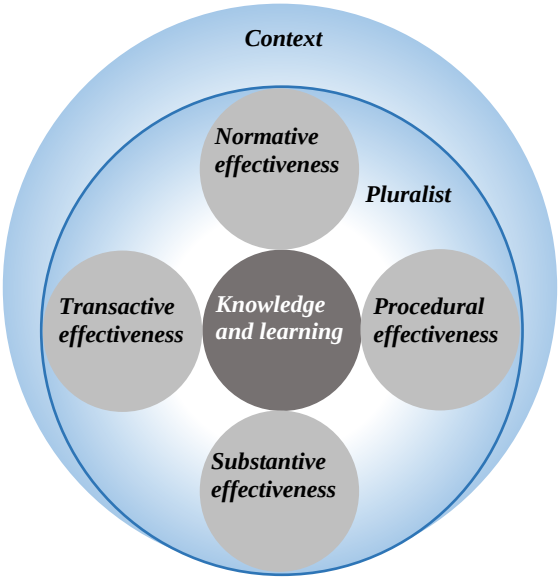


Figure 3.3. Integrated effectiveness evaluation model of SEA

3.3 Evaluation criteria in SEA effectiveness studies

Figure 3.4. shows the distribution of adopted criteria in six effectiveness dimensions, respectively. The knowledge and learning effectiveness is not included because its evaluation criteria are too few. Herein, the discussion is conducted in three respects: the discussion frequency of effectiveness dimensions, the distribution of criteria's adoption frequency, and the differences of adopted criteria between the Chinese and international contexts. Many scholars pointed out the problems of China's SEA system. The frequency of each inadequacy being discussed is also calculated, explaining the adoption frequency of the corresponding criteria.

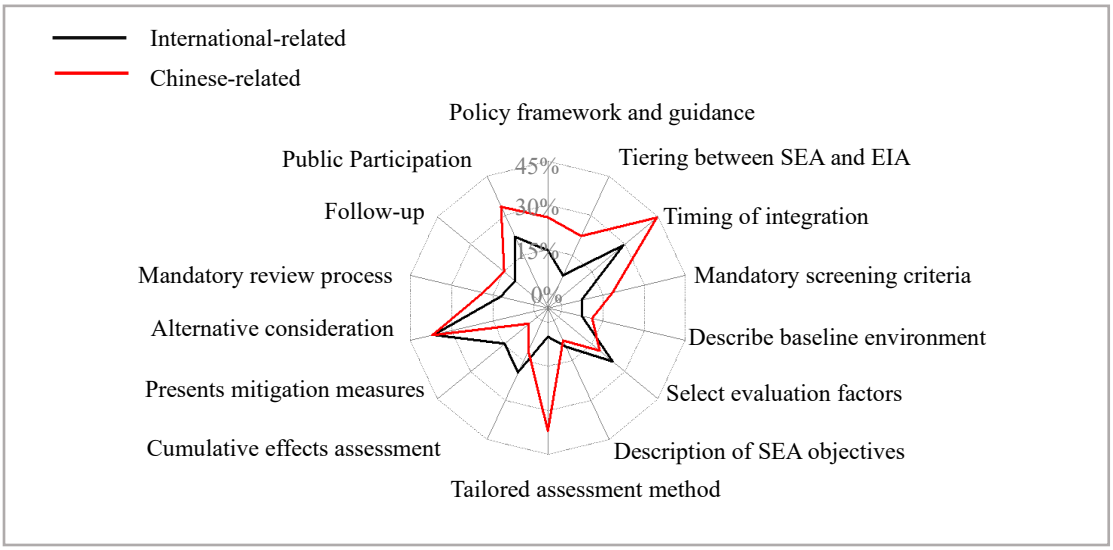


Figure 3.4a. Procedural effectiveness

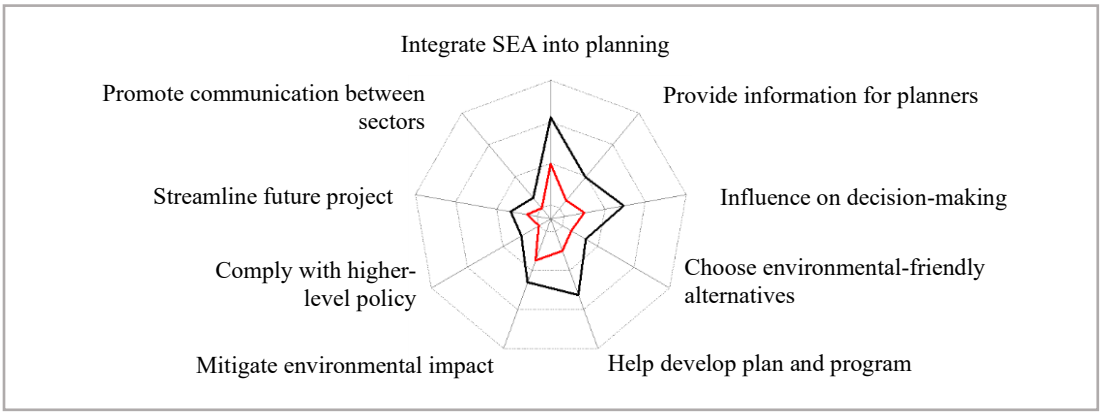


Figure 3.4b. Substantive effectiveness

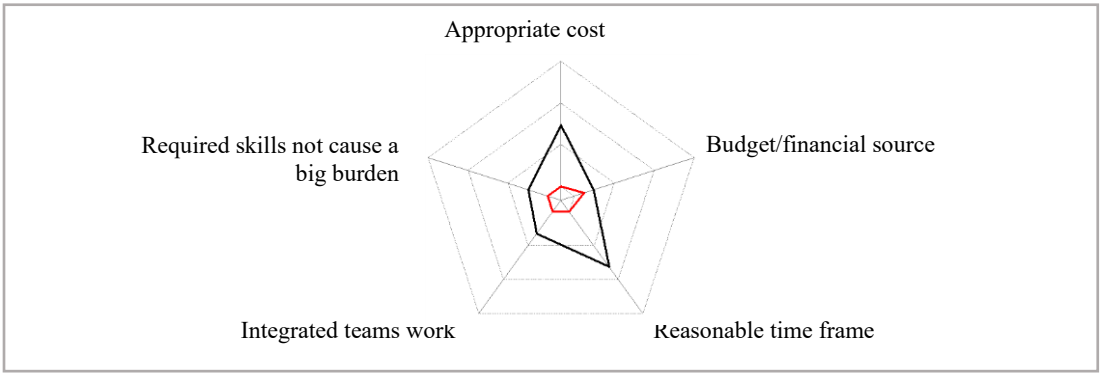


Figure 3.4c. Transactive effectiveness

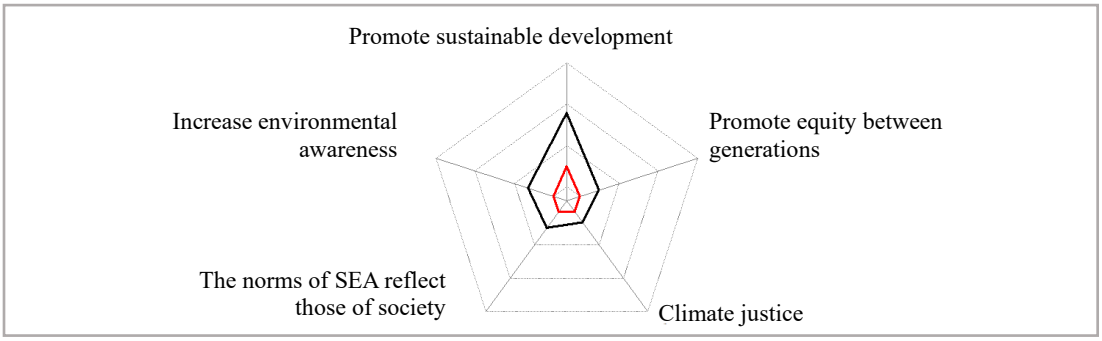


Figure 3.4d. Normative effectiveness

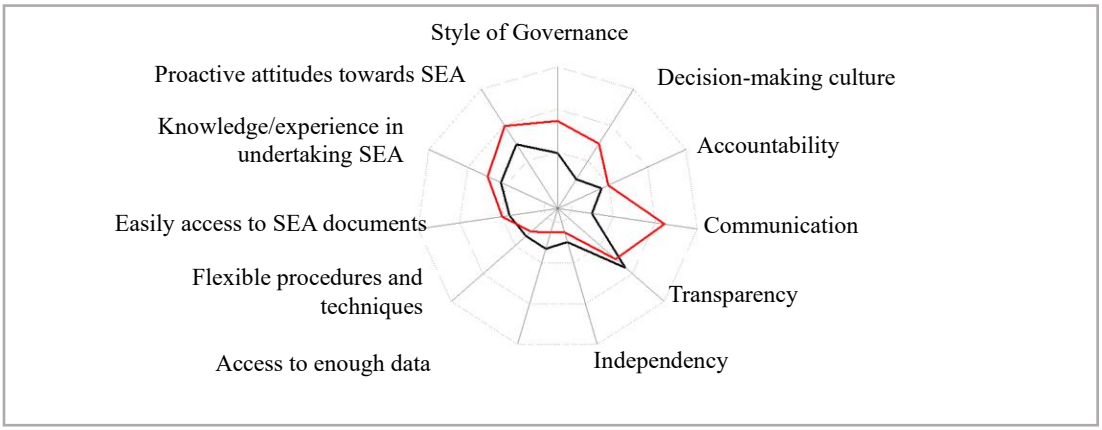


Figure 3.4e. Contextual effectiveness

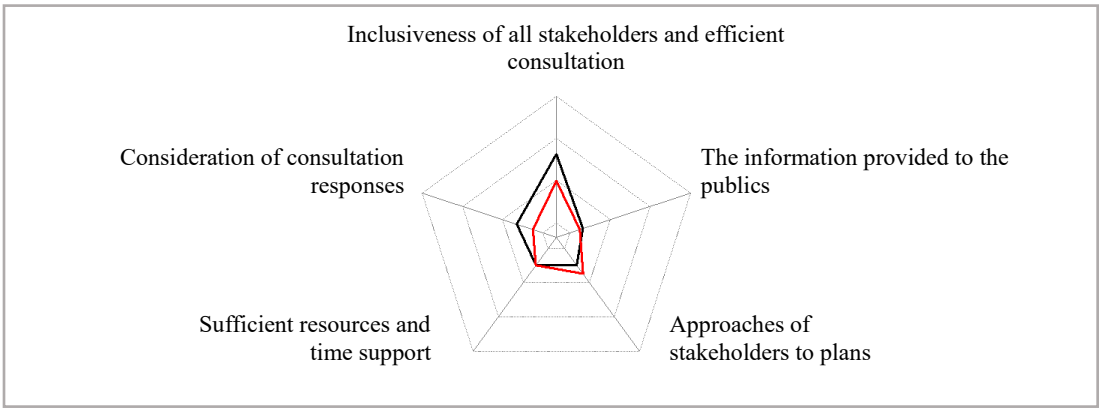


Figure 3.4f. Pluralist effectiveness

Figure 3.4. Adoption frequency of evaluation criteria from different effectiveness perspectives: comparison between the Chinese and international contexts (a. procedural; b. substantive; c. transactiveness; d. normative; e. contextual; f. pluralist effectiveness. The black lines represent the analysis of internationally-related studies, and the red lines represent the Chinese situation. The figure's lateral axis refers to the adopted criteria, and the vertical axis refers to the adoption frequency of each criterion. The six figures' vertical axis range is unified, with frequency from 0% to 45%.)

3.3.1 Procedural effectiveness

The procedural effectiveness focuses on whether the SEA is undertaken in line with established procedures and criteria and can provide insights into the quality of the SEA report and process (van Doren et al., 2012). As shown in **Figure 3.4a**, it is the hotspot of effectiveness studies. 27 of 41 international-related papers proposed fourteen criteria concordant with the typical SEA process: screening, scoping, assessment, report review, monitoring, follow-up and public participation. Scholars propose various criteria to examine the important issues in each stage. For example, does the screening process follow mandatory screening criteria; does the scoping process include a clear description of the baseline environment, the establishment of SEA objectives, and identification of evaluation factors; does the assessment process adopt the tailored method and assess the cumulative effects; or does the SEA report propose the mitigation measures and alternative consideration. In addition, the policy framework, which stipulates all the requirements and provides guidance for the SEA's implementation, is important and attracts significant attention.

In the studies discussing international SEA, the most cited criterion is the consideration of alternatives adopted by 37% of the papers. Describing and assessing each alternative's pros and cons is essential because it can provide decision-makers with a good source to identify the most environmentally friendly alternative and integrate the environmental consideration into planning (Runhaar et al., 2019). Next is the timing of integration. 33% of articles adopt it mainly because a late SEA start may result in planning decisions being made without appropriate environmental consideration or lead to SEA exerting little or no influence on the final decision-making. 24% of papers mention the criterion of selection of evaluation factors, which concerns if the assessment is comprehensive or not. As is stated by past scholars, SEA needs to assess the social, cultural, ecological and biophysical impact (Hanna and Noble., 2015; Pope et al., 2018; Semeraro et al., 2020), climate change and adaption (King and Smith., 2016; Geißler et al., 2019), and human health (Geißler et al., 2019). Public participation is also important in the SEA process (Li and Li., 2019). Researchers even propose the pluralist dimension to explore whether SEA helps achieve greater public participation (Peterson and Vahtrus., 2019).

24 of 27 Chinese-related papers evaluate the procedural effectiveness of SEA, which covers all the criteria proposed by the papers evaluating SEA in the international context. Regarding the distribution of the adopted criteria, the Chinese situation resembles the internationally recognized ones except for some criteria. As illustrated in **Figure 3.4a**, the biggest difference lies in that Chinese-related papers adopt more of the criterion of tailored assessment method and less of the present mitigation measures criterion. The SEA in China is developed from Project EIA, and its assessment method continues to use Project EIA's, which pay special attention to the polluted spots of projects. Therefore, only 4% of the studies examine if the SEA presents mitigation measures (K.Y. Zhou and Sheate., 2011), while 37% of the researchers state that the methodologies are unsuitable for Planning EIA (Che et al. 2011; Wu et al. 2011; Wang et al., 2014).

The international-related papers adopt the criterion of alternative consideration the most frequently (36%) because it is the core of SEA and can facilitate decision-making. Similarly, 37% of the papers point out that considering alternatives in China is inadequate (Bina et al., 2011; Li et al., 2016; Fan et al., 2017). Nevertheless, the Chinese-related studies adopt the criterion timing of integration the most frequently (44%) because SEA is integrated into the planning process too late, which results in few or no environmental considerations in the planning (Lam et al., 2009; Jia et al., 2011; Li et al., 2016). Besides, 26% of the researchers propose that the legislative support (standards, guidelines) in the implementation of SEA is inadequate (Bina et al., 2011; Li et al., 2016).

3.3.2 Substantive effectiveness

The substantive effectiveness considers the extent to which the objectives are realized (Therivel and González., 2019). 28 international-related papers proposed eight criteria that show the multiple roles of SEA. As the direct objectives, the SEA can help to provide information for planners to choose environmental-friendly alternatives and develop plans and programs. Integrating SEA into the planning process influences the final decision-making and mitigates the environmental impact. In the long run, it helps to streamline future project-level development and optimize the higher-level policies. Among the criteria, 32% of the scholars examined whether the SEA is integrated into planning, the most frequently cited criterion, because it is the prerequisite to realizing other objectives. Besides, 24% of papers assess if the SEA helps develop plans. 22% of articles discuss the influence of SEA on decision-making.

Beyond the immediate and visible effects on planning and decision-making, there are more indirect and long-term benefits: help to realize sustainable development and promote equity between generations. However, scholars prefer to classify these ideal normative objectives into normative effectiveness (Baker and McLelland., 2003). Although the distinction between substantive and normative effectiveness is not clear, this study's classification follows the principle that the substantive dimension asks whether SEA leads to changes, and the normative dimension explains if it leads to the right kind of changes (Therivel and González., 2019).

The objectives of the SEA are similar worldwide. Thus, the substantive effectiveness' criteria distribution resembles between international and Chinese context. As shown in **Figure 3.4b**, the criteria mentioned on the right side attract more attention than those on the left side. Left-side criteria are related to the decision-making process, while right-side criteria include indirect objectives: complying with higher-level policies and streamlining future projects. It should be noted that there is no article discussing if the SEA in China promotes communication between sectors. The phenomenon is accordant with the discussion in pluralist effectiveness that the communication during the SEA process is insufficient.

3.3.3 Transactive effectiveness

The transactive dimension studies the time and cost of SEA. 14 international-related papers put forward five criteria. 24% of them examine if the SEA is completed within a reasonable time frame, which concerns the time spent by planners and consultants in carrying out the SEA (Geißler et al., 2019; González et al., 2019; Noble et al., 2019). 22% of them adopt the reasonable cost criterion, including the cost of statutory consultee, public participation, and monitoring the plan's actual environmental impacts (Therivel and González., 2019). 8% of the literature mention the importance of budget source (Theophilou et al., 2010; Fundingsland Tetlow and Hanusch., 2012; van Doren et al., 2012). As to human resources, 11% of papers examine integrated teams working on SEA, and 8% of researchers expect the required skills do not cause a heavy burden. Undoubtedly, the SEA has many benefits apart from the cost. Tokarczyk-Dorociak et al. (2019), Musil and Smutný (2019) and Arce-Ruiz, Soria-Lara and González-Del-Campo (2019) propose the criterion of the proportion of costs and benefits.

There is no doubt that planners want to use the least money to get the maximum benefit in a reasonable time (Baker and McLelland., 2003). Nevertheless, only one paper discusses the transactive effectiveness and points out the lack of funding in China (Li et al., 2016). The discussion is limited partly because situations in different provinces vary, and the type of plans are so diverse that it is difficult to evaluate.

3.3.4 Normative effectiveness

Compared with substantive effectiveness, normative effectiveness considers whether the SEA process achieves its ideal, normative goals (Therivel and González., 2019). 16 papers raise five criteria. 27% of the studies focus on sustainable development, which is typically perceived as balancing economic, social, and environmental objectives (Peterson and Vahtrus., 2019). It is the most frequently adopted criterion. The other four criteria are only discussed by a few scholars, around 7% of the papers. Among them, Therivel and González (2019), Peterson and Vahtrus (2019), and Chanchitpricha, Morrison-Saunders and Bond (2019) pay special attention to promoting equity between generations. Therivel and González., (2019) discuss if SEA helps realize climate justice. Therivel and González (2019) and Tokarczyk-Dorociak et al. (2019) state that SEA norms should reflect those of society. Furthermore, Arce-Ruiz, Soria-Lara and González-Del-Campo (2019), Acharibasam and Noble (2014), Arts et al. (2012a), and Lyhne et al. (2017) evaluate if the SEA helps to improve the environmental awareness of different stakeholders.

Compared with other effectiveness dimensions, normative effectiveness discussions are limited both in the international and Chinese context, because all relevant criteria are abstract and difficult to evaluate. Nevertheless, as presented in **Figure 3.4d**, promoting sustainable development is well-acknowledged as the final objective of the SEA. Article 1 of China's EIA Law stipulates that "This Law is formulated to implement a sustainable development strategy, prevent the adverse effects on the environment after implementing planning and construction projects, and promote the coordinated development of economy, society, and environment". With the meta-analysis, only 2 of 27 papers adopt the criterion sustainable development. Wu et al. (2011) point out that SEA in China failed to accomplish the primary objective of sustainable development. Lam, Chen and Wu et al. (2009) state that the effectiveness studies over-emphasize procedural technicalities instead of sustainability. The studies on China's SEA call for more papers to evaluate other normative effectiveness discussed in the international SEA.

3.3.5 Contextual effectiveness

Contextual factors set the context within which the SEA is carried out. 23 international-related studies proposed ten criteria. This study subdivided them into four categories according to Arts et al. (2012), namely the characteristics of governance mechanism, the decision-making culture, the course of EIA procedurals, and the characteristics of actors. To evaluate the effectiveness of governance mechanism, scholars examine the political agendas of each context (De Montis et al., 2014; Tokarczyk-Dorociak et al., 2019), the compulsion of SEA (Runhaar et al., 2019), the existence of training and Guidance (Therivel and González., 2019), the independence of consultant agencies (van Doren et al., 2012), and the accountability of stakeholders during the SEA process (Fundingsland Tetlow and Hanusch., 2012; Acharibasam and Noble., 2014). For the decision-making culture, researchers discuss if the responsibility for SEA is assigned to proponents (Runhaar et al., 2019), the transparency of SEA procedure (Acharibasam and Noble., 2014; Hanna and Noble., 2015; Chanchitpricha et al., 2019), and the communication between stakeholders (De Montis et al., 2014; Lyhne et al., 2017). Besides, the criteria of course of EIA procedurals is to evaluate if there is enough data for assessment (van Doren et al., 2012), if the procedures and techniques are flexible and adaptive (Hanna and Noble., 2015; King and Smith., 2016; Lyhne et al., 2017), if the SEA documents are easy to access (Malvestio and Montaño., 2013) and if the process is understood by stakeholders (Hanna and Noble., 2015). As to stakeholders' characteristics, it is important to examine stakeholders' attitudes towards SEA (Musil and Smutný., 2019) and engineers' knowledge and experience in undertaking the SEA (Peterson and Vahtrus., 2019).

19 of 27 Chinese-related papers assess the contextual effectiveness of SEA in China, covering all the criteria proposed by the international-related papers. As illustrated in **Figure 3.4e**, the frequency of adopted criteria is similar to or higher than the international ones, which means the contextual factors attract great attention in China. For example, 26% of the studies examine governance style; 22% discuss the decision-making culture. A top-to-bottom management system characterizes decision-making in China (Bina et al., 2009; Bina et al., 2011; Li et al., 2016). Nonetheless, the review opinions from different levels differ: the national review standards are stricter, while the reviews by Bureaus of Ecology and Environment (BEEs) at the provincial and lower level are relatively lax (Wang et al., 2019). In addition, the institutional setup is fragmental, and some government departments' interests conflict (Lam et al., 2009). Specifically, the Environmental Protection Bureaus (EPBs), in charge of Planning EIA, generally have less influence over decision-making than those responsible for the development plans. The EPBs have limited capacity to enforce SEA application and review SEA reports (Bina et al., 2011; Yang et al., 2012; Li et al., 2016).

The biggest difference in the frequencies lies in the criterion of communication. Around 7% of the international-related papers adopt this criterion, while 33% of Chinese-related studies mention it. Communication in China is always one-way information providing, lacking dialogue and coordination between stakeholders (Gao et al., 2013). The cooperation between SEA teams and planning teams is also limited (Che et al., 2011; Gao et al., 2014). Due to the fragmental system setup and the miscommunication among different governmental departments, each department's workload may increase, and overlapping responsibilities may arise. In the international context, scholars consider transparency during the whole SEA the most frequently. In contrast, most Chinese-related studies concern stakeholders' attitudes towards SEA and environmental protection. 30% of the papers point out that both the planning department and the public lack the willingness to conduct SEA (Wu et al., 2011; Tu et al., 2014; Xiong and Mei et al., 2018). It can be concluded that

most Chinese people still prioritize economic development and lack the awareness of involvement in the decision-making process.

3.3.6 Pluralist effectiveness

Many researchers have grappled with the theoretical framework to make assessment a neutral or objective exercise. However, this points to a fundamental difficulty: the problem is viewed differently by different actors, so the assessment goals are also contested (Bond, Morrison-Saunders, and Howitt., 2012). Bond and Morrison-Saunders (2011) argue that rather than adopting a specific framing for effectiveness, a more pluralistic approach is needed to accept multiple value systems and include all perspectives of different stakeholders. Therefore, the pluralist dimension is brought forward to explore whether SEA achieves greater public participation (Peterson and Vahtrus., 2019).

In the meta-review of 41 papers discussing SEA effectiveness in the international context, 16 studies mention five criteria concerning three perspectives: who is involved in the SEA process, what information is provided to the public, and how the stakeholders can participate. 24% of articles examine the inclusiveness of all stakeholders. Many authors insist that diverse public opinion should be heard, not only of the government officials and experts but also the general public (Bond, Morrison-Saunders, and Howitt., 2012). Furthermore, De Montis et al. (2014) and Cepuš et al. (2019) point out the importance of considering consultation responses. Two papers evaluate if the public can access enough information to ensure they know about the SEA and give useful feedbacks (Cepuš et al., 2019; Peterson and Vahtrus., 2019). Three articles examine public participation approaches to evaluate if diverse methods are involved, for example, the questionnaire survey, interview, and public hearing (Hanna and Noble., 2015; Peterson and Vahtrus., 2019; Tokarczyk-Dorociak et al., 2019). Besides, Zhang, Christensen and Kørnøv (2013) and De Montis et al. (2014) propose that providing sufficient resources and time is essential and can improve public participation effectiveness.

As seen in **Figure 3.4f**, the distribution of the pluralist effectiveness' criteria in the international and Chinese-related studies resembles so much, which shows that the approaches to improve public participation are similar worldwide. Both of them adopt the criteria inclusiveness of all stakeholders and efficient consultation the most frequently because it is very important to include the opinions of weak parties: the general public. Nine papers directly state that China's public participation is inadequate, and eight papers point out the specific deficiencies, which cover all the criteria proposed in the international context.

In China, only government officials and experts are invited to participate in the SEA process. In contrast, few citizens are involved, and the people from localities and rural areas are usually ignored (Bina et al., 2009; Bina et al., 2011; K.Y. Zhou and Sheate., 2011; Li et al., 2016). The information is not completely disclosed (Wu et al., 2011). The public participation approach is limited to the questionnaire survey and consultation meeting (Che et al., 2011; Wu et al., 2011; Fan et al., 2017). The time for giving feedbacks is insufficient: the stage of public participation is exclusively at the final stage of PEIA, on the assessment itself, rather than at the key stages of scoping. The financial and legal support to the public to participate in SEA is also lacking (Bina., et al. 2009; Fan et al., 2017). Furthermore, the public's feedback is not well implemented (Gao et al., 2013).

3.3.7 Knowledge and learning

Acknowledgment is growing that "learning" is also a key source of SEA effectiveness. Compared with other effectiveness dimensions, the discussion of knowledge and learning is limited;

only nine international-related papers are included. There are no evaluation criteria proposed. But most authors examine the type of learning involved in the SEA process, whether it is single-looping or double-loop learning (Stoeglehner., 2010; Geißler et al., 2019; McLauchlan and João., 2019). Single-loop learning corresponds to instrumental learning, with which people, organizations or groups modify their actions to improve policy and achieve objectives. However, this type of learning can only make small adjustments; causes of problems remain. Double-loop learning, which is conceptional learning, is required to change stakeholders' beliefs and fundamentally alter their perspectives towards policy and the ways of achieving it. Accordingly, Bond, Morrison-Saunders and Howitt (2012) define this effectiveness dimension as how and to what extent the assessment process facilitates instrumental and conceptual learning.

Besides discussing the learning types, Sánchez and Mitchell (2017) reconceptualize the SEA as a learning process and set out three key questions. The first is who can learn, whether it involves diverse actors, including individuals and organizations. The second is what can be learned, if it concerns skills and knowledge, new behaviors, norms and values. The third is how learning can be achieved, whether it includes formal education, experience and public participation. The evaluation of the learning process can also follow this classification.

Despite the increasing attention to knowledge and learning in the international context, few related studies discuss China's situation from this effectiveness dimension. Only one paper mentions that the public has a limited chance to learn about planning (Geißler et al., 2019). It is not easy to evaluate knowledge and learning because the learning process cannot be studied directly. Instead, its action can be inferred from behavioral changes and the SEA system (Geißler et al., 2019). In addition, the extent of learning can be analyzed through examining the influence factors, for example, the use of consultant bodies in the assessment process, the existence of training and information sharing platform (McLauchlan and João., 2019), and the conducting of SEA follow-up (Bond, Morrison-Saunders, and Howitt., 2012). All these experiences in the international context can shed light on future research in China.

3.4 Comparison between the Chinese and internationally-recognized criteria

Regarding the discussion frequency of effectiveness dimensions, articles on China's SEA discuss the procedural dimension most frequently. Those in international cases show the same trend. It is partly because procedural effectiveness is the basis of all effectiveness dimensions. The planning EIA in China is still immature and requires a significantly sound legal framework. The next is the contextual effectiveness, which is unquestionable to get so much attention given SEA's context-specific characteristic. The Chinese-related papers give more discussion on the contextual factors than international scholars, especially on the style of governance, decision-making culture, transparency, communication and stakeholders' attitudes towards SEA. These all are the factors that impede the SEA implementation within the Chinese context. Besides, many studies evaluate the pluralist effectiveness to discuss public participation, which is accordant with the result that 44% of the articles point out that public participation in China is extremely insufficient.

Compared with the above basic effectiveness dimensions, four other perspectives attract less attention partly because they are difficult to evaluate. The criteria for substantive and normative effectiveness are very general. It is not easy to assess the influence of SEA on the decision-making of the plan and its contribution to sustainable development (Cashmore et al., 2004). A very limited

number of papers discuss the transactive effectiveness dimension because planning types are too diverse to use one unified standard (Wu et al., 2011). China still lacks clear legal requirements for the time and financial cost of SEA. Also, knowledge and learning are seldomly involved in China's SEA (Li et al., 2016). In general, future research calls for more discussion on these effectiveness perspectives. For example, if China's SEA helps realize sustainable development, is China's SEA conducted with reasonable financial and time cost, and is the knowledge and learning process involved in the SEA process.

The distribution of criteria's adoption frequency in different effectiveness dimensions resembles at a substantial extent. The criteria adopted in China's SEA studies are accordant with the international cases, except for some specific ones. The substantive effectiveness and normative effectiveness resemble the most. It demonstrates that the SEA objectives are similar worldwide, facilitating the decision-making process and realizing sustainable development. However, there are still differences in adoption frequencies between Chinese and international contexts. The significant differences lie in the criteria of assessment methods and communication. In addition, there is more discussion in China over the criteria of public participation, tiering between SEA and EIA, stakeholders' attitudes towards SEA and the decision-making culture. These factors are all serious drawbacks that influence the implementation of SEA in China.

3.5 Summary

This chapter largely answers whether the effectiveness evaluation criteria adopted by studies evaluating China's SEA accord with internationally acknowledged ones. With meta-analysis, the effectiveness evaluation criteria are quantified, and the criteria adopted in the Chinese context with those in the international context are compared. The identified research gaps shed light on China's transition from the current Planning EIA to the internationally recognized SEA. Meanwhile, the problems of China's SEA system pointed out by past studies are statistically analyzed, explaining the frequent adoption of some criteria. Unlike the past studies that examine experts' perceptions using questionnaire surveys or interviews to evaluate China's SEA effectiveness, this study reveals the frequencies of each problem to show its relative severity and urgency.

The study is not without limitations. First, only academic journal articles were included in the meta-review. Some other earlier works on SEA effectiveness, including books, conference proceedings, textbooks and dissertations, have not been counted in the frequency analysis. Second, only 68 articles ranging from 2009 to 2019 have been reviewed, and in this case, it is unavoidable to ask if it is enough to draw any conclusions. Third, this study might have missed relevant articles published within the period during the literature search.

Nevertheless, the broad inclusion of the papers reviewed by this study can be verified from two perspectives: the involvement of all big names in the SEA effectiveness research field recognized by past scholars (Caschili et al., 2014) and the inspection of all three main journals acknowledged by past studies (Fischer and Onyango et al., 2012). Besides, recent research studies also adopt the criteria proposed by earlier research and somewhat reflect the outcomes in earlier years. Therefore, notwithstanding these limitations, it is convinced that this meta-analysis provides useful insights into the adoption frequencies of evaluation criteria and the consistency between Chinese and international contexts.

Chapter 4. Evaluating SEA's Effectiveness

Currently, China is under a period of rapid economic and social development. Consequently, the pressure on resources and the environment has become increasingly prominent. The government has realized the growing importance of preventing environmental pollution and ecological damage from the source of decision-making. This provides a good development opportunity for strategic environmental assessment (SEA). Researches and practices on SEA in China have been developed rapidly, and a continuous accumulation of experiences has been gained. SEA has played a greater role in integrating environmental protection into comprehensive decision-making (Shen, Zhu, & Zhang, 2017). This chapter aims to evaluate SEA's effectiveness in China.

4.1 Research background and purpose

Through continuous efforts, the laws and regulations related to China's Planning EIA (PEIA) have been gradually improved, and some successful experiences have been obtained (Xiong & Mei, 2018). However, there are still some problems in institutional improvement, practical implementation, and evaluation technologies. The SEA effectiveness studies have made remarkable progress because of the growing breadth and depth of theoretical studies and case studies (T. Li et al., 2016). T. Li et al. (2016) examine the factors that influence the performance of SEA in China. Bina (2008) proposes a conceptualization of SEA effectiveness that combines direct and incremental impacts with integrating China's specific context. Bao and Wen (2019) discuss the procedural and substantive effectiveness of the current PEIA. H. Wang (2014) develops a conceptual evaluation model which includes the contextual, procedural, substantive, and indirective effectiveness and uses it to evaluate the effectiveness of Tianjin Binhai New Area Planning EIA. Fan (2017) adopts an AHP- fuzzy synthetic evaluation method and evaluates the effectiveness of Nanyang Petrochemical Specialized Park Planning EIA. Bina, Jing, Brown, & Partidário (2011) examine the reasons for ineffectiveness in procedural, substantive, and incremental effectiveness perspectives. However, no article evaluates SEA effectiveness by incorporating Baker and McLelland's effectiveness evaluation model (2003), Bond's sustainability model (2012) and J. Arts' conception model (2012), including procedural, substantive, transactive, normative, contextual, pluralist, knowledge and learning effectiveness.

Baker and McLelland (2003) apply effectiveness as a criterion to measure the participation of First Nations participation in British Columbia's environmental assessment process. Effectiveness is reviewed as a means to measure policy implementation, and an expanded framework is proposed to measure effectiveness. In the expanded effectiveness evaluation framework, procedural (practice), substantive (performance), and transactive (proficiency) aspects are borrowed from Sadler (1996), and a normative (purpose) aspect is added. Baker and McLelland's evaluation model (2003) is presented as a circular effectiveness cycle. The cycle focuses on practice, performance, proficiency, and purpose, which are linked to policy by their respective efficacy measurements. The overall policy effectiveness is reflected by how the policy works from all four aspects. Utilization of the framework begins with the practice of a policy and proceeds in a clockwise direction. Afterward, Bond (2012) incorporates the critical influences of pluralism, and knowledge and learning into a typology of effectiveness. The typology is used to examine the sustainability assessment process in

Canada, England, Western Australia and South Africa. J. Arts (2012) develops a conceptual model and evaluates the EIA Practice in the Netherlands and the UK. The study discusses the contextual factors from four perspectives, including the characteristic of assessment results, the course of EIA procedure, the characteristic of actors, and the decision-making context. All the seven effectiveness dimensions are exhibited in **Figure 4.1**.

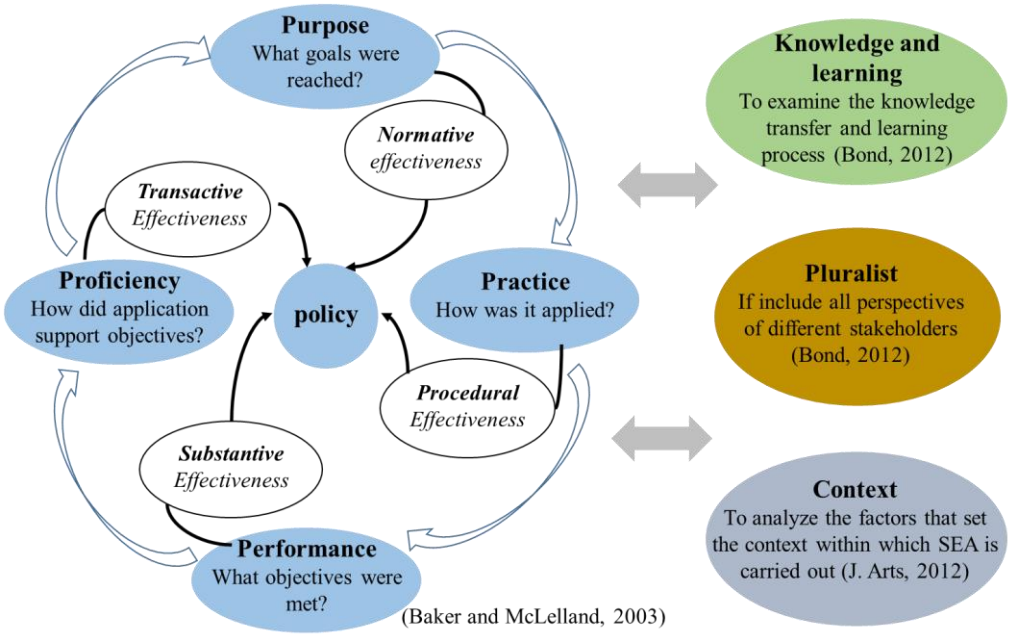


Figure 4.1 Typology of SEA effectiveness dimensions

(Source: Baker and McLelland, 2003; Bond, 2012, J. Arts, 2013)

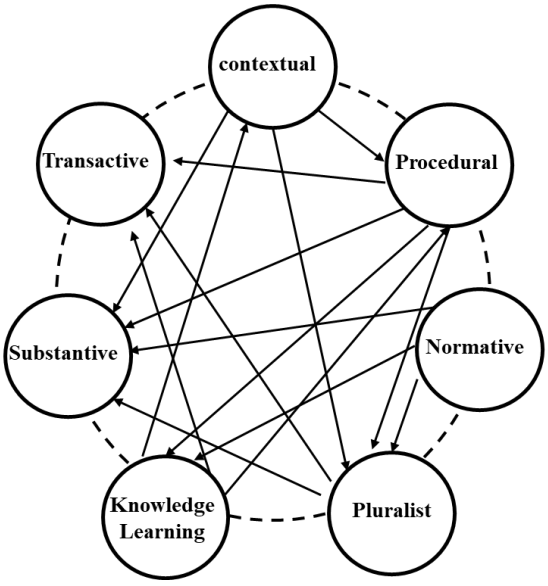


Figure 4.2 Relationship between the various SEA effectiveness dimensions

(Source: Geißler, 2019; González et al., 2019)

The different effectiveness is not independent. Instead, they are interrelated and mutually influenced. The relationship between the various SEA effectiveness dimensions is presented in

Figure 4.2. Procedural effectiveness and knowledge and learning are prerequisites for substantive and normative effectiveness. Well-timed and integrated SEA and target-oriented tiering enhance the chance of implementing changes brought by the SEA, while change is a consequence of learning. The procedural effectiveness of public participation serves as a basis for pluralist effectiveness. A strong focus on transactive effectiveness might undermine procedural and substantive effectiveness. Contextual factors influence other effectiveness dimensions (Geißler, 2019; González et al., 2019).

This chapter aims to evaluate the effectiveness of SEA in China by adopting the integrated model. A meta-analysis of 27 academic papers published from 2009 to 2019 is supplemented with document analysis and information obtained from government websites. Papers used to evaluate SEA's effectiveness are shown in **Figure 4.3**[9]. To ensure a comprehensive investigation, the selected papers cover three well-recognized EIA-related journals (Fischer & Onyango, 2012), including Environmental Impact Assessment Review (EIA Review), Impact Assessment and Project Appraisal (IAPA) and Journal of Environmental Assessment Policy and Management (JEAPM) and involve the leading researchers' names in the EIA-related studies (Caschili et al., 2014). Apart from the effectiveness evaluation studies, the papers discussing SEA's problems and drawbacks are also scrutinized because they are indispensable to answer the question about effectiveness. The result is shown by elaborating the strengths and weaknesses of SEA. The constraint factors that influence the SEA performance are also identified. Especially, the interrelation and mutual influence of different effectiveness perspectives are elaborated.

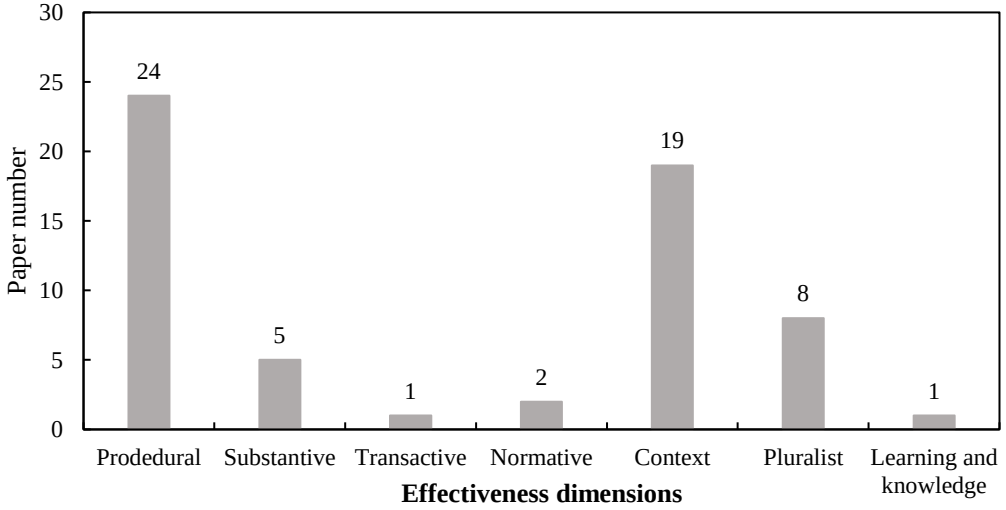


Figure 4.3 Papers used to evaluate SEA's effectiveness in China

4.2 Evaluation of SEA's effectiveness

4.2.1 Procedural effectiveness

After several decades of development, laws and regulations for Planning EIA are relatively comprehensive. However, legislative support is still lacking in SEA's implementation (T. Li et al., 2016). The 2009 Regulations on Planning EIA (Article 2) list the type of plans that needs to carry out EIA. Each kind of plan, with its characters, requires its specific framework to make a SEA. However, the absence of specific regulations makes it impossible to follow a standard guide to assess

[9] The detail of the papers is listed in **Part 3.2.3, table 3.3.** Studies on SEA effectiveness in the Chinese context.

the proposed plans (Gao et al., 2014). The guidance provided by the technical guidelines is also insufficient (Xiong & Mei, 2018; X. Chen, 2016). Except for the Technical guidelines for Planning EIA - General Principles (HJ 130 - 2019) and the Coal industry mining area plan (HJ 463 - 2009), the guidelines for some other planning types are under preparation or pending.

The tiering between SEA and EIA is incomplete. The current Chinese SEA system is for plans only. To better realize SEA's objective of influencing the decision-making process, the policy is encouraged to be officially covered by related laws in the future. In recent years, growing attention is paid to the construction of a comprehensive SEA system. Due to the low implementation rate and late starting of Planning EIA, it can only provide limited guidance for construction projects. Opinions are issued to strengthen the linkage between Planning EIA and Project EIA. The Implementation Plan for the Reform of EIA in "13th Five-Year" stipulates to carry out some pilot policy EIAs and develop the strategic-level EIA by integrating the "three lines and one list". Afterward, a specific law for policy is necessary to be issued.

The EIA is required to be performed during the preparation process of integrated plans, and for specific plans, the EIA is carried out after the draft planning being finished and before its submission for review (Articles 7 and 8, EIA Law; Article 10, Regulations for Planning EIA). However, it is extremely common that the EIA process lags behind the planning process. By September 2014, this lagging happens in 44% of the coal mining areas (Geng, 2016). That was partly due to the nonexistence of specific regulations on the timing and method of integration. Besides, the accountability mechanism is lacking in the later implementation process. The planning system and decision-making culture also exert an influence (Xiong & Mei, 2018).

Screening process is to determine if an EIA is necessary to be carried out. Article 2 of Planning EIA law (2009) and Articles 7 and 8 of EIA Law (2016) stipulate the plans subjects to EIA. However, the development plan formulated by the Development and Reform Department is lacking, which is seen as the core of China's political system (C. Bao & Wen, 2019). Especially, the social development planning is conducive to the rational and effective allocation of public resources, guiding the market to play a decisive role in resource allocation, and at the same time promoting sustained, rapid, coordinated and healthy development of the national economy and overall social progress. Thus, the EIA for development plans is significant to be included. Yang (2012) also suggests including SEA for policies and more plans, such as economic and social five-year plans at different levels: national, provincial, city and county. In addition, it is better to improve and emphasize the screening criteria and encourage provinces to establish their scopes according to local situations.

According to the TG (HJ 130 – 2019, Part 7), the resource-, ecological and environmental impacts of planning implementation are identified in the scoping process. Their produced methods and influencing nature, scope and degree are analyzed. For the plans that may produce pollutants prone to bioaccumulation and harmful to people after long-term exposure, the contact methods and the possible population health risks also need to be assessed. Assessment modes are also carried forward from Project EIA. Nevertheless, the current indicator system is insufficient given the complexity, extensiveness and multi-level nature of strategic environmental assessment objects. Especially, it cannot reflect the mutual influence consequences of environment, society and economy (Tu, 2014). The current evaluation focus is on environmental elements, including atmosphere, water, soil, animals and plants, and the environmentally sensitive areas such as nature reserves and scenic spots. In contrast, rural environmental issues, climate change issues, and marine

environmental issues have not been given sufficient attention (Geng, 2019b). In practical cases, evaluation indicators are often poorly selected (K.-Y. Zhou & Sheate, 2011). He, Liang and Feng (2019) examined 40 Planning EIA report and pointed out that the environmental quality status investigation in 15% of reports is incomprehensive and identifies environmental protection objectives in 13% documents is incomplete.

SEAs are expected to be carried out at the strategic level. However, the current assessment methods are developed or improved from Project EIA (S. Wang et al., 2009), and the SEA application is not supported by sufficiently advanced and appropriate methodologies (T. Li et al., 2016). Che, English, Lu and Chen (2011) criticize that the techniques and methodologies of SEA are not well developed at a strategic level in Shandong Province and even in China. K. Y. Zhou and Sheate (2011) conduct case studies and found that the impact assessment methods were overly simplistic. The most widely used environmental impact prediction and evaluation tool were Overlay Map, and almost all impacts were evaluated by this tool without discriminating the nature of different impacts. In addition, although setting clear objectives based on the identified indicators is important, the assessment objectives are sometimes not justified. The characteristics of environmental impacts such as frequency, duration, permanent or temporary impact, and reversible or irreversible were not considered when impacts were being assessed (K. Y. Zhou & Sheate, 2011).

Alternative analysis is supposed to be provided for planners as a decision-support tool, including the no-action alternative (Geißler et al., 2019; Malvestio & Montaño, 2013). However, the assessments of alternatives have been commonly inadequate in China (T. Li et al., 2016; Geng, 2016). Wu, Chang, Bina, Lam, and Xu (2011) state that alternative research is mostly performed for special plans and less for integrated and directive macro plans. Among 24 Planning EIA cases from 2003 to 2005 in Shanghai, 21% of the cases conduct alternative analysis, focusing only on one or two specific environmental elements but not on structured alternative analysis. For 9 Planning EIA cases for specific plans in 2007 in Shanghai, 7 cases implement the generally alternative analysis, and only 1 alternative analysis is good with high quality. The planning preparing process and SEA's integration timing contribute to the insufficient consideration of alternatives (Z. Zhu, Bai, Xu, & Zhu, 2011). The decision-making system is characterized by top-down, and the prepared plan must comply with the higher-level policies and plans. The assessors are left with minimum options on alternatives evaluation (J. Wu et al., 2011). In practical implementation, the EIA process is carried out before the draft plan is submitted for review or is conducted after the planning details are revised (Xiong & Mei, 2018). In other words, the EIA is integrated very late and carried out under the consent that the planning will definitely be implemented. There is no discussion on "no-action alternatives". Besides, the alternative assessment is not legally required, suggested by the TG of Planning EIA (K. Y. Zhou & Sheate, 2009). Many regulations and technical manuals for key planning, including land use planning, urban and rural planning, and mineral resource development planning, do not stipulate alternatives, which may not provide a basis for the alternative considerations in the EIA process (Tu, 2014).

Articles 24 to 30 in RPEIA require a follow-up evaluation. However, the follow-up is inadequate (Lam, Chen and Wu, 2009; X. Chen, 2016). Neither the EIA Law nor the RPEIA has deterrent accountability clauses (Tu, 2014). In some EIA reports, there are no detailed monitoring and follow-up assessment plans (K.-Y. Zhou & Sheate, 2011; T. Li et al., 2016; Fan, 2017). Besides, enforcement is poor, administrative supervision is lacking, and follow-up monitoring is insufficient. They are all important reasons for the ineffective implementation of Planning EIA (Shoudong Wang et al., 2019). The environmental protection administrative department has a leading position in the

review process of the EIA report, which can require the planning to implementing EIA and provide revision comments for the assessment conclusion. Nevertheless, they do not have enough power in the supervision of the implementation of EIA. In addition, unlike Project EIA, which has the environmental acceptance process to examine the accordance between EIA requirements and practical construction, the Planning EIA does not have this examining process (S. Wang et al., 2019).

4.2.2 Substantive effectiveness

To discuss to what extent SEA realize its objectives, some researchers state that SEA did fulfill its objective of proposing countermeasures and actions to prevent or mitigate adverse environmental impacts (J. Wu et al., 2011) and playing an important role in optimizing the spatial layout of cities and regions, adjusting the industrial structure and curtailing the gross volume of pollutants (Che et al., 2011). However, Planning EIA provides little or no guidance for Project EIA (X. Chen, 2016) and gives limited decision-making influence (Xiong & Mei, 2018). Fischer and He (2009) distributed 20 questionnaires to Chinese scholars attending a workshop. “A lack of real influence” was identified as the greatest shortcoming; nearly 80% of the respondents point out SEA’s lacking influence in spatial planning, while only 30% in transport PPP making. This difference is attributed to the characteristics and work experience of respondents. Bao and Wen (2019) criticize that Planning EIA did not play a good preventive role, notably the “empty cities” and “ghost cities” associated with over-urbanization that are widely concerned by society further demonstrate that the EIA is not really integrated into the planning process, and cannot exert a substantial influence on decision-making.

The ineffectiveness can be attributed to the characteristics of the planning system (Xiong & Mei, 2018) and late integration (J. Wu et al., 2011). To think of China’s planning system, the planning formulation, approval, implementation, and modification are not standard enough, and there are uncertainties in planning revisions, which increases the difficulty of Planning EIA. Especially, the development zones in some western provinces face great difficulties in attracting investment. Some parks have not implemented projects for a long time, or the practical implemented projects are far from the park planning. As a result, the planning details of industrial parks are then changed frequently. And the EIA also needs to be revised accordingly. Thus, agencies prefer to proceed with the EIA process after construction projects. Under these circumstances, the Planning EIA plays a limited role in the decision-making process.

4.2.3 Transactive effectiveness

The transactiveness is to examine the financial and temporal cost of SEA. In China, the situations in different provinces vary, and the type of plans are so diverse, making it difficult to evaluate the transactiveness effectiveness. Article 5 of RPEIA requires that the expenses required for the PEIA shall be included in the financial budget according to the provisions of budget management. Strict expenditure management should be conducted under audit supervision. However, neither the RPEIA nor the related legal provisions include detailed requirements of expenses for PEIA. Li et al. (2016) identify the lack of funding as a constraint influencing the SEA effectiveness. In addition, there is no specific law for Policy EIA, which in turn leads to the lack of financial support for the SEA at the law level. Some decision-makers take it as an excuse to hamper the implementation of SEA at a high level (S. Wang et al., 2009).

4.2.4 Normative effectiveness

There is some sustainability thinking in the related laws and regulations. Article 1 of RPEIA states that “the regulations are made to improve the scientificalness of planning, prevent

environmental pollution and ecological damage from the origin, and promote the comprehensive, coordinated and sustainable development of economy, society and environment". Article 8 requires analyzing the relationship between economic, social and environmental benefits after planning implementation and the relationship between current and long-term interests. Article 11 stipulates to evaluate the environmental carrying capacity in the affected areas and its environmental coordination with the related planning. In addition, the revised TG for Planning EIA (HJ130-2019) incorporates the requirement of "three lines and one list". The EIA is supposed to be carried out considering the overall layout of the area from a sustainable development perspective.

However, there are still gaps to realize sustainable development for the current SEA system. In practical implementation, the SEA over-emphasizes procedural technicalities instead of sustainability (Lam et al., 2009). The current technocratic-rational approach contributes little to building a sustainable society that meets the public aspirations and develops the potential ecological and social capabilities (D. Zhu & Ru, 2008). Many constraint factors may exacerbate the normative ineffective. For example, the implementation rate of Planning EIA is still low (C. Bao & Wen, 2019), the formal regulation on Policy EIA is lacking, and the environmental consciousness is insufficient (Shen et al., 2017).

4.2.5 Contextual effectiveness

The current governance system in China does not facilitate SEA development. Different plans are under the management of different organizations, and the relationship between the different plans is chaotic (C. Bao, Zhou, & Zeng, 2014). For example, the national economic and social development planning belongs to the national development and reform commission; the town planning belongs to the urban and rural construction management department; the land use planning belongs to the land department, and there is no unified system for spatial planning. The division of authority puts different environmental elements under the management of different departments or even the same environmental element under the management of multiple departments. As a result, the planning content in different departments may overlap or even contradict; the support data and information may not be transferred. The communication between administrative departments and different stakeholders is not timely or effective (Yang, 2012; Gao et al., 2014; Lam et al., 2009). Cooperation between sectors is limited (T. Li et al., 2016). These problems further result in a lot of confusion and inconvenience in the development of Planning EIA.

Although environmental protection departments have the power to review environmental impact statements, it is the local government and industry authorities that approve the implementation of the plan (Xiong & Mei, 2018). In current China, the environmental protection departments at all levels have relatively weak positions (Yang, 2012; T. Li et al., 2016). Namely, departments in charge of PEIA generally have 'less influence' over decision-making compared to those responsible for development plans (Bina et al., 2011). Consequently, the follow-up supervision and enforcement are inadequate for the application of SEA. In addition, the attitude of decision-makers and competent authority toward SEA directly affect SEA implementation (J. Wu et al., 2011). Nevertheless, some local governments and planning departments lack the willingness to conduct SEA (Yang, 2012; Xiong & Mei, 2018). Scholars suggest strengthening the link between PEIA practice and leaders' annual performance evaluation (Bina et al., 2009).

Relatively good flexibility is found (Gao et al., 2014). Due to the different characteristics of different plans, the SEA guidelines should not be used uniformly for all of them. Under the top-to-bottom management system, the guidelines and indicators are given at a very general scope at the

national level, and the detailed regulations are then developed at local levels. Article 9 in TG of Planning EIA also requires different evaluation emphasis for different plans.

4.2.6 Pluralist effectiveness

The pluralist effectiveness is put forward to examine if a pluralistic approach is adopted in the SEA process to include all perspectives of different stakeholders and achieve greater public participation (Peterson & Vahtrus, 2019). Regarding this question, many researchers state that public participation in China is inadequate (Bina et al., 2011; K.-Y. Zhou & Sheate, 2011; Lam et al., 2009). Only government officials and experts are invited to participate in the SEA process. In contrast, few citizens are involved, and the people from localities and rural areas are usually ignored (K. Y. Zhou & Sheate, 2011; Bina et al., 2011; Bina et al., 2009; T. Li et al., 2016). Besides, the disclosed information is not sufficient to meet the basic needs of public participation. Wu et al. (2011) investigated 81 professional practitioners and government officials and pointed out that 58% of interviewees insist that the information is not completely disclosed, 30% of them disagreed that the disclosed information is easy to understand.

The public participation approach is also limited (J. Wu et al., 2011; Che et al., 2011). Fan (2017) states that the main form of public participation is the questionnaire survey. However, due to the low response rate and not giving certain prompts and frames for some questions in the questionnaires, the public opinions are distorted to a certain extent. The time for giving feedback is insufficient. As said by Bina et al. (2009), the stage of public participation is exclusively at the final stage of PEIA, on the assessment itself, rather than at the key stages of scoping. Che et al. (2011) also criticize that public participation is undertaken after all the major decisions have already been made with little or no opportunity for genuine consideration. The public's feedback is not well implemented (Gao et al., 2013). The financial and legal support to the public to participate in SEA is lacking (Fan, 2017). All these problems weaken both the effectiveness of public participation and the PEIA.

4.2.7 Knowledge and learning

The SEA can be reconceptualized as a learning process (Sánchez & Mitchell, 2017). Bond, Morrison-Saunders and Howitt (2012) define the knowledge and learning effectiveness as how and to what extent the assessment process facilitates instrumental and conceptual learning. Instrumental learning is single-looping learning, with which people, organizations or groups modify their actions to improve policy and achieve objectives. However, this type of learning can only make small adjustments and causes of problems remain. Conceptual learning is double-loop learning, with which stakeholders' beliefs change and their perspectives towards policy and the ways of achieving it alter.

It is difficult to evaluate because the learning process cannot be studied directly. The related studies are also few. This paper tries to give some discussion by examining some influence factors. The SEA database has not been usefully established, and there has been no expert database for SEA professionals. In some provincial governments and provincial EPBs, it was not easy to find provincial SEA regulations and documents on the websites (Yang, 2012). People have a limited approach to accessing SEA-related knowledge. In addition, the insufficient communication and cooperation between government agencies and inadequate public participation weaken the knowledge transfer during the assessment process.

The EIA consultants at provincial and county levels have undertaken most of the EIA work for construction projects, while the experience of SEA is still lacking. It is necessary to conduct training courses and help them learn about SEA-related knowledge. Bina et al. (2011) define a set of evaluation criteria to help move the current formal, narrow interpretation of PEIA to a wider and more strategic interpretation. In the strategic level assessment, follow-up plans are encouraged to propose activities that enable organizational and social learning throughout the assessment and beyond.

4.3 Recommendations

All in all, it can be concluded that China-related studies focus more on easily-evaluated and basic effectiveness perspectives. Future research calls for more discussion on the deeper and outstretched effectiveness perspectives. For example, if China's SEA helps realize sustainable development, is China's SEA conducted with reasonable financial and time cost, is the knowledge and learning process involved in the SEA process. Finally, in view of the shortcomings in China's Planning EIA system identified through meta-analysis, the following improvement measures are proposed.

(1) A law for policy EIA needs to be enacted, and the technical guidance for Planning EIA needs to be improved. Specifically, the timing of integrating SEA into the planning process should be stipulated so that it can facilitate decision-making.

(2) The communication between stakeholders and different government departments is advisable to be strengthened. The hierarchy position of environmental protection departments is recommendable to be enhanced to ensure its influence in the decision-making process. By changing one-way information transfer to two-way communication, public participation can be strengthened.

(3) Stakeholders' attitudes towards SEA and environmental protection needs to be improved. It is urgent to change the economic-oriented mindset to a sustainability-oriented one that realizes the coordinated development of the economy, society, and environment. Different social media can be used for the purpose, for example, WeChat and Weibo.

4.4 Summary

This chapter aims to answer the question of how effective the SEA in China by integrating Baker and McLelland's effectiveness evaluation model (2003), Bond's sustainability model (2012) and J. Arts' conception model (2012). A meta-review of 27 academic papers published from 2009 to 2019 is conducted, supplemented with the information obtained from document analysis and internet surveys. The evaluation is carried out with procedural, substantive, transactive, normative, contextual, pluralist and knowledge and learning effectiveness. The strengths of the current SEA system are illustrated, the constraint factors are identified, and how they weaken the effectiveness are explained. It can be found that the effectiveness dimensions are not independent and influence each other.

Procedural effectiveness has attracted the most attention. After several decades of its development, SEA has obtained relatively comprehensive and effective legal support, albeit lack of regulations on some key issues, for example, the Policy EIA, TG for more planning types, clear stipulation on integration timing and approach. In some cases, PEIA starts too late, which greatly

weakened the substantive effectiveness. The assessment methods of current PEIA remain immature. Environmental elements have been analyzed the most; SEA help to propose encounter measures and mitigate adverse environmental impacts to a certain extent. However, the issues that really matter, including the mutual influence of social, economic and environmental impacts, have seldom been covered. There is still a huge gap to accomplish its ultimate objective which is sustainable development.

The discussion of knowledge and learning effectiveness in past studies is limited. Instead, this chapter discusses the related constraint factors that may weaken the knowledge transfer in the SEA process, such as low cooperation among agencies and insufficient public participation. The pluralist effectiveness examination explains the reasons for inadequate public participation, such as limited participation approach, ineffective consulting with the general public, especially those from localities and rural areas. Contextual effectiveness illustrates how the Chinese characteristic governance mechanism and decision-making culture leads to the late integration of PEIA, poor cooperation and communication among departments, and insufficient transparency. Besides, the planning agencies and government departments lack the willingness to carry out SEA; the general public lacks environmental consciousness. These further result in ineffectiveness in other dimensions.

It is undeniable that the number of reviewed papers may be limited due to few including classical books, conference proceedings and studies published before 2009. This study is conducted with the viewpoint that the latest papers are better to reflect the lasting and ongoing problems, and the statement of researchers included in the books and conference proceedings can somewhat be found in the academic papers. Notwithstanding the limited papers being meta-analyzed, this study provides a comprehensive effectiveness evaluation against seven perspectives and significantly sheds light on the future reform and development of SEA in China.

Chapter 5. Conclusions and Future Studies

In this dissertation, the definition and objectives of EIA are explicated, its historical development in China is introduced, and the implementation status quo is described. After an extensive literature review, the necessity and significance of evaluating reformed EIA system's effectiveness are clarified. The widely applied Ahmed and Wood's model (2003) has been revised to make it appropriate to the Chinese characteristics, against which the performance of the reformed EIA system has been evaluated. A meta-analysis is adopted to conduct a statistical examination on the evaluation criteria, and a comparison of the adopted criteria has been carried out between the international and Chinese context. In addition, a thorough effectiveness evaluation of SEA is carried out by integrating Baker and McLelland's effectiveness evaluation model (2003), Bond's sustainability assessment model (2012) and J. Arts' conceptual model (2013), which including seven effectiveness perspectives: procedural, substantive, transactive, normative, contextual, pluralist, and knowledge and learning dimensions.

As a result, it can be found that the EIA in China has developed a relatively comprehensive legislative system for both Project EIA and Planning EIA. The procedural effectiveness has largely been realized and the effectiveness of the reformed EIA system is significantly improved. The approval of Project EIA has been simplified and the post-event supervision has been strengthened. Besides, the legal provisions are developed relatively comprehensive. However, there still lacks some specific laws and detailed stipulations on some issues. For example, there still lack specific laws for Policy EIA and supporting laws to guide the implementation of Planning EIA; no supporting legislative provisions elaborate on what the overall management explicitly entails and how to realize it; no declare the environmental right of citizens; and no requirement of alternative consideration of "without/delay project". Some legal terms are too general to result in different interpretations, and some provisions are too inflexible to result in unnecessary work.

Although the reformed EIA system is procedurally effective, the biggest question lies in how to improve its enforcement and implementation. There is still a huge gap to realize the objectives of EIA. The substantive objectives, which including the short-term and long-term aims, have not been well achieved. For instance, Planning EIA has frequently integrated into the decision-making process early, mitigating adverse environmental impacts, providing guidance for project EIA, etc., and the normative goals of achieving sustainable development. Both Project EIA and PEIA have proposed encounter measures and mitigate adverse environmental impacts. Nevertheless, the issues that really matter, including the mutual influence of social, economic and environmental impacts, have seldom been covered.

The discussion on transactive, and knowledge and learning effectiveness is few. The pluralist effectiveness examination explains the reasons for inadequate public participation, such as limited participation approach, ineffective consulting with the general public, especially those from localities and rural areas. Contextual effectiveness illustrates how the Chinese characteristic governance mechanism and decision-making culture leads to the late integration of Planning EIA, poor cooperation and communication among departments, and insufficient transparency. In addition, the Chinese context factors, such as low cooperation among agencies and insufficient public participation, have not facilitated the knowledge transfer in the EIA process.

To sum up, the three objectives set up by this dissertation have achieved. The effectiveness evaluation models appropriate for Chinese context are proposed; the effectiveness of reformed EIA

system in China is evaluated; the weaknesses have been found and improvement measures are put forward. For example, the hierarchical position of Environmental Protection Law should be improved; the environmental right of citizens should be explicitly declared and their right of appeal should be guaranteed; the relative provisions for consideration of alternatives should be considered; the responsibility list of environmental protection departments should be explicit; communication between stakeholders and different government departments is advisable to be strengthened; and stakeholders' attitudes towards SEA and environmental protection needs to be improved.

A big percentage of this dissertation has been paid to procedural effectiveness evaluation, which is an indispensable and significant basis of an effect EIA. However, more research is needed to evaluate other effectiveness perspectives, such as the extent of realizing normative goals, the existence of knowledge and learning process, and the reasonability of temporal and financial cost of Planning EIA. Considering the reforms emphasize reinforcing the linkage between Planning EIA and Project EIA, future research requires more papers on this perspective evaluating if and to what extent the Planning EIA and project EIA have been linked. China has started to compile "three lines ad one list". Future studies call for more discussion on integrating "three lines and one list" into EIA.

References

Acharibasam, J. B., & Noble, B. F. (2014). Assessing the impact of strategic environmental assessment. *Impact Assessment and Project Appraisal*, *32*(3), 177–187. https://doi.org/10.1080/14615517.2014.927557

Ahmad, B., & Wood, C. (2002). A comparative evaluation of the EIA systems in Egypt, Turkey and Tunisia. *Environmental Impact Assessment Review*, *22*(3), 213–234. https://doi.org/10.1016/S0195-9255(02)00004-5

Arce-Ruiz, R. M., Soria-Lara, J. A., & González-Del-Campo, A. (2019). SEA effectiveness in Spain: insights from practice. *Impact Assessment and Project Appraisal*, *37*(3–4), 327–333. https://doi.org/10.1080/14615517.2019.1602382

Arts, J., Runhaar, H. A. C., Fischer, T. B., Jha-Thakur, U., Van Laerhoven, F., Driessen, P. P. J., & Onyango, V. (2012). The effectiveness of EIA as an instrument for environmental governance: Reflecting on 25 years of EIA practice in the Netherlands and the UK. *Journal of Environmental Assessment Policy and Management*, *14*(4). https://doi.org/10.1142/S1464333212500251

Aung, T. S., Fischer, T. B., & Shengji, L. (2020). Evaluating environmental impact assessment (EIA) in the countries along the belt and road initiatives: System effectiveness and the compatibility with the Chinese EIA. *Environmental Impact Assessment Review*, *81*(June 2019), 106361. https://doi.org/10.1016/j.eiar.2019.106361

Baker, D. C., & McLelland, J. N. (2003). Evaluating the effectiveness of British Columbia's environmental assessment process for first nations' participation in mining development. *Environmental Impact Assessment Review*. https://doi.org/10.1016/S0195-9255(03)00093-3

Bao, C. (2015). Reform of environmental impact assessment aims to return to its essence. *Chinese Environmental Management*, *7*(3), 33–39.

Bao, C. (2016). EIA reforms should focus on improving the effectiveness. *Chinese Ecological Civilization*, (5), 33–35.

Bao, C., & Wen, Y. (2019). Upgrading of Planning Environmental Impact Assessment for the Reform. *Environmental Protection*, *47*(22), 16–20. https://doi.org/10.14026/j.cnki.0253-9705.2019.22.003

Bao, C., Zhou, F., & Zeng, G. (2014). Thinking about potential help of PEIA to the new-urbanization construction. *Environmental Protection*, *42*(9), 18–22. https://doi.org/10.14026/j.cnki.0253-9705.2014.09.004

Bao, Z. (2015). *The factors influencing the environmental policy implementation in China*.

Bina, O. (2008). Context and Systems: Thinking More Broadly About Effectiveness in Strategic Environmental Assessment in China. *Environmental Management*, *42*(4), 717–733. https://doi.org/10.1007/s00267-008-9123-5

Bina, O., Ausra, J., & Zhang, H. (2009). *Transition from Plan Environmental Impact Assessment to Strategic Environmental Assessment, Recommendations of the Project "Policy Instruments for a Sustainable Chinese Future."*

Bina, O., Jing, W., Brown, L., & Partidário, M. R. (2011). An inquiry into the concept of SEA effectiveness: Towards criteria for Chinese practice. *Environmental Impact Assessment Review*, *31*(6), 572–581. https://doi.org/10.1016/j.eiar.2011.01.004

Bond, A. J., & Morrison-Saunders, A. (2011). Re-evaluating Sustainability Assessment: Aligning the vision and the practice. *Environmental Impact Assessment Review*, *31*(1), 1–7. https://doi.org/10.1016/j.eiar.2010.01.007

Bond, A., Morrison-Saunders, A., & Howitt, R. (2012). Framework for comparing and evaluating sustainability assessment practice. *Sustainability Assessment: Pluralism, Practice and Progress*, 117–131. https://doi.org/10.4324/9780203112625

Bond, A., Morrison-Saunders, A., & Pope, J. (2012). Sustainability assessment: The state of the art. *Impact Assessment and Project Appraisal*, *30*(1), 53–62. https://doi.org/10.1080/14615517.2012.661974

Cape, L., Retief, F., Lochner, P., Fischer, T., & Bond, A. (2018). Exploring pluralism – Different stakeholder views of the expected and realised value of strategic environmental assessment (SEA). *Environmental Impact Assessment Review*, *69*(June 2017), 32–41. https://doi.org/10.1016/j.eiar.2017.11.005

Caschili, S., De Montis, A., Ganciu, A., Ledda, A., & Barra, M. (2014). The Strategic Environment Assessment bibliographic network: A quantitative literature review analysis. *Environmental Impact Assessment Review*, *47*, 14–28. https://doi.org/10.1016/j.eiar.2014.03.003

Cashmore, M., Gwilliam, R., Morgan, R., Cobb, D., & Bond, A. (2004). The interminable issue of effectiveness: Substantive purposes, outcomes and research challenges in the advancement of environmental impact assessment theory. *Impact Assessment and Project Appraisal*, *22*(4), 295–310. https://doi.org/10.3152/147154604781765860

Cepuš, S., Strmšnik, K., Harmel, M., Krajnc, A., Premelč, M., Harmel, E., & Weldt, S. (2019). The effectiveness of the SEA process in Slovenia. *Impact Assessment and Project Appraisal*, *37*(3–4), 312–326. https://doi.org/10.1080/14615517.2019.1595934

Chanchitpricha, C., & Bond, A. (2013). Conceptualising the effectiveness of impact assessment processes. *Environmental Impact Assessment Review*, *43*, 65–72. https://doi.org/10.1016/j.eiar.2013.05.006

Chanchitpricha, C., Morrison-Saunders, A., & Bond, A. (2019). Investigating the effectiveness of strategic environmental assessment in Thailand. *Impact Assessment and Project Appraisal*, *37*(3–4), 356–368. https://doi.org/10.1080/14615517.2019.1595941

Chang I.S., Wang W., Wu J., Sun Y., & Hu R. (2018). Environmental impact assessment follow-up for projects in China: Institution and practice. *Environmental Impact Assessment Review*, *73*, 7–19. https://doi.org/10.1016/j.eiar.2018.06.005

Chang, J. (2014). New Act on Environmental Protection: the Strictest Environmental Law and the Hardest Law on Enforcement in Chinese Legislative History. *Environmental Protection*, (10).

Che, X., English, A., Lu, J., & Chen, Y. D. (2011). Improving the effectiveness of Planning EIA (PEIA) in China: Integrating planning and assessment during the preparation of Shenzhen's Master Urban Plan. *Environmental Impact Assessment Review*, *31*(6), 561–571. https://doi.org/https://doi.org/10.1016/j.eiar.2010.12.003

Chen, F. (2017). The environmental impact assessment system in China. Hunan University.

Chen, X. (2010). Study of the effectiveness of public participation of EIA based on effective management model. Jilin University.

Chen, X. (2016). Analysis on the effectiveness of Planning EIA. *Light Industry and Technology*, (4), 71–73.

De Montis, A., Ledda, A., Caschili, S., Ganciu, A., & Barra, M. (2014). SEA effectiveness for landscape and master planning: An investigation in Sardinia. *Environmental Impact Assessment Review*, *47*, 1–13. https://doi.org/10.1016/j.eiar.2014.03.002

Fan, S. (2017). Study on Effectiveness of Planning Environmental Impact Assessment Based on AHP — fuzzy Synthetic Evaluation Method. *Environmental Science and Management*, *42*(7), 6–9.

Fischer, T. B. (2002). SEA performance criteria – the same requirements for every assessment ?, *4*(1), 83–99.

Fischer, T. B., & Gazzola, P. (2006). SEA effectiveness criteria-equally valid in all countries? The case of Italy. *Environmental Impact Assessment Review*, *26*(4), 396–409. https://doi.org/10.1016/j.eiar.2005.11.006

Fischer, T. B., & Onyango, V. (2012). Strategic environmental assessment-related research projects and journal articles: An overview of the past 20 years. *Impact Assessment and Project Appraisal*, *30*(4), 253–263. https://doi.org/10.1080/14615517.2012.740953

Fischer, T. B., & Xu, H. (2009). Differences in perceptions of effective SEA in the UK and China. *Journal of Environmental Assessment Policy and Management*, *11*(4), 471–485. https://doi.org/10.1142/S1464333209003452

Fundingsland Tetlow, M., & Hanusch, M. (2012). Strategic environmental assessment: The state of the art. *Impact Assessment and Project Appraisal*, *30*(1), 15–24. https://doi.org/10.1080/14615517.2012.666400

Gałaś, S., Gałaś, A., Zeleňáková, M., Zvijáková, L., Fialová, J., & Kubíčková, H. (2015). Environmental Impact Assessment in the Visegrad Group countries. *Environmental Impact Assessment Review*, *55*, 11–20. https://doi.org/https://doi.org/10.1016/j.eiar.2015.06.006

Gao, J., Christensen, P., & Kørnøv, L. (2014). The changing Chinese SEA indicator guidelines: Top-down or bottom-up? *Environmental Impact Assessment Review*, *44*, 22–30. https://doi.org/10.1016/j.eiar.2013.08.003

Gao, J., Kørnøv, L., & Christensen, P. (2013). Do indicators influence communication in SEA? - Experience from the Chinese practice. *Environmental Impact Assessment Review*, *43*, 121–128. https://doi.org/10.1016/j.eiar.2013.06.004

Geißler, G., Rehhausen, A., Fischer, T. B., & Hanusch, M. (2019). Effectiveness of strategic environmental assessment in Germany?–meta-review of SEA research in the light of effectiveness dimensions. *Impact Assessment and Project Appraisal*, *37*(3–4), 219–232. https://doi.org/10.1080/14615517.2019.1587944

Geng, H. (2016). The Development Direction of China's Strategic Environmental Assessment from the Characteristics of Foreign Strategic Environmental Assessment. *Environmental Protection*, *44*(12), 34–37. https://doi.org/10.14026/j.cnki.0253-9705.2016.12.006

Geng, H. (2019a). Integrating the strategic environmental assessment into social and economic development planning. *China Policy Research Network*.

Geng, H. (2019b). Thoughts About Strategic Environmental Assessment in China in New Era. *Environmental Protection*, *47*(2), 35–38. https://doi.org/10.14026/j.cnki.0253-9705.2019.02.009

Glasson, J., Therivel, R., & Chadwick, A. (2005). Introduction to environemntal impact assessment. *The Natural and Built Environment Series* (Vol. 15).

González, A., Bullock, C., Gaughran, A., & Watkin-Bourne, K. (2019). Towards a better understanding of SEA effectiveness in Ireland. *Impact Assessment and Project Appraisal*, *37*(3–4), 233–246. https://doi.org/10.1080/14615517.2019.1580475

Guo, S. (2017). Study of the effectiveness of Planning EIA based on AHP method. Henan Normal University.

Hanna, K., & Noble, B. F. (2015). Using a Delphi study to identify effectiveness criteria for environmental assessment. *Impact Assessment and Project Appraisal*, *33*(2), 116–125. https://doi.org/10.1080/14615517.2014.992672

He, Y., Liang, X., & Feng, Y. (2019). Discussion on Effective Linkage between Planning EIA and Project EIA. *Environmental Impact Assessment*, *41*(6).

Hegazy, I. (2014). Strategic environmental assessment (SEA) worldwide: different perspectives and one aim, *11*, 133–157.

Jia, H., Sun, S., Cunkuan, B., Fan, C., & Dahe, J. (2011). Experts' perspective on the performance of Chinese technical guidelines for Plan Environmental Impact Assessment. *Environmental Impact Assessment Review*, *31*(6), 587–592. https://doi.org/10.1016/j.eiar.2011.01.005

Jiliberto, R. (2011). Recognizing the institutional dimension of strategic environmental assessment. *Impact Assessment and Project Appraisal*, *29*(2), 133–140. https://doi.org/10.3152/146155111X12959673795921

Jin, G. (2017). Researches on the effectiveness of Construction Projects EIA in Jilin Province. *Journal of Changchun Institute of Technology*, *18*(1), 86–92.

Jin, Z. (2015). Environmental Impact Assessment Law in China's courts: A study of 107 judicial decisions. *Environmental Impact Assessment Review*, *55*, 35–44. https://doi.org/10.1016/j.eiar.2015.06.008

Khosravi, F., Jha-Thakur, U., & Fischer, T. B. (2019). Evaluation of the environmental impact assessment system in Iran. *Environmental Impact Assessment Review*, *74*(October 2018), 63–72. https://doi.org/10.1016/j.eiar.2018.10.005

King, H., & Smith, L. (2016). Many Rivers to Cross: Evaluating the Benefits and Limitations of Strategic Environmental Assessment for the Koshi River Basin. *Journal of Environmental Assessment Policy and Management*, *18*(2). https://doi.org/10.1142/S1464333216500113

Lam, K. C., Chen, Y. D., & Wu, J. (2009). Strategic environmental assessment in China: Opportunities, issues and challenges. *Journal of Environmental Assessment Policy and Management*, *11*(4), 369–385. https://doi.org/10.1142/S1464333209003415

Li, T., Wang, H., Deng, B., Ren, W., & Xu, H. (2016). Strategic environmental assessment performance factors and their interaction: An empirical study in China. *Environmental Impact Assessment Review*, *59*, 55–60. https://doi.org/10.1016/j.eiar.2016.03.008

Li, W., & Zhao, Y. (2015). Bibliometric analysis of global environmental assessment research in a 20-year period. *Environmental Impact Assessment Review*, *50*, 158–166. https://doi.org/10.1016/j.eiar.2014.09.012

Li, Yifan, & Li, H. (2019). Institutional Analysis on Stakeholder Participation in China's Environmental Impact Assessment: A State–Attribution–Motivation–Interaction–Reengineering Framework. *Integrated Environmental Assessment and Management*, *15*(4), 607–620. https://doi.org/https://doi.org/10.1002/ieam.4146

Li, Yue. (2017). A Comparative Study on Chinese and Canadian Legal System of Environmental Impact Assessment. China University of Geosciences.

Liu, Y. (2019). Analysis on the approval and supervision of environmental impact assessment under the background of "disposal of clothing"-A case study of Gui'an New District. *Environment and Development*, (1), 200–201. https://doi.org/10.16647/j.cnki.cn15-1369/X.2019.01.116

Loomis, J. J., & Dziedzic, M. (2018). Evaluating EIA systems' effectiveness: A state of the art. *Environmental Impact Assessment Review*, *68*(November 2016), 29–37. https://doi.org/10.1016/j.eiar.2017.10.005

Lv, X. (2006). Study of the effectiveness of environmental impact assessment - Apply the circular economy notion to EIA. Jilin University.

Lyhne, I., van Laerhoven, F., Cashmore, M., & Runhaar, H. (2017). Theorising EIA effectiveness: A contribution based on the Danish system. *Environmental Impact Assessment Review*, *62*, 240–249. https://doi.org/10.1016/j.eiar.2015.12.002

Ma, T., & Liu, Q. (2018). China reshapes ministries to better protect environment. *China Dialogue*, 2–5. Retrieved from https://dialogochino.net/10837-china-reshapes-ministries-to-better-protect-environment/

Malvestio, A. C., & Montaño, M. (2013). Effectiveness of strategic environmental assessment applied to renewable energy in Brazil. *Journal of Environmental Assessment Policy and Management*, *15*(2), 1–21. https://doi.org/10.1142/S1464333213400073

Marara, M., Okello, N., Kuhanwa, Z., Douven, W., Beevers, L., & Leentvaar, J. (2011). The

importance of context in delivering effective EIA: Case studies from East Africa. *Environmental Impact Assessment Review*, *31*(3), 286–296. https://doi.org/10.1016/j.eiar.2010.10.002

McLauchlan, A., & João, E. (2019). Recognising 'learning' as an uncertain source of SEA effectiveness. *Impact Assessment and Project Appraisal*, *37*(3–4), 299–311. https://doi.org/10.1080/14615517.2019.1595940

Musil, M., & Smutný, M. (2019). Effectiveness of strategic environmental assessment in the Czech Republic. *Impact Assessment and Project Appraisal*, *37*(3–4), 199–209. https://doi.org/10.1080/14615517.2019.1578482

Naser, H. A. (2012). Evaluation of the Environmental Impact Assessment System in Bahrain. *Journal of Environmental Protection*. https://doi.org/10.4236/jep.2012.32029

NGO. (2015). With the delegation of review responsibility,the total installed capacity of thermal power projects is significantly excessive.

Ning, D., Wang, H., & Whitney, J. (1988). Environmental impact assessment in China: Present practice and future developments. *Environmental Impact Assessment Review*, *8*(1), 85–95. https://doi.org/https://doi.org/10.1016/0195-9255(88)90062-5

Noble, B., Gibson, R., White, L., Blakley, J., Croal, P., Nwanekezie, K., & Doelle, M. (2019). Effectiveness of strategic environmental assessment in Canada under directive-based and informal practice. *Impact Assessment and Project Appraisal*, *37*(3–4), 344–355. https://doi.org/10.1080/14615517.2019.1565708

Pediaditi, K., Banias, G., Sartzetakis, E., & Lampridi, M. (2018). Greece's reformed EIA system : Evaluating its implementation and potential. *Environmental Impact Assessment Review*, *73*, 90–103. https://doi.org/10.1016/j.eiar.2018.07.007

People. (2015a). The feedback of examination results to the Ministry of Environmental Protection by the central third inspection team.http://politics.people.com.cn/n/2015/0210/c1001-26542556.html.

People. (2015b). Three EIA storms and the illegal high-polluted projects being stopped.

Peterson, K., & Vahtrus, S. (2019). Factors affecting SEA effectiveness in Estonia. *Impact Assessment and Project Appraisal*, *37*(3–4), 210–218. https://doi.org/10.1080/14615517.2019.1595935

Pope, J., Bond, A., Cameron, C., Retief, F., & Morrison-Saunders, A. (2018). Are current effectiveness criteria fit for purpose? Using a controversial strategic assessment as a test case. *Environmental Impact Assessment Review*, *70*(January), 34–44. https://doi.org/10.1016/j.eiar.2018.01.004

Qiao, H. (2007). A Comparison between EIA Systems of China and the UK. *Shanghai Environmental Sciences*, (3).

Ram B., K., Stefan, G., Ananda R., J., Shailendra, G., & Ajay B., M. (2013). *Environmental Impact Assessment*.

Ran, Q. (2013). Study on Effectiveness of Environmental Impact Assessment Based on "State-Structure-Performance" (SSP). *Ecological Economy*, *2013*(07).

Ren, X. (2013). Implementation of Environmental Impact Assessment in China. *Journal of Environmental Assessment Policy & Management*, *15*(3). https://doi.org/10.1142/S1464333213500099

Ren, Y. (2017). Comparative Analysis of environmental impact assessment system between China and the United States. *Energy and Energy Conservation*, (1). https://doi.org/10.16643/j.cnki.14-1360/td.2017.01.046

Ruan, L. (2016). Discussion of the legal effect of review conclusion of evironmental impact assessment. *Journal of Jishou University*, *37*(4), 25–29. https://doi.org/10.13438/j.cnki.jdxb.2016.04.004

Runhaar, H., Gommers, A., Verhaegen, K., Cooman, K., & Corens, P. (2019). The effectiveness of environmental assessment in Flanders: An analysis of practitioner perspectives. *Environmental Impact Assessment Review*, *76*(February), 113–119. https://doi.org/10.1016/j.eiar.2019.02.006

Sadler, B. (1996). International Study of the Effectiveness of environmental impact assessment in a changing world: Evaluating Practice to Improve Performance. Retrieved from https://www.ceaa.gc.ca/Content/2/B/7/2B7834CA-7D9A-410B-A4ED-FF78AB625BDB/iaia8_e.pdf

Sánchez, L. E., & Mitchell, R. (2017). Conceptualizing impact assessment as a learning process. *Environmental Impact Assessment Review*, *62*, 195–204. https://doi.org/10.1016/j.eiar.2016.06.001

Semeraro, T., Radicchio, B., Medagli, P., Arzeni, S., Turco, A., & Geneletti, D. (2020). Integration of Ecosystem Services in Strategic Environmental Assessment of a Peri-Urban Development Plan. *Sustainability*, *13*(1), 122. https://doi.org/10.3390/su13010122

Shakil, S. H., & Ananya, T. H. (2014). Effectiveness of Environmental Impact Assessment (EIA): Bangladesh Perspective. *SSRN Electronic Journal*, (February). https://doi.org/10.2139/ssrn.2381707

Shen, J., Zhu, M., & Zhang, Z. (2017). Strategic environmental assessment and sustainable development. *Energy Conservation and Environment Protection*, 160.

Sohu. (2005). Interview with the Deputy Director General of National Environmental Protection Administration about the three EIA storms.

Sohu. (2006). Starts another environmental storm in 2006: officials who do not punish polluting companies may be dismissed.

Stoeglehner, G. (2010). Enhancing SEA effectiveness: lessons learnt from Austrian experiences in spatial planning. *Impact Assessment and Project Appraisal*, *28*(3), 217–231. https://doi.org/10.3152/146155110X12772982841168

Sun, S. (2008). *Effectiveness studies on the Planning EIA in China*. Tongji University.

Suwanteep, K., Murayama, T., & Nishikizawa, S. (2016). Environmental impact assessment system in Thailand and its comparison with those in China and Japan. *Environmental Impact Assessment Review*, *58*, 12–24. https://doi.org/10.1016/j.eiar.2016.02.001

Tan, X. (2018). Discussion of the vertical management reform of environmental monitoring and enforcement departments below the provincial level.

Tan, Z. (2010). Research on EIA effectiveness analysis and indicators optimization in China. *Journal of Anhui Agriculture Science*, *38*(32), 10–12.

Theophilou, V., Bond, A., & Cashmore, M. (2010). Application of the SEA Directive to EU structural funds: Perspectives on effectiveness. *Environmental Impact Assessment Review*, *30*(2), 136–144. https://doi.org/https://doi.org/10.1016/j.eiar.2009.08.001

Therivel, R., & González, A. (2019). Introducing SEA effectiveness. *Impact Assessment and Project Appraisal*, *37*(3–4), 181–187. https://doi.org/10.1080/14615517.2019.1601432

Tokarczyk-Dorociak, K., Kazak, J. K., Anna, H., Szewrański, S., & Świąder, M. (2019). Effectiveness of strategic environmental assessment in Poland. *Impact Assessment and Project Appraisal*, *37*(3–4), 279–291. https://doi.org/10.1080/14615517.2019.1601441

Tu, J. (2014). From Ideal to Reality: The Status, Problems and Countermeasures of China's SEA. *Ecological Economy*, *30*(3), 184–188.

van Doren, D., Driessen, P. P. J., Schijf, B., & Runhaar, H. A. C. (2012). Evaluating the substantive effectiveness of SEA: Towards a better understanding. *Environmental Impact Assessment Review*, *38*, 120–130. https://doi.org/10.1016/j.eiar.2012.07.002

Veronez, F., Aparecida Veronez, F., & Montaño, M. (2015). EIA Effectiveness : conceptual basis for an integrative approach. *IAIA15 Conference Proceedings: Impact Assessment in the Digital Era*, (April), 6. https://doi.org/10.13140/RG.2.1.4698.0965

Wang, H. (2012). Measurement indicators and an evaluation approach for assessing Strategic Environmental Assessment effectiveness. *Ecological Indicators*, *23*, 413–420. https://doi.org/10.1016/j.ecolind.2012.04.021

Wang, H. (2014). Conceptual Model and Evaluation Method of Strategic Environmental Assessment Effectiveness. *Urban Environment & Urban Ecology*, *27*(4), 39–42.

Wang, M. (2016). Theory of Environmental Impact assessment system in China. Hebei GEO University.

Wang, Shoudong, Xu, H., Cheng, J., Zhang, L., & Yang, Y. (2019). Study on the Effectiveness and Countermeasures of Inland Port Planning EIA in the Yangtze River Economic Zone. *Environmental Impact Assessment*.

Wang, Shujun, Liu, J., Ren, L., Zhang, K., & Wang, R. (2009). The development and practices of Strategic Environmental Assessment in Shandong Province, China. *Environmental Impact Assessment Review*, *29*(6), 408–420. https://doi.org/10.1016/j.eiar.2009.02.005

Wang, Y., Morgan, R. K., & Cashmore, M. (2003). Environmental impact assessment of projects in the People's Republic of China: New law, old problems. *Environmental Impact Assessment Review*, *23*(5), 543–579. https://doi.org/10.1016/S0195-9255(03)00071-4

Wood, C., & Dejeddour, M. (1992). Strategic environmental assessment: EA of policies, plans and programmes. *Impact Assessment*, *10*(1), 3–22. https://doi.org/10.1080/07349165.1992.9725728

Wu, J., Chang, I. S., Bina, O., Lam, K. C., & Xu, H. (2011). Strategic environmental assessment implementation in China - Five-year review and prospects. *Environmental Impact Assessment Review*, *31*(1), 77–84. https://doi.org/10.1016/j.eiar.2010.04.010

Wu, L. (2016). *A compatative study between the EIA system of China and Korea*. Hunan Normal University.

Xiong, J., & Mei, R. (2018). The Planning EIA in China: the problems and improvement measures. *Chinese Engineering Consulting*, (3), 56–59.

Xu, J., Murayama, T., & Nishikizawa, S. (2016). Content Analysis of National EIA Reports in China. *Journal of Environmental Information Science*, *44*(5), 45–50. https://doi.org/10.11492/ceispapersen.44.5.0_45

Yang, S. (2012). Reasons for the slow establishment of provincial systems in mainland China. *Journal of Environmental Assessment Policy and Management*, *14*(03), 1250016. https://doi.org/10.1142/S1464333212500160

Yin, M. (2004). Effectiveness study of EIA in Shenzhen. *Security and Environmental Engineering*, *11*(4), 5–8.

Zhang, J., Christensen, P., & Kørnøv, L. (2013). Review of critical factors for SEA implementation. *Environmental Impact Assessment Review*, *38*, 88–98. https://doi.org/10.1016/j.eiar.2012.06.004

Zhang, J., Kørnøv, L., & Christensen, P. (2013). Critical factors for EIA implementation: Literature review and research options. *Journal of Environmental Management*, *114*, 148–157. https://doi.org/10.1016/j.jenvman.2012.10.030

Zhang, L. (2007). *Analysis on the effectiveness of highway noise environmental impact assessment*. Beijing University of Chemical Technology.

Zhang, X. (2010). *The comparason research of EIA system in China and Japan*. Jiangxi University of Science and Technology.

Zhang, Y. (2002). Effectiveness study of environmental impact assessment. *Chinese Environmental Science*, *22*(4), 324–328.

Zhao, Q. (2018). Study on the Project EIA system in China. ChangAn University.

Zhou, K.-Y., & Sheate, W. R. (2011). Case studies: Application of SEA in provincial level expressway infrastructure network planning in China — Current existing problems. *Environmental Impact Assessment Review*, *31*(6), 521–537. https://doi.org/https://doi.org/10.1016/j.eiar.2010.10.005

Zhou, K. Y., & Sheate, W. R. (2009). Comparative analysis of SEA legal requirements and institutional structure in China (Mainland), Canada and the UK (England). *Journal of Environmental Assessment Policy and Management*, *11*(4), 387–426. https://doi.org/10.1142/S1464333209003427

Zhou, K. Y., & Sheate, W. R. (2011). EIA application in China's expressway infrastructure: Clarifying the decision-making hierarchy. *Journal of Environmental Management*, *92*(6), 1471–1483. https://doi.org/10.1016/j.jenvman.2010.12.011

Zhu, D., & Ru, J. (2008). Strategic environmental assessment in China: Motivations, politics, and effectiveness. *Journal of Environmental Management*, *88*(4), 615–626. https://doi.org/10.1016/j.jenvman.2007.03.040

Zhu, T., Wu, J., & Chang, I. S. (2005). Requirements for strategic environmental assessment in China. *Journal of Environmental Assessment Policy and Management*, *7*(1), 81–97. https://doi.org/10.1142/S1464333205001906

Zhu, Z., Bai, H., Xu, H., & Zhu, T. (2011). An inquiry into the potential of scenario analysis for dealing with uncertainty in strategic environmental assessment in China. *Environmental Impact Assessment Review*, *31*(6), 538–548. https://doi.org/10.1016/j.eiar.2010.02.001

Appendix A. Important laws and regulations

1. Administrative Litigation Law (Presidential Decree of the People's Republic of China [2017] No.16)
2. Environmental Protection Law (Presidential Decree of the People's Republic of China [2014] No.9)
3. Environmental Impact Assessment Law (Presidential Decree of the People's Republic of China [2016] No.48)
4. Guidance for Compiling the Ecological Conservation Redline, Environmental Quality Bottom Line, Resource Utilization Upper Limit Line, and List for Environmental Permits (Ministry of Environmental Protection [2017] No. 99)
5. Guidance on Capacity Building for Construction Projects Environmental Impact Assessment Report (Form) (Trial) (Decree of the Ministry of Ecology and Environment [2019] No.9)
6. Measures for Public Participation in Environmental Impact Assessment (Ministry of Ecology and Environment of People's Republic of China [2018] No.4)
7. Opinions for Strengthening the Linkage Between Project EIA and Planning EIA (Ministry of Environmental Protection, Environment [2015] No. 178), 2021).
8. Regulations on Environmental Protection Management of Construction Projects (Decree of the State Council of the People's Republic of China [2017] No. 682)
9. Regulations on Planning Environmental Impact Assessment (Decree of the State Council of the People's Republic of China [2009] No.559)
10. Technical guideline for planning environmental impact assessment —General principles (HJ130-2019)

Appendix B. Legislative provisions involved in the EIA system in China

System	Levels	Legislative provisions	Content	Issued year and revisions
EIA laws and regulations	Constitution	Article 26 of the Constitution	Regulating that the country has the responsibility to protect the environment and prevent pollution.	● It came into force in 1954. ● The latest revision was issued in 2018.
	Laws	Environmental Protection Law (EPL)	Setting out the conditions of requiring an EIA, which is supplemented by 15 specific laws related to noise, management of solid conservation, air pollution.	● The trial version was issued in 1979. ● The formal version was announced in 1989 and revised in 2014 and came into force from 2015.
		Environmental Impact Assessment Law (EIAL)	Providing the details of how EIA should be carried out concerning both plans and projects.	● It was firstly issued in 2002 and came into force in 2003. ● Later, it was revised in 2016 and 2018.
	administrative regulations	Regulations on Environmental Protection Management of Construction Projects (REPMCP)	Regulating the environmental protection measures during the construction process, including the details for construction projects EIA and three simultaneous systems.	● It issued and came into force in 1998. ● Later, it was revised in 2017.
		Regulations on Planning Environmental Impact Assessment (RPEIA)	Regulating the process for Planning EIA.	● It was issued and came into force in 2009.
	Departmental regulations	Measures for Recordation of Registration Forms of Environmental Impact of Construction Projects	Classifying the construction project into specific categories and sub-categories, while regulating which kind of EIS should be carried out (full EIA report, less detailed EIA form, or basic EIA registration forms).	● It was firstly issued in 2002 and came into force in 2003. ● Later, it was constantly revised in 2008，2015, 2017 and 2018.
		Measures for Public Participation in Environmental Impact Assessment (MPPEIA)	Describing the measures for public participation in the EIA process.	● The temporal method was firstly issued in 2006. ● The formal method was issued in 2015 and revised in 2018.
		Measures for Post Environmental Impact Assessment of Construction Projects (Trial Implementation)	Regulating the details for how the post EIA should be carried out.	● It was issued and came into force in 2015 and came into force in 2016.
		Administrative Litigation Law (ALL)	Stipulating public's the right to sue.	● It as firstly issued in 1989, and came into force in 1990. ● The newest version was issued in 2017.
	Local government regulations	Hierarchical approval measures for Environmental Impact Assessment statements of construction projects in Shanghai	Regulating the approval of project EIA in Shanghai province.	● It was issued and came into force in 2019.

technical guidelines and standards	Technical Guidelines	Technical guidelines for environmental impact assessment - General program (TG-General)	Regulating the detailed technical method for assessment. It is complemented by specific guidelines for environmental elements (e.g., atmosphere, soil, groundwater, ecological environment) and constructional projects (e.g., Pesticide, petrochemical, Urban Rail Transit).	● The latest versions are: general program (2016), atmospheric environment (2018) surface water environment (2018), groundwater environment (2016), soil environment (2018), Ecological Impact (2011)
	Standards	Environmental quality standard.	They are involved with national and provincial standards concerning specific environmental elements.	● Ambient air quality standards (2012), Standards for irrigation water quality (2005)
		Pollutant Emission Standard	They include the specific standard for different environmental elements in various industries.	● Discharge standard for water pollutants from ships (2018) ● Emission standard of pollutants for the battery industry (2013)
Service system		Measures for the Qualification of Environmental Impact Assessment agencies	Regulating the application and utilization methods of the qualification of EIA agencies.	● It was firstly issued in 1989. and revised in 1999 and 2005. ● It was now canceled in 2019.
		Supervision and Management Measures for the compiling of Environmental Impact Assessment Reports (Forms)	Regulating the requests and responsibilities for compiling the EIA reports (forms).	● It was issued in August 2019 and came into force in December 2019.
		Guidance on Capacity Building for Construction Projects Environmental Impact Assessment Report (Form) (Trial) (GCBCPEIA (trial))	Measures for the training of engineers.	● It was issued and came into force in 2019.
		Information Disclosure Management Regulations on EIA Agencies and Engineers (trial) (IDMRAE (trial))	Stipulating the measures and requirements for information disclosure of EIA Agencies and Engineers.	● The trial version was promulgated in 2019.
		Management measures for the qualification of Environmental Impact Assessment Engineers (MMQEIAE)	Regulating the requests for the qualification of EIA engineers.	● It was issued and came into force in 2004, and was revised in 2015.

Source: Chen, et al., 2017. There include three categories: (1) laws and regulations stipulate the necessity and principles of EIA, (2) EIA technical guidelines and standards require the techniques to conduct EIA, and (3) service-related foundation methods supplement the management of EIA agencies and engineers

Appendix C. SEA effectiveness in China: examining the legislative supports and identifying the weaknesses

Procedural Effectiveness

Criteria	Questions	Legislative support	Weakness	References
P1 Policy framework and guidance	Is there sufficient policy framework and guidance for the SEA process	● EIA Law and RPEIA stipulate the subject, procedures and contents; TGs of PEIA are issued, including the General principles and Coal industry mining area plan.	● Lacks specific regulations and technical guidelines for different planning types; Lacks specific law for Policy EIA.	(Lam et al., 2009) (Bina et al., 2011) (K. Y. Zhou & Sheate, 2011) (Gao et al., 2014) (X. Chen, 2016) (T. Li et al., 2016) (Xiong & Mei, 2018)
P2 Tiering between SEA and EIA	If the hierarchy for SEA is complete	● Guidance for "13th Five-Year" requires strengthening Planning EIA, developing strategic-level EIA, and carrying out some pilot policy EIAs; Issues the opinions for strengthening the linkage between Project EIA and Planning EIA.	● Limited guidance is provided to projects by Planning EIA due to its low implementation rate and late starting.	(Shujun Wang et al., 2009) (K. Y. Zhou & Sheate, 2011) (Tu, 2014) (Geng, 2016) (Xiong & Mei, 2018) (C. Bao & Wen, 2019) (Shoudong Wang et al., 2019)
P3 Timing of integration	If SEA is integrated into the decision-making process at the early stage	● Article 10, RPEIA For integrated plans, EIA needs to be performed during the planning preparation phase. For specific plans, EIA is carried out after the draft plan is prepared before submitting the proposal for its review and approval.	● Lacks regulation on accurate integration timing and method; Starts too late in practical cases.	(Lam et al., 2009) (Shujun Wang et al., 2009) (Bina et al., 2011) (Che et al., 2011) (Jia et al., 2011) (J. Wu et al., 2011) (K.-Y. Zhou & Sheate, 2011) (Z. Zhu et al., 2011) (Geng, 2016) (T. Li et al., 2016) (Fan, 2017) (Xiong & Mei, 2018)
P4 Mandatory screening criteria	If the screening process is mandatory	● Article 2, RPEIA The plans require EIA include one land, three areas, and ten specific plans.	● Fails to cover more plans, e.g., development plan, economic and social five-year plans at different levels.	(Yang, 2012) (Geng, 2016) (C. Bao & Wen, 2019) (Shoudong Wang et al., 2019) (Tu, 2014)
P5 Description of the baseline environment	Is there enough description of the baseline environment	● Article 6, TG of PEIA to analyze the evaluation region's environmental quality, retrospect the area's ecological environment and evaluate the ecological system's importance and sensitivity.	● Baseline description is lacking or nonexistent.	(K. Y. Zhou & Sheate, 2011) (He et al., 2019) (Fischer & Xu, 2009)
P6 Selection of evaluation factors	If the selected evaluation factors are comprehensive and accurate	● Article 7.2, TG of PEIA Identifies the indicators related to resource-, ecological and environmental constraints. Involves population health risks assessment for some plans.	● Fails to cover climate issues and the mutual influence consequences of environment, society and economy; Insufficient and inaccurate Selection in practical cases.	(Tu, 2014) (K.-Y. Zhou & Sheate, 2011) (Geng, 2019b) (He et al., 2019)
P7 description of the SEA objectives	If there are clear and accurate SEA objectives	● Article 7.3, TG of PEIA Sets evaluation objectives based on identified indicators.	● Assessment objectives were not justified, inability to address issues that matter.	(K.-Y. Zhou & Sheate, 2011)

P8 Tailored assessment method	If an appropriate assessment method is adopted	● Article 8, TG of PEIA Multi-scenario impact prediction and evaluation are carried out.	● Methods are inappropriate for SEA, which are developed from project EIA; Overly simplistic in some cases.	(Shujun Wang et al., 2009) (Bina et al., 2011) (Che et al., 2011) (J. Wu et al., 2011) (K. Y. Zhou & Sheate, 2011) (Tu, 2014) (H. Wang, 2014) (T. Li et al., 2016) (Xiong & Mei, 2018) (Geng, 2019b)
P9 Cumulative effects assessment	If there is an assessment on cumulative effects	● Article 8.2, TG of PEIA … to analyze inorganic and organic pollutants, radioactive pollutants and microorganisms, which may be liable to bioaccumulate and have long-term exposure to harmful effects on humans and organisms …	● Characteristics of environmental impacts such as frequency, duration, permanent or temporary impact, and reversible or irreversible were not considered when impacts were being assessed.	(Shujun Wang et al., 2009) (K.-Y. Zhou & Sheate, 2011)
P10 Presents mitigation measures	If the mitigation measures are proposed	● Article 11, RPEIA The countermeasures to prevent or mitigate adverse environmental impacts are required.	● Some mitigation measures are not appropriate due to the wrong identification of indicators.	(K. Y. Zhou & Sheate, 2009)
P11 Alternative consideration	If there is an assessment of alternatives	● —	● Inadequate consideration of alternatives; Lacks “no-action alternatives.”	(Fischer & Xu, 2009) (K. Y. Zhou & Sheate, 2009) (Bina et al., 2011) (J. Wu et al., 2011) (Z. Zhu et al., 2011) (Tu, 2014) (Geng, 2016) (T. Li et al., 2016) (Fan, 2017) (Xiong & Mei, 2018)
P12 Mandatory review process	If the review process is mandatory	● Article 15-23, RPEIA For integrated plans, the EIA chapter/illustration is reviewed by the planning approval authorities. For specific plans, an independent environmental impact report is reviewed by a review team organized by the environmental protection departments.	● —	(Lam et al., 2009) (J. Wu et al., 2011) (H. Wang, 2014) (Fan, 2017) (C. Bao & Wen, 2019)
P13 Follow-up	If there is a follow-up evaluation	● Article 24-30, RPEIA … a follow-up evaluation is required …	● Lacks effective follow-up evaluation	(Lam et al., 2009) (K.-Y. Zhou & Sheate, 2011) (Tu, 2014) (X. Chen, 2016) (T. Li et al., 2016) (Fan, 2017) (Shoudong Wang et al., 2019)
P14 Public Participation	If there is sufficient public participation	● Article 13, RPEIA For integrated plans, public participation is not required. It is compulsory for specific plans to listen to opinions from relevant units, experts, and the general public.	● Insufficient public participation	(Lam et al., 2009) (Bina et al., 2011) (K.-Y. Zhou & Sheate, 2011) (H. Wang, 2012) (C. Bao et al., 2014) (Tu, 2014) (Geng, 2016) (Xiong & Mei, 2018) (Geng, 2019a)

Substantive effectiveness

Criteria	Questions	Legislative support	Weakness	References
S1 Integrating SEA into the planning process	If SEA is well integrated into the planning process	Article 4.2, TG of PEIA PEIA should be involved in the early stages of planning…	● Lacks integration	(Jia et al., 2011) (K.-Y. Zhou & Sheate, 2011) (X. Chen, 2016) (Xiong & Mei, 2018)
S2 Provide information for planners	If SEA has provided sufficient and useful information to planners	Appendix A, TG of PEIA … the identified constraint factors…the analysis and assessment conclusions…should feedback to the planning compiling agencies…	● Fails to provide information timely due to the late integration	
S3 Influence on decision-making	If SEA influences the decision-making process	Article 9.3, TG of PEIA …to propose operable adjustment suggestions for the planning contents…	● Limited influences	(J. Wu et al., 2011)
S4 Choosing environmentally friendly alternatives	If SEA help planners choose the environmentally friendly alternatives	—	● Lacks discussion on alternatives	
S5 Helping develop plan and program	If SEA makes the planning content better	Article 1, RPEIA … to improve the scientificness of planning…	● Lacks real influences	(Fischer & Xu, 2009) (C. Bao & Wen, 2019)
S6 Mitigate the environmental impact	If SEA help mitigate the environmental impact	Article 1, RPEIA …to prevent environmental pollution and ecological damage from the origin…	● SEA indeed helps mitigate the environmental impact, but the implementation rate remains low.	(H. Wang, 2012)
S7 Comply with higher-level policy	If SEA help the planning comply with higher-level policy	Article 5.3, TG of PEIA … to clarify the compliance of the plan with relevant laws, regulations, and policies…	● As long as SEA can be compiled, it is prospective to examine planning's compliance with the higher-level policy.	
S8 Streamlining future project	If the PEIA guides future projects	Article 11, TG of PEIA … take the conclusion of PEIA as a basis of Project EIA	● As long as SEA can be compiled, it is prospective to guide future projects.	
S9 Promote communication between sectors	If SEA promotes the communication between sectors	—	● —	

Transactive effectiveness

Criteria	Questions	Legislative support	Weakness	References
T1 Appropriate cost	If an appropriate cost is paid for SEA	—	● —	
T2 Budget/financial source	What is the financial source of SEA, and enough budget can be obtained	Article 5, RPEIA The expenses required for the PEIA shall be included in the financial budget according to the provisions of budget management.	● Lacks funding; Lacks financial support for policy due to lack of regulations on it.	(Shujun Wang et al., 2009) (T. Li et al., 2016)
T3 Reasonable time frame	If SEA has been completed within a reasonable time	—	● —	
T4 Integrated teams to work on SEA	If SEA is carried out with an integrated team	—	● —	
T5 Required skills do not contribute a big burden	If the required skills of consultants create a big burden to planning agencies	—	● —	

Normative effectiveness

Criteria	Questions	Legislative support	Weakness	References
N1 Promote sustainable development	If and to what extent SEA promote sustainable development	Article 1, RPEIA …promote the comprehensive, coordinated and sustainable development of economy, society and environment…	● Limited contribution to realizing sustainable development.	(Lam et al., 2009) (J. Wu et al., 2011)
N2 Promote equity between generations	If and to what extent SEA promote equity between generations	—	● —	
N3 Climate justice	If and to what extent SEA realize climate justice	—	● —	
N4 The norms of SEA reflect those of society	If and to what extent SEA reflect the norms of society	—	● —	
N5 Increase environmental awareness	If and to what extent SEA increase environmental awareness	—	● —	

Contextual effectiveness

Criteria	Questions	Chinese characteristics	Weakness	Reference
C1 Style of Governance	If governance style facilitates the development of SEA	Different plans are under the management of different organizations; Environmental protection departments generally have less power than the planning departments.	● The planning content in different departments may overlap or even contradict; Environmental protection departments have limited capacity to enforce SEA applications and review SEA reports.	(Bina et al., 2011) (Yang, 2012) (C. Bao et al., 2014) (X. Chen, 2016) (T. Li et al., 2016)
C2 Decision-making culture	If decision-making culture facilitates the development of SEA	The national review standards are stricter, while the provincial and a lower level environmental protection departments are relatively lax.	● SEA integrates too late.	(Shujun Wang et al., 2009) (T. Li et al., 2016) (Fan, 2017) (Shoudong Wang et al., 2019)
C3 Accountability	If the responsibilities are distributed to stakeholders clearly	—	● No clear allocation of responsibilities and roles.	(Lam et al., 2009) (Bina et al., 2011) (Yang, 2012) (T. Li et al., 2016)
C4 Communication	If communication exists in the SEA process	—	● Lacks of dialog and coordination among agencies.	(Lam et al., 2009) (Che et al., 2011) (H. Wang, 2012) (Yang, 2012) (Gao et al., 2013) (C. Bao et al., 2014) (Gao et al., 2014) (H. Wang, 2014) (T. Li et al., 2016)
C5 Transparency	Is the SEA process transparent	—	● Lacks of transparency.	(Lam et al., 2009) (Che et al., 2011) (H. Wang, 2012) (H. Wang, 2014) (Yang, 2012) (T. Li et al., 2016)
C6 Independency	Is the consultant agency independent		● The planning agencies have dual roles in PEIA conduction and planning preparation.	(Tu, 2014)
C7 Access to enough data	If assessors can access enough data for assessment	Article 4, RPEIA Governments at or above the county level and their relevant departments shall share the materials required for PEIA.	● Inconsistency of the information between departments; Lacks of relevant baseline data.	(Fischer & Xu, 2009)
C8 Flexible procedures and techniques	If the assessment procedures and methods flexible	The evaluation focus differs according to the planning types. Relatively good flexibility has been found.	● Too much dependency on the procedures.	(T. Li et al., 2016) (Gao et al., 2014)
C9 Easy and timely access to SEA documents and information	If the SEA documents and information can be accessed easily	The information can't be publicized in the early stage of decision-making due to its confidential attribute.	● No data sharing system for all levels in China; Baseline data is difficult to access and monopolized by industrial departments and is only accessible with compensation.	(Bina et al., 2011) (Che et al., 2011) (Yang, 2012) (T. Li et al., 2016)

C10 Knowledge/experience in undertaking SEA	If assessors are competent having enough knowledge and work experience	—	● Lacks experienced technical staff in the SEA institutions.	(Bina et al., 2011) (Gao et al., 2014) (Tu, 2014) (T. Li et al., 2016) (Fan, 2017) (Xiong & Mei, 2018)
C11 Proactive attitudes towards SEA	If stakeholders are proactive towards SEA	—	● Planning agencies and government departments lack the willingness to carry out SEA.	(Shujun Wang et al., 2009) (Che et al., 2011) (J. Wu et al., 2011) (H. Wang, 2012) (Yang, 2012) (Tu, 2014) (H. Wang, 2014) (Xiong & Mei, 2018)

Pluralist effectiveness

Criteria	Questions	Legislative support	Weakness	References
Inclusiveness of all stakeholders and efficient consultation	If the SEA process involves various stakeholders and conducts efficient consultation	Article 13, RPEIA …Before the draft plan is submitted for approval, the opinions of relevant units, experts, and the public needs to be publicly solicited…	● Only officials and experts are invited, few general public was involved.	(T. Li et al., 2016) (Bina et al., 2011) (K. Y. Zhou & Sheate, 2011) (Bina et al., 2009)
The information provided to the public	If enough and understandable information are provided to the public	—	● Information is not completely disclosed.	(J. Wu et al., 2011)
Approaches of stakeholders to plans	If stakeholders have approaches to access plans	Article 13, RPEIA …through various methods, such as questionnaires, symposiums, argumentation meetings, and hearings.	● The approach of public participation is limited to questionnaire surveys and consultation meetings.	(J. Wu et al., 2011) (Fan, 2017) (Che et al., 2011)
Sufficient resources and time support	If sufficient resources and time are given to collect opinions	—	● The stage of public participation is exclusively at the final stage of PEIA, on the assessment itself, rather than at the key stages of scoping; Lack of genuine financial and legal support to the public to participate in SEA.	(Bina et al., 2009) (Fan, 2017)
Consideration of consultation responses	If the responses are taken into consideration	Article 19, RPEIA The written comment formed in the review meeting of the EIA report include: … (5) the rationality of accepting and non-admission of public opinions and explaining the reasons; …	● Feedback from the public is not well adopted and implemented.	(Gao et al., 2013)