

Applying Circular Economy Theory in Environmental Impact Assessment

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¹ **Abstract**—This paper presented that applying circular economy theory in environmental impact assessment (EIA) can both promote the development of circular economy and enhance the effectiveness of EIA. The paper systematically analyzed how to apply circular economy theory in the whole technical process of plan EIA. And then, in order to improve the capabilities of EIA to promote circular economy development, the paper put forward some measures.

Keywords—circular economy; environmental impact assessment; the whole technical process

I. INTRODUCTION

Circular economy is a prior model to drive sustainability strategy in the world^[1], and has soon come into China's top economic strategy. The government emphasizes the significance of developing circular economy and has taken many measures to promote it. But it is a really big systemic Engineering involving many levels and areas of the economic system and social system, and there are difficulties for the concept and notion of circular economy comprehensively running through these levels and areas. China is in urgent need of a set of methods and mechanisms which can guarantee the full implementation for the theory of circular economy, while environmental impact assessment (EIA), which is recognized as a useful tool for promoting sustainable development^[2], can meet the need. At the same time, applying of circular economy in EIA can help EIA pay more attention to resource conservation and recycle so as to raise the quality of economic growth, and therefore it can enhance the effectiveness of EIA.

II. CIRCULAR ECONOMY THEORY INTO PROJECT EIA

Since the middle of 1990s, China has been requiring cleaner production analysis be incorporated into construction project EIA, which offers a good basis for applying circular economy theory in project EIA. However, circular economy is more extensive than cleaner production. So in order to promote circular economy development more effectively, we should still expand the "visual field" of project EIA. Exchange of byproducts (including waste material and waste heat) and share of infrastructure with other enterprises, environmental impact of the main

materials in their whole life cycle and eco-design ideas (e.g. more modular approaches and trying to sell more production function instead of the production itself) should be considered, as well as giving priority to cleaner raw materials and technologies, and strengthening the reduction, reuse and recycle within the enterprise.

III. CIRCULAR ECONOMY THEORY INTO PLAN EIA

Plans lie on the macro level and belong to decision-making sphere. The government frequently sets development aims, guides the investment direction and deploys public sources through plans; thus a plan may cast important influences on the economic and social development direction and mode. A plan EIA can play a greater role in promoting circular economy development than an individual project EIA, and circular economy theory should be integrated into the whole technical process of plan EIA.

In this paper, the basic procedure of plan EIA generally conform to the procedure in Technical Guidelines for Plan EIA (on Trial) (HJ/T 130-2003, simplified as "the Guidelines" below). Besides that circular economy theory is integrated into the whole technical process, there are still other minor distinctions:

1) We deem that two links—plan analysis and environmental baseline survey & assessment—should feed back each other and the two should together act as the base for the link of identifying environmental impacts and developing environmental aims/assessment index.

2) We deem that plan EIA can propose suggestions but has no right to directly make decisions to modify or give up the plan, or adopt an alternative, moreover, the situation of giving up planning seldom occurs in practice, so the word "suggesting" should be added before "modifying the planning aims or implementation schemes" and "adopting an environment-permitting alternative", and "giving up planning" in the Guidelines should be deleted.

A. In the Step of Plan Analysis

Usually the main task in the step of plan analysis is to analyze the compatibility and coordination between the assessed plan and relevant plans, policies & regulations, on the basis of chewing over the plan and summarizing its aims, index and implementation schemes. Apart from this, preparatory scoping (deciding the scope of the EIA and

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identifying main environmental impacts) can also be made in this step.

In order to integrate circular economy notion in plan EIA, at the process of compatibility and coordination analysis, whether the assessed plan accords with relevant requirements on developing circular economy should be analyzed.

Here, “requirements on developing circular economy” include not only specialized plans, policies, laws and regulations on circular economy development (such as Circular Economy Promotion Law of the People's Republic of China, Regulations on the Promotion of Circular Economy in Shenzhen Special Economic Zone and Circular Economy Development Plan during “the Eleventh Five-year” Period of Beijing City), but also relevant contents of comprehensive plans, policies and regulations (such as Chapter Six, “Constructing a Resource-saving and Environment-friendly Society” of Outline of the Eleventh Five-year Plan for National Economic and Social Development of PRC), as well as plans, policies and working programs on eco-provinces or eco-cities construction, renewable resource development, energy saving and emission reduction, resource saving and comprehensive utilization (such as Outline of the Ecological Province Construction Plan of Hainan Province, the Medium and Long-Term Development Plan for Renewable Energy in China, the Eleventh Five-year Plan of Water-saving Society Establishment in China, Working Program on Energy Saving and Emission Reduction of Tianjin City). If the assessed plan just proposes a catchword of “circular economy”, but its resource consumption indexes do not conform to the constraining indexes fixed in upper level plans, it should be regarded as incompatible with the requirements on developing circular economy of upper level plans.

Besides, in preparatory scoping, a brief and basic analysis may be made on what aspects of circular economy would be involved in the assessed plan, and according to this, a judgment may be made on what “relevant requirements on developing circular economy” should be mainly analyzed.

B. In the Step of Environmental Baseline Survey & Assessment

Traditional contents of environmental baseline mainly include the quality of conventional environmental factors, such as water, air, noise, solid waste and ecology. After integrating circular economy notion, environmental baseline should cover basic information on the status of circular economy development.

First, resources with great significance to circular economy should be surveyed assessed, such as energy, water, land and mineral resources. Key index on these resources, e.g. total utilization volume, utilization efficiency, utilizable reserves, supply and demand structure should be confirmed.

Besides, the following information should be collected: the industrial structure and leading industry, environmental protection industry, resource recovery and recycle industry, eco-industrial chains and eco-industrial parks; policies, institutions and administrative abilities, research & development abilities, infrastructures (such as reclaimed water network, waste trading platform) relevant to circular

economy. And then, a preparatory SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis of circular economy development can be done.

C. In the Step of Identifying Environmental Impacts and Developing Environmental Aims/Assessment Index

Corresponding with the extension of environmental baseline, not only the environmental impacts of the plan on conventional environmental factors like water, air, noise, solid waste and ecology, but also the impacts on circular economy development should be identified, e.g. impacts on the conservation of energy, water, land and mineral resources, impacts on renewable resource development, impacts on resource recycle and comprehensive utilization, impacts on the industrial structure and eco-industrial chains, including both direct impacts and indirect, cumulative ones.

In the whole contents of plan EIA, assessment index is very important and can cause significant influence on the contents and depth of the final Environmental impact statement. So the assessment index system may be the most convenient starting point of applying circular economy theory in plan EIA [3]. For plans closely related to circular economy development, besides conforming to general principles like the combination of scientificity and feasibility, pertinence and completeness, it should also abide by circulation economy theory, especially the principle of reduction, reuse and recycle (“3R”).

Apart from conventional indexes like pollutant discharge amounts and environment qualities, characteristic indexes of “3R” (such as decreasing rate of energy consumption, elastic coefficient of coal, land use efficiency, land rehabilitation rate, reclaimed water rate, comprehensive utilization rate of solid waste, recycle rate of electronic waste, rate of recycling metals to total metal output) and relevant indexes (such as public transport rate, rate of renewable energy to total energy consumption, cleaner production audit rate of the enterprises) should also be included. For plans closely related to ecological industry, indexes that can reflect the flexibility, stability and efficiency of eco-industrial chains should also be considered, such as the number of producers and consumers of major byproducts, the ratio between the number of industrial chains and that of the knots, the rate of output value of the eco-industrial chains to the gross output value.

D. In the Step of Environment Impact predicting, Analysis and Assessment

In principle, all the identified impacts those are fairly significant or irreversible should be analyzed and evaluated, including the impacts on circular economy development, and in this process, relevant circular economy theory should be applied, such as material flow and material metabolism theory, industrial ecology theory.

For most plans, the impacts on material flow and material metabolism should be analyzed, especially those rare or unrenovable resources, pollutants that are total amount controlled, toxic or hazardous, persistent (hard to degrade) and main greenhouse gases.

For industrial plans, analysis on the industrial ecosystem is of significance, usually including analysis about its structure, function, efficiency, stability and effective means to mend it.

E. In the Step of Making Mitigation Measures and Follow-Up Monitoring Plan

In this step, not only those end-of-pipe treatment measures (such as construction of sewage treatment plants and landfill site of municipal solid waste), but also the measures that can reduce the amount of resource consumption and pollution discharge, promote the reuse and recycle of byproducts and waste (such as coal-seam gas and waste heat utilization, development of waste trading platform, smart design of eco-industrial parks) should be paid great attention to.

As for the follow-up monitoring plan, the actual implement status of the measures to develop circular economy should be included, e.g. whether the main aims of relevant phase has been achieved, whether the resource efficiency has been raised and pollution discharge has been reduced, whether eco-industrial chains have been established and improved.

F. In the Step of Public Participation

In public participation, specialists in fields like industrial ecology, cleaner production, and renewable resource development should be consulted, as well as general environmental protection specialists. For industrial plans, ideas and suggestions from the upstream and downstream industries in the eco-industrial chains should also be considered. For plans involving green consumption, ideas and suggestions from the proposed consumer and residents should also be collected. In addition, opinions from environmental nongovernmental organizations along with any people who shall undertake potential environmental risks and those who are interested in environment protection or resource conservation should not be excluded. So that public participation can become a process of education on environmental protection and circular economy to the public.

IV. NEW REQUIREMENTS FROM CIRCULAR ECONOMY ON EIA DEVELOPMENT

EIA is an important instrument and method to promote the putting-into-practice of circular economy theory; on the other hand, the aim to develop circular economy also proposes higher requirements on EIA's development. In order to drive forward the circular economy development more efficiently and more powerfully, EIA should be further improved in China.

A. Extending the Application Scope of EIA (and SEA)

Circular economy is involved with multiple levels of economy, politics, culture and social life, but at present, the legal application of EIA in our country is limited in plans and projects and the plans is also limited in fourteen categories of plans, while policies, regulations and some other plans (e.g. national economic and social development

plan) which occupy higher position in the decision-making chain and have great impact on the environment and circular economy, are not included in the legal scope. This has weakened EIA's role and capability in promoting circular economy. On the other hand, China has got some experiences in this field. For example, EIAs of national economic and social development plan in several areas like Inner Mongolia Municipality, Wuhan City and Dalian City have been finished.

In order to better suit itself to the aim of developing circular economy, EIA ought to extend its legal application scope. In the future, national economic and social development plans, policies, and regulations shall be included step by step, on the basis of making more pilots, carrying out more typical case study and further borrowing foreign experience. Besides, noninstitutional EIA study (such as EIA applied on technology, lifestyle and artworks) should also be encouraged so that mutual complement and promotion can be achieved between it and institutional EIA.

B. Strengthening Follow-up Supervision and Post-EIA

It is a long-term task to develop circular economy, which requires pushing forward continuously. Currently, the examination result of the EIA documents by relevant authorities (pass or no pass) usually has been paid much attention to; however, the follow-up supervision is often been neglected, which is an important reason why many mitigation measures and suggestions to develop circular economy proposed by EIA documents are not well implemented. Therefore, follow-up Supervisions should be strengthened especially on the implementation of mitigation measures and suggestions proposed by both EIA documents and the authorities during the examination process, as well as on the environment quality and resource supply and demand status.

Once the actual situation disagrees with the EIA documents obviously, a post-EIA shall be started immediately and new counter-measures shall be proposed after making new analysis, prediction and assessment aiming at new situations. Besides, a batch of plans and projects should be chosen to make comparison between the situation predicted by EIA documents and the actualities after implementation, and reasons for the differences should be found so as to improve the methods and models used in EIA.

C. Strengthening Technology and Data Support

A large number of technology approach and data materials are needed in analyzing and assessing circular economy, but the current EIA obviously lack adequate support in this aspect. We should further strengthen technological study and training, summarize experience, bring in advanced and practical technology from abroad, borrow technological approaches from other subjects like ecology, economics and science of policy; strengthen EIA basic database construction and include in it excellent cases, verified technology and approaches, environment capacity and resource endowment; establish an open system with information share in order to break the data monopoly in certain sectors; consummate statistic checking system and

strengthen relevant data on circular economy like resource consumption, renewable energy exploitation, waste comprehensive utilization, recycling industry development as well as biodiversity conservation, pollution reduction covering town enterprises and villages; strengthen the legalization of statistics to guarantee the accuracy of statistic data.

D. Strengthening the Formulation and Revision of Technological Standards

Standards are the base for technicians and managers to carry out EIA practice, but the current EIA technology standards can not meet the demand for developing circular economy. First, contents concerning circular economy assessment and cleaner production assessment should be included in the process of formulating and revising EIA technical guidelines. Second, circular economy standards and pollutant discharge standards as well as environment quality indexes that conform to local environmental baseline and ecological function should be made and issued as soon as possible.

V. CONCLUSION

As an important instrument of macroeconomic regulation and control in China^[4], EIA can be a necessary

and effective tool for implementing the circular economy theory and promoting the development of circular economy. Applying circular economy theory in EIA will not only promote the development circular economy, but also enhance the effectiveness of EIA, which is necessary and feasible. Now, the use of EIA is not sufficient, relevant measures should be taken to further improve the capabilities of EIA to promote the development of circular economy.

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