

# A Study on Ecological Impacts of the Large Scale Engineering Project Evaluation System under the View of Life Cycle

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**Abstract**—Construction of a huge number of large scale engineering projects boosts Chinese economy, but at the same time, it exerts great impacts on the ecological environment. This paper put the ecological impacts of large scale engineering projects as the research object. By elaborating on large scale engineering projects' impacts on land, water, climate, geology and energy resources, it presents a reasonable evaluation system should address various ecological issues including the conservation and rational use of materials, conservation and intensive use of land, energy saving projects, prevention of geological disasters, protection of natural ecosystem and promotion of resource-environment-economy-social harmonious development in projects. Based on the ecological impact assessment needs, using scientific principles, this paper gives the index system for major ecological impact assessment of the Large Scale Engineering Projects in order to provide a reference.

**Keywords**- life cycle; the large scale engineering project; ecological impact; evaluation system

## I. INTRODUCTION

Large scale engineering projects are the ones which have great impacts on people's livelihood or socio-economy, politics, culture and ecological environment in certain areas with certain scale of investment. Large scale engineering projects include major water conservancy and hydropower projects, major transportation projects, industrial areas of important projects and other projects, and they are the projects which are likely to lead to social conflicts. Large Scale Engineering Projects demand long construction period, large capital investment, huge scale of construction and throughout the life cycle after their construction and commissioning. Therefore, the large scale construction of ecological civilization is the fundamental method to alleviate the problems of ecology.

Ecological cumulative effects of large scale projects have great influence on the scope of its ecology. In space, the ecological impacts of large scale projects show a "three-dimensional" feature and have impacts on hydrology, climate, soil, humanities; in time, effects of Large Scale projects on Ecology show a "long-term" characteristic. Characteristics of the ecological effects of large scale projects determine that only by studying the effects of large scale projects on ecology from the perspective of life cycle

can we jump out of the traditional project management routines, integrate all elements of projects such as project objectives, targets, processes and technology under the view of lifecycle, and strive to achieve overall optimal goal throughout the lifecycle. Therefore, based on the life cycle theory, this paper establishes a more scientific large scale project evaluation index system to assess its ecological impacts on the whole process from the decision-making, experience design argument, construction and operation maintenance to scrap recycling.

## II. LITERATURE REVIEW

The life cycle theory application in the engineering project was first put forward by Cheng Hu in 2000. He pointed out we should study engineering management from the life-cycle perspective. Chen Qun explored project management mode for the life cycle; and successively used this idea in substations, large public buildings, city rail transport achieved good results.

Research on the impact of project construction on ecological are currently focused on the impact analysis of project construction, ecosystem health assessment, analysis of the ecological carrying capacity and other aspects. Based on ecological footprint analysis method Deng RuiXue, WangZhongChen, made scientific evaluation on the ecological impact assessment of large scale project by calculating the ecological footprint of the highway, stone coal resources comprehensive utilization project, the ecological bearing capacity of the three gorges project.

Although many people are doing researches on ecological impact assessment of projects, it is still not up to the standard when it comes to the ecological impact assessment of large scale projects. Here are some specific shortages. Therefore, based on life cycle theory, this paper setup index system of ecological impacts from decisions-making to scrap stage of the large scale projects and provides the basis for the construction of ecological civilization of large scale projects.

## III. THE LARGE SCALE ENGINEERING PROJECT CONSTRUCTION'S IMPACTS ON THE ECOLOGY

Large scale projects will have sustained, long-term ecological impacts on certain regions and these impacts are multi-dimensional. Therefore, we should take full account

of its impacts on regional ecology from the multi angle of the life cycle of the project including decision-making, design, construction, maintenance, updates and scrap phases.

#### A. *Impact on land resources*

We should consider the impact of the project on land seriously, for any change to the original design can lead to huge waste of resources. The important impacts of large scale projects on land resources are reflected in several aspects: First, project development takes up a lot of land and the construction process inevitably causes great damage to the land resources in its area; secondly, construction waste dust, toxic substances generated during construction will change the performance of land resources and even make it difficult to achieve reclamation; Finally, whether the land can be reclaimed after the project is scrapped is also a problem to be considered.

#### B. *Impact on water resources*

Significant impacts of the construction of large scale projects on water resources are reflected in changing the natural form of water resources in the project life-cycle period. Take large-scale water conservancy projects for example, its construction breaks the existing equilibrium groundwater system and causes great changes in hydrodynamic field and various balancing factors; construction of reservoirs raises the water level and changes the river aquatic ecosystems, thus affects the hydrological conditions and necessary environment for the growth of organisms, spawning, reproduction.

#### C. *Impact on climate*

Climatic condition is the most important factor affecting ecosystem stability. Effects of large scale projects on the climate are mainly reflected in forests, grasslands, crops growth after the completion of construction. Due to the engineering construction, regional climate changes so that some forest, grassland suffers a devastating loss; the micro-climate change on the local area will bring influence to temperature, precipitation and wind speed of the region.

#### D. *Impact on geology*

Influences of the large scale project construction on geology are reflected in geological damage in the construction process and bad maintenance after its completion. Vegetation damage caused by construction may produce soil erosion and even debris flow, which may have serious impacts on the survival of human security; bare slope of open-pit, waste dumps left by some mineral resource projects may form geological disasters such as rock avalanches, ground collapse and thus pose a security risk to humans.

#### E. *Impact on energy saving and emission reduction*

"High input, high consumption" is a typical feature of the large scale project. We should began from the decision of the project design phase to formulate reasonable energy conservation and emission reduction targets in the life cycle

to be implemented during the construction and continue to carry out in the operation and maintenance phase. Therefore, efficient utilization of energy resources with lower carbon emissions is an important indicator of whether the project has sustainable development.

#### IV. PROBLEMS TO SOLVE IN THE EVALUATION OF ECOLOGICAL IMPACT OF THE LARGE SCALE PROJECT

According to the characteristics of large scale projects construction and the analysis of the ecological factors, problems to solve in ecological impact assessment of major projects are the following:

##### A. *Conservation and rational use of construction materials*

Construction materials are the basis of large scale projects, its saving and rational utilization is the direct embodiment of the construction of ecological civilization projects construction. Ecological impact assessment of large scale projects construction should be based on the systematic recognition of the construction of projects. Whether the project being implemented. And then adjust the implementation of reasonable construction materials using scheme to promote the utilization level of engineering project construction material saving. It is the basic problem of the large scale project ecological impact assessment to be solved.

##### B. *Conservation and intensive use of Land*

In large scale engineering project construction process, land reclamation and ecological reconstruction are the key steps to achieve conservation and intensive use of land. Ecological impact assessment of large scale projects must be a scientific analysis of project construction on the land resources use and destruction scale, structure. The damage law of project construction and land utilization should be discovered in order to provide a basis for rational use of land resources.

##### C. *Energy saving project.*

Energy input is the foundation of large scale engineering project construction and the economical utilization is the requirement to realize the sustainable development of the project. Ecological impact assessment of large scale project should focus on the total amount of energy utilization, structure, efficiency and utilization way in the process of project construction through the effective grasp of the characteristics of energy utilization to promote the development and use of energy efficiency technology. At the same time accurately predict the impact on the ecosystem. Must be "doing" "Energy" and "reduction" work together to promote the sustainable and healthy development of engineering construction.

##### D. *Prevention of geological disasters*

Large scale project construction directly induces the local geological disasters. Effective measures to prevent the occurrence of geological disasters must be taken. Ecological impact assessment of large scale projects must be combined with the local geological disaster

characteristics scientifically. The idea of system science should be used to analyze the reasons, type, prevention and control measures of disasters in order to present the importance of the geological disaster prevention in the ecological impact assessment objectively. Large scale project construction side can revise the construction schedule appropriately based on the evaluation results to reduce the risk of geological disasters radically.

*E. Protection of natural ecosystems of the project area.*

Large scale project area relies on natural adjustment ability to maintain the balance of ecological system and provides a series of ecological services for regional production and living, such as maintaining ecological balance, regulating climate, purifying environment. Protection of animals and plants as the core of natural ecosystems affected by the project is an important index for evaluating the ecological impact of large scale projects. Taking advantage of the conclusions large scale projects ecological impact assessment system to promote the protection of natural ecosystems construction projects from the height of ecological civilization construction.

*F. Promotion of the project in resource-environment-economy-social harmony and development.*

Large scale project construction is an important matter that involves the national economy and people's livelihood, realizing the sustainable and harmonious development of resource-environment-economy-society is the ultimate goal of large scale engineering projects. In our country, with many ecological problems and under the multiple pressures of resources-environment-economy, making reasonable evaluation index system is the prerequisite for scientific assessment of large scale projects ecological civilization construction. Thus, the ecological impact of large scale projects assessment system should become the evaluation criteria of ecological civilization projects construction.

V. CONSTRUCTION OF MAJOR PROJECTS ECOLOGICAL IMPACT ASSESSMENT SYSTEM

Large scale project of ecological impact assessment is the starting point of promoting the project of ecological civilization construction and the establishment of scientific index system plays a fundamental role in the evaluation process. Based on this, the principle of ecological impact evaluation index system constructed in this paper is scientific, comprehensive and independent; The purpose is to promote ecological value and protection of natural ecological environment in the process of large scale project construction, increase the contribution of large scale project on national energy conservation and emissions reduction strategy to alleviate the resource environment economy pressure in the construction process and speed up technical innovation and the course of ecological protection construction process.

In large scale project ecological impact evaluation practice, it is particularly important to consider the effects of large scale engineering project on the ecology in the

perspective of life cycle from the engineering project decision-making stage to scrap stage. In life cycle of large scale projects including decision-making stage, design stage, construction stage and operation maintenance and scrap phase, the ecological impact degree is different, so it should be distinguished in the evaluation. Extent of the ecological impact of the different stages is shown in figure 1. As can be seen from figure 1, decision-making phase of large scale project construction is the most important and its impact on the ecology runs through the life cycle of the project. Therefore, we must pay attention to ecological environment impact of the project from the project decision-making stage, and reflecting it in the design phase, using it rationally in the construction phase, continuing to operate it in the maintenance phase and giving priority to it in the scrap stage.

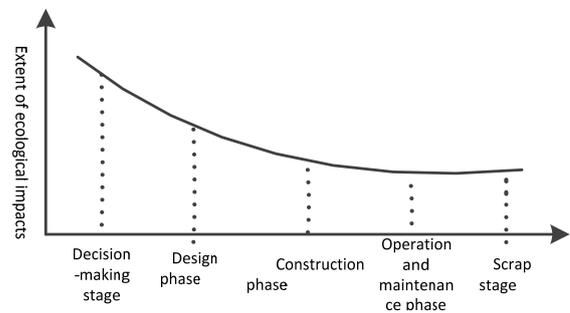


Figure 1. Under different stages of life cycle perspective project on ecological impact

Based on the full consideration of large scale project ecological impact factors, this paper builds index system of ecological impacts of large scale project under life cycle perspective that are divided into three levels, namely overall layer, system layer and index layer. System layer including construction resources utilization system, ecology protection system, ecological economic system, social development systems, engineering guarantee system. Specific evaluation index systems are shown in figure 2

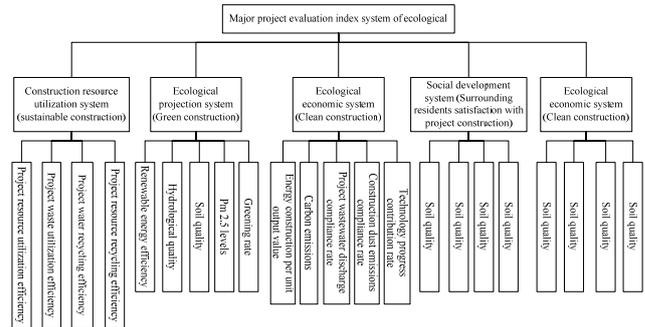


Figure 2. Evaluation index system of ecological impact of large scale project

It must be noted that the construction of large scale project index system is a complex engineering scientific selection. Each indicator is improved in the process of continuous understanding of large scale project. The above

index system for different large scale project should focus on the choice of "adjust measures to local conditions", only in this way can it make scientific assessment of ecological impact of major projects construction and truly promote ecological civilization construction of major projects.

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