Some methods in estimation of effectiveness of the environmental protection investment

Hwang Sun Hui

Faculty of Economics

Supreme Leader **Kim Jong Un** said as follows.

"Environmental protection work should be improved so as to protect and increase the country's resources and keep its air, rivers and seas completely free from pollution."

It is very important to increase the environmental investment and enhance its effectiveness in improving and strengthening the environmental protection.

In order to increase the environmental protection investment and enhance its effectiveness it is necessary to work out the scientific methods of calculation of effectiveness indices reflecting the results of the environmental protection investment.

The environment has the great impact on the social economic development and peoples' lives. Thus analyzing the effectiveness of the environmental protection investment from different aspects and complete its calculation method is the important basis of the environmental protection with scientific theory and methods.

The effectiveness of the environmental protection investment is the result, success or profit to be gained from the funds invested for the purpose of the environmental protection.

The result of the environmental protection investment is expressed in terms of the environmental, social and economic effectiveness. Among this effectiveness the environmental and social effectiveness is concerned with the fundamental purpose of the environmental protection investment which precedes the economic effectiveness.

The environmental effectiveness is reflected in the constant improvement of quality and enhancement of environmental purification capacity.

The change of the quantity and quality of environment is influenced by several natural and economic phenomena. So there can be no single method of estimating the environmental effectiveness and it is very difficult to sum up in value because the environment investment is not producing the products, unlike the fixed asset investment. If we want to calculate the environmental effectiveness, we should choose the indirect method.

Thus the environmental effectiveness is calculated in direct and indirect methods.

The environmental effectiveness is directly calculated by evaluating the state of the improved environmental factors.

The improved state of the air can be calculated in a way of comparison of the index of density of contaminated things. The improved state of the atmosphere is assessed by calculating the pollution level of air distinguishing the particle and gas.

The improved state of water is calculated by comparing the indices of assessment of water contamination before the investment with those after the investment. The indices of assessment of water

include BOD, COD, DOSS, PH, the number of colon bacillus and TOC.

The improved state of forest and land can be estimated in this way.

The environmental effectiveness can be calculated indirectly by using the benefit indices to be gained from the reduction of the natural and biological loss.

The natural and ecological loss is caused by the decline of the quality and quantity of water, forest and biological resources as well as damage of land, underground resources and tourism resources.

The decrease in the loss of the environmental resources is equal to the benefit that can be gained from the environmental protection investment. The benefit of the environmental investment is not of short-term and small scale, but of long term and large scale. Thus economic loss to be made in case of no investment made on the projects constantly affecting on the environment, should be estimated in scales of time and space.

In terms of time the eco loss caused by the damage of the environmental resources is not that make not only in one or less than one year but also in several years. So it should be calculated cumulatively. It is related to that the environmental resources are suffered and the damage level is expanded if the environmental resources damage is not protected.

In space the damage of the environment spread in the different regions and environmental factors and resulting in a grater ecological damage.

Thus the economic loss of the environmental resources can be calculated by summing up the long-term economic loss and the damage of other environmental factors.

For instance, the eco-loss resulted from the outflow of the waste water into the river from a factory should be calculated by cumulating the damage of the river made in a long period of time and loss of other factors such as soil, air and so on.

In this case the economic loss that each factor has can be calculated by the experiential and statistical method.

In addition, the loss of each environmental resource can be calculated by the amount of the reduced amount of environmental resources. This method can be applied to the case that the contraction in amount of environmental resource can be calculated in quantity. The reason is that the reduced amount of environmental resource is equal to the loss of the damaged environmental resource.

It should be considered that the environmental effectiveness has the protracted character and it is reflected in various forms, not in a form in calculation of the indices related to the environmental effectiveness.

All organizations should do this work from the stand and attitude of giving importance to the environmental protection investment and they should further improve the method of calculating the quality and quantity of the environment.

The social effectiveness is reflected in improvement of the work condition, living condition and environment and contribution to their health by investing for the environmental protection. The effectiveness in social aspect means the improvement of the working condition and living environment.

The social effectiveness can be studied with indices that reflect the improvement of the healthy and clean working and living condition.

Those indices include the number of workers working in the production process equipped with the

environmental protection facilities, its ratio and percent of the environmental protection facilities.

The ratio of the number of workers working in the productive process equipped with the environmental protection facilities to the total number of workers is the index that reflects how many percentage of workers work in the standard condition that satisfies the demand of the environmental protection.

In comparison of this index of present and in the past, we can find that increase of the number of the workers working in the clean and hygienic environment thanks to the environmental investment.

The index of security of environmental protection facility reflects the level of security of the facility that residents use. This index is calculated by the ratio of thousand because that index is the comparison of the total amount of the environmental protection facility.

The scientific accuracy of the calculation of the index of security of environmental protection facility per 1000 people comes down to how the total amount of the environmental protection facility is calculated.

Those facilities include the some buildings and other artificially built facilities to maintain the natural environment, to make a favorable environment, to prevent the pollution and to make the living condition more hygienic and clean. More detail there are sanitation facilities to dispose the waste things and water, environmental protection facilities in the public institution, parks, funfairs, gardens and grass and lawns made to purify the air as well as all buildings and facilities to provide people with good and healthy environment.

The total amount of the environmental protection facilities can be measured from the point of a certain time. This is because the index is reflecting the scale of the facilities being used, not the damage of them. The protection facility in use should be defined only the scale of the assets existing at a certain time.

It is very important to apply the correct assessment price in measuring them because the total amount of the environmental protection facility is measured in terms of money.

So its price suitable for calculation must be the complete price. This is because the index is to show the physical scale of the facilities that people are using, not the defacement of them.

The effectiveness of the demand satisfaction of environment protection facility that people use is only related to the physical state, not the damage level. Thus in the condition that people use the facilities they maintain their physical utility during that time, thus application of the complete price is scientific method.

The social effectiveness can be also calculated with the morbidity rate, average death age, and healthy life expectancy. This is because the result of the environmental investment makes the morbidity rate and death rate decline and makes people live ling and healthy.

The morbidity rate is the index that reflects the percentage of patients among the total residents.

Morbidity rate = number of patient / total residents

The number of patients should be calculated once when they are registered. This index is calculated in accordance with regions, time, classification of residents and disease.

The most important index is just the morbidity rate of infectious diseases. This is because it is related to the pollution of environmental resources greatly.

Normally the infectious disease is caused by the infection of the pathogen and it is spread to others. The diseases that can be spread from person to person such as pest, cholera, typhoid and flu are called the infectious disease.

After liberation our state has made a lot of efforts to prevent the infection of diseases under the guidance of our Party and thus many kinds of infectious diseases have disappeared and the death rate of our country is in the low level because the prophylactic treatments have taken place against the malignant diseases.

The average death age of population is the weighted average of the age of dead people weighted according to their ages so it shows the length of lives of the dead people.

$$average\ death\ age = \frac{\sum death\ age * number\ of\ dead\ peopl\ at\ ages}{\sum number\ of\ dead\ peopl\ at\ ages}$$

The average death age reflects the average age of the population group of the dead. Higher this index, better working and living conditions are supplied and longer the people in that region live, it means.

Healthy life expectancy reflects for how many years people live in health during their lives.

It can be calculated in terms of rate of difficulties at different age groups to indices for average life expectancy calculation.

We can find the following equation by summing up the average survivals with health among the average survivals that live by age of x.

$$L'x = Lx(1 - Dx)$$

Here L'x is the number of average survivals with health among the average survivals and Lx is the number of the average survivals at age of x, Dx is the rate of survivals of trouble.

The equation of the number of the average survivals with health by age of x is as follows.

$$T'x = \sum L'x$$

Dividing the number of the average survivals with health by the number of survivals at ages, we can find the healthy life expectancy.

HE=T'x/lx

Here lx means the number of survivals.

As can be seen from above the level of improvement related to the population is the important index that reflects the social effectiveness of the environmental investment.

Of course the indices related to the population and health is affected by some other factors but they should be based on the supposition that they do not change greatly in the certain circumstances and environment in concentration.

If those indices related to health and population is affected by the change of the circumstances and time, we should calculate effectiveness by defining the weight of each factor.

The social effectiveness can be also calculated in terms of the social benefit index made from the environmental protection investment.

The social benefit that we can get from the environmental investment can be equal to the profit to be made by preventing the social loss in the case that human economic activity is done without any

practices to protect the environment.

The social loss is caused by the environmental pollution and damages affecting people.

The social loss is a serious loss incomparable to the economic loss greatly. This is because the social loss causes the reduction of social labor force and damage of human health and mentality.

It is very difficult to calculate the social loss in terms of money and in a number directly.

It can be calculated by the additional cost to spend recovering the damaged labor force and health indirectly. Of course, it is impossible to recover the damaged health of people thus the additional cost is the minimum cost.

The economic effectiveness means the economic benefit and result that we can get from the environmental protection investment.

The economic benefit is the profit that we can get by preventing the economic loss in the case that human activity is taken place without protective measures.

The economic profit that we can be related to environmental protection may be equal to the economic loss that can be made by the pollution and damage of the environment because of no protective measures.

The human activity is the key factor that causes the pollution and damage of the environment. This pollution and damage of the environment gives the great loss to the society and brings the economic loss.

The economic loss caused by the pollution and damage of the environment can be divided into two categories: direct and indirect huge economic loss.

The direct economic loss causes the decline of production and quality. For example, if the air pollution happens by the further economic activities, S_2O in the air reduce the agricultural production and make the metal equipments and facilities rust thus the direct economic loss occurs. In both cases the reduced amount of agricultural production and the depreciation and cost to mend the facility and equipment in the period of the reduction of expectancy.

The indirect economic loss is caused by the production and consumption affected by the environmental pollution and damage.

For instance, more solid waste things, more soil polluted. When the rain water flows through the polluted underground water, the pollution of depositing occurs indirectly. In this case the additional cost to improve the quality of water for drink and economy is increased and this cost is the economic loss.

This economic loss included the cost to mend, to maintain the buildings and equipments, the reduction of production in some economic branches and the additional cost to prevent the decline of quality.

The other form of the economic loss is caused by the wastes and garbage made things and dust in the process of production and life.

The increase of the wastes in the production and life means the increase in amount of loss of materials in contrast.

The capability of processing raw materials and resources in a certain level of the economic technology the degree of processing the materials is limited and the loss is essential. The degree of processing the materials is related to the level of the tech-economic standard of the factory and enterprise.

If the wastes are recycled by investing for recycle of the waste things, the recycled resources can be both economic loss and the economic profit.

The investment related to the recycle of the waste things is the list of the environmental protection investment thus the cost of the recycled resources can be the effectiveness of the environmental protection investment.

As can be seen here, the reduction of the loss of the materials and economic loss caused by the environmental damage by investing for protection is clearly the economic benefit in the prospect of the production and this is just economic effectiveness.

If the economic and social effectiveness is calculated in methods mentioned above, we can calculate the economic and social effectiveness of the environmental protection investment in comparison of the environmental protection investment.

$$SZ = \frac{\sum_{i=1}^{n} \sum_{j=1}^{m} TSij - V}{ZT}$$

Here SZ means the economic and social effectiveness, TS means the economic effectiveness of j investment lists according to the loss index of i and V means the cost to maintain the environmental protection facilities and ZT means the investment for the protection works and practices.

When subtracting the cost to maintain the facility from the social effectiveness and comparing it with the amount of investment, we can calculate the economic and social effectiveness of the environmental protection investment.

To sum up, the effectiveness of the environmental protection investment can be calculated in various ways and it is very important to work out efficient methods of calculation in order to carry out the policy of our party to protect the environment.

Keywords: environmental protection investment, social loss, effectiveness