26. Environmental Repercussive Analysis on Industrial Location of Developing Countries Arising from Model Reference Adaptive Theory

モデル規範適応理論に基づく開発途上国の工業立地の環境波及分析

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ABSTRACT;The present study investigates the features of sustainable development and environment, and future prospects for the adaptation policies of developing countries based on Model Reference Adaptive Theory. When we intend to seek the sustainable development and environment, it is therefore very important to investigate a number of paths which converge the sustainable development and environment. It is well known that pollution will always accompany industrial manufacturing activities. Therefore it is necessary to investigate the repercussive pollution arising from large-scale industry in allow for the government to plan protection. This research has adopted the method of measuring the repercussive pollution based on Input-Output Model, and measured the repercussive impact arising from the location of manufacturing industries in the Eastern Seaboard Industrial Complex in Thailand. In main results, Central region has the highest level of pollution and the indirect repercussive pollution impacts Bangkok.

KEYWORDS;Model reference adaptive theory, Repercussive impact, Thailand.

1.Introduction

The majority of the population of developing country seem to accept the policy of industrialization, but there appears to be much concern regarding the industrial pollution problems that can arise. Industrial development in developing country will normally result in the development of technology and ultimately economic development but on the other hand, as a consequence, the developing country has to face environmental problems. Stated in detail, it is necessary to investigate the equilibrium between the development based an efficiency and stability in scientifically and the sustainable based on the reasonable value decision criteria (Yamamura, 1999). When we intend to seek the sustainable environment based on the reasonable value decision criteria. It is therefore very important to investigate a number of paths which converge the

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sustainable environment and in investigate the adaptation policies of the system and its stability of motorization in developing countries. This research has adopted the method of measuring the repercussive pollution based on Input-Output Model, and measured the repercussive impact arising from the location of manufacturing industries in the Eastern Seaboard Development Program (ESDP) in Thailand. In main results, Central region has the highest level of pollution and the indirect repercussive pollution impacts Bangkok.

2.Model Reference Adaptive Model

When we intend to seek is the sustainable environment based on the reasonable value decision criteria. It is therefore very important to investigate a number of paths which converge the sustainable environment and investigate the adaptation policies of the systems and its stability based on Model Reference Adaptive theory (Yamamura, 1977, 1979, 1980, 1983, 1985, 1986, 1989a, 1989b, 1990, 1991a, 1991b, 1992a, 1992b,1993,1998, 1999; Yamamura and Thirumurthy, 1996).

This model takes the sustainable environment that is based on the reasonable value decision criteria as a reference model and the actual environment as adjustable model.

According to the comparison of these two environments, these are four models of adaptation of the actual environment to the sustainable environment.

The primary model is parallel model. This model considers the adaptation policy how which is adaptable to sustainable environment by direct comparison between the two environments.

The second model is a series model. This model introduces a reasonable environment standard into the actual environment straightway, and in this model, considers the adaptation policy how which is adaptable to sustainable environment in the actual environment. The actual environment faces rapid collapse, and in this model, the stabilizing of actual environment must be immediately attempted by the introduction of reasonable value decision criteria.

The parallel series and series parallel models are in the middle of above-mentioned models.

The third model is parallels-series model. This model is based on the correction of adaptation policy with the maximization of development and environment by the sustainable environment. Moreover, this model is the case of adaptation's being possible to the sustainable environment into the actual environment with either adaptation policy with the maximization of development or environment.

The fourth model is a series-parallel model. In this model, both adaptation policies with the maximization of development and environment are defined as unstable. Moreover, this model is in the case of adaptation's being possible to the sustainable environment into the actual environment with both adaptation policies with the maximization of development and environment.

It is important to note that the actual environment is to become the effective circulation when thinking of adaptation policies by these model.

3.Repercussive Pollution Analysis

The mathematical formation of the method for measuring the repercussive pollution arising from the location of manufacturing industries is the methodology of this study.

The following conditions should be considered to formulate the method for measuring the repercussive pollution:

(1) The necessity to measure the repercussive pollution by industries and scales.

(2) The differences of the impact of repercussive pollutions arising from the location of manufacturing industries.

(3) The impact of pollutions both from the direct repercussive effects and the indirect repercussive effects.

(4) The indirect repercussive pollution both from the locational region and other regions.

The definition of the notations of the partitioned matrices are as follows:

A : input coefficients matrix by regions.

I : identity matrix.

S : matrix having the values of inputs from other industries to locational industries along the main diagonal (the diagonal running from the upper left to the lower right) and zero elsewhere.

D:matrix having the values of input of locational industry along with the column and zero elsewhere.

R : emission factors.

X represents the matrix of the total repercussive pollution and satisfies the following equations.

$$X = D*R + A \cdot S*R + A^2 \cdot S*R + \cdots$$
$$= D*R + [I + A + \cdots] A \cdot S*R$$
$$= D*R + [I - A]^{-1} \cdot A \cdot S*R$$

Where, $D*R$ is the direct repercussive pollution and $[I-A]^{-1} \cdot A \cdot S*R$ is the indirect one.

The repercussive pollutions have been allocated into 5 regions namely: Central, Bangkok, Northeast, North and South. The direct repercussive pollutions will be the impact experienced in Central region where the locational industries located ; and the indirect repercussive pollutions will be the impact in other regions. The study will be based on pollutions emission by industries.

In this study, Thailand is classified into 5 regions i.e. Bangkok, Central, Northeast, North and South. The Eastern Seaboard Development Program (ESDP) is located in Central region as well as Bangkok. The Types of industry are classified into 21 Sectors and the types of industry in ESDP, according to the classification.

The ESDP is not merely the growth of an existing industrial situation but rather a fundamental change in the economic complex of Central region.

The main locational industries are the international competitive industries, heavy and petrochemical industries, polluting industries located at Map Ta Phut ; and export processing and light industries, non-polluting industries located at Laem Chabang.

The ESDP is expected to becomes prosperous according to the result of an earlier research. The Output of locational industries in the year 1995 will become very high as well as the Employment Opportunities.

The repercussive pollutions are measured into 4 emission sectors i.e. Sulfur Oxide (SOX), Chemical Oxygen Demand (COD), Suspended Solid (SS) and Industrial Waste Disposal (IWD).

The main research results are as follows : -

1) The direct repercussive pollution of SOX in locational areas is about as twice high compared to the Central region due to the amount of SOX emission from the manufacturing activities of Petroleum, Basic Chemical and Non-Metal Products. The indirect repercussive pollution in Northeast region is of the lowest impact due to the fact that the number of factories located in Northeast region is the least compared with other regions.

2) The direct repercussive pollution of COD in locational areas is the highest owing to fact that Petroleum manufacturing activity which consumes a large volume of water is located there. Central region also has a high level due to the Electricity production activity. The indirect repercussive pollution in Northeast region produces the lowest impact because of the least number of factories among other regions.

3) The direct repercussive pollution of SS in Central regions is higher than in locational areas due to Mining and the Electricity production activities which have high levels of SS. Locational areas also has a high level of SS due to the Petroleum manufacturing activity. The indirect repercussive pollution to the Northeast region has the lowest impact which is similar to SOX and COD.

4) The direct repercussive pollution of IWD in Central region is higher than in locational areas due to the Electricity production activity while locational areas do not have Electricity Sector located. The indirect repercussive pollution in Northeast has the lowest impact which is similar to SOX, COD and SS.

5) The total repercussive pollutions of SOX and COD have the highest impact in locational areas while SS and IWD have the highest impact in Central region. Though Central region does not have the highest SOX and COD impact, it still has high levels.

6) From the research result, Northeast region has the lowest indirect repercussive SOX, COD, SS and IWD impact due to the least number of factories located there when compared with other regions.

7) The total repercussive pollutions of SOX, COD, SS and IWD are the highest indirect repercussive impact in Bangkok when compared with other regions even though Bangkok is only a province and not a region such as others but Bangkok is the closest city to the locational industrial area which contains all of the infrastructure facilities.

4.Conclusion

An attempt has been made to measure the repercussive pollutions arising from the Eastern Seaboard Development Program. The Input-Output Method has been used to estimate the direct and indirect repercussive pollutions arising from industries located in Eastern Seaboard Industrial Complex.

The result of the research indicates that the total direct repercussive pollutions in locational areas has the highest impact and Central region has the second highest impact. The indirect repercussive pollutions impact in other regions were not as high as expected. Northeast region has the lowest impact.

However, regarding industrial pollution problems, SOX, and COD are the serious direct repercussive pollution problems which mean air pollution and water pollution. These pollution impacts have effected life, health and property of the people in the industrialized countries.

Japan experiences should be a good lesson for Thai government to study for planning the protection of the environment against industrial pollution especially in the area of Eastern Seaboard Development Program.

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