CHINA'S REGIONAL GREEN DEVELOPMENT ASSESSMENT BASED ON NETWORK DATA ENVELOPMENT ANALYSIS

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Overview

With the increasingly obvious constraint on resources and the environment, promoting the efficiency has become a critical component of achieving green development. In recent years, Data envelopment analysis (DEA) has recently become a popular approach in measuring the energy and environmental performance. A common limitation of traditional DEA models is the neglect of internal or linking activities in production operation. In this paper, the production processes of China's 29 administrative regions are divided into two stages, energy use and economic production (EE) as the first system and environment protection (EP) as the second system. Then a slacks-based network DEA model, called Network SBM, is utilized to evaluate stage efficiencies along with the overall efficiency of decision making units (DMUs). What's more, the sub-stage efficiency scores could be used to assist in identifying the sources of the inefficiency of regional green development. Input and output indicators are shown in Fig 1.

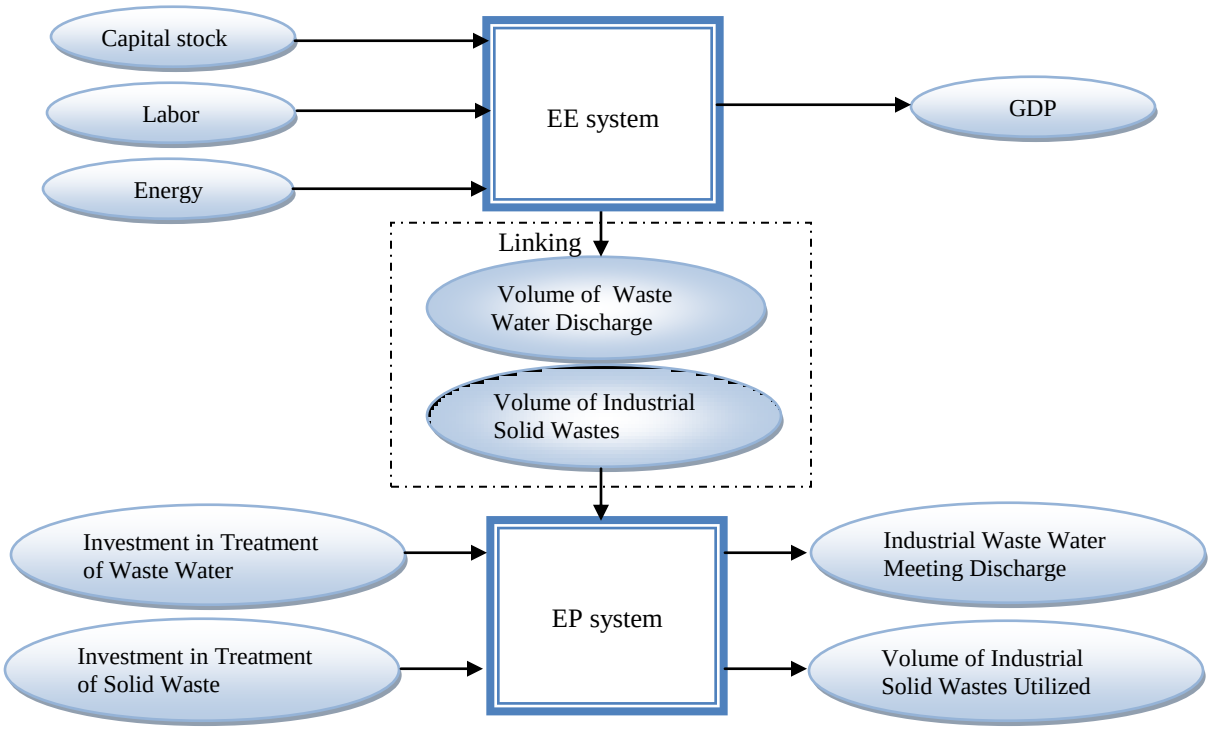

Fig.1 Input and output indicators in network DEA model

The paper is organised as follows: After the introduction the second section gives a brief overview about SBM model, SBM model incorporating with undesirable outputs and network SBM model. The third section evaluates the NSBM-based regional overall efficiency and sub-division efficiency, the types of returns, as well as energy conservations and pollutants reduction potentials for China's 29 regions during 2005–2010. In section four, policy implications are derived. Section five concludes this paper

Methods

A slacks-based measure in data envelopment analysis (SBM、USBM)

A slacks –based measure in network DEA model (NSBM)

Results

First, Comparing the results obtained from single-stage SBM model and network SBM model under constant returns to scale .

Second, the average efficiency scores of energy use and economic production system is higher than the environment protection system.

Third, China's 29 regions have large slack variables in energy conservations and pollutants reduction.

Forth, pollutants reduction is identified the most effective method to increase efficiency based on a sensitivity analysis.

Conclusions

Overall efficiency scores obtained from network SBM model are lower and more discriminating than the scores obtained by using the single-stage SBM model. Shanghai, Beijing and Guangdong are evaluated as the most overall-efficient cities under network DEA model, while the most inefficiency cities are Guizhou, Qinghai, Ningxia. Most of the cities have great potential for energy conservations and pollutants reduction. We should pay more attention to protect our environment instead of developing the economic, especially in Shanxi, Hebei.

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