Improving Eco-Efficiency of a System through Allocation of Non-Discretionary Input

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Abstract

In the presence of undesirable outputs, external regulations (non-discretionary inputs) may be imposed on a Decision-Making Unit (DMU) to restrict its generation of pollutants for the purpose of environmental sustainability. While conventional DEA models maximize efficiency of each DMU separately, we in this paper address the improvement of overall ecological efficiency of a system that consists of some homogeneous but relatively independent DMUs. We assume that there is a system manager who takes the responsibility of allocating the non-discretionary inputs to DMUs to improve the overall ecological efficiency of the system. It is found that when non-discretionary inputs are allocated to DMUs based on their eco-efficiencies in the previous period, the overall ecological efficiency of the system can then be improved period by period. Results of an application case, for a system that consists of 32 paper mills along the Huai River in China, indicate that the non-discretionary input allocation mechanism is effective in improving the overall eco-efficiency of the system, and can be easily implemented in practice.

Keywords: DEA, Eco-Efficiency, Non-Discretionary Inputs, Undesirable Outputs, Resource Allocation.