Chapter 3
Financial Assessment Model for Energy Streams: Evidence From the Middle East

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ABSTRACT

The energy assessment in any industrial/engineering project is an important aspect of project identification in the environmental impact assessment (EIA) plan. It figures out the efficiency of projects through data envelopment analysis (DEA) in comparison with revenue, prior to the establishment of full-scale industries. This study assessed eight groups of Iranian small and medium-sized industries (ISMSI) for the energy stream/revenue. The DEA model is supported by weighing systems of Friedman test, criteria importance through intercriteria correlation (CRITIC), analytical hierarchy process (AHP), and entropy Shannon to assess the efficiency of industries. Four weighing systems of the multi-criteria decision-making (MCDM) model revealed no significant differences among findings of industrial groups, keeping in view the sensitivity analysis conducted and good reliability of Cronbach's Alpha ($\alpha = 0.858$). Therefore, the application of the DEA model is highly recommended for managing energy streams in the EIA plan.

INTRODUCTION

The ISMSI holds a prominent role in the economic cycle of any nation. In Iran, the dependence of the economic cycle of the country to ISMSI is 98% in comparison with large industries that its proportion is around 2% in this regard (Singh *et al.*, 2016). The project identification step is the first step of any industrial project before it goes to the next levels of assessment like screening. According to enacted rules of EIA, the whole inventory of availability of industrial projects must be listed as materials &

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energy streams, land area required for industrial projects individually, plus an inventory of facilities and equipment implemented (Lohani *et al.*, 1997). In this case, the Iranian evaluator team of the in-charge organizations took the assessment and tabulated the initial data for Iranian industrial projects. This research only used the collected data of the evaluator team for the first year of running industries before complete constructing them and data were processed to find the efficiency score.

There is no difference between guidelines for handling industrial projects in lots of nations in the EIA plan. The concept and procedure are the same depending on an inventory of the availability of projects. The importance of projects in itself and the environment depends on the properties of projects. The environmental impact pertains to pollutants dissipated from project ambient and mitigation of defined environmental impacts to impede culminating emissions. By the screening step of the project identification is sorted out the energy and materials streams and is listed whole facilities and equipment accommodated in the project ambient. On the other hand, experts can manage the time to make a list of whole properties of the project which underpin the content of financial, environmental, and economical assessments and pave the way towards modeling based on an inventory of properties and decision-making theory. Lots of criteria can be sorted out to assess financial, and environmental aspects. The variables or criteria proceed the projects towards decision-making science and configure the matrix of decision based on a variety of models developed. If the projects move ahead by a completed review in an uncertain situation decision theory brings MCDM models to solve the challenges raised. The prominent organizations that participated in the EIA plan of projects are industries organization, environment protection agency, World Bank, European Development Bank, Asian Development Bank, etc. (Lohani *et al.*, 1997).

DEA is an important decision-making instrument with a strong base in economic sciences consisting of a variety of introduced variables to assess the performance of projects. Concerning this fact that a wide range of DEA models was recently introduced and developed but all of them follow the same purpose to find the efficiency score of alternatives and discover the way to offer some improvement points for escalating the performance of assessed alternatives (Zurano-Cervello *et al.*, 2018).

DEA as a powerful management instrument for performance evaluation has gained considerable attention over the past decade. A decision tree is a data mining technique for classifying samples into nonlinear and nonparametric regression. Nowadays, the DEA model is recognized as a suitable method for evaluating the performance of units in which, based on the available information, the efficiency boundary is estimated empirically. As mentioned, DEA is an instrument to measure the relative efficiency of homogeneous decision-making units that have multiple inputs and outputs. In the conventional model of DEA analysis, decision-making units are viewed as a black box and therefore their internal structure is generally ignored and it is assumed that the performance of the decision-making unit is a function of selected inputs and outputs. But in many cases, decision-making units have hierarchical multilevel structures or an internal network of activities and decisions that the performance of each of these levels can affect the performance of the entire organization. DEA technique is not able to consider the necessary details, including the impact of decisions of different departments, existing levels, and mediating activities between these levels, each of which may affect the overall outcome of the performance appraisal, in calculating efficiency. Multilevel mathematical planning models are known as mathematical planning instruments that can solve decentralized planning problems with multiple implementers in a multilevel or hierarchical organization. Therefore, to eliminate the above shortcomings, by combining the concepts of DEA analysis and multilevel mathematical programming, an integrated model (called multilevel DEA analysis) can be presented. Mathematical techniques are methods that reduce mental effects and resort to objective methods and have the ability to combine different theoretical tendencies