A New Look at Selecting Third-Party Reverse Logistics Providers

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ABSTRACT

The use of Data Envelopment Analysis (DEA) in many fields is based on total flexibility of the weights. However, the problem of allowing total flexibility of the weights is that the values of the weights obtained by solving the unrestricted DEA program are often in contradiction to prior views or additional available information. Also, many applications of DEA assume complete discretionary of decision making criteria. However, they do not assume the conditions that some factors are nondiscretionary. To select the most efficient third-party reverse logistics (3PL) provider in the conditions that both weight restrictions and nondiscretionary factors are present, a methodology is introduced. A numerical example demonstrates the application of the proposed method.

Keywords: 3PL Provider, Assurance Region, Data Envelopment Analysis, Nondiscretionary Factors, Third-Party Reverse Logistics Provider

INTRODUCTION

Many manufacturers have understood that their core competences are not in the logistics-field, and have therefore progressively sought to buy logistics services and functions from third-party reverse logistics (3PL) provider (Bottani & Rizzi, 2006). The outsourcing of non core processes and activities makes it possible to focus on core manufacturing activities, while, at the same time, 3PL providers have specific logistics core competences, and they can manage logistics processes more efficiently than their customers.

3PL providers play a role in helping organizations in closing the loop for products offered by those organizations. Traditionally, reverse logistics is an activity within organizations delegated to the customer service function, where customers with warranted or defective products would return them to their supplier.

One of the uses of data envelopment analysis (DEA) can be 3PL provider selection. In original DEA formulations the assessed decision making units (DMUs) can freely choose the weights or values to be assigned to each input and output in a way that maximizes its efficiency,
subject to this system of weights being feasible for all other DMUs. This freedom of choice shows the DMU in the best possible light, and is equivalent to assuming that no input or output is more important than any other.

The free imputation of input-output values can be seen as an advantage, especially as far as the identification of inefficiency is concerned. If a DMU (3PL provider) is free to choose its own value system and some other 3PL provider uses the same value system to show that the first 3PL provider is not efficient, then a stronger statement is being made. The advantages of full flexibility in identifying inefficiency can be seen as disadvantages in the identification of efficiency. An efficient 3PL provider may become so by assigning a zero weight to the inputs and/or outputs on which its performance is worst. This might not be acceptable by decision makers (DMs) as well as by the analyst, who after spending time in a careful selection of inputs and outputs sees some of them being completely neglected by 3PL providers.

DMs may have in 3PL provider selection problems value judgments that can be formalized a priori, and therefore should be taken into account in 3PL provider selection. These value judgments can reflect known information about how the factors used by the 3PL providers behave, and/or “accepted” beliefs or preferences on the relative worth of inputs, outputs or even 3PL providers. For example, in 3PL provider selection problem in general, one input (price) usually overwhelms all other inputs, and ignoring this aspect may lead to biased efficiency results. 3PL providers might also supply some outputs that require considerably more resources than others and this marginal rate of substitution between outputs should somehow be taken into account when selecting a 3PL provider. To avoid the problem of free (and often undesirable) specialization, input and output weights should be constrained in DEA.

On the other hand, discretionary models for evaluating the efficiency of DMUs assume that all criteria are discretionary, i.e., controlled by the management of each DMU and varied at its discretion. Thus, failure of a DMU to produce maximal output levels with minimal input consumption results in a decreased efficiency score. In any realistic situation, however, there may exist exogenously fixed or nondiscretionary criteria that are beyond the control of a management. Banker & Morey (1986) illustrate the impact of exogenously determined inputs that are not controllable in an analysis of a network of fast food restaurants. In their study, each of the 60 restaurants in the fast food chain consumes six inputs to produce three outputs. The three outputs (all controllable) correspond to breakfast, lunch, and dinner sales. Only two of the six inputs, expenditures for supplies and expenditures for labor, are discretionary. The other four inputs (age of store, advertising level, urban/rural location, and presence/absence of drive-in capability) are beyond the control of the individual restaurant manager. Their analysis clearly demonstrates the value of accounting for the nondiscretionary character of these inputs explicitly in the DEA models they employ; the result is identification of a considerably enhanced opportunity for targeted savings in the controllable inputs and targeted increases in the outputs. In the case of 3PL provider selection, location and industry experience are generally considered nondiscretionary criterion.

The objective of this article is to propose a model for selecting 3PL providers in the presence of both weight restrictions and nondiscretionary factors. This article depicts the 3PL provider selection process through a DEA model, while allowing for the incorporation of DM’s preferences and nondiscretionary factors simultaneously. The chief advantage of the proposed model is that it does not demand exact weights from the decision maker and considers nondiscretionary factors.

This article proceeds as follows. In the next Section, literature review is presented. Then the proposed method for 3PL provider selection is discussed. Next, numerical example is illustrated. Finally, concluding remarks are discussed.
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