Abstract

The purpose of the article is to present the use of network DEA models in evaluating courier and messenger companies. A general network DEA concept to deal with efficiency assessments in multi-stage processes has been provided in this dissertation. Then, the framework of a special DEA network model as an alternative for traditional DEA model to evaluate courier and messenger companies was presented. A numerical example was given to illustrate this approach.

Keywords: network DEA; efficiency; supply chain; couriers; messengers

1. Network DEA

Data envelopment analysis (DEA) is a popular, widely used tool for measuring the relative efficiency of decision making units (DMUs) that have multiple inputs and outputs. DMUs set may be manufacturers, retailers and service companies, but especially public sector entities, where the typical criteria based on financial indicators are not adequate. DMUs that perform specific public functions do not focus on profit-making. While evaluating their efficiency it is appropriate to refer not only to the financial indicators. Hence, the DEA method has been widely used in studies of public sector units like schools and universities [1, 5].

Network DEA models are multistage models that allow examining efficiency of DMUs that have internal network structures, and provide measures for the components (stages of processes/divisions that DMUs comprise of) that make up the DMUs [3]. Network DEA models eliminate the drawbacks of the traditional DEA models which is the neglect of internal products and services or linking activities. Two examples of multistage process that can be considered by network DEA are presented in Fig. 1.
The illustrated examples of two combinations can easily be extended and adopt to deal with real data and real process flow.

2. Supply chain

A supply chain model is a logistic network of organizations, people, activities, information, and resources involved in delivering product or service from supplier to customer. Fig. 2 presents a typical chain connecting customers, retailers, distributors, manufacturers and suppliers.

Supply chain performance evaluation problem is one of the most comprehensive strategic decisions that must be considered for long term operations [7]. Supply chain can be viewed as integrated system where each supply chain member utilizes its inputs to produce its outputs but also uses intermediate inputs/outputs associated with other supply chain member [9]. A characteristic feature of supply chains is that efficiency improvement for one member of the chain could lead to a decrease in the efficiency of the other members. There could be a conflict between chain members’ interests and for example one member’s objective to maximize the revenue can at the same time be the minimisation of costs for the second member. Therefore the application of standard DEA and interpretation the simple efficiency score can be misleading. In Fig. 3 was presented the four-stage network structure with inputs and outputs and intermediate inputs/outputs.
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