Chapter 31
Efficiency Effects in Supply Chain Management:
A Production Frontier Approach

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ABSTRACT

Explaining the course of technical efficiency and determining factors which might affect it, have been for a long time, and continue to be, one of the most important topics of economic literature. In response to this most important question, and with the increase in data availability, economic literature has shown a resurgence of interest in testing and quantifying various theories of economic growth and explaining technical efficiency growth. The basic aim of this chapter is the analysis of supply chain management technical efficiency and benchmark logistic activities, regarding technical efficiency attainment levels. The related challenge is to define a robust approach towards empirical implementation and defining the most adequate and reliable methods to put into practice.

INTRODUCTION

One of the most important hypotheses in modern economic theory is based on the assumption of optimizing behavior, either from a producer or a consumer approach. As far as producer behavior is concerned, economic theory assumes that producers optimize both from a technical and economic perspective:

- From a technical perspective, producers optimize by not wasting productive resources.
- From an economic perspective producers optimize by solving allocation problems involving prices.

However, not all producers succeed in solving both types of this optimization problem under all circumstances. In real economic life, it is unlikely that all (or possibly any) producers operate at the full efficiency frontier, with failure to attain the efficiency frontier implying the existence of technical or

DOI: 10.4018/978-1-5225-2458-8.ch031

allocative inefficiency (Reifschneider and Stevenson, 1991). More precisely, as described in Levitt and Joyce (1987), as well as Worthington (2001), respectively, for a producer to be efficient, there are three requirements to hold:

- The first requirement of technical efficiency is that the maximum possible amount is produced with the resources used, or in other words, it must be impossible to reduce the volume of any input without reducing the volume of output. Technical efficiency may then refer to the physical relationship between the inputs used (i.e. capital, labour and equipment) and output. These outcomes may either be defined in terms of intermediate outputs or final output.
- The second requirement is that the cost of any given level of output is minimized by combining inputs in such a way that one input cannot be substituted for another without raising the total cost. This is allocative efficiency, where an allocatively efficient producer would produce that output using the lowest cost combination of inputs.
- The third requirement is that the mix of outputs of different goods and services produced form the given resources maximizes the benefit to consumers.

For these reasons, it is important to analyze the degree to which producers fail to optimize and the extent of any resulting distances from the frontier of full technical and economic efficiency, mainly due to the following reasons:

- First, only by measuring efficiency, and by separating the associated effects from those of the operating environment, it is possible to explore hypotheses concerning the sources of efficiency, essential to improve performance.
- Second, efficiency measures are success indicators by which producers are evaluated and the ability to quantify efficiency provides a control mechanism with which to monitor the performance of a production unit.
- In addition, if policy and planning is to concern itself with the performance of a particular economic unit, it is important to know to what level a given producer may be expected to increase output by simply increasing efficiency, without absorbing any further resources.

Efficiency measures can be defined as relative productivity over time or space, or both. For instance, it can be divided into intra- and inter-firm efficiency measures. The former involves measuring the use of the firm's own production potential by computing the productivity level over time relative to a firm-specific production frontier, which refers to the set of maximum outputs given the different level of inputs. In contrast, the latter measures the performance of a particular firm relative to its best counterpart(s) available in the industry (Lansink et al, 2001).

Explaining the course of technical efficiency and determining factors which might affect it, have been for a long time, and continue to be, one of the most important topics of economic literature. In response to this most important question, and with the increase in data availability, economic literature has shown a resurgence of interest in testing and quantifying various theories of economic growth and explaining technical efficiency growth. As Reifschneider and Stevenson (1991) declared, if the occurrence of inefficiency is not totally random, then it should be possible to identify factors that contribute to its existence.

The basic aim of this chapter is the analysis of the relationship between efficiency and supply chain management and logistic activities. The chapter suggests that potential for technical efficiency enhance-