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Procedia Engineering 194 (2017) 529 – 536

Procedia Engineering

www.elsevier.com/locate/procedia

10th International Conference on Marine Technology, MARTEC 2016

The Effects of Coordination Mechanism on Vendor Buyer System of A Supply Chain

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Abstract

In this study, a supply chain consists of vendor and buyer, where the vendor and buyer are two distinct independent logistic organizations have been investigated. Supply chain management has the difficulties for the disconnected and independent economic individuals. Further, rapid technological changes and high competitiveness make supply chain more complex. Various companies have realized the potential for achieving a competitive advantage through effectively coordinating different logistics members in the supply chain. In this research, it is assumed that vendor and buyer are coordinated by sharing their status. Further, it is assumed the coordination mechanisms that can align their objectives and coordinate their activities by sharing the information between vendor and buyer. This plays an important role in decision making in order to mitigate the current challenges and to increase the system performance and individual profitability of the supply chain. The coordinated mechanism among the members of supply chain has been proposed to achieve the optimal solution. This study formulates mixed integer linear fractional programming models that maximize the ratio of return on investment. Numerical example with the sensitivity of different parameters has been deployed to validate the models. Results show that by coordination, the individual profit over and above joint profit could be increased and consumers purchasing price could be decreased.

Peer-review under responsibility of the organizing committee of the 10th International Conference on Marine Technology.

Keywords: Vendor-buyer; Coordination; Price Reduction; Linear Fractional Program

1. Introduction

The importance of Supply Chain Management (SCM) is increasing day to day. Optimize the profit and cost, minimize the risk are the main factors that play an important role in supply chain. The design of an optimal distribution network in supply chain is become extensively contemporary enterprises. SCM assists the business organization to compete in the international market. SCM is needed for various reasons like: increasing profits, improving operations, better outsourcing, enhancing customer satisfaction, increasing globalization, tackling competitive pressures, generating quality outcomes, and growing complexity of supply chains.

In the literature, a single-vendor and a single-buyer inventory models introduced by Goyal [1] in order to optimize the joint total cost. The integrated inventory models where the total cost of the SCM were minimized, were developed to overcome the weakness of the traditional inventory management system in which the members of the SCM make their own optimal decision independently. A vendorbuyer integrated production inventory model considering Joint

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Peer-review under responsibility of the organizing committee of the 10th International Conference on Marine Technology.
doi:10.1016/j.proeng.2017.08.181

Economic Lot Sizing (JELS) policy with price sensitive demand of the buyer described by Jokar and Sajadieh [2]. There are copious researches on LFP to find the best solution approach. Among these, Charnes and Cooper [3] described a transformation technique that transforms the LFP into equivalent linear program. This method is quite simple but need to solve two-transformed model to obtain the optimal solution.

Many research discussed the benefits of coordination mechanism. Min[4] determined that supply chain coordination provides risk reduction, access to resources and competitive advantage. In addition, Cristiaanse and Kuldeep [5] argued that Supply chain coordination dictates the cost improvement and value that can be gained. Jorgensen and Georges [6] also expressed that uncoordinated decision-making creates inefficiency with the channel members and profits significantly lower for each channel member independently and collectively than what could be achieved with coordination. That is why, considering the benefits of the coordination mechanism and the existing limitations of the facility location problem, we are interested to apply the coordination theory as an alternate approach to solve facility location problem.

The reminder of this paper is organized as follows. In Section 2, notations, assumptions and mathematical models formulation are briefly discussed. In Section 3, a numerical example with solution approach is considered. In Section 4, the results of these models and sensitivity or the parameters are discussed. Finally, Section 5, contains some conclusions of this research.

2. Model Formulation

In this section, we have investigated an integrated vendor-buyer model that consists of the tradeoff among the location, transportation cost, and distribution considering a multi-product, multi-facility, and multi-buyer location-production-distribution system. It is assumed that a logistics center pursues to determine an integrated and coordinate plan of a set of m vendors and n buyers. Each vendor has an available supply of the commodity to distribute in various buyer's destinations, and each vendor has a forecast demand of the commodity to be received from various buyers. The buyer demands for multiple commodities are to be fulfilled from this set of manufacturing facilities.Therefore, the production capacities of each of these facilities effectively represent its current and potential capacities. This work focuses on developing a MILF programs to optimize the ratio on investment.

2.1. Mixed Integer Linear Fractional Program

Presently, numerous optimization problems that involve the ratio of functions, such as time/cost, volume/cost, profit/cost, loss/cost or other quantities measuring the proficiency of the method have been the subject of wide interest in non-linear programming problem.Fractional Programming problem is a mathematical programming problem in which the objective is the ratio of two functions and has to optimize with respect a set of constraints. If the numerator and denominator of the objective function and the constraints set are linear, then the fractional programming problem is called Linear Fractional Programming (LFP) problem. On the other hand, if the problem is LFP types, then it is called Mixed Integer Linear Fractional Programming (MILFP) problemUddin et. al. [7].

2.2. Notations and Assumptions

In this formulated model several assumptions, parameters declaration, decision variables and notations are essential. The notations, assumptions, parameters declaration and decision variables for the MILFP based vendor-buyer coordination models are described in this subsection.

Assumptions:

1. All of the products can be produced in each manufacturing zone. 2. The selling price of the products depends on the buyer to buyer agreement, order quantity, discounts etc. 3. The company and buyer have approved earlier on the inventory distribution outline so the transport plans would be articulated accordingly.