Decision Support Systems 48 (2009) 224–236

Contents lists available at ScienceDirect

Decision Support Systems

journal homepage: www.elsevier.com/locate/dss

The impact of corporate social responsibility in supply chain management: Multicriteria decision-making approach

Jose M. Cruz *

Department of Operations and Information Management, School of Business, University of Connecticut, Storrs, CT 06269-2041, United States

ARTICLE INFO

Article history:
Received 8 August 2007
Received in revised form 8 July 2009
Accepted 30 July 2009
Available online 8 August 2009

Keywords:
Supply chain networks
Environment
Corporate social responsibility
Risk management
Multicriteria optimization

ABSTRACT

This paper develops a decision support framework for modeling and analysis of supply chain networks with corporate social responsibility (CSR). We consider the multicriteria decision-making behavior of the various decision makers (manufacturers, retailers, and consumers), which includes the maximization of net return, the minimization of emission, and the minimization of risk. The emission and the risk are penalized by variable weights. The model allows one to investigate the interplay of the heterogeneous decision makers in the supply chain and to compute the resultant equilibrium pattern of product outputs, transactions, product prices, and levels of social responsibility activities. The results show that social responsibility activities can potentially reduce transaction costs, risk and environmental impact.

1. Introduction

In recent years, there has been a considerable shift in thinking with regard to improving the social and environmental performance of companies [81]. On one hand, there are those that argue that the government should regulate the social and environmental performance of companies [69]. On the other hand, there are those that believe that the private sector generally prefers the flexibility of self-designed voluntary standards [80]. Many researchers have tried to understand business motivation to voluntarily adopt CSR programs [23,54]. Swindley [79] argues that many firms regard CSR as cost of doing business though other firms may find CSR beneficial. Firms engage in CSR activities as a way to enhance their reputation [30,31], preempt legal sanction [68], respond to NGO action [78], manage their risk [32,38], and to generate customer loyalty [4,5]. Bowman [7] asserts that firms with proactive CSR that engage in managerial practices like environmental assessment and stakeholder management [84] tend to anticipate and reduce potential sources of business risk, such as potential governmental regulation, labor unrest, or environmental damage [67].

CSR has been a theme of many researchers. Carroll [9] traced the evolution of the CSR concept and found that the CSR construct originated in the 1950s. Carroll [10,11] integrated various streams of CSR research to define a model that extended corporate performance beyond traditional economic and legal considerations to include ethical and discretionary responsibilities. Wartick and Coghran [82] traced the evolution of the corporate social performance model by focusing on three challenges to the concept of CSR: economic responsibility, public responsibility, and social responsiveness. They examined the management of social issues as a dimension of corporate social performance and concluded that the corporate social performance model is valuable for business and society. Carter and Jennings [15] indicated that CSR not only is synonymous with business ethics but also encompasses dimensions including philanthropy, community, workplace diversity, safety, human rights, and environment.

CSR issues surrounding supply chains have only recently come to the fore, notably, in the context of conceptual and survey studies [13,15]. Murphy and Poist [55] stated that although supply chain practitioners have been slow to adopt CSR considerations, social responsibility concepts in the supply chain are increasing in importance. Carter and Jennings [13,15] empirically established primary supply chain CSR categories of environment, diversity, human rights, philanthropy, and safety. Some researchers have examined individual elements of CSR in the supply chain. In response to growing CSR concerns, researchers have begun to deal with environmental risks [2,8,12,70,71], labor practices [25,73,74], procurement [13,14,37,72], and affirmative action purchasing [16]. Moreover, organizations are expanding their responsibility for their products beyond their sales and delivery locations (cf. [6]) and start managing the CSR of their partners within the supply chain [25,49].

Nevertheless, decision support models that integrate CSR into supply chain management and design are surely needed. Within this new business environment, trade-offs between various objectives while providing resources to CSR activities, are becoming increasingly complex. The questions that arise when applying CSR to supply chain

* Tel.: +1 413 210 6241; fax: +1 860 486 4839.
E-mail address: jose.cruz@business.uconn.edu.

0167-9236/$ – see front matter
doi:10.1016/j.dss.2009.07.013

management and design are: (1) given that there is a vast array of decisions to be made on all levels (strategic, tactical, and operational), how does CSR govern and apply to those decisions, and (2) what are the potential conflicts that arise from CSR decision-making in supply chain management and design? To that end, this paper presents a decision support model that incorporates the challenges, opportunities and constraints that managers face when deciding on the level of investment in CSR activities and the choice of trading partners (manufacturer or retailer) given their transaction cost, environmental consciousness and perceived riskiness.

In particular, we develop a multicriteria decision-making supply chain network framework that captures the economic and CSR activities of manufacturing, retailer, and demand market. The models that yield the system optima associated the maximization of net profit, emission (waste) minimization, and the minimization of risk, with the weights associated with the environmental and risk criteria being distinct and variable for each such decision maker. This framework makes it possible to simulate different scenarios depending on how concerned (or not) the decision makers are about environmental issues, risk and CSR over all. Moreover, it allows for the explicit determination of the equilibrium levels of social responsibility activities between the decision makers, as well as, product transactions and prices. Hence, the resulting network model allows the decision makers to assess the impact of CSR activities on their key objectives, profit, environment and risk.

The network model presented is multilevel in structure and the flows are product transactions and levels of social responsibility activities. We consider both business-to-business (B2B) and business-to-consumer (B2C) transactions. Prices are associated with the nodes in the network which correspond to the different tiers of decision makers. Manufacturers are assumed to produce homogeneous product and to sell them either over physical or electronic links via the Internet to retailers and through electronic links directly to consumers. Retailers, in turn, can sell the products over physical or virtual links to consumers. Increasing levels of social responsibility activities are assumed to reduce transaction costs, risk, and environmental emissions.

This paper is organized as follows. In Section 2, we develop the model and describe the decision makers' multicriteria decision-making behavior. We establish the governing equilibrium conditions along with the corresponding variational inequality formulation. The variables are the equilibrium prices, the equilibrium product flows, and the equilibrium levels of social responsibility activities. In Section 3, we propose an algorithm, which is then applied to several illustrative numerical examples in Section 4. In Section 5, we provide managerial insights. In Section 6, we discuss the role of decision support systems in CSR. We conclude the paper with Section 7 in which we summarize our results and suggest directions for future research.

2. The supply chain network sustainability equilibrium model

In this section, we develop the network model with manufacturers, retailers, and demand markets in which we explicitly integrate levels of social responsibility activities between buyers and sellers. The model assumes that the manufacturing firms are involved in the production of a homogeneous product and considers I manufacturers, and J retailers, which can be either physical or virtual, as in the case of electronic commerce. There are K demand markets for the homogeneous product in the economy. We assume, for the sake of generality, that each manufacturer can transact directly electronically with the consumers at the demand market through the Internet and can also conduct transactions with the retailers either physically or electronically. We let l refer to a mode of transaction with $l=1$ denoting a physical transaction and $l=2$ denoting an electronic transaction via the Internet.

The top-tiered nodes in the supply chain network in Fig. 1, enumerated by $1,\dots, i\dots, I$, represent the I manufacturers. We assume that each manufacturer seeks to determine his optimal production and his sales allocations of the product to the retailers and demand market in order to maximize his own profit. We also assume that each manufacturer seeks to minimize the total emission and risk associated with production and transportation to the retailers and demand markets.

Retailers, which are represented by the second-tiered nodes in Fig. 1, function as intermediaries. The nodes corresponding to the retailers are enumerated as: $1,\dots j,\dots, J$ with node j corresponding to retailer j. They purchase the product from the manufacturers and sell the product to the consumers at the different demand markets. We assume that the retailers compete with one another in a noncooperative manner. Also, we assume that the retailers are multicriteria decision makers with environmental and risk concerns and they also seek to minimize the emissions and risk associated with transacting (which can include transportation) with manufacturers and consumers as well as in operating their retail outlets.

The bottom-tiered nodes in Fig. 1 represent the demand markets, which can be distinguished from one another by their geographic locations or the type of associated consumers such as whether they correspond, for example, to businesses or to households. There are K bottom-tiered nodes with node k corresponding to demand market k.

The structure of the network in Fig. 1 guarantees that the conservation of flow equations associated with the production and distribution is satisfied. The flows on the links joining the manufacturers with the retailers and demand market nodes are denoted respectively by the components of the vectors Q^1 and Q^2. The flows on the links joining the retailer nodes with the demand markets are given by the respective components of the vector: Q^3. The variables for this model are given in Table 1. All vectors are assumed to be column vectors.

We now turn to the description of the functions. We first discuss the production cost, transaction cost, handling, and unit transaction cost functions given in Table 2. Each manufacturer is faced with a certain production cost function that may depend, in general, on the entire vector of production outputs. Furthermore, each manufacturer and each retailer are faced with transaction costs. The transaction costs are affected/influenced by the amount of the product transacted and the levels of social responsibility activities.

Each retailer is also faced with what we term a handling/conversion cost (cf. Table 2), which may include, for example, the cost of handling and storing the product. The handling/conversion cost of a retailer is a function of how much he has obtained of the product from the various manufacturers in what transaction mode.

The consumers at each demand market are faced with a unit transaction cost. As in the case of the manufacturers and the retailers, higher level of social responsibility activities may potentially reduce

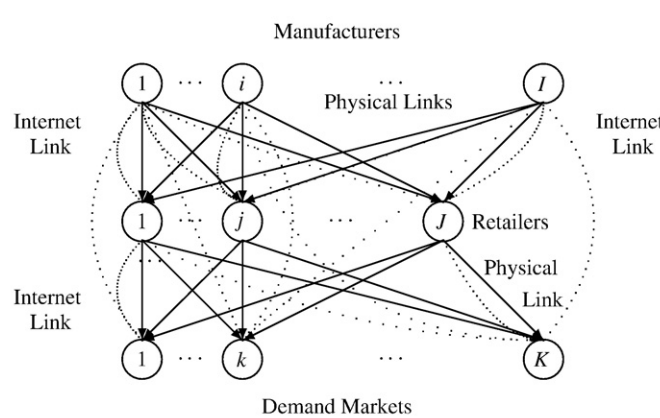

Fig. 1. The structure of the supply chain network with electronic commerce.