Chapter 2
The Economic and Environmental Benefits of VMI Adoption in Multi-Retailer Systems

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ABSTRACT

There is an increasing push towards integrating environmental considerations in decision making in organizations. Rethinking and realigning existing business processes has been touted to offer significant potential in reducing the ecological footprint. Specifically, the role of logistics and supply chain has come into prominence in this regard. In this chapter, a supply chain with a single vendor and multiple retailers has been considered. Initially, we assume that the retailers take care of their respective replenishment decisions. Then, it is shown that by adopting vendor managed inventory, the organizations involved can benefit through cost reduction, and at the same time reduce their greenhouse gas emissions, thereby highlighting the role of supply chain coordination in meeting the twin objectives. Managerial and policy insights based on our numerical analysis have also been provided.

INTRODUCTION

Environmental deterioration has become one of the most pressing issues facing the modern human civilization. Individuals, civil society groups, businesses and governments are all involved in discussions on the need to safeguard the long term interests of all the stakeholders. This debate has shaped business thinking in more ways than one. The shift to the triple bottom line reporting, with its focus on people, planet and profits can be attributed to this changed thinking. There is an ongoing worldwide debate about the harmful impact of greenhouse gas (GHG) emissions, mitigation strategies, reduction targets and regulations (Palak, Ekşioğlu, & Gunes, 2014). In fact,
researchers have argued that in order to prevent global warming and climate change, GHG emissions should be reduced by 50 percent of their 1990 levels by 2050 (Rogner et al., 2007).

Policy makers have instituted wide ranging measures to combat this threat in a number of countries. For example, the European Union Emissions Trading Scheme (EU ETS) is one of the largest such initiatives covering more than 11,000 factories and other installations. Under this scheme, which operates on the cap and trade system, the total amount of GHG emissions is capped for the participating facilities and the allowances for these emissions are allocated or auctioned. Breach in these limits result in penalties. Programs with similar objectives and different stipulations have been instituted in other countries also.

Driven in part by the impetus provided by such mechanisms, organizations have been striving to modernize their ways of planning and operations (Toptal, Özlü, & Konur, 2013). At the same time, companies would be more willing to implement ‘green’ practices if they can gain both financial and environmental benefits (Bowen et al., 2001). These practices have been incorporated across various areas, including supply chains (SC), thereby giving rise to new way of functioning (Al-e-hashem & Rekik, 2013).

This change in business paradigm has attracted the attention of a number of researchers who have analyzed and suggested a number of approaches to incorporate sustainability considerations in the decision making process. However, most of these studies focus on development of greener technologies and changing over to more energy-efficient processes (Tiwari, Chang, & Choudhary, 2015). According to recent reports, focusing on redesigning the existing business practices may offer potentially more benefits through improved coordination (Daskin & Benjaafar, 2010). Based on this realization a number of companies across industries like Walmart, Tesco, HP etc. have capitalized on such opportunities and derived economic and environmental rewards (Sundarakani, 2010). Thus, this value chain approach to management of operational policies merits more sustained and detailed examination.

In our paper, we present one such approach in which we show that SC coordination through vendor managed inventory (VMI) can lead to significant economic benefits, and at the same time lead to a reduction in GHG emission. Our work builds on existing studies that try to integrate the production, inventory and transportation decisions, along with a focus on the environmental considerations as well. We compare and contrast the results obtained under two modes of operations, viz. retailer managed replenishment and VMI.

In the next section, we review relevant literature. Then, we explain the problem analyzed in this chapter. Post that, we derive the mathematical models for the two modes of operation mentioned above. Numerical analysis has been carried out after model development. Subsequently, managerial and policy insights emanating from the preceding analysis have been discussed. Concluding remarks have been provided in the last section.

LITERATURE REVIEW

A growing number of studies have examined operational approaches that seek to address environmental considerations in SC. Topics explored include, among others, relevant management practices (Min & Galle, 2001; Vachon & Klassen, 2006), internal and external drivers of adoption and the associated performance outcomes (Rao & Holt, 2004; Sarkis, Gonzalez-Torre, & Adenso-Diaz, 2010; Wu, Ding, & Chen, 2012; Zhu & Sarkis, 2004). Recent literature surveys of the broader field of green supply chain management are available (see for example Dekker, Bloemhof, & Mallidis, 2012; Sarkis, Zhu, & Lai, 2011; Tang & Zhou, 2012). In our paper, we concentrate on a more focused domain of integrating environmental considerations in operational decision making. Specifically, we integrate the literature on VMI