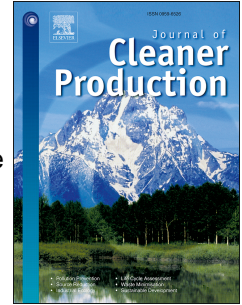


# Accepted Manuscript

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PII: S0959-6526(18)30465-7

DOI: [10.1016/j.jclepro.2018.02.152](https://doi.org/10.1016/j.jclepro.2018.02.152)

Reference: JCLP 12099

To appear in: *Journal of Cleaner Production*

Received Date: 8 April 2017

Revised Date: 5 January 2018

Accepted Date: 14 February 2018

Please cite this article as: Ma P, Zhang C, Hong X, Xu H, Pricing decisions for substitutable products with green manufacturing in a competitive supply chain, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.02.152.

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# Pricing decisions for substitutable products with green manufacturing in a competitive supply chain

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**Abstract:** In this paper, we examine the pricing strategies in a two-stage supply chain with two competitive manufacturers and one retailer. We address six game models: the centralized model (Model I), the MS-Bertrand model (Model II), the MS-Stackelberg model (Model III), the RS-Bertrand model (Model IV), the RS-Stackelberg model (Model V) and the cost-sharing contract model (Model VI) to explore the optimal pricing strategies of substitutable products. We address the optimal green manufacturing level, retail prices, wholesale prices and the profits of supply chain members as well as the whole supply chain under different models. Numerical examples are provided to demonstrate the efficiency and effectiveness of the proposed models. First the impact of green investment on the green manufacturing level and supply chain performance is examined. Then the impact of price elasticity, cross-price sensitivity and green manufacturing coefficient on the green manufacturing level is analyzed. We find that the centralized model is the best, and the cost-sharing contract model will be better than the four decentralized models when the cost-sharing proposition is in a certain interval. Additionally, in decentralized scenarios, the Stackelberg model has an advantage for manufacturers while the Bertrand model is superior for the retailer. Our results also indicate that green manufacturing will benefit the manufacturer involved in green investment.

**Keywords:** Green supply chain; Pricing strategies; Green investment; Cost-sharing contract; Green manufacturing level

## 1. Introduction

With the development of society and the economy and the increased standard of living, green manufacturing gradually gains awareness. Consumers and companies are more conscious of environmental issues and the risks posed by unmitigated climate change (Fahimnia et al., 2015; Laari et al., 2016). Today, increasing numbers of consumers buy no-pollution and environmentally harmless green products, while many manufacturers and retailers produce or sell green products to enhance their competitive advantage (Li et al., 2015; Ülkü et al., 2017). Consumers prefer to pay more for low-carbon, energy saving and

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