

# **Analysing the impact of green initiatives on firms and supply chains under green sensitive consumer demand**

## Abstract

The increasing environmental concerns of nations world over have lead organisations to reconsider their existing supply chain designs and operations from a sustainability standpoint. With regulations and changing consumer preferences, firms are greening their products and processes. The changing consumer preference holds potential for companies to take advantage of the growing 'green' consumer base while simultaneously managing the costs of doing so. General Motors for example invests in variety of advanced propulsion technologies to improve the performance of its vehicles in terms of vehicle fuel efficiency, pollution etc([www.gm.com](http://www.gm.com)). General Motors caters to the changing demand for greener vehicles across various parts of the world by driving innovative solutions in its vehicles. In another example, Walmart reported that the tangible profits generated by Walmart's sustainability strategy in the first year of implementation were roughly equivalent to the profits from several Walmart Super Centers (Plambeck, 2007).

On one hand we observe voluntary initiatives by several companies to gain competitive advantage, on the other hand, increased government regulations and non-governmental organisations are also forcing companies to go 'green'. The European Commission for example has mandated the information technology sector to become 20% more energy efficient by 2015 and to help other industries get greener as well ( [www.businessweek.com](http://www.businessweek.com) ). Further, the World summit on climate change held at Copenhagen between December 7 to December 18, 2009 is a strong indicator of the

willingness of governments to enforce environmental standards in the future([www.copenhagenclimatecouncil.com](http://www.copenhagenclimatecouncil.com)).

These factors have resulted in a change in the strategies of several companies towards sustainable growth and companies are willing to relook at their products and processes. The change in products and processes make an interesting area of study in supply chain management. To illustrate, the effects of 'greening' initiatives by a player in the supply chain will not only impact the individual player but also have far reaching consequences for its partners in the supply chain. This necessitates an overall understanding of the impact of green initiatives on firms, their competitors and supply chains. In this thesis we explore some of these issues. We study three problems:

In the first problem, we study various 'greening' and 'pricing' decisions of players in a single retailer-manufacturer based supply chain. In this supply chain, although both the retailer and manufacturer may benefit out of the 'green' conscious demand, it is the manufacturer who incurs the cost of greening. We compare and contrast two modes of decision making here: the level of greening achieved jointly vis-a-vis the case where the manufacturer individually decides the level of greening. We name the first case *Joint Policy* where the level of green innovation that is to be achieved is jointly decided by the retailer and the manufacturer. We name the second case *Decentralized Channel Policy* where the manufacturer incurs the cost of greening and determines the level of greening too. The retailer controls the retail price for his profit maximisation. In these channels we analyse the effect of greening decisions on prices of the 'green' product, profitability of the individual players and channel. We further explore a contract which can coordinate the decentralized green supply chain.

In the second problem, we explore another model of decision making which involves cooperation between players in the chain. Based on the tenets of cooperative game theory, we analyse cooperation between the single retailer-single manufacturer based

green supply chain. Cooperation in this model involves bargaining between the players on greening investments. We study two cases here. We name the first *Cooperative Policy* based on our model of decision making and the other *Decentralized Channel Policy*. We explore the impact of bargaining on the price of the green product and profitability of the individual players and supply chain as a whole. Further, we apply the bargaining framework to design a cost sharing contract between the retailer and the manufacturer and explore its implications on their key decisions. Our approach throws interesting insights into the strategies of the players. Through our analytical approach we aim to capture extensively various decision making models in green supply chains.

In the third problem, we explore the effect of environmental regulations and costs of greening on firms. Our problem deals with the case of a single firm, a duopoly and the case of cooperation between them. We use these market settings to study the pricing and greening decision of players under environmental regulation and increasing costs. We also analyse the impact of government regulations on consumers. Further, we explore several contracts between the players under competition. Through this problem we address the burgeoning challenges that firms face in the presence of competition and environmental regulations.

The thesis addresses several issues arising out of green initiatives of firms like the greening levels of a product in a vertical supply chain, the impact of supply chain structures on greening levels of products, prices of green products, profitability of channel members who participate in the green consumer market and incentive design for channel members who incur the cost of greening. It also studies the effect of environmental regulations on firms and consumers. Under a competitive market setting, it explores the decisions of firms on greening levels and prices. It analyses the profitability of firms under these settings. Further, it analyses the impact of contracts between firms on the decision variables under study. This research lays out the platform for future work in the area of 'green' product pricing, environmental contract design mechanisms for channel members and study of impact of environmental regulations on firms and supply chains.