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# Collaborative Mechanism of a Sustainable Supply Chain with Environmental Constraints and Carbon Caps

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**Abstract:** Negative impacts on environment such as carbon emissions and pollution resulting from the business activities of firms in a supply chain have attracted great attention worldwide. Hence, one of the crucial issues for supply chain management is the trade-off between economic objectives and environmental sustainability. This paper focuses on investigating the government policy incentive mechanism, with which supply chain members are motivated to work collaboratively to reduce carbon and pollutant emissions by investing in producing environmental-friendly products (EFP). Such a mechanism affects the transfer price through negotiation between the supply chain firms, and consequently it has an impact on the supply chain's value transition and profit allocation. A collaborative supply chain decision-making framework is formulated with environmental constraints and carbon caps; its objective is to maximize the net present value of an integrated supply chain as well as satisfy the interests of its individual members. Our key contribution lies in exploring a decision-making mechanism for an environmentally sustainable supply chain that is jointly constrained by environmental carrying capacities and carbon caps, and also takes into account government policy incentives. The results show that collaboration between supply chain members plays a crucial role in improving their environmental performance, as the transfer price is determined through negotiations to share government subsidies to satisfy the individual interests of supply chain members while the level of pollutants and carbon emissions are in compliance with environmental standards.

**Keywords**: supply chain; carbon emission; environmental constraint; collaborative; profit allocation

## 1. Introduction

In today's globalized supply chains, environmental issues are of critical importance. During the past decade, carbon emissions and pollution associated with economic development have caused serious issues such as the greenhouse effect, abnormal climate, and environmental degradation. Hence, it has become a consensus worldwide to reduce carbon emission and pollution. Both consumers and regulators continuously exert pressure on firms to innovate in ways that will reduce their impact on the natural environment (Sarkis et al., 2011), as increasing government regulation and stronger public mandates for environmental accountability have made environmental issues a crucial business concern. Business firms are particularly under increasing pressure to reduce the negative environmental impact of their supply chains, to the point where environmental consciousness has become critical in the design and operation of globally-integrated supply chain networks (Sundarakani et al., 2010).

As corporations attempt to move toward environmental sustainability, their managements must extend their efforts to improve their environmental practices across their supply chains. However, this complex job requires the collaborative efforts of many related parties including governments, supply chain firms, customers, and the community (Sommerville et al., 2010). Environmental collaboration was defined specifically to focus on inter-organizational interactions between these supply chain members, including aspects such as joint environmental goal-setting, shared environmental planning, and working together to reduce pollution or other environmental impacts (Vachon and Klassen, 2008).

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