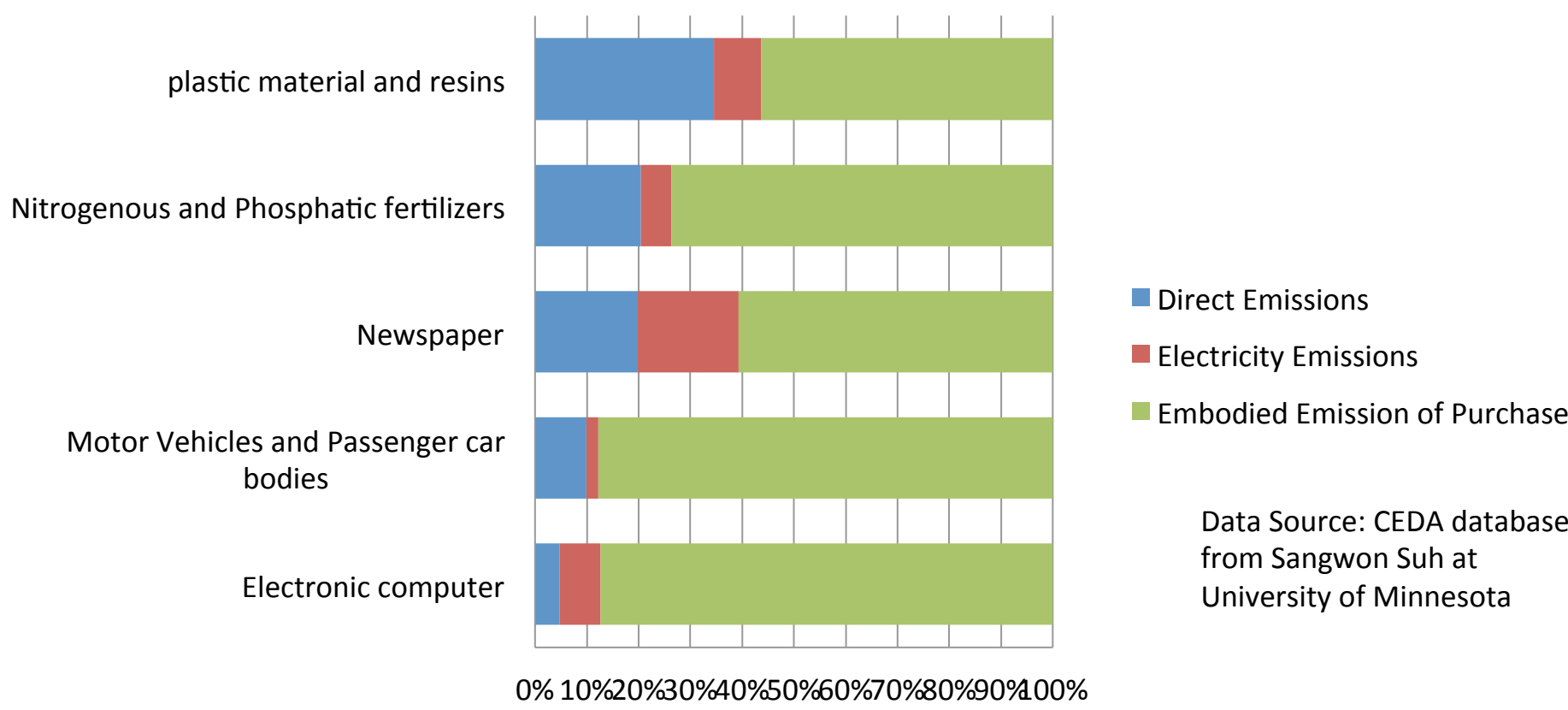


The Significant Role of the Supply Chain

- On average, direct emission from company owned or controlled activities and indirect emission from purchased energy make up only 26% of the total supply chain emission. (Matthews et al. 2008)

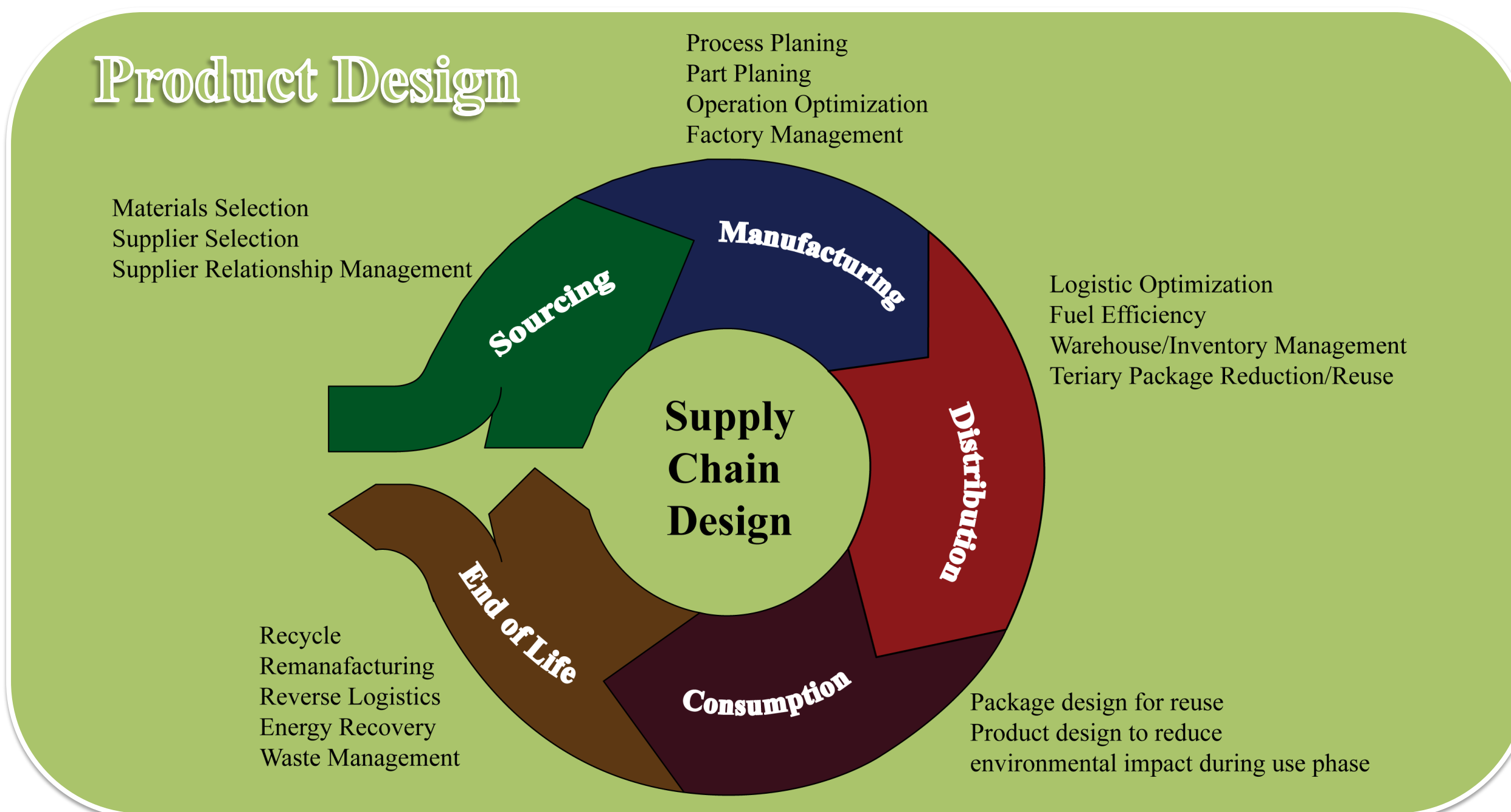
Carbon Emission in Upper Stream Supply Chains in Selected Manufacturing Industries



Motivation of Green Supply Chain

- Public Awareness**
 - Environmental awareness among public is arising.
- Government Regulations**
 - Regulations that force companies to be accountable for all supply chain emissions are under developing. E.g., Waxman-Markey and Kerry-Boxer bills, and California AB 32
- Brand Equity**
 - Customers and other stakeholders do not distinguish between a company and its suppliers. (Sarkis 2006)
- Win-Win Opportunity**
 - Opportunity to reduce supply chain cost while helping environment

Overview of Supply Chain Management



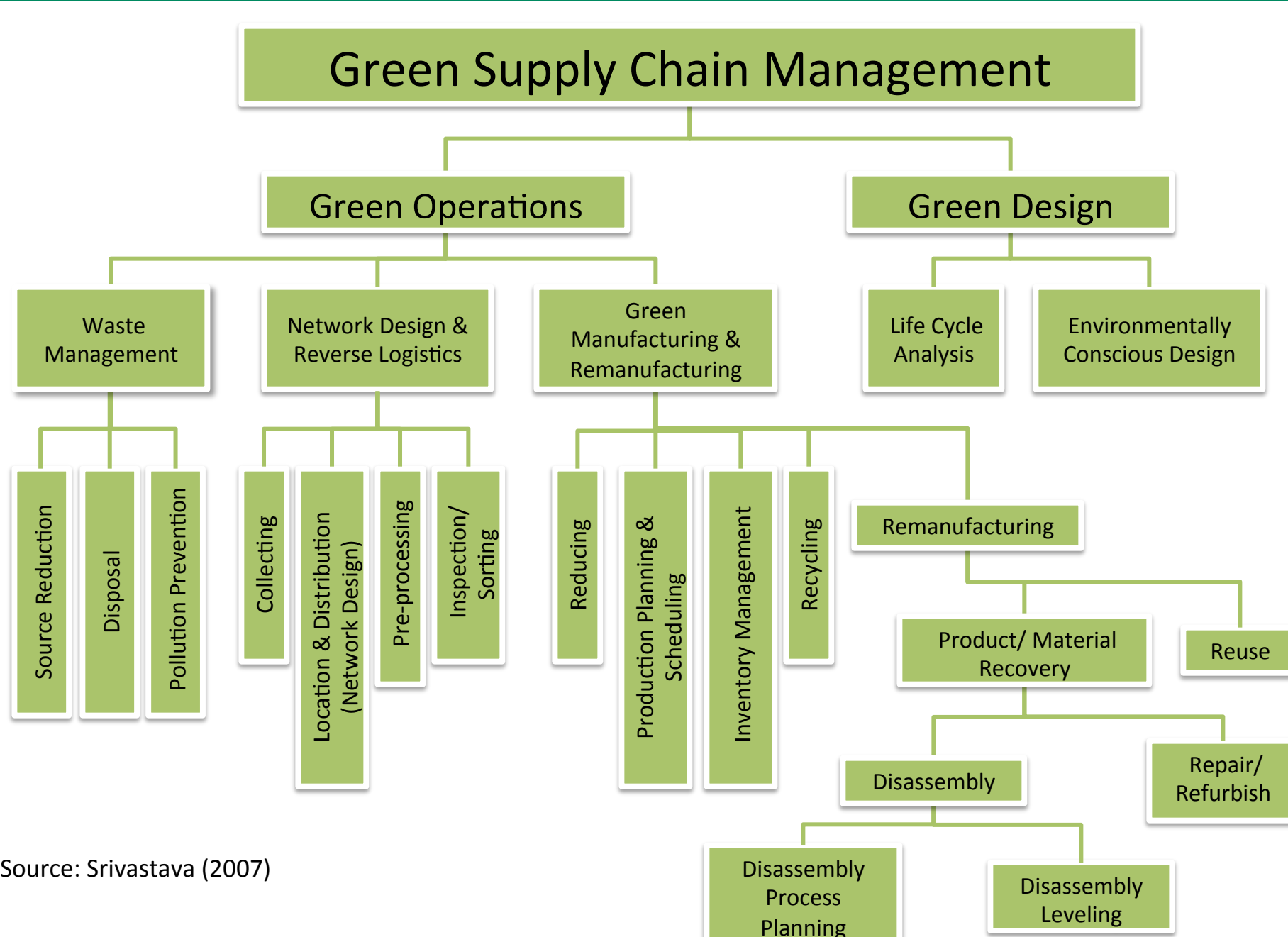
- Decisions in Supply Chain Design:**
 - Facility Location:** Where to locate the facility? (manufacture, supplier, distribution center, recycle/collection center)
 - Supplier Management/Selection:** Which supplier to choose?
 - Logistics Optimization:** What is the best strategy for distribution and inventory management?
 - Coordination:** How to coordinate the whole supply chain?

Tradeoffs in Green Supply Chain

Action to Reduce Carbon Emission	Related Issues
Transportation	
Reduce shipment frequency	To maintain the service level, the inventory level has to be increased.
Increase the lot size so that the products can be shipped by larger trucks and the carbon emission per product will be reduced	➔ Need larger warehouse and keep a single product longer in warehouse.
Change to a low-carbon transportation mode	The lead time may be longer due to slower shipment
Sourcing	
Change to local suppliers (reduce the emission from transportation)	may increase emission if local supplier has higher Carbon emission
Change to the suppliers who has less Carbon emission (reduce the emission in the upper stream)	may increase emission from transportation
Manufacturing	
Change the production process to reducing energy consumption	may have impact on batch size, number of WIPs

Interactions and tradeoffs in each stage of supply chain need to be taken into consideration to optimize the overall environmental and economic performance in a supply chain

Researches in Green Supply Chain



Source: Srivastava (2007)

Future Work

- Integrated Supply Chain Model**
 - Consider the environmental impact and cost in a multi-objective model and find a balance between them
 - Include the tradeoffs in supply chain activities in the model
- Supply Chain Design for Environment**
 - Construct a comprehensive supplier selection model/framework on environmental, social and economic aspect.
 - Include the end-of-life phase in the reverse chain
- Supply Chain Coordination**
 - Analyze the performance of supply chain coordination under different environmental policy/regulation