Exploring collaboration between companies as a strategy to leverage the acquisition of electric trucks
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Background

- In order to face the negative environmental impacts due to transportation, some governmental agencies in California are evaluating to implement regulatory emissions policies. E.g. encouraging companies to buy electric vehicles (EVs) or penalizing for the generated emissions.
- It is not clear how these policies could affect the economy of the companies, given the capacity limitations and high cost of the EVs. It is not cost efficient, how companies can make more affordable the EVs purchase?

Method

Hypothesis: By coordinating the replenishment of multiple companies’ inventories, it is possible to simultaneously reduce their logistic (individual) costs, as well as their amount of trips and emissions, within finite capacity constraints. This better coordination allows exploiting economies of scale that in turn could leverage the purchase of EVs

Solving this problem imply solving the next questions:
- How often each company’s item should be replenished?
- How should the collaborative surplus be allocated?
- What is the trade-off between emissions and cost?

Since the problem is computationally complex (NP-Hard) we introduced a heuristic procedure as solution method; our heuristic is composed by A Genetic Algorithm embedded into a heuristic who integrates the Shapley Value function

Results

- Completely reducing freight transport emissions could be very expensive, but there are good solutions that could generate a significant reduction at a relatively low cost. Understanding the trade-off between the logistics cost and the emissions allows to make more accurate decisions to coordinate the replenishment of inventory and change/purchase regular vehicles by EVs

Collaboration in bills...

Related Costs:
- Transportation costs: Investment + operational
- Fixed inventory cost: Ordering, managing and holding
- Variable inventory cost: handling, tracking, insurance and fees

Working as collaborative partners

Lineal Method

- Saving 7%
- Company 1:60%  Company 2:5%  Company 3:35%

Proposed Method

- Saving 18%
- Company 1:64%  Company 2:4%  Company 3:32%

Insights

- The empirical case results show that the ratio emission reduction / is not linear. E.g. reducing emissions by 60% represents an increase in the total cost of replenishment of 1.52%, and specifically in transportation costs represents an increase of 160.97%. But, to reduce the remaining 40% of emissions, the cost of total replenishment increases by 5.43% and that of transportation by 232.71%, evidencing that aggressive policies could represent a big financial challenge for companies.

- Collaboration between companies has the potential not only to reduce the cost of operations in the supply chain, but it could also help mitigate environmental impacts.