Optimizing Last Mile Fleet Size & Composition

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Sponsor: Coppel

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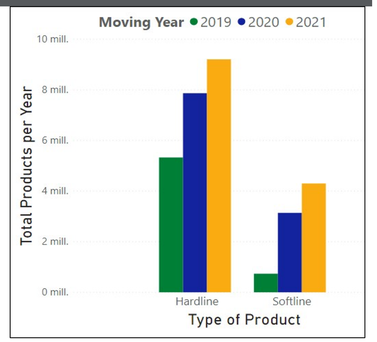
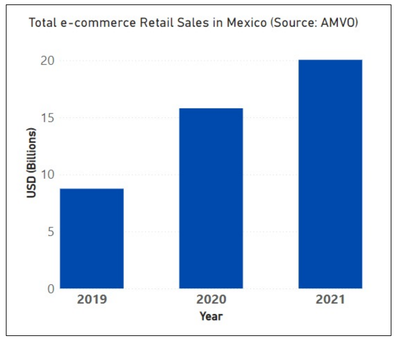
Motivation / Background

Coppel, one of the largest retailers in Mexico, delivers around 11 million products per year to customers by driving over 30M KM. Since 2019, Coppel's last mile deliveries grew 73% for Hardline products, while Softline grew 485%. This growth is visible in the figure on the right.





Coppel's growth in ecommerce, resulting in more last mile deliveries, mirrors the accelerated growth rate the overall industry is experiencing. The industry growth rate is visible in the figure on the left. This project created a strategic fleet planning tool that allows Coppel to define the optimal last mile fleet and composition.

Key Questions / Hypotheses

- What is the optimal last mile delivery fleet in terms of the optimal number of last mile vehicles and delivery vehicle mix?
- What is the best order allocation strategy for this newfound last mile delivery fleet?

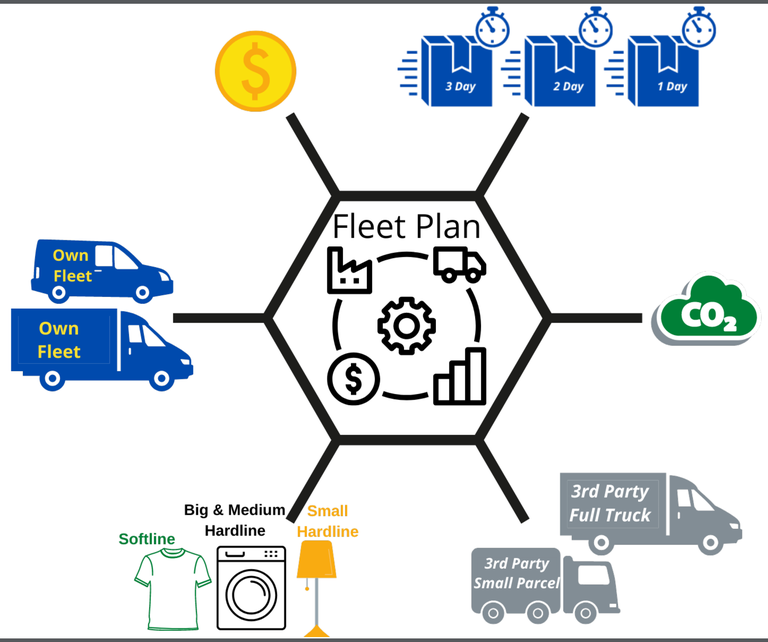
Relevant Literature

Baldi, M. M., Manerba, D., Perboli, G., & Tadei, R. (2019). A Generalized Bin Packing Problem for parcel delivery in last-mile logistics. *European Journal of Operational Research*, *274*(3), 990–999. https://doi.org/10.1016/j.ejor.2018.10.056

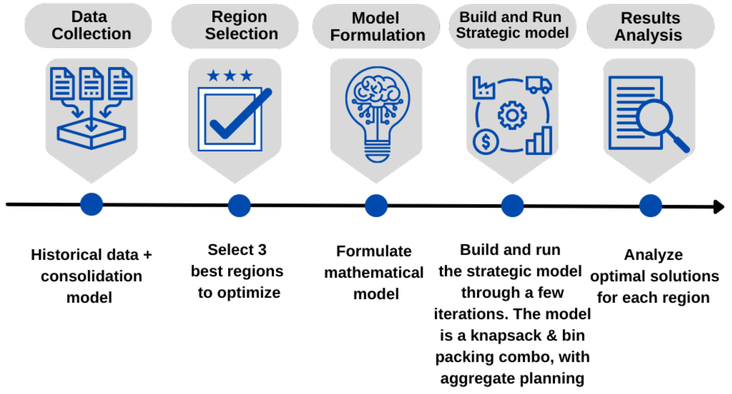
Harris, I., Mumford, C. L., & Naim, M. M. (2014). A hybrid multi-objective approach to capacitated facility location with flexible store allocation for green logistics modeling. *Transportation Research Part E: Logistics and Transportation Review*, *66*, 1–22. https://doi.org/10.1016/j.tre.2014.01.010

Assi, M., & Haraty, R. A. (2018, November). A Survey of the Knapsack Problem. *2018 International Arab Conference on Information Technology (ACIT)*. 2018 International Arab Conference on Information Technology (ACIT), Werdanye, Lebanon. https://doi.org/10.1109/acit.2018.8672677

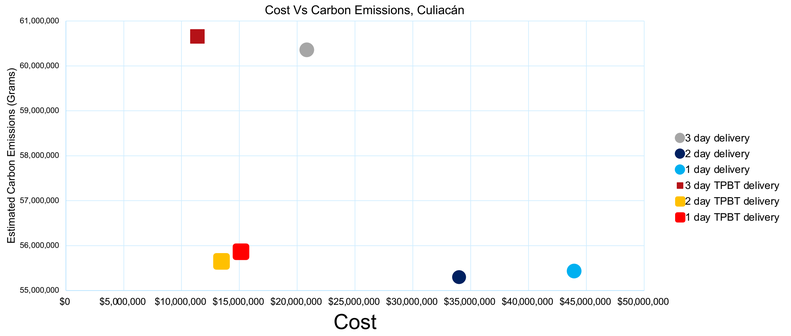
Problem



Methodology



Results



- The figure above displays the cost vs CO_2 for the Culiacán Region, highlighting the benefits of using third-party big trucks. All regions tested resembled this figure above.
- Using third-party big truck rentals achieves cost optimality, as displayed above.

The analysis of all three regions revealed that:

- Reducing the usage of third-party small parcel carriers reduces costs and increases own-fleet utilization.
- Reducing order allocation constraints will increase utilization of own-fleet trucks and lower costs.

Expected Contribution

- A strategic fleet planning tool that provides financial and environmental impact for new last mile fleet strategies, including green vehicles.
- Estimate 5% reduction in cost & CO_2 emissions by improving fleet allocation

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