DEVELOPING A HEURISTIC TO IMPROVE FLEET UTILIZATION THROUGH BACKHAULS

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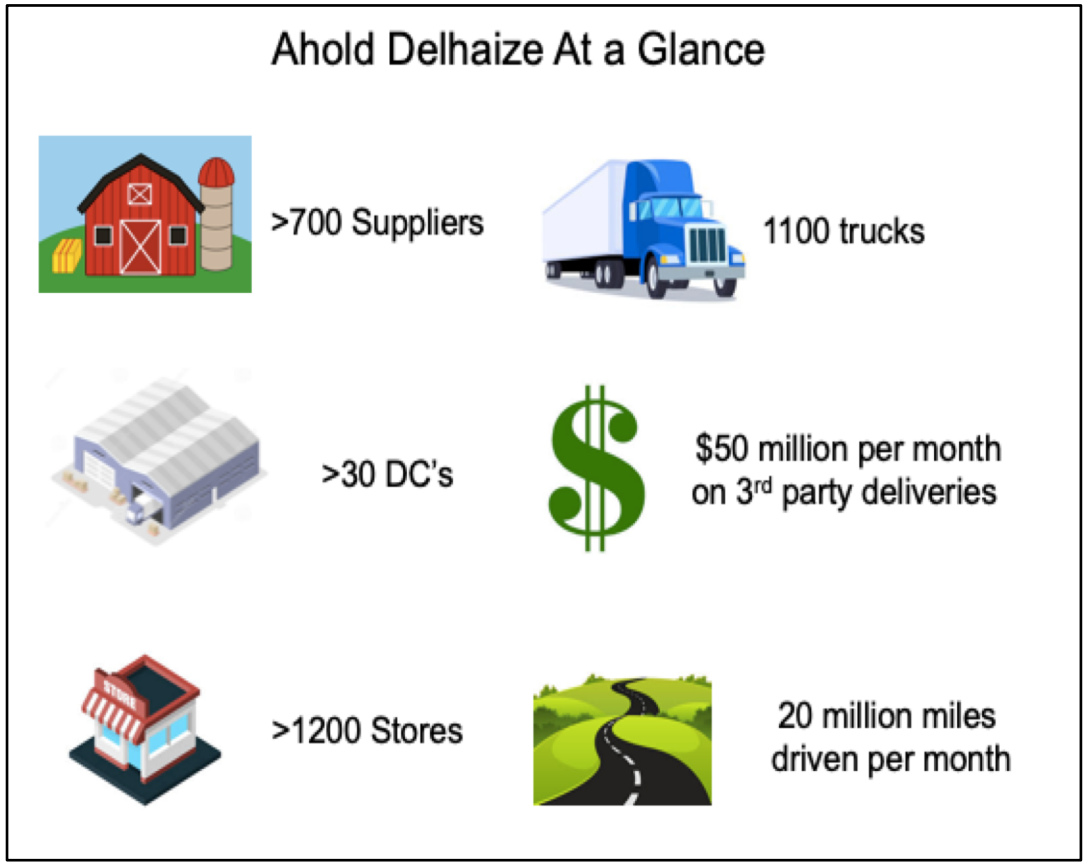
Supply Chain MANAGEMENT

AHOLD DELHAIZE AND RETAIL BUSINESS SERVICES

- Parent Company: Ahold Delhaize - a world-leading food retailer with 6,700 stores worldwide
- The fourth largest grocery retail group in the United States with more than 1950 Stores
- RBS is the service company of Ahold Delhaize USA and manages the logistics for Ahold Delhaize Supply Chain

Brands:

FOOD LION | Giant | GIANT FOOD STORES, LLC | Hannaford | Peapod | Stop&Shop



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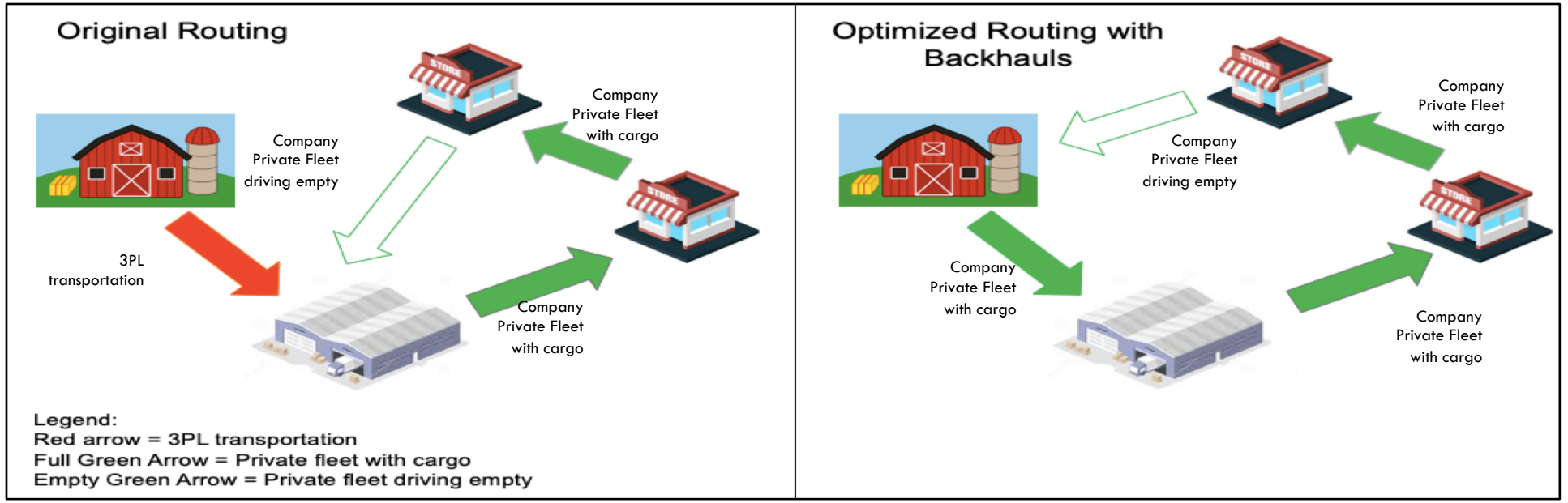
THE PROBLEM STATEMENT

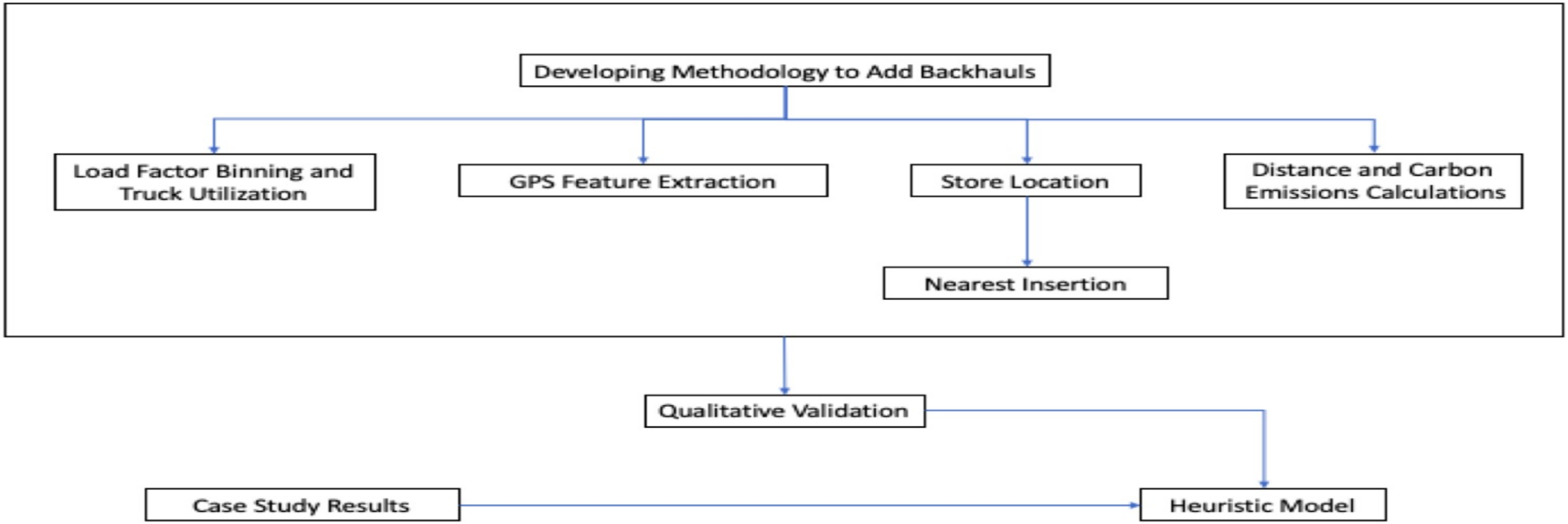
Transportation from Vendors to Ahold DCs is managed with a combination of contracted fleet and private fleet

There is a potential to reduce empty backhaul miles of outbound network by using them for inbound transportation



METHODOLOGY

Methodology for optimization of an integrated backhaul network



Case Study: Food Lion

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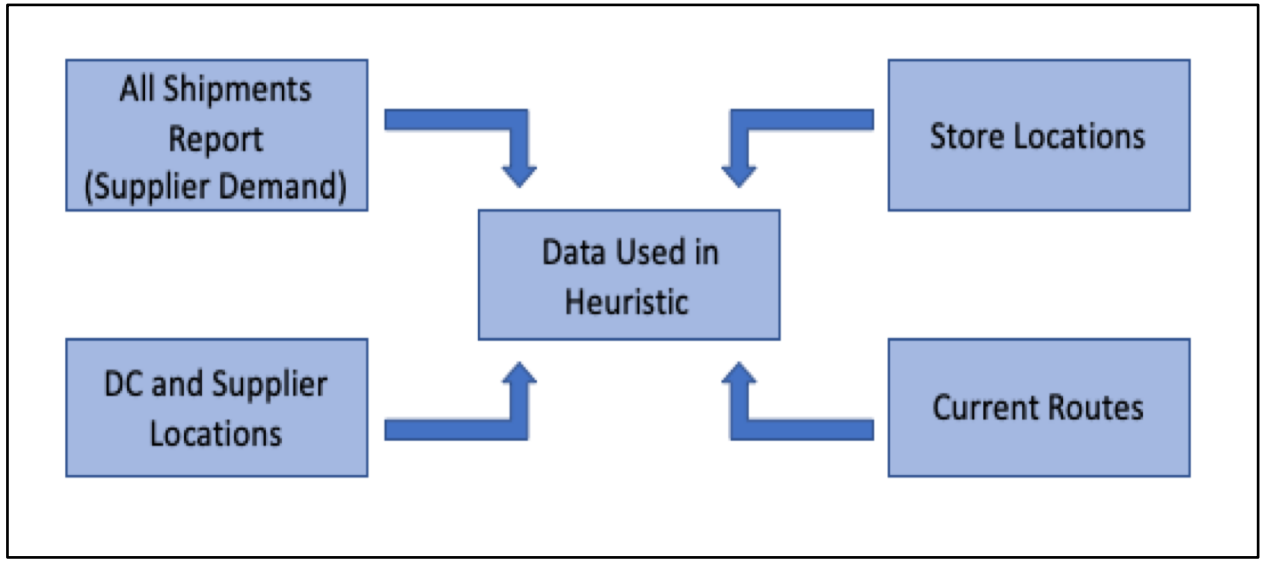
DATA SOURCES

Data:

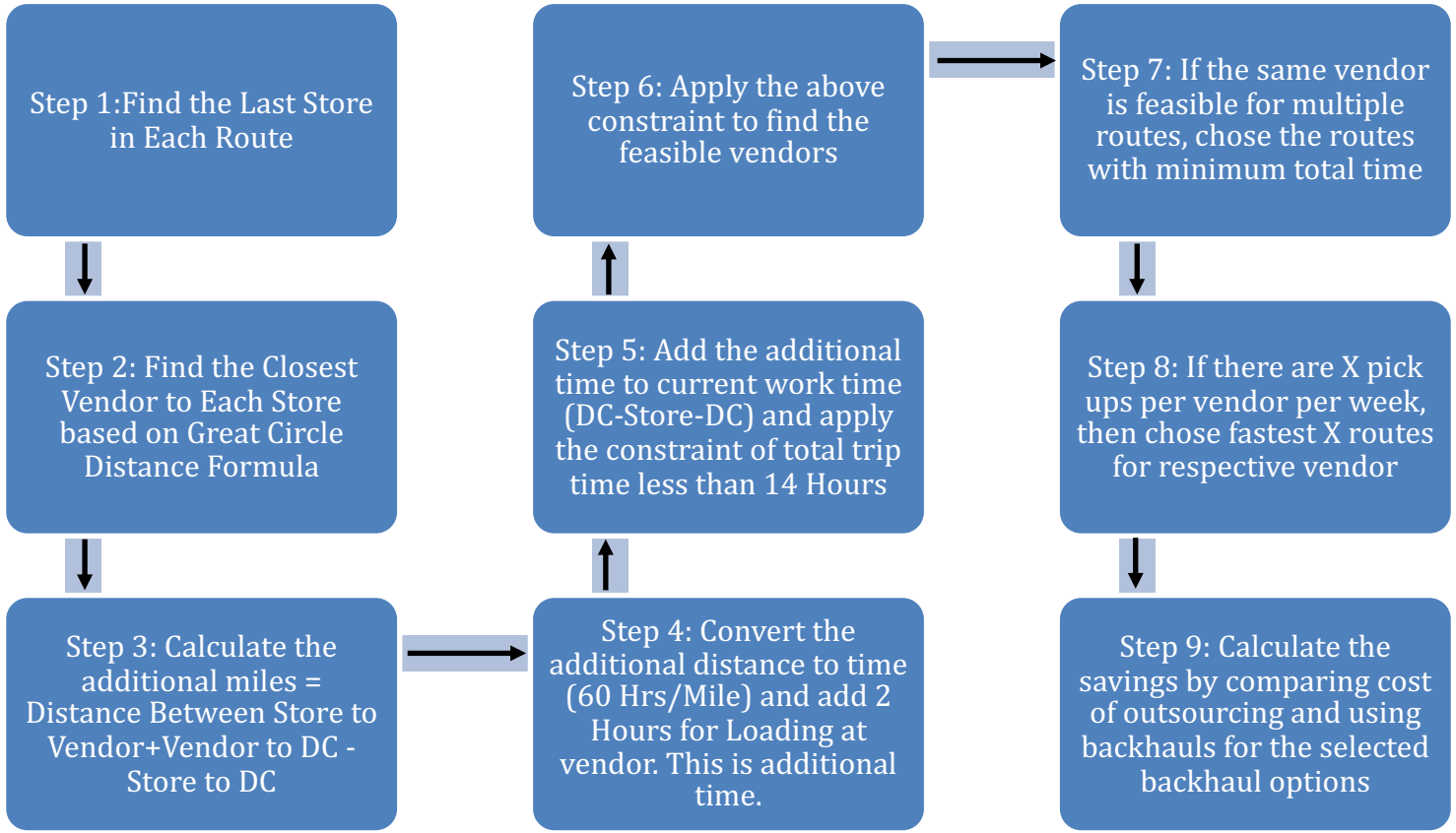
- Location of Stores and Existing Outbound Routes
- Delivery and Pick-up Schedule
- Location of CPU Vendors* and existing Backhaul pickups
- Outbound and inbound shipment demand
- Costs with and without backhauls

* - Not all Vendor location coordinates were available



Data Used in Developing the Heuristic

APPROACH: HEURISTIC FOR IDENTIFYING BACKHAUL SOLUTIONS



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APPROACH: MATHEMATICAL MODEL

Objective Function: Minimize Total Trip Time

Variables: y_{ij} = travel time, w_{ij} = loading time, x_{ij} = binary decision variable, N = number of vendors

Constraints:

1. Trip time need to be less than 14 hours
2. Using loading time as 2 hours and driving time as 60 mph
3. Match supply and demand to make sure there are pickups for the backhaul solutions

Where:

$$Min\ z \sum_{i=1}^{N} \sum_{j=1}^{N} (w_{ij} + y_{ij}) x_{ij} \quad (1)$$

Subject to:

$$\sum_{i=1}^{N} \sum_{j=1}^{N} (w_{ij} + y_{ij}) x_{ij} \leq T \quad (2)$$

$$x_{ij}\ \epsilon\ (0,1)\ \forall\ i,j \quad (3)$$

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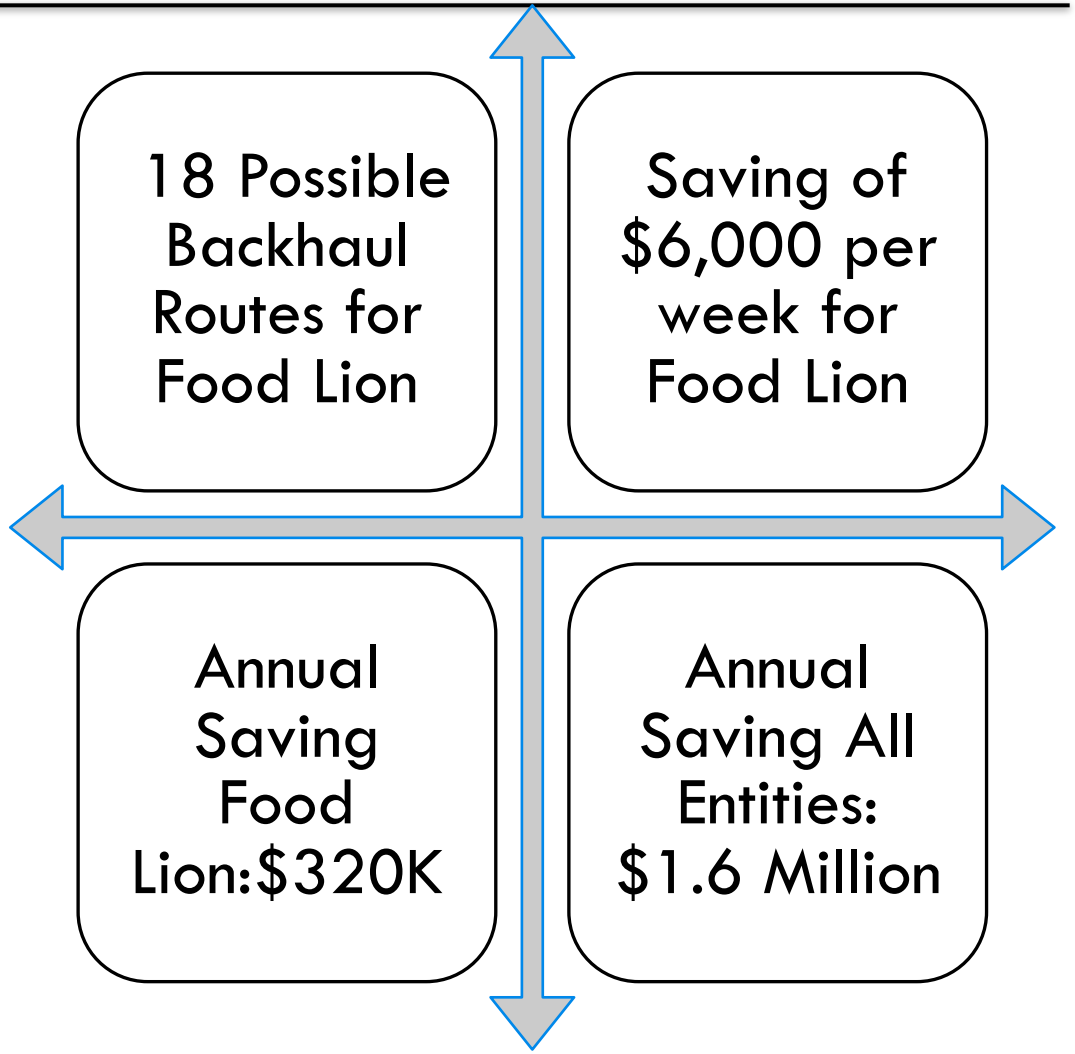
RESULTS: FINANCIAL IMPACT

Based on the analysis of data for Food Lion, we found at least 18 possible backhaul pick-ups based on the current routing

Implementing backhauls on these18 routes has a potential of weekly cost savings of $6,051 and annual savings of $320,000 for Food Lion

Extrapolating these results for the rest of the company, we determined that Ahold Delhaize could save up to $1.6 million from this backhaul heuristic



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RESULTS: ENVIRONMENTAL IMPACT

Adding backhauls reduces the total distance traveled by vehicles used for outbound and inbound shipments and also reduces CO_2 emissions

The reduction in CO_2 emissions for Food Lion are 3,208 pounds per week, which is a reduction of 166,800 pounds annually

Extrapolating these results to the other brands, Ahold Delhaize could reduce their carbon footprint by 830,000 pounds per year. This is equivalent to:

Source: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

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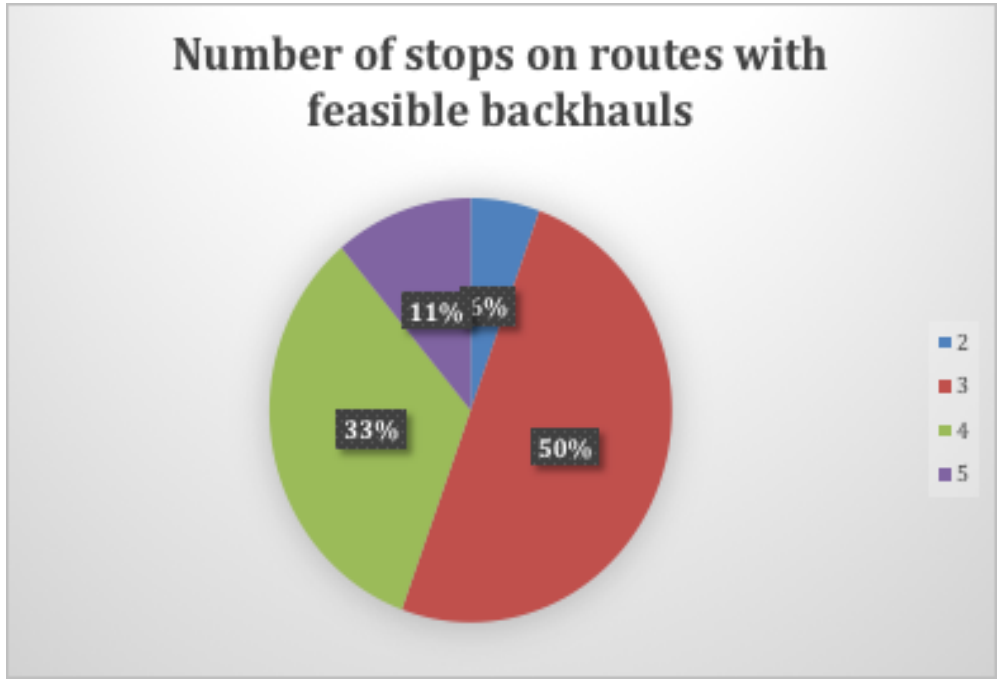
SENSITIVITY ANALYSIS FOR FOOD LION

Scenario	Change	New Value	Savings
Base Case			$320,000
Increase in Cost of Backhaul	20%	$3.6/Mile	$200,194
Decrease in Cost of Outsourcing	20%	$4/Mile	$137,979
Combination of 1 and 2		Both 1 & 2 above	$24,000
Increase in loading time at the vendor	50%	3 Hours	$315,000
Increase in total trip time		+ 2 Hours	$264,000
Increase in cost of outsourcing	10%	$5.5/Mile	$400,000

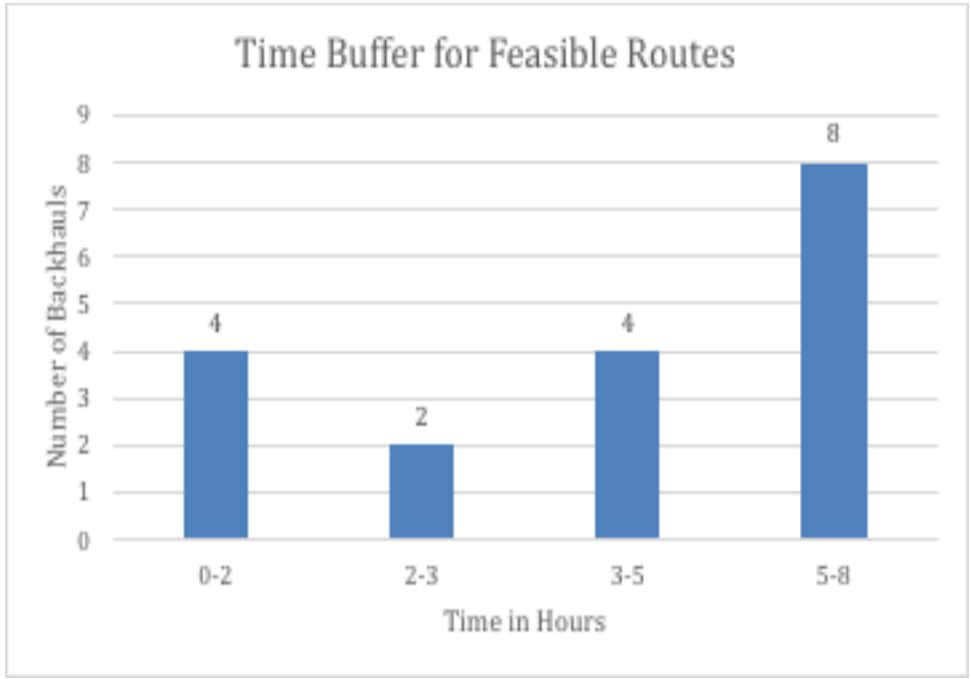
Base Case: Cost of Backhaul-$3/Mile, Cost of Outsourcing- $5/Mile, Loading time at vendor- 2 Hours

OTHER OBSERVATIONS



50% of the feasible routes have three stops and 33% have four stops. In order to maximize backhauls and fleet utilization, routes should be planned with fewer stops (around three or four) to enable trucks to also complete backhauls.

This analysis is helpful in prioritizing backhauls since the routes with larger time buffers should be prioritized since they have more flexibility and can more easily accommodate delays in loading or traffic and still make it back to the DC within 14 hours.



PATH FORWARD

Our recommendations to Ahold Delhaize are as follows:

- Analyze the other operating brands in Ahold Delhaize
- For each banner, identify practical solutions based on the trip durations and their sensitivity to increases in loading time and decreases in driving speed
- Establish a group to review which routes they are going to implement and how to monitor operations
- If the operating entities are able to share assets and no longer operate in silos, this entire exercise can be repeated using the entire network and fleet of Ahold Delhaize

ADDITIONAL SLIDES

LIMITATIONS

The heuristic does not consider the following constraints:

1. DC Operating Hours

2. Vendor Pick-Up times

3. Limitations capacity of the outbound fleet to adapt to changes in increase in trip time due to backhauls

KEY CONSIDERATIONS FOR IMPLEMENTATION

- The number of feasible backhauls will depend on the transportation network and the proximity of stores to suppliers and DC's
- For cases where the network is spread over a larger region, we expect fewer solutions and vice versa for denser networks
- Impact of operational constraints across banners due to the difference between unionized and non-unionized fleets
- Variability of demand and deliveries throughout the year: Due to Changes in demand over the course of the year, some vendors might not have enough pickups to satisfy the backhaul solutions assigned to them
- If there are weeks when the vendors do not have enough pickups for the backhauls, then the heuristic needs to be repeated to identify another backhaul opportunity

FORMULAE & ASSUMPTIONS

For Financial Impact:

Savings = Cost of Outsourcing*Distance from Vendor to DC – Cost of Backhaul* Extra Miles

Cost of Outsourcing = $5/Mile

Cost of Backhaul = $3/Mile

For Environmental Impact:

Total Emissions = Emission Factor *Distance*[Fuel Consumption (empty trailer) + (Fuel Consumption (full trailer) - Fuel Consumption (empty trailer)) *Load Factor)

Where,

CO_2 Emission Factor	2621	Gm/Ltr
Fuel Consumption (empty trailer)	0.288	ltr/km
Fuel Consumption (full trailer)	0.504	ltr/km
Load Factor for Full Truck Load transportation	1	