

# *The Impact of Product Portfolio Optimization on Fleet Size*

*Construction Chemicals*

*Sebastián Bello and Santiago Mollard  
Advisor: Jarrod Goentzel*

# AGENDA

1. Sponsoring company context and problem description
  2. Methodology used
  3. Results obtained
  4. Conclusions and next steps
-

**1.**

**COMPANY CONTEXT**

**and**

**PROBLEM DESCRIPTION**

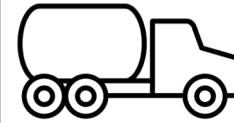
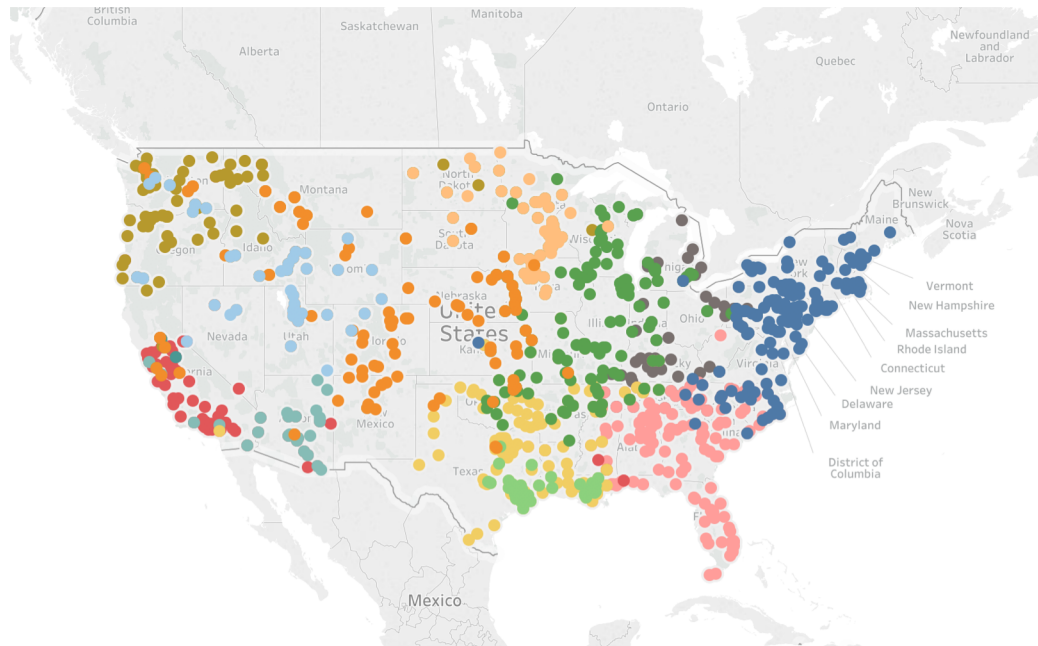
# Transportation represents +60% of the costs

Procurement of chemicals

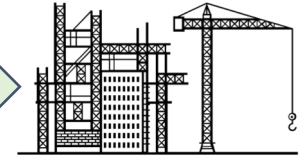


Mixture manufacture

**11 Plants**  
**+3,000 Customers**



Delivery to customers



**+100 compartment trucks**



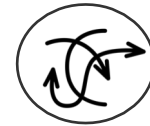
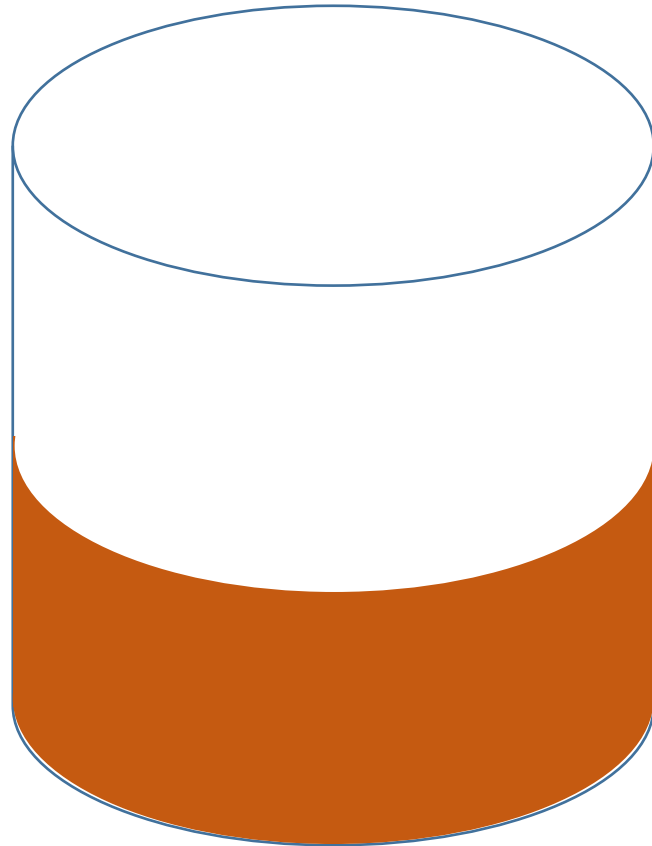
# The sponsor believes the complex product portfolio affects fleet size

60

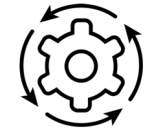
total products

23

products could  
be replaced



How does complexity affect transportation?



How would product replacement impact the operation?



How would the fleet size change in different product portfolio scenarios?

*How can we assess the impact of product portfolio complexity on fleet size?*

2.

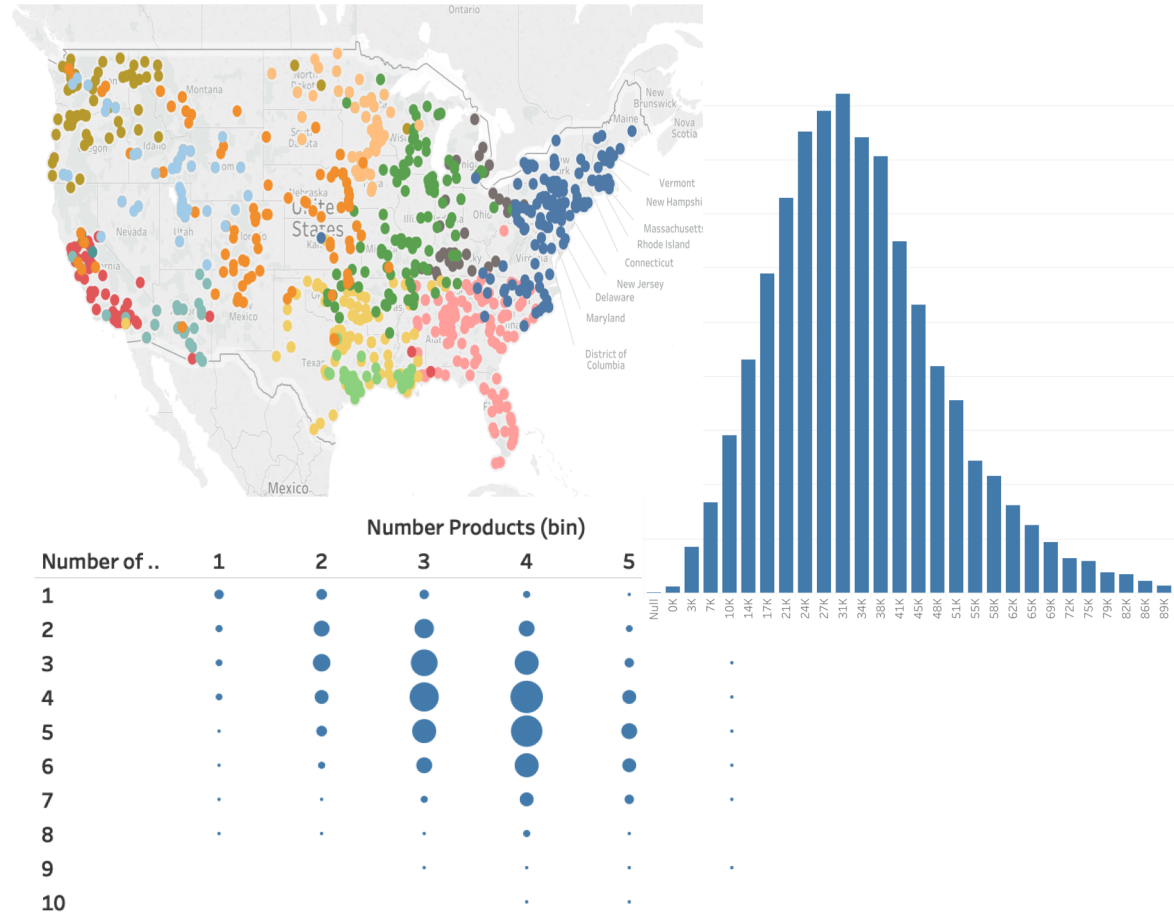
# METHODOLOGY

# A Monte Carlo simulation was used to answer the question

Data analysis

Toy Model coding

Output validation



Simulation roll-out

Results Analysis

# A Monte Carlo simulation was used to answer the question

Data analysis

Toy Model coding

Output validation



Simulation roll-out

Results Analysis

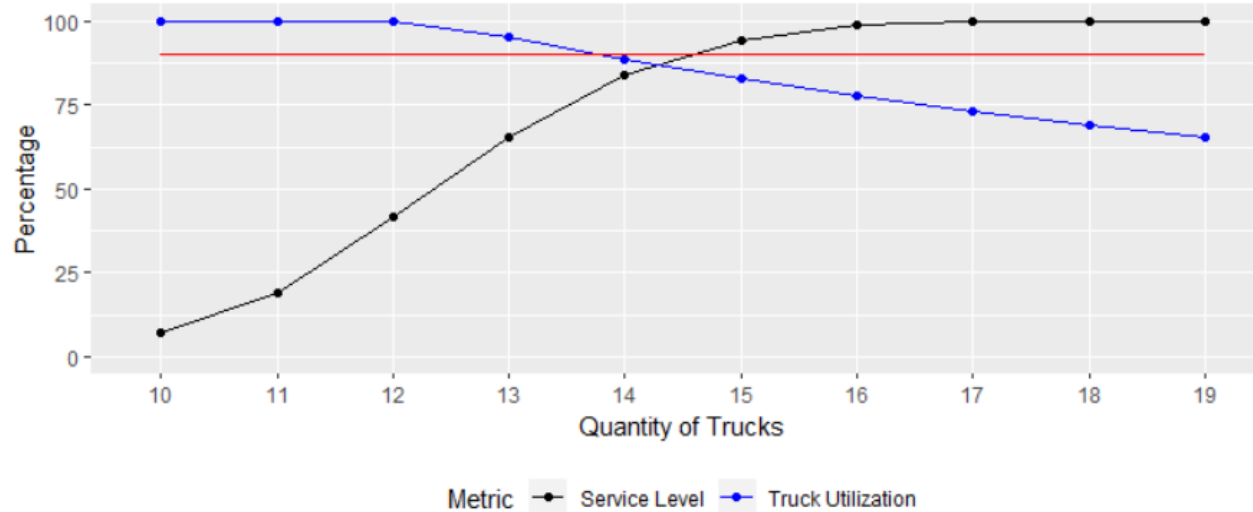


# A Monte Carlo simulation was used to answer the question

Data analysis

Toy Model coding

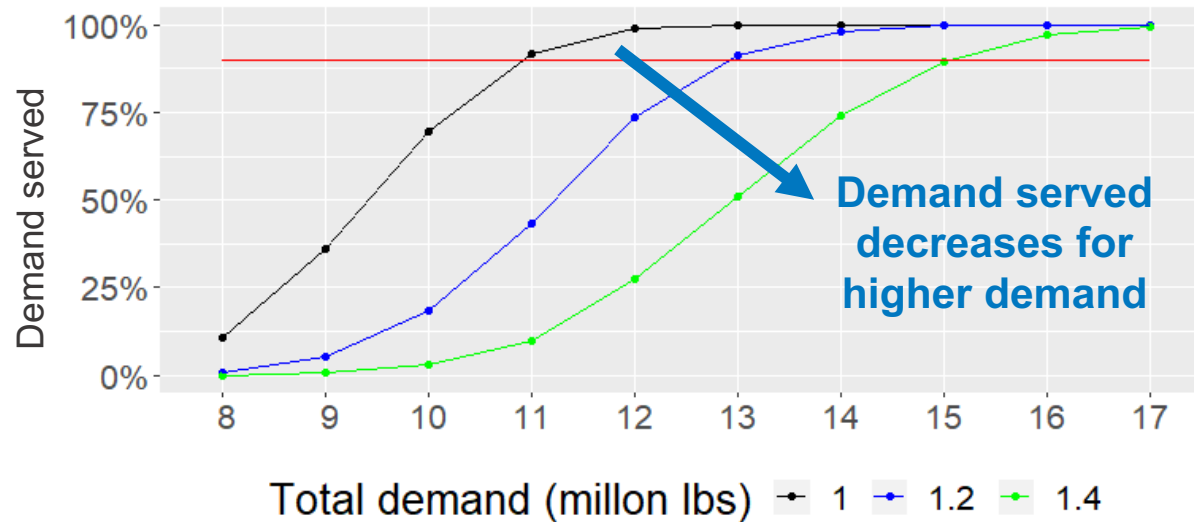
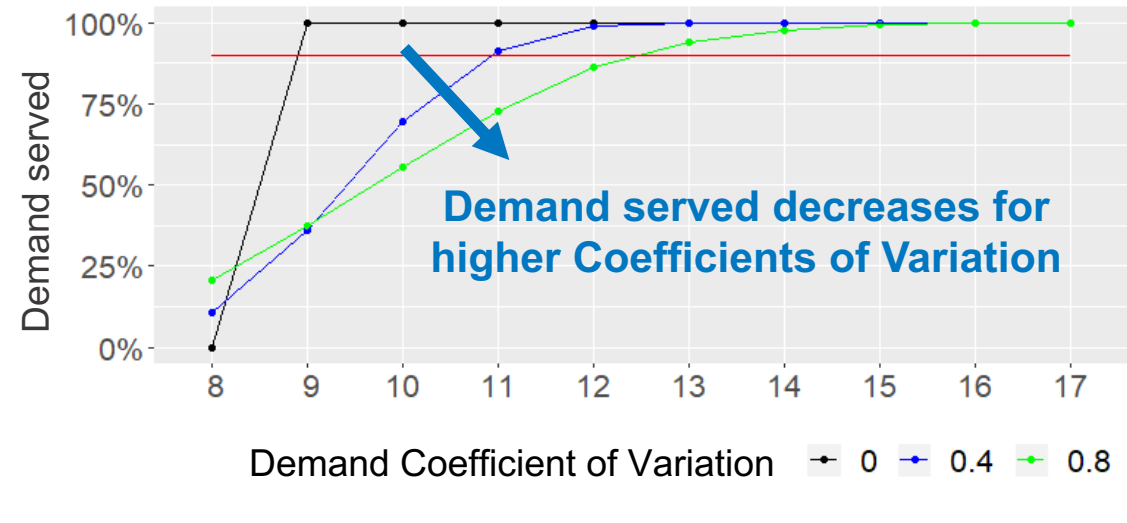
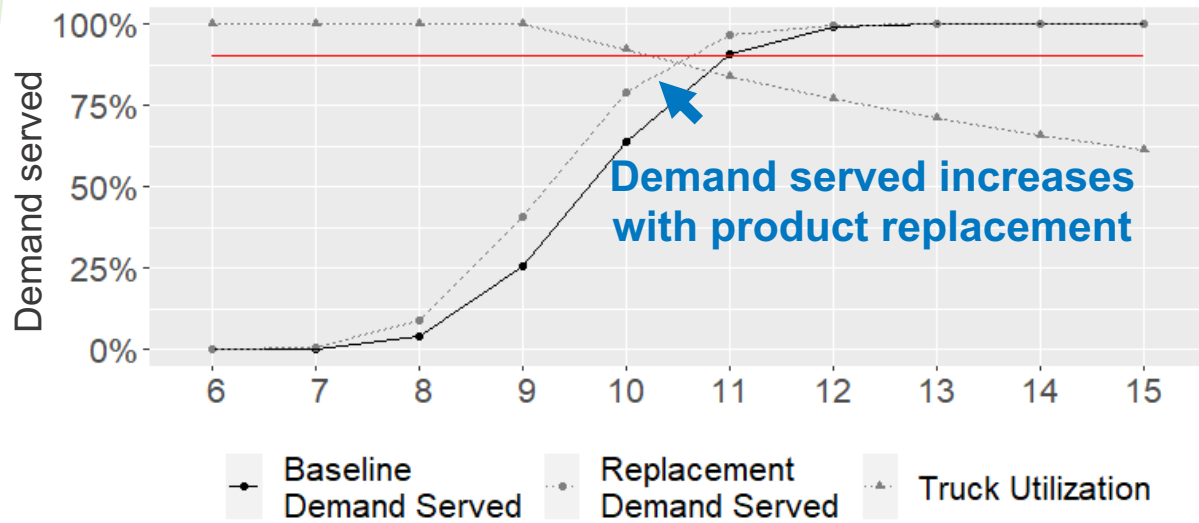
Output validation



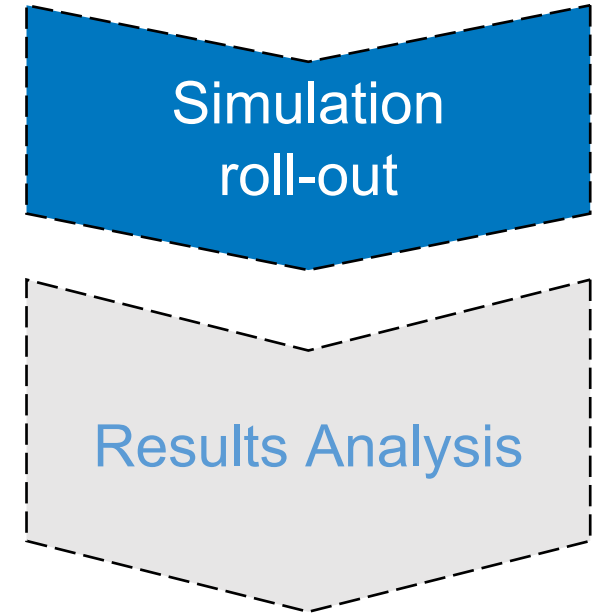
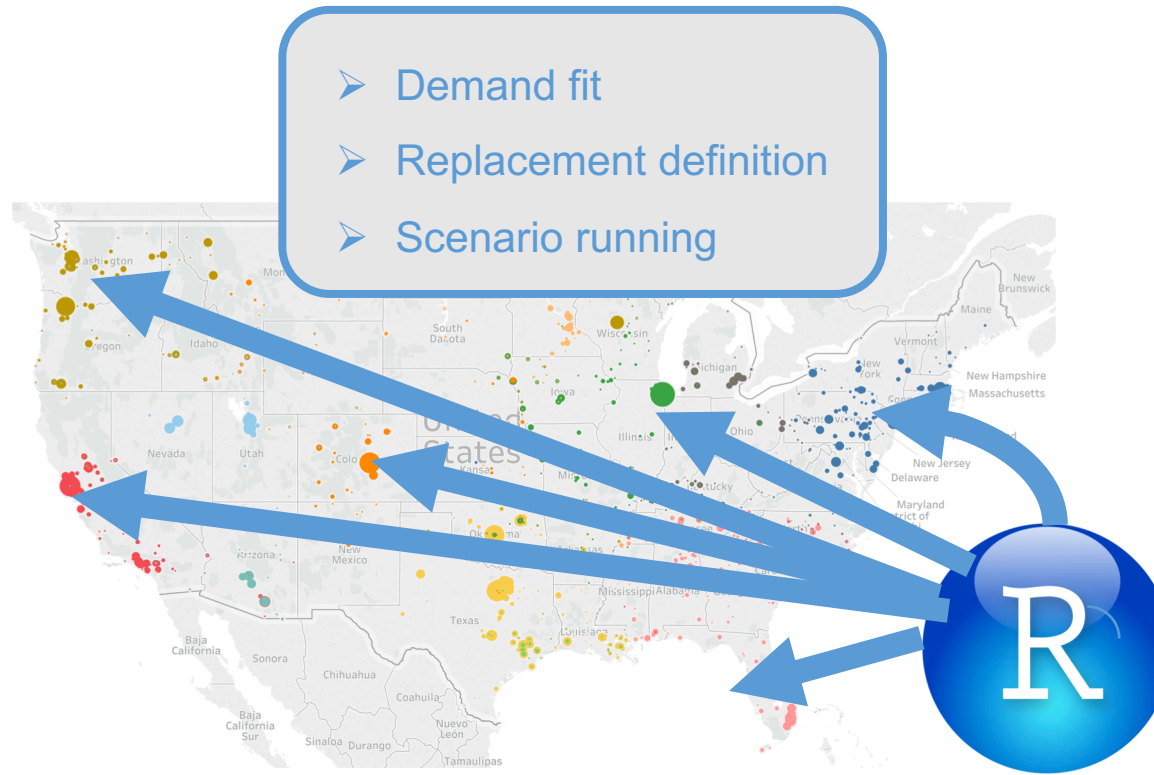
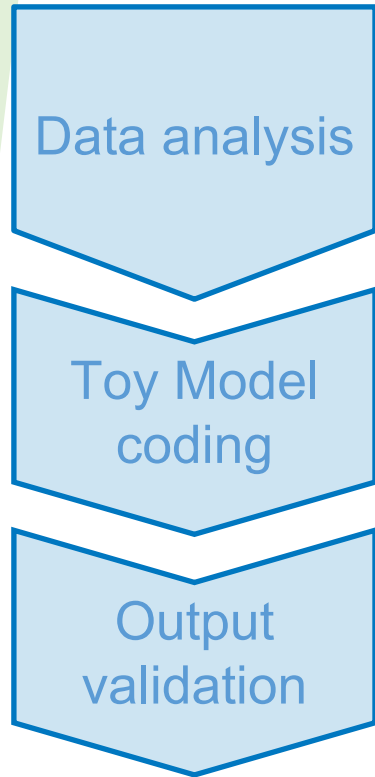
Simulation roll-out

Results Analysis

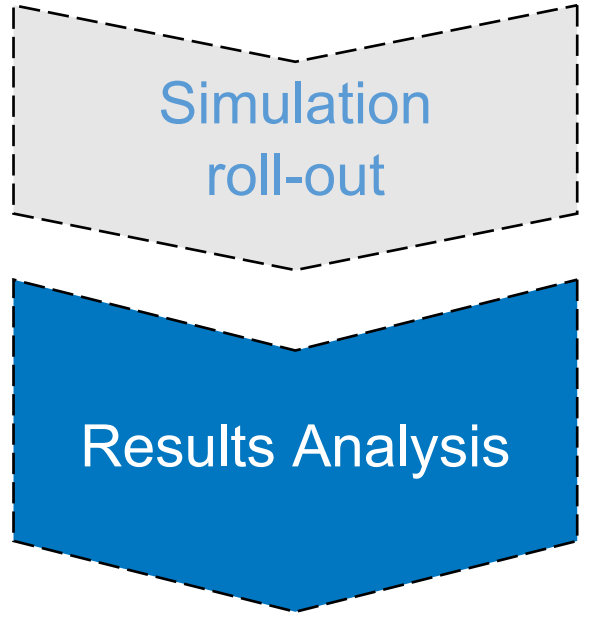
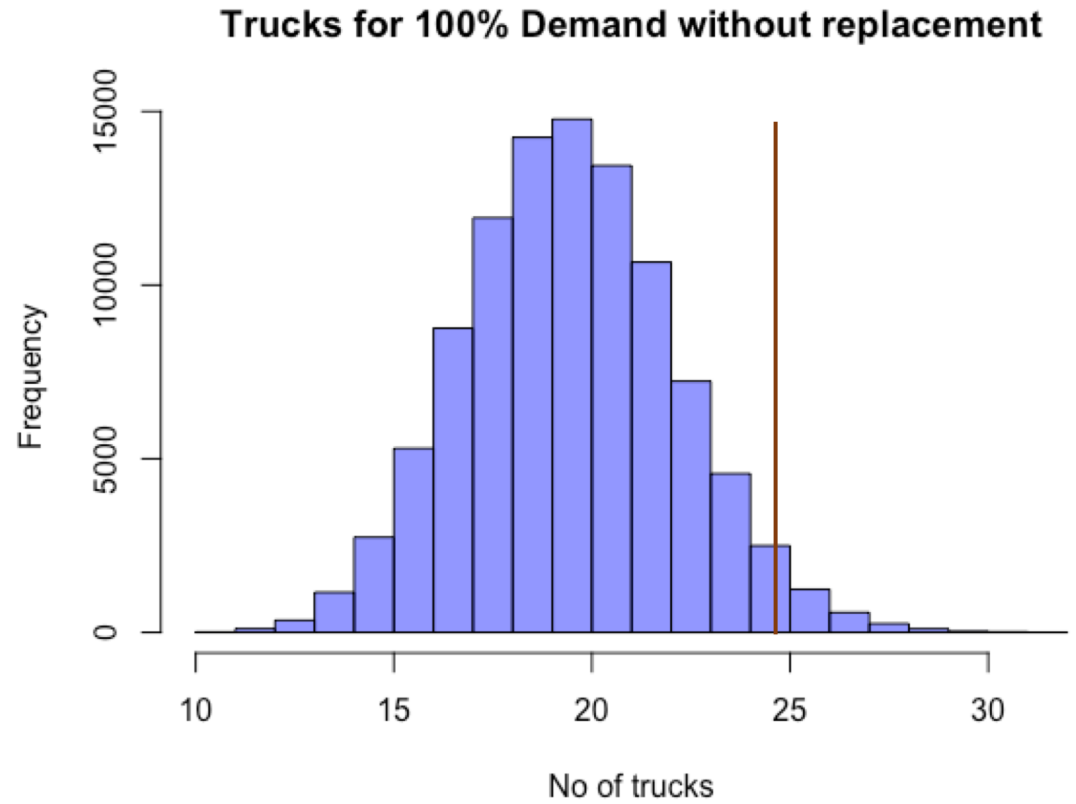
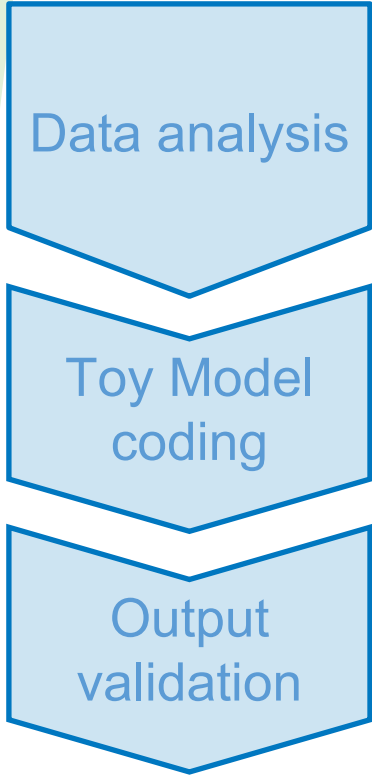
# Results were consistent with sponsor expectations



# A Monte Carlo simulation was used to answer the question



# A Monte Carlo simulation was used to answer the question



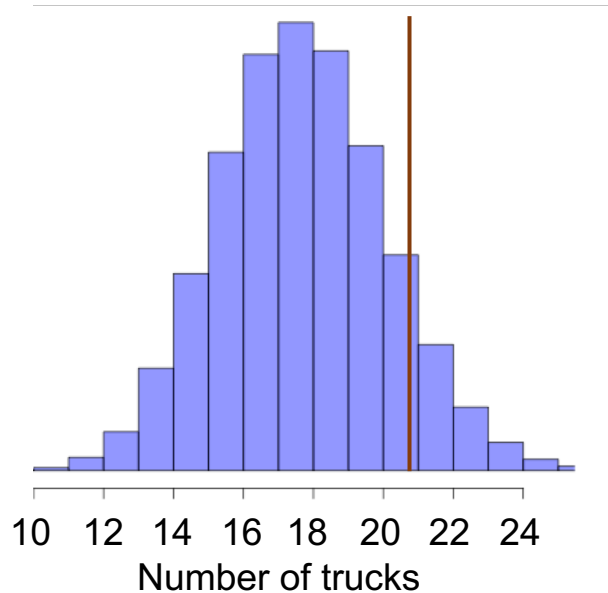
**3.**

# **RESULTS**

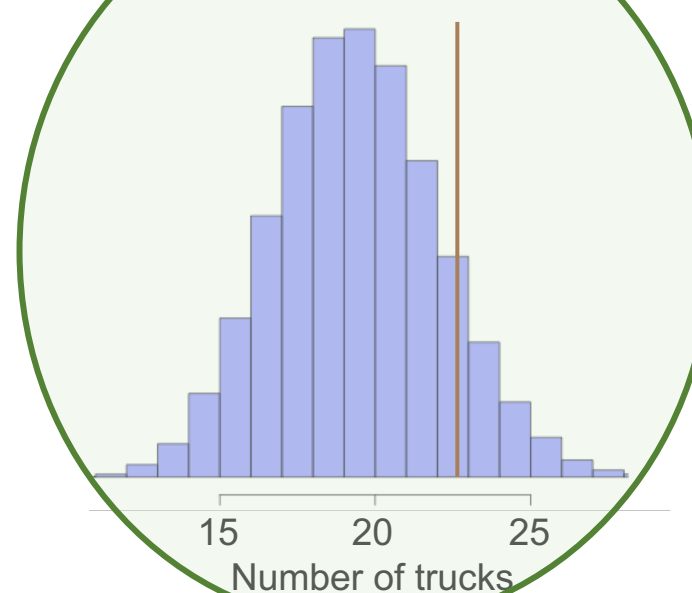
# Each plant was analyzed for two scenarios on each quarter

Scenario	Quarter	Products	Average Demand	Average Distance	Serve 90% of demand			Serve 100% of demand			Demand Served with 15 trucks			
					Mean	Standard Deviation	90% of the runs	Mean	Standard Deviation	90% of the runs	Mean	Standard Deviation	100% demand served	Trucks
Baseline	Q1	27	1,155,937	958	17.7	2.4	20.8	19.4	2.7	22.8	79%	11%	4%	15
Baseline	Q2	29	1,070,363	953	16.8	2.1	19.5	18.4	2.3	21.4	83%	10%	6%	15
Baseline	Q3	30	1,042,858	965	16.8	2.0	19.3	18.5	2.2	21.3	82%	9%	4%	15
Baseline	Q4	28	1,264,716	901	18.4	2.9	22.1	20.2	3.2	24.3	76%	12%	4%	15
Replaced	Q1	19	1,096,587	958	16.3	2.4	19.4	18.0	2.6	21.3	84%	11%	13%	15
Replaced	Q2	21	998,364	953	15.2	2.0	17.8	16.8	2.2	19.6	89%	9%	22%	15
Replaced	Q3	22	979,338	965	15.3	1.9	17.8	16.9	2.1	19.6	89%	9%	19%	15
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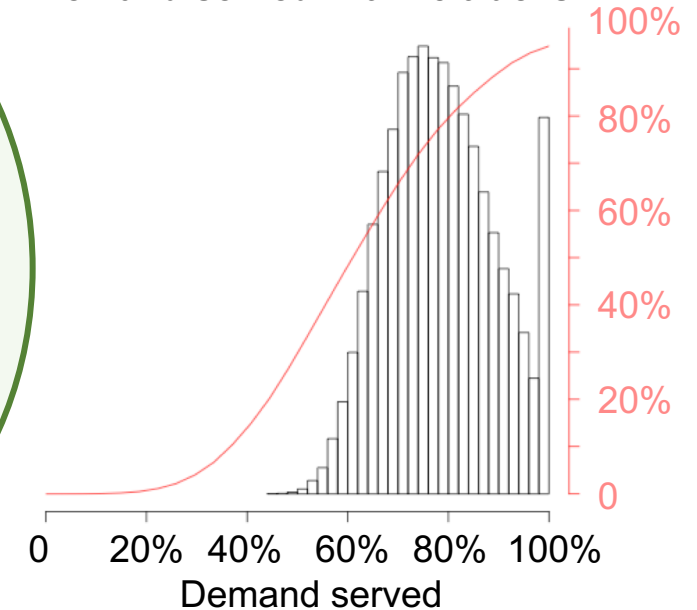
Trucks for 90% of demand



Trucks for 100% of demand



Demand served with 15 trucks



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8

PRODUCTS REPLACED

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6%

DEMAND DECREASE

8

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6%

DEMAND DECREASE

8

PRODUCTS REPLACED

7%

FLEET SIZE REDUCTION

# Similar results occurred after analyzing the 11 plants

Scenario	Quarter	Products	Average Demand	Average Distance	Serve 100% of demand	
					Mean	90% of the time
Baseline	Q1	61	8,655,765	700	117.2	140.3
Baseline	Q2	59	8,554,123	753	126.3	151.8
Baseline	Q3	59	8,807,100	756	130.8	157.9
Baseline	Q4	59	9,736,646	734	137.5	174.2
<b>Baseline</b>		<b>61</b>	<b>8,938,408</b>	<b>736</b>	<b>128.3</b>	<b>156.6</b>
Replaced	Q1	45	8,126,155	699	107.9	130.3
Replaced	Q2	44	7,979,280	752	115.1	140.1
Replaced	Q3	44	8,206,579	756	119.6	145.9
Replaced	Q4	44	9,185,746	733	127.2	163.4
<b>Replaced</b>		<b>45</b>	<b>8,374,440</b>	<b>735</b>	<b>117.8</b>	<b>145.5</b>

16

PRODUCTS REPLACED

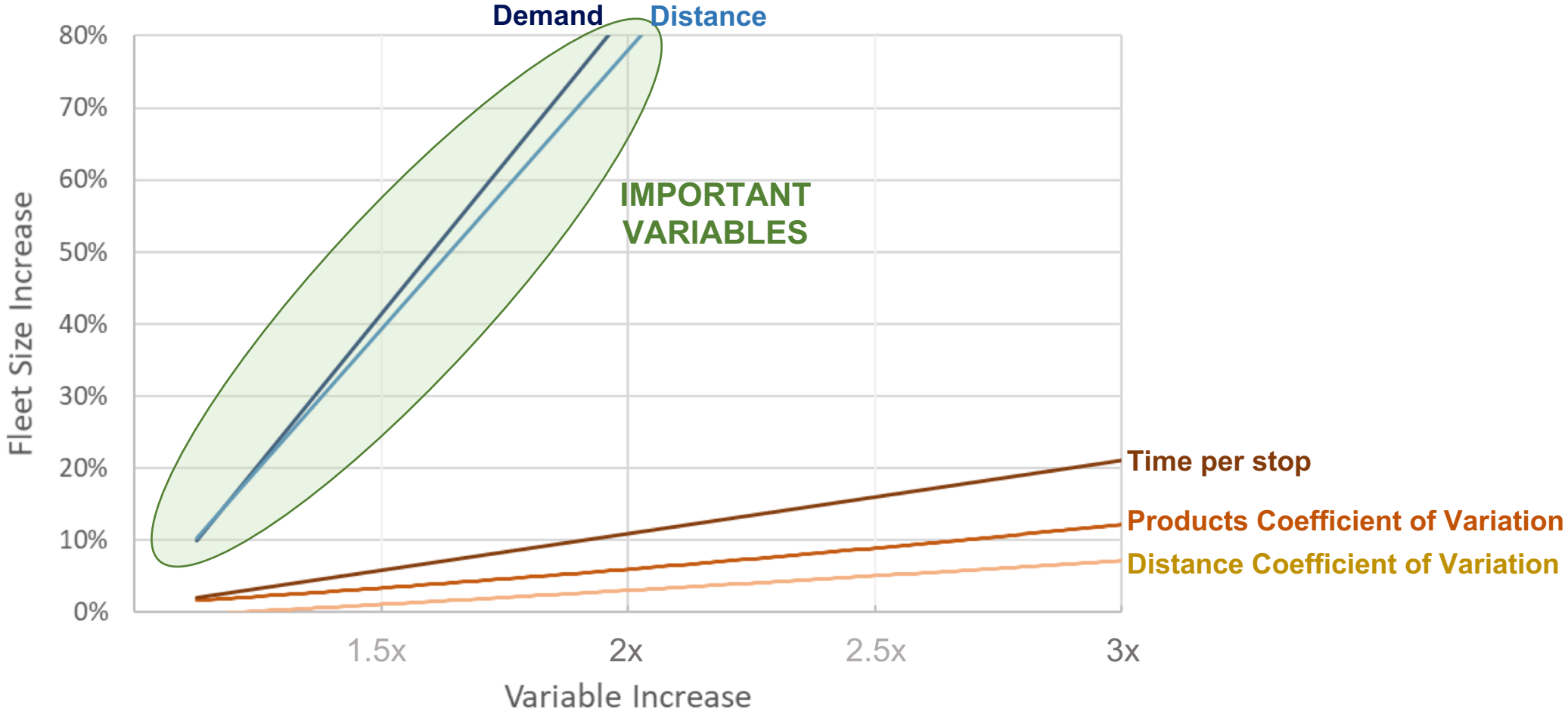
6%

DEMAND DECREASE

7%

FLEET SIZE REDUCTION

# Sensitivity analysis detected the most important variables



4.

**CONCLUSION**

**And**

**NEXT STEPS**

7% fleet size reduction assumes constant routing

**7%**

## **FLEET SIZE REDUCTION**

### **Key variables**

Weekly average DEMAND (lbs.) ✓

Weekly average DISTANCE per trip (miles)

### **Secondary variables**

Average TIME PER STOP (hrs.)

Weekly PRODUCT DEMAND CV ✓

Weekly DISTANCE per trip CV

# Distance and truck utilization impacts should be analyzed before replacing products

## NEXT STEPS

- Capitalize quick wins: very low concentration products should be replaced.
  - Analyze how does product replacement affect routing: impact to average distance and CV.
  - Analyze how does product replacement affect truck utilization.
  - Replace low concentration products that produce inefficient routing.
-

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QUESTIONS?

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