



The Unsolvable Equation of Fleet Management

How Data Optimisation Delivers a Definitive Answer ➤

Presentation By Medha Saha, Nadia González Guarner, Gema Lozano Soto



Introduction

"Our project slide sets the stage for the 'Travel Startup Paradox.' We operate in a space where booking too early is a financial risk, but booking too late is a service risk. As our graphics show, we are caught between the 'Ghost Bus'—where we pay for empty seats—and the 'Stranded Customer.'

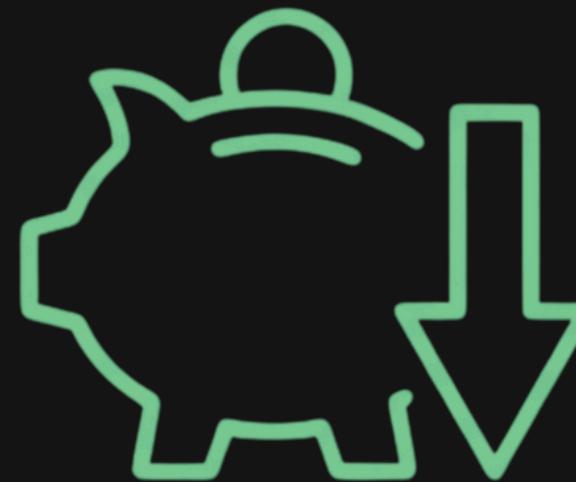
This project moves away from intuition and toward a mathematical resolution. By the end of this presentation, you will see how we use a specific total cost of €15,800 as our benchmark for efficiency and how seasonal data from Barcelona dictates our daily operations."



Every Logistics Manager Faces a Fundamental Conflict

We are tasked with achieving maximum cost efficiency, yet we must serve a customer base with highly volatile & unpredictable demand.

THE GOAL: COST EFFICIENCY



Larger groups & full vehicles
drive down per-passenger
costs.

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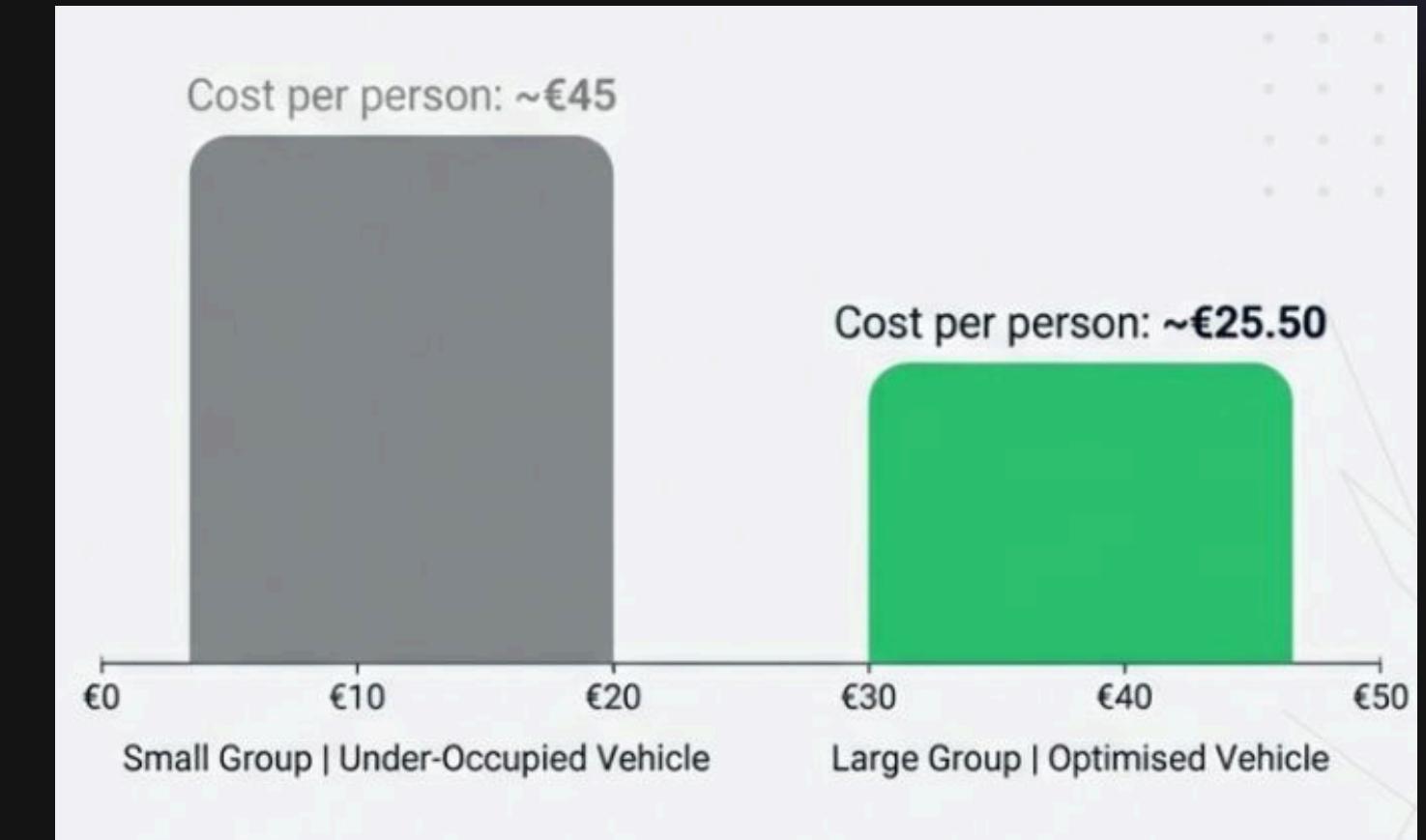


Demand fluctuates wildly,
peaking seasonally & on
weekends.

The Financial Penalty for Mismatched capacity is Severe ↗

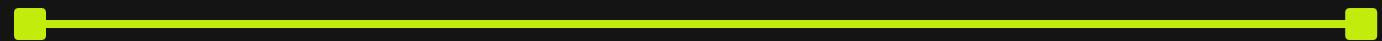
Nearly 45% reduction

in per-passenger cost from small to large groups.

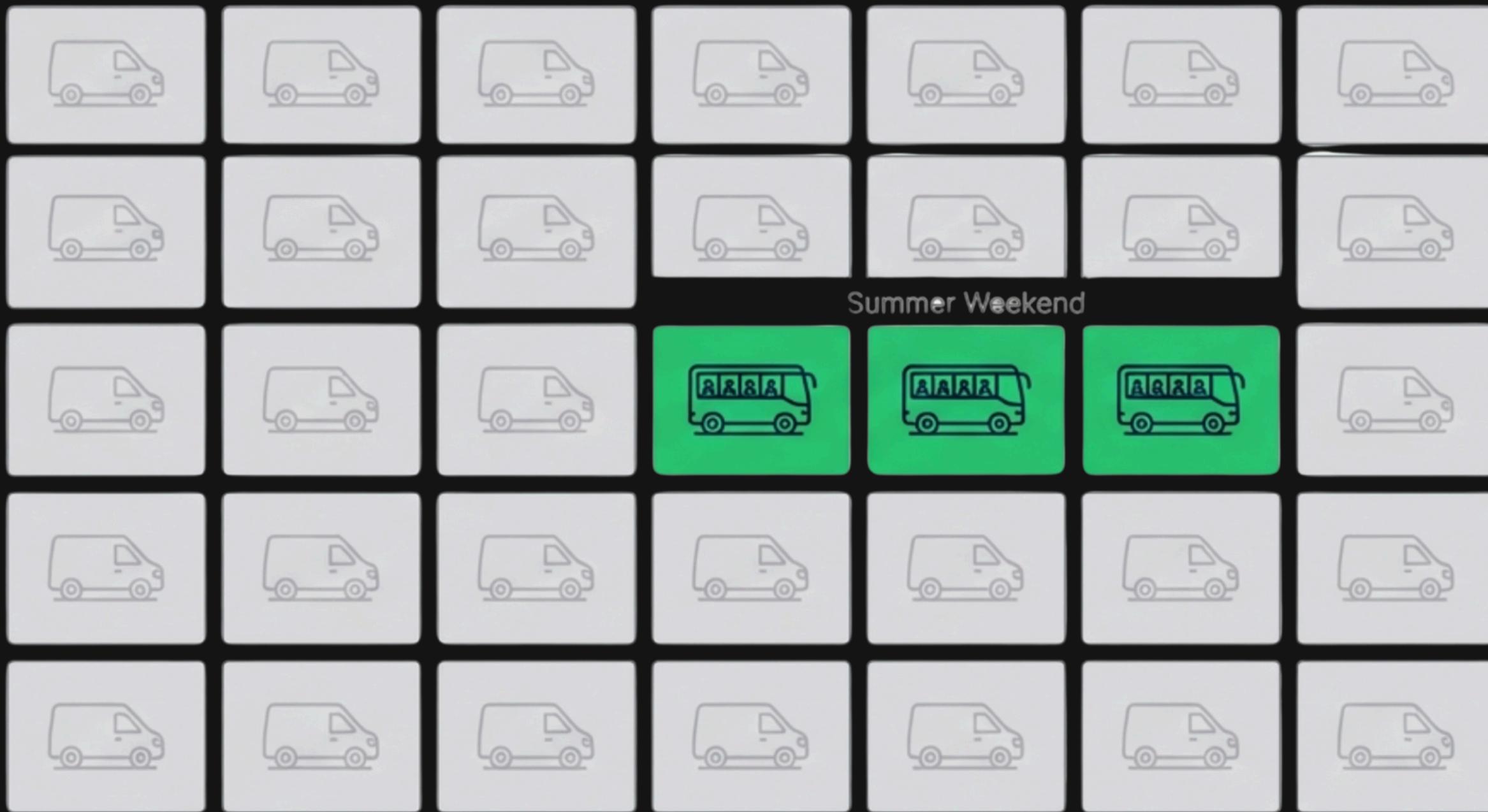


This gap highlights a strong mathematical incentive to maximize vehicle occupancy. Every trip that falls short of the benchmark average cost of €30.83 represents lost profit.

The Inefficiency Trap: A Fleet Built for Peak Demand Guarantees Off-peak Waste



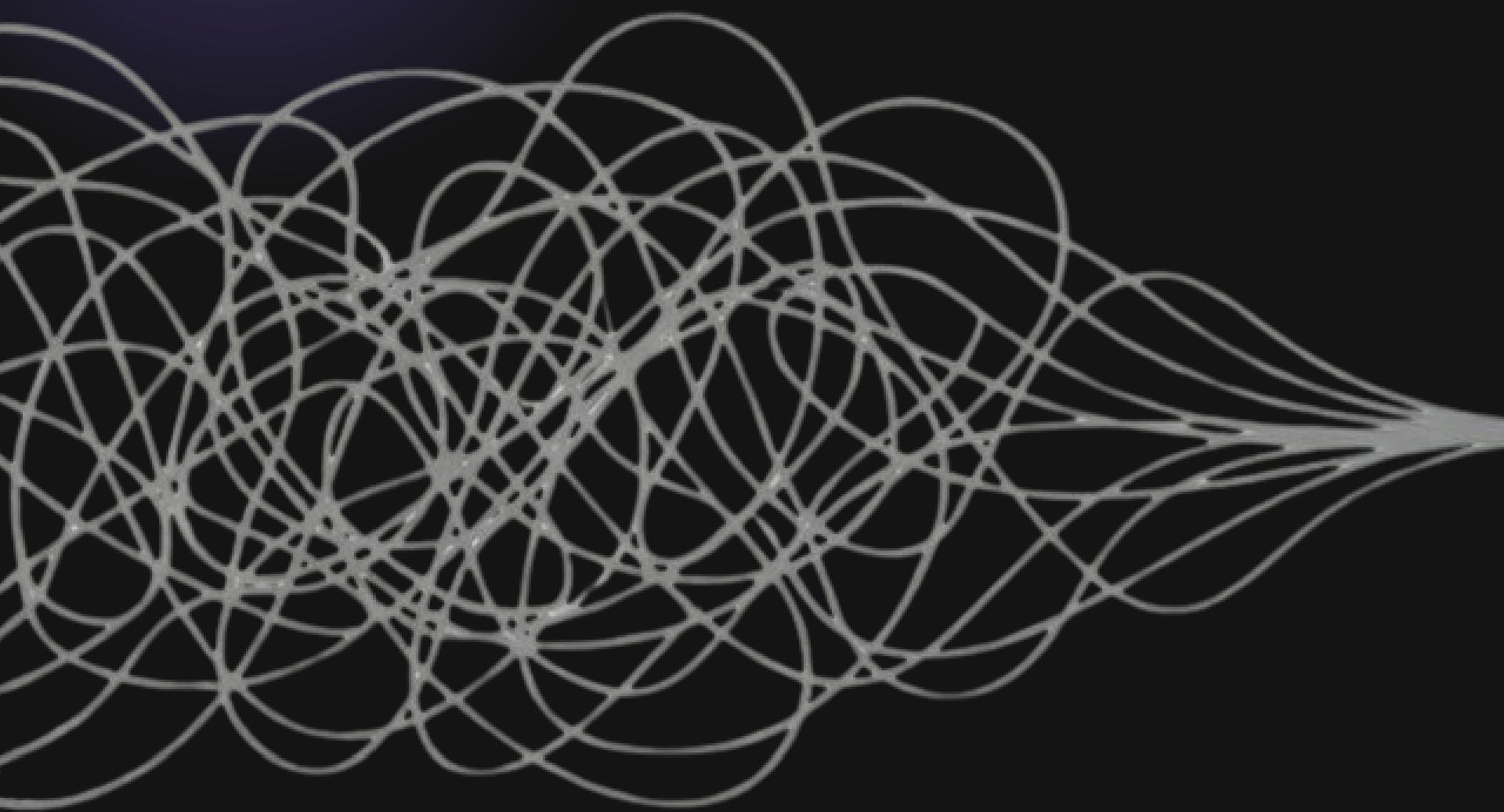
The conventional approach of maintaining a fleet large enough to handle maximum potential demand is a direct route to poor utilisation. For the majority of the year, expensive vehicles sit idle, depreciating in value while contributing nothing to the bottom line.



Summer Weekend



This isn't a people problem; It's a Maths problem with a Definitive Solution



Linear Programming

Instead of relying intuition or historical precedent to solve this complex equation, we can use a proven mathematical method to find the single best outcome. This method is called Linear programming.

Deconstructing Linear Programming: A Framework for Optimal Decisions

LP provides a structure to define your goal, your opinions, and your limitations in purely mathematical terms.



Objective Function

What is your ultimate goal?

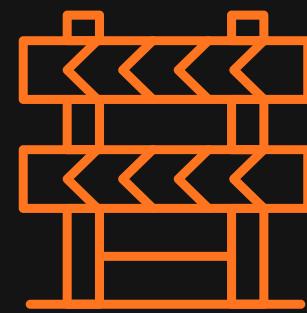
This is the mathematical expression of what we want to achieve. (e.g., Minimise total cost).



Decision Variables

What choices can we make?

These are the levers we can pull. (e.g., The numbers and type of vehicles to deploy).



Constraints

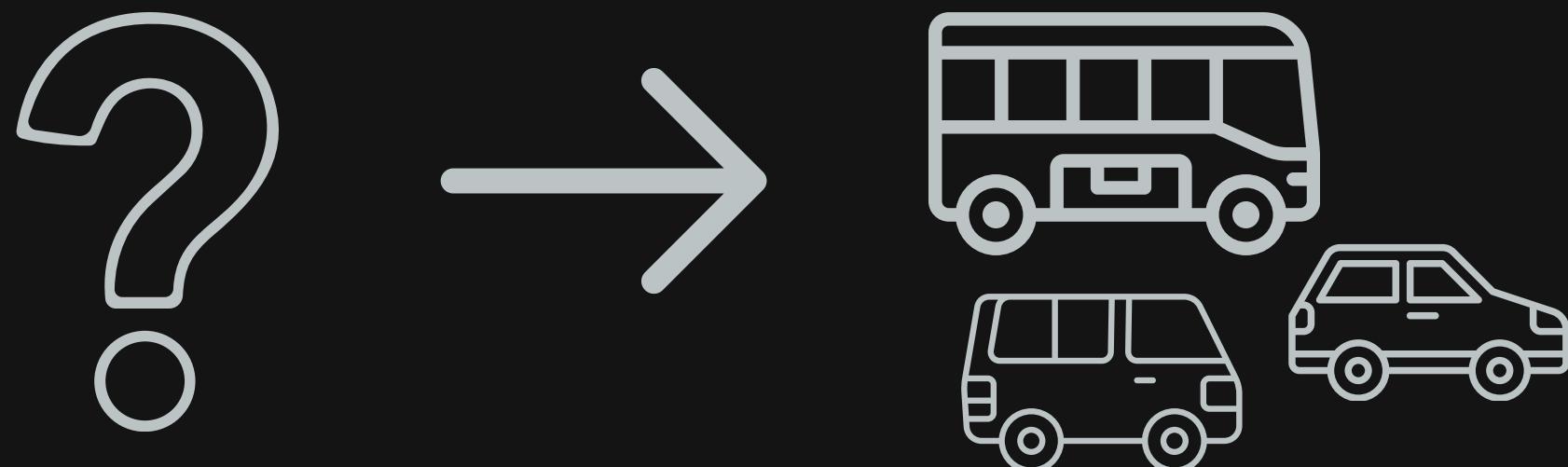
What are the rules we must follow?

These are the real-world limits on our choices. (e.g., We must meet passenger demand; we can't use half a bus).

Let's make it real: A practical case Study



The Mission: Find the most cost-effective vehicle combination to transport exactly 40 passengers.



Translating the business Problem into a mathematical Model



VAN

Capacity: 8 Passangers
Cost per Trip: €200
Cost per seat: €25.00



MINIBUS

Capacity: 20 Passangers
Cost per Trip: €350
Cost per seat: €17.50



BUS

Capacity: 50 Passangers
Cost per Trip: €600
Cost per seat: €12.00

Translating the Business Problem into a Mathematical Model

We can now express our mission using the LP framework



// Decision Variables

Let v = number of Vans deployed

Let m = number of Minibuses deployed

Let b = number of Buses deployed

// Objective Function: MINIMISE TOTAL COST

Minimise $C = 200v + 350m + 600b$

// Constraints: THE RULES OF THE ROAD

$8v + 20m + 50b \geq 40$ (The Demand Constraint: We must accommodate at least 40 people) v, m, b must be whole numbers (The Integer Constraint: We cannot deploy fractions of vehicles)

The Model's Verdict is Unambiguous & Optimal



Optimal Solution: $v=0, m=0, b=1$

Total Passangers accomodated: 50

Total Cost: €600

Deploy 1 Bus

Why One Bus? The Logic of Per-seat Optimization

While other combinations might seem cheaper at first glance (e.g. two minibuses for €700). The LP model correctly identifies that the Bus offers the lowest cost per required seat. It fulfills the 40 passengers constraint at the most efficient rate.



Prioritises the asset with the lowest per-seat cost (€12.00) capable of meeting the demand

The Model is Versatile: It can Optimise for Occupancy First

An alternative LP model can be constructed to prioritise filling the most cost-effective vehicles to capacity before deploying others. This is crucial for larger, more complex scenarios.

For larger scale operations, this logic of prioritising the cheapest per-unit capacity first can lead to significant savings.

Example from a Larger Model

Focus: Optimising passenger allocation across a full fleet.

Core Logic: The model will always fill the cheapest per-seat vehicles to capacity first to meet total demand.



€15,800

(for a larger, unspecified demand).



An Optimisation Model Is Only as Reliable as Its Input Data

The accuracy of the LP model's output is directly dependent on the quality of the data we provide.
Garbage in, garbage out applies absolutely.

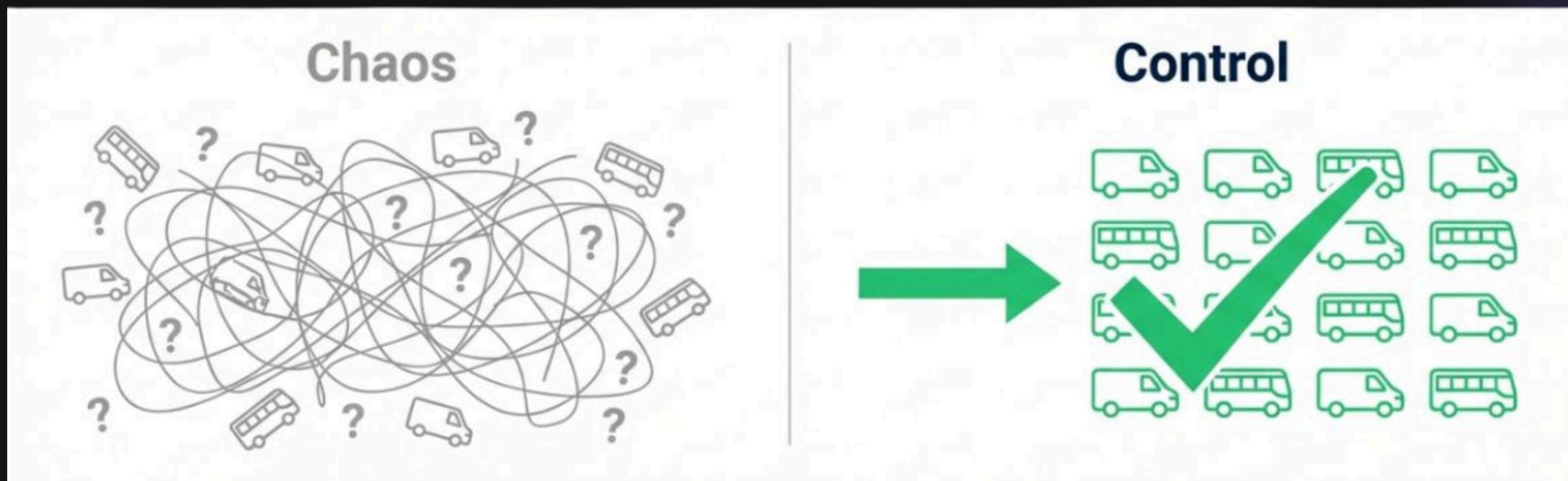
Actionable Requirement: To build an effective optimisation tool, organisations must commit to gathering precise, real-world data.

Key Data Points to Collect:

- Actual fuel costs per vehicle type
- True driver costs (salary, benefits, overtime)
- Vehicle rental or leasing fees
- Maintenance and depreciation schedules
- Accurate vehicle capacities

The Ultimate Advantage: Moving from Guesswork to Data-Backed - Data-Backed Certainty

Linear Programming is more than a calculation tool; it's a strategic framework. It transforms the complex, chaotic variables of fleet management into an unambiguous, lowest-cost solution. It replaces gut feeling with a reliable foundation for critical business decisions.



Thank You
So Much