

From Algorithms to Dinner Tables

*Scaling Smart Fulfilment at Gousto to Deliver
Personalised, Affordable Meals*

gousto

The Decision Intelligence Summit

“Empowering Bold Decisions”



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Gousto

On the Menu Today

1. Who we are
2. Our fulfilment operation
3. Our scalability challenge
4. The Gurobi transformation
5. Test before you invest
6. Lessons Learned



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About **gousto**





Based on 5 meals for 4 people subscription box. Excludes £3.99 delivery. T&C's and geographical restrictions apply. Discounts apply to new customers only. To verify visit gousto.co.uk/choice.

About Us

VISION

To be the most loved way to eat dinner

PROPOSITION

Customers love us because we offer the best choice. We achieve this by servicing more...

Households



Tastes



Budgets



Occasions



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To be the most loved way to eat dinner



Our Promise

Customers come First

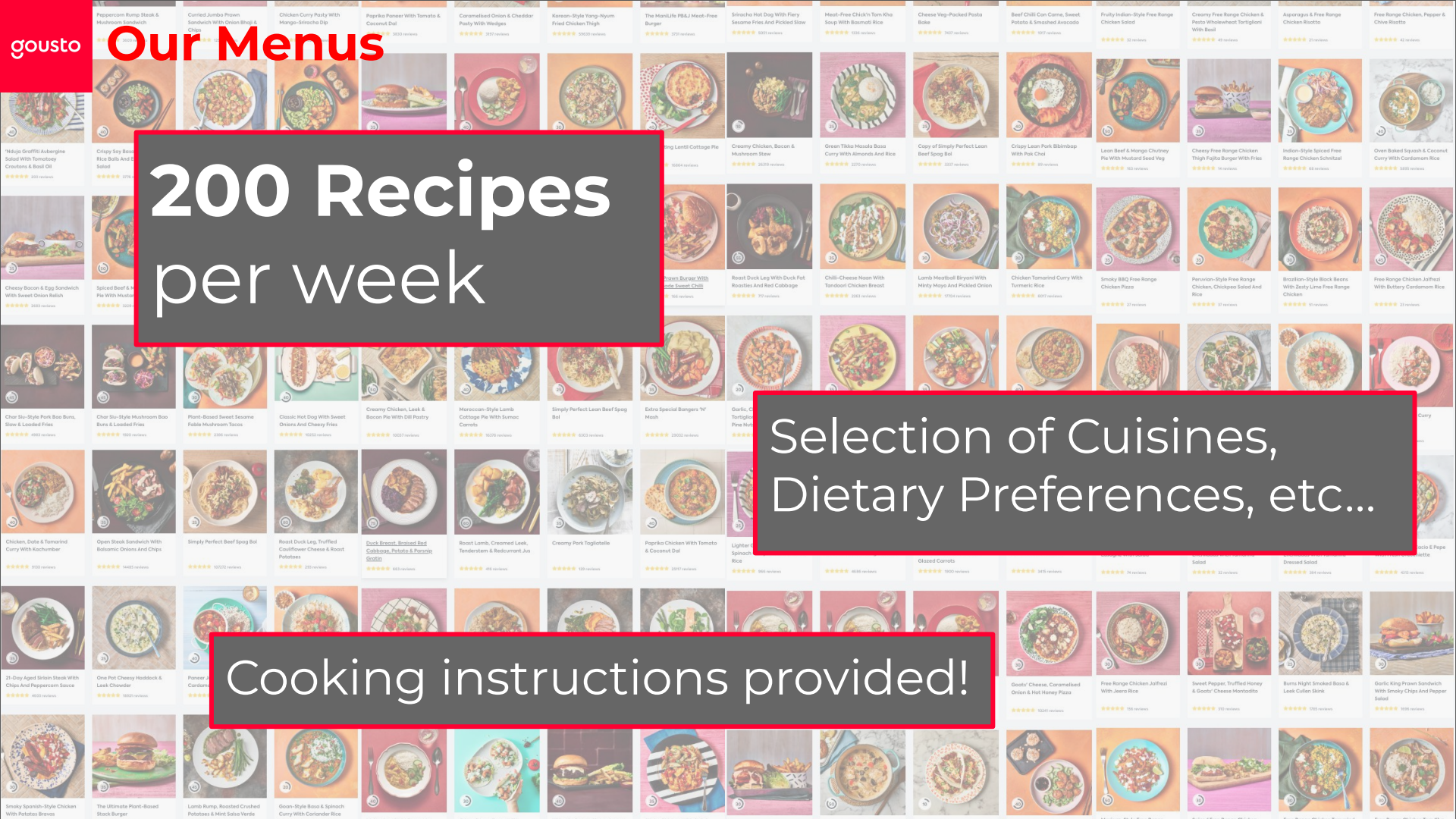


Our Menus

200 Recipes per week

Selection of Cuisines, Dietary Preferences, etc...

Cooking instructions provided!



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Our Factories

200k

boxes per week

1 box

every 3 seconds

~50

ingredients per box



Our Commitment

food waste

0.3%

YTD 2024

2m

meals redistributed
to those in need

packaging waste



carbon footprint

4.3kg

CO2 per portion |🌱|

2.2kg

by 2030

Net Zero

by 2050

Our Tech

A long chain of decisions





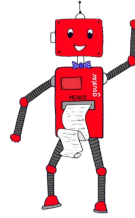
- Optimising Menus for **relevance & variety**
- Forecasting demand for **labour capacity**
- Supply Chain planning for **inventory availability**
- Fulfilling orders for maximal **freshness**



Decisions all along the chain



Tech Stack



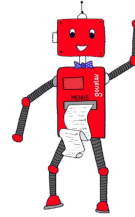
- ★ Customer Recommendation - **[Deep Learning]**
- ★ Menu Optimisation - **[Optimisation]**
- ★ Order Volume Forecast - **[Machine Learning]**
- ★ Network Allocation - **[Optimisation]**
- ★ Factory Configuration - **[Optimisation]**



Decisions all along the chain




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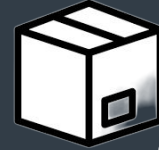


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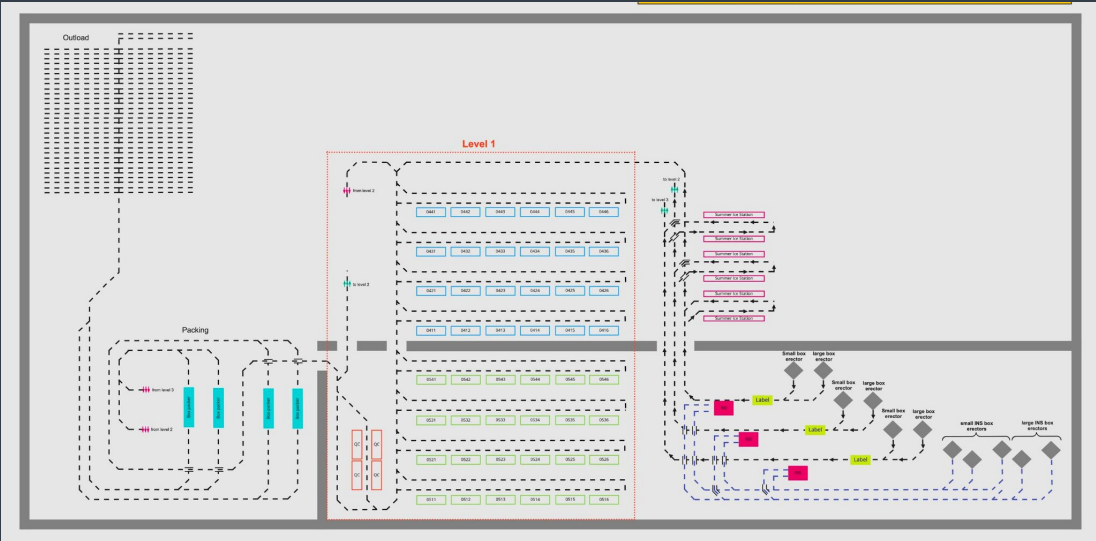


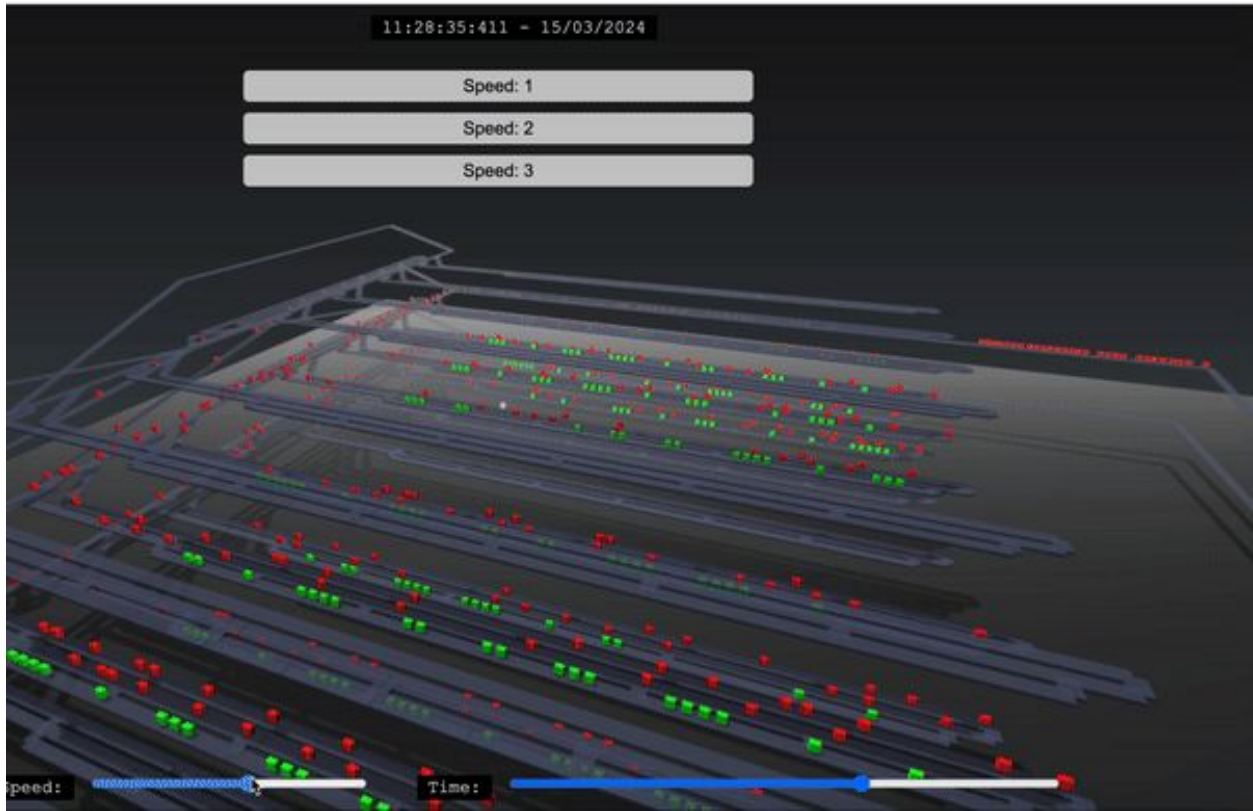
Packing Boxes




Where efficiency is king

gousto Inside Fulfilment - a Living System





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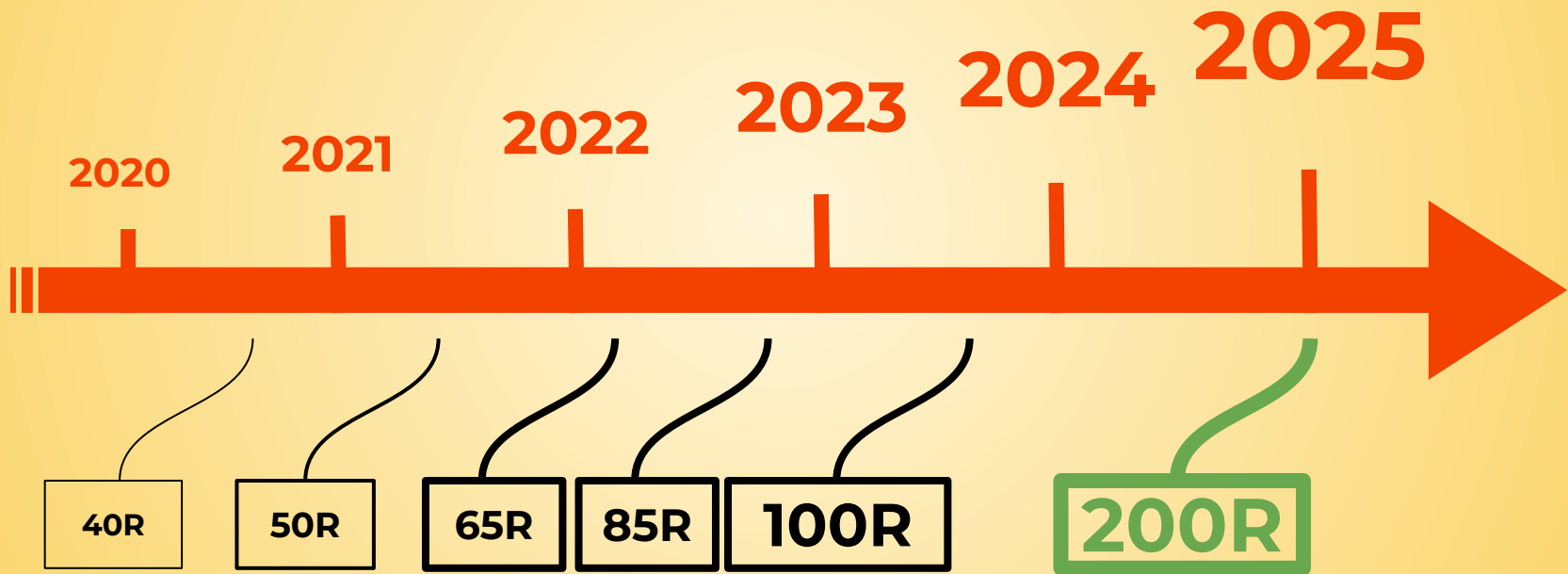


Choice brings Complexity



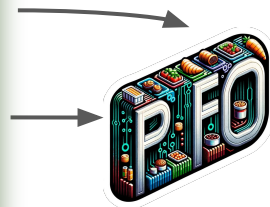
A continuous journey

Menu size scaling

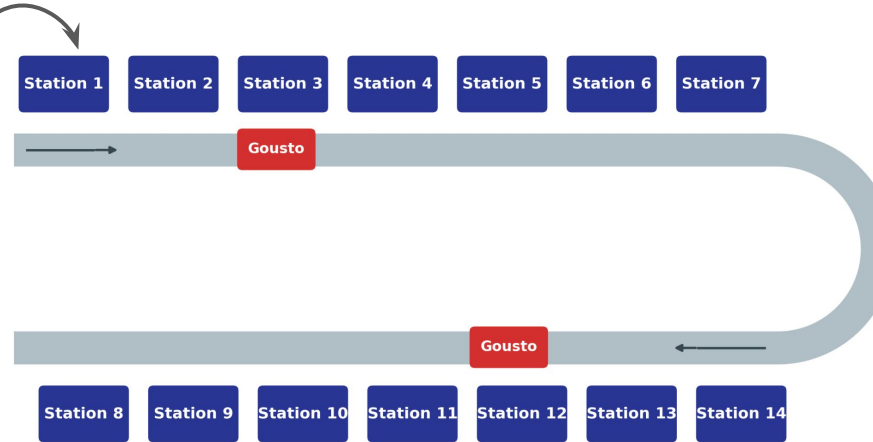


A complex allocation problem

Menu SKUs



Pickline



A blocker to our ambition

The Issues...

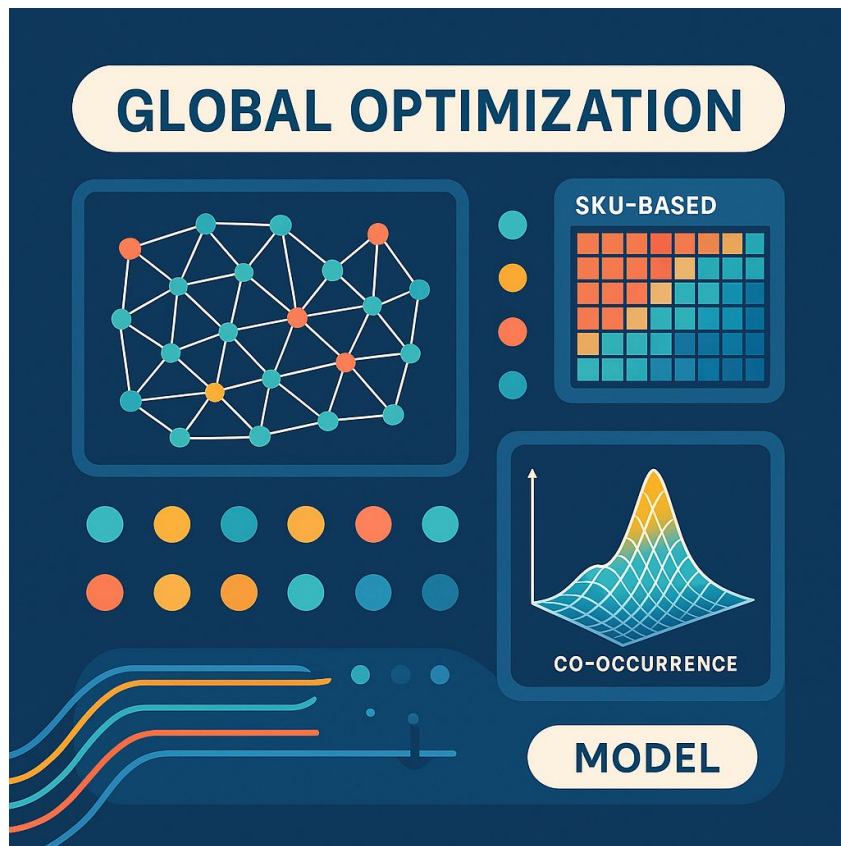
- The rapid menu expansion led to an explosion of possible **allocation combinations**.
- Our legacy, **rule-based algorithm**, only handled the placement of Recipes.
- This method, based on **sequential decisions**, wasn't space efficient.
- **High Risk**: PFO product breaks down and fails to configure weekly production line.



A new framework required

The Requirements!

- We need a **scalable model** that can handle high level of complexity.
- We need a **SKU-based** allocation system.
- If possible, we would like a **global optimisation** method.
- **Recommendation**: make use of the **Popularity** & **Co-occurrence** of SKUs in customer orders



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Gurobi Partnership



An open and supportive relationship

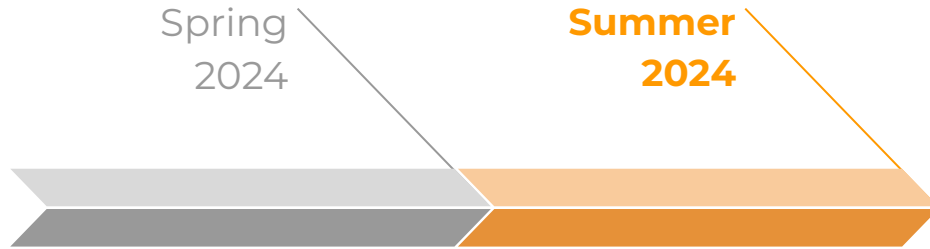
Spring
2024



Initial Engagement

Conversations started at the back of a Data roundtable in London

An open and supportive relationship



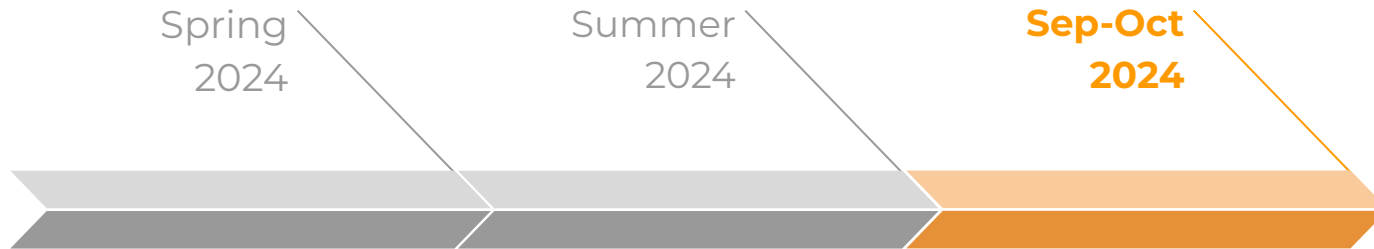
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Proof of Concept

Data Scientists converting rule based algorithm into *Linear Programming* approach using Gurobi

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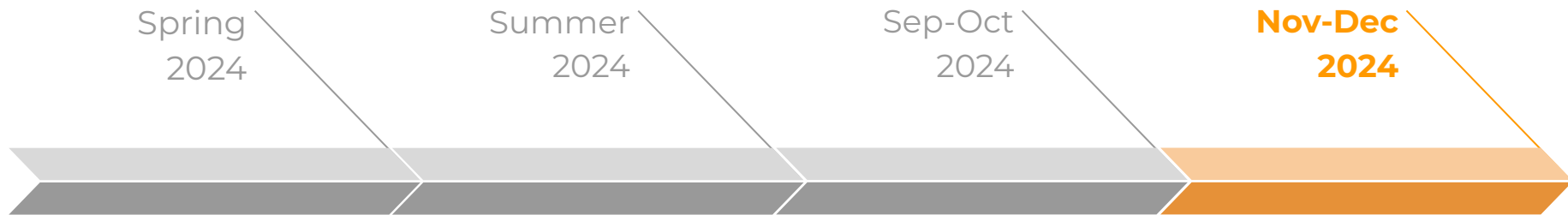
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Value Delivered

Unlock 200R with production ready model PFO-Gurobi.v0

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Value Delivered

Unlock 200R with production ready model PFO-Gurobi.v0

Further Benefits

Additional operational efficiency found by taking advantage of the new solver, delivering PFO-Gurobi.v1

The solution

Sets

\mathcal{I} : set of SKUs (indexes by i)

\mathcal{J} : set of stations (indexed by j)

\mathcal{P} : set of recipe portions (indexed by p)

Parameters

S_j : required number of SKUs at station $j \in \mathcal{J}_{\text{cap}}$

$\pi(1), \pi(2), \dots$: SKU popularity ranking (descending-forecasted_popularity)

$\mathcal{R}_p \subseteq \mathcal{I}$: SKUs required by portion p (recipe_sku_mapping)

Constraints

$$\sum_{i \in \mathcal{I}} x_{ij} = S_j \quad \forall j \in \mathcal{J}$$

$$\sum_{j \in \mathcal{J}} x_{ij} \geq 1 \quad \forall i \in \mathcal{I}$$

$$\sum_{j \in \mathcal{J}} x_{\pi(k),j} \leq \sum_{j \in \mathcal{J}} x_{\pi(k-1),j} \quad \forall k = 2, \dots, |\mathcal{I}|$$

Decision Variables

$$x_{ij} = \begin{cases} 1 & \text{if SKU } i \text{ is placed on station } j \\ 0 & \text{otherwise} \end{cases}$$

$$y_{pj} = \begin{cases} 1 & \text{if recipe portion } p \text{ can be fully fulfilled at station } j \\ 0 & \text{otherwise} \end{cases}$$


r_j : number of fulfilled portions at station j

t : minimum fulfilled portions across targeted stations

Objective Function

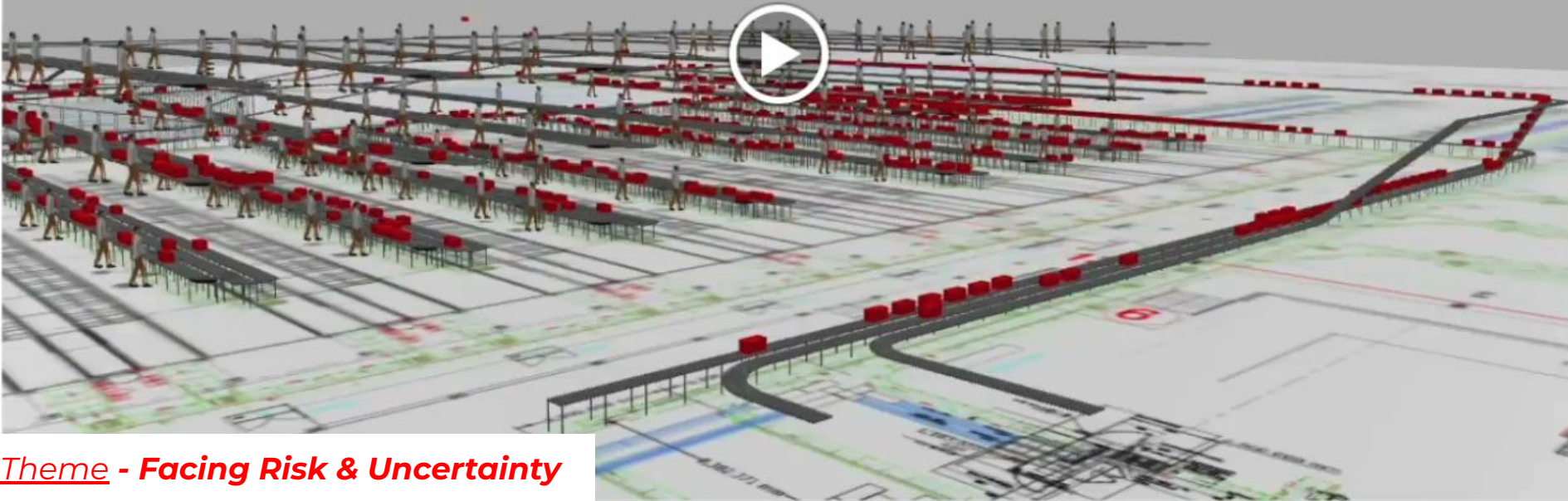
$$\max t$$

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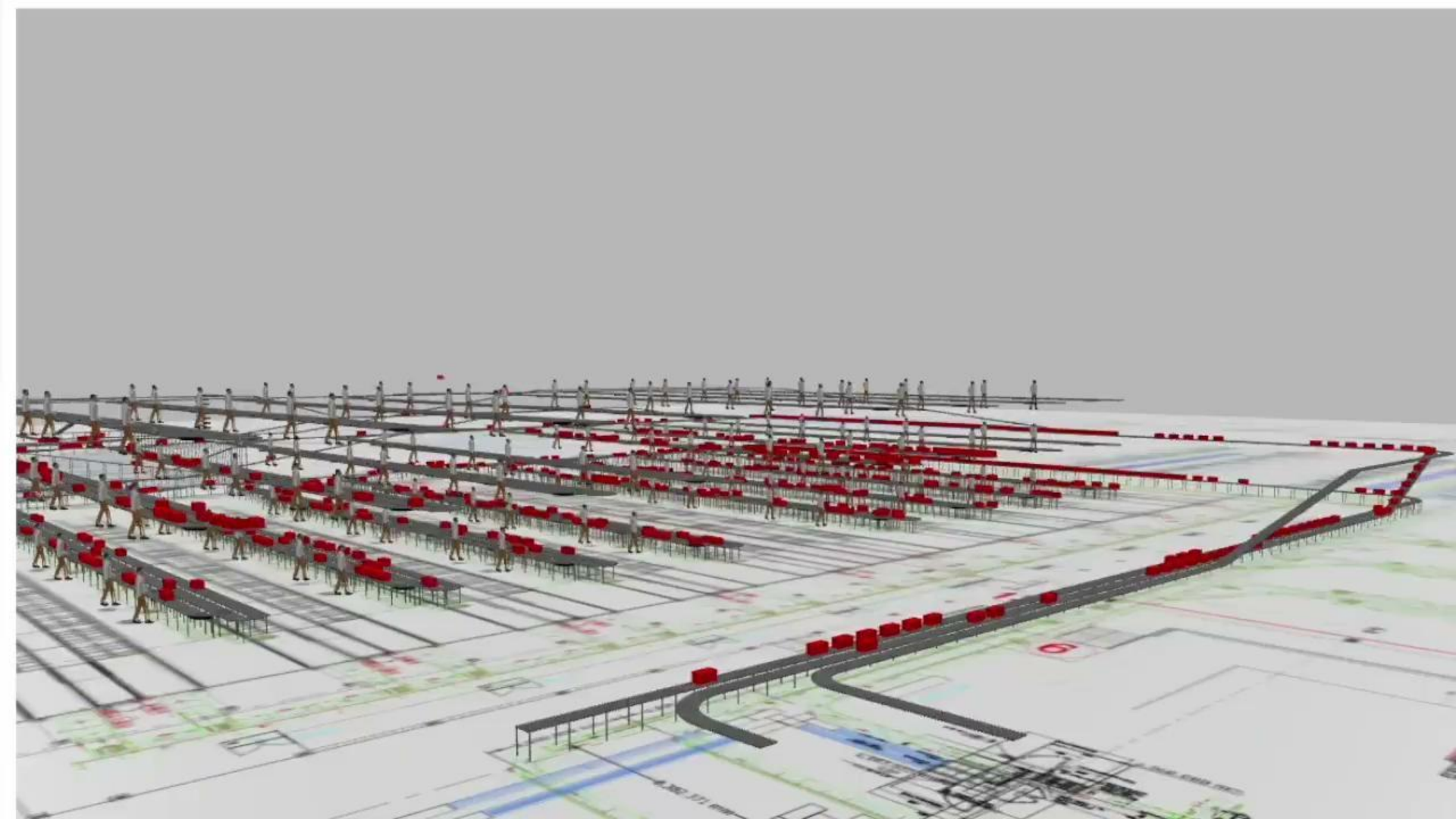
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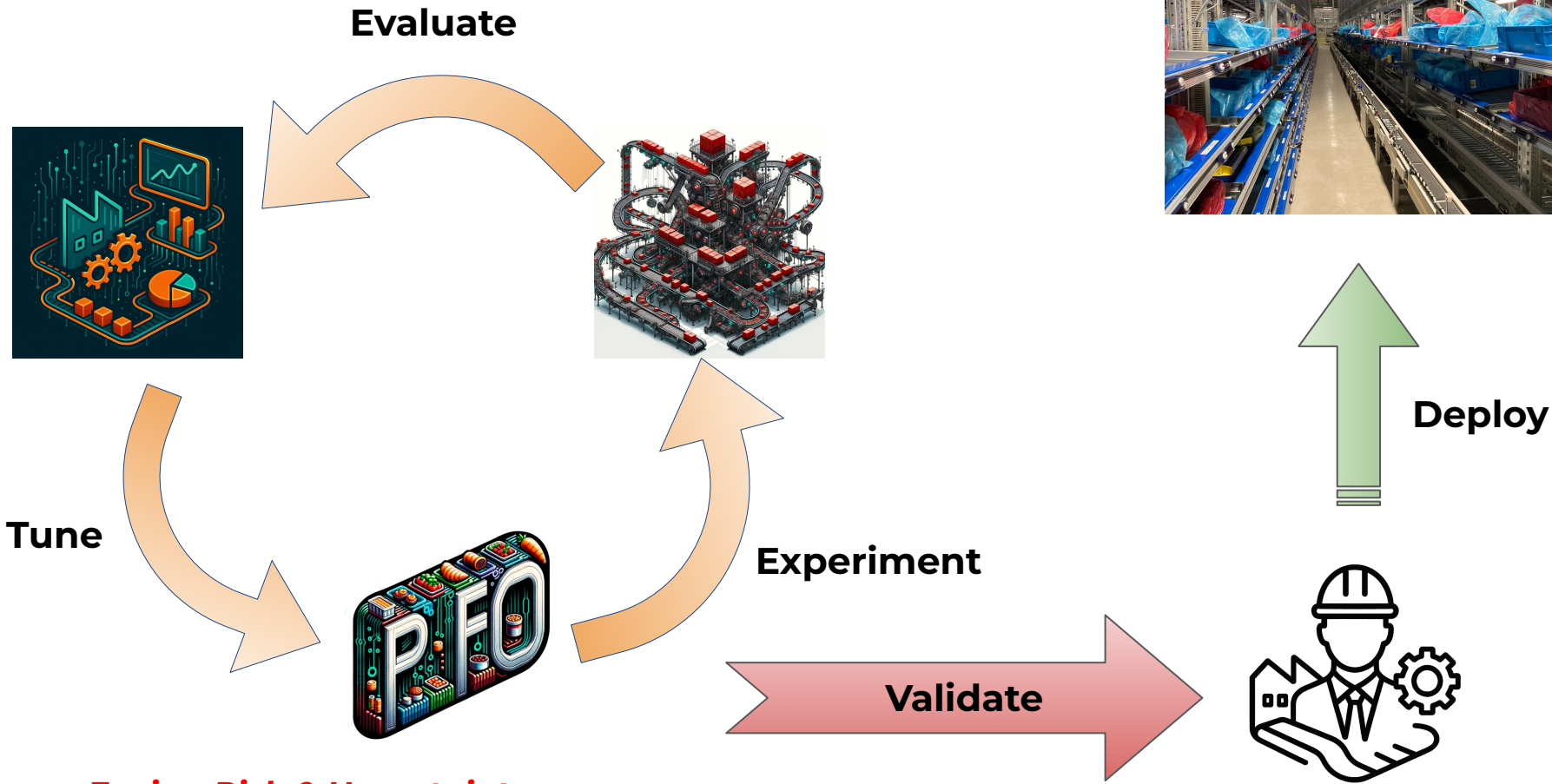
Production Simulation



Theme - **Facing Risk & Uncertainty**

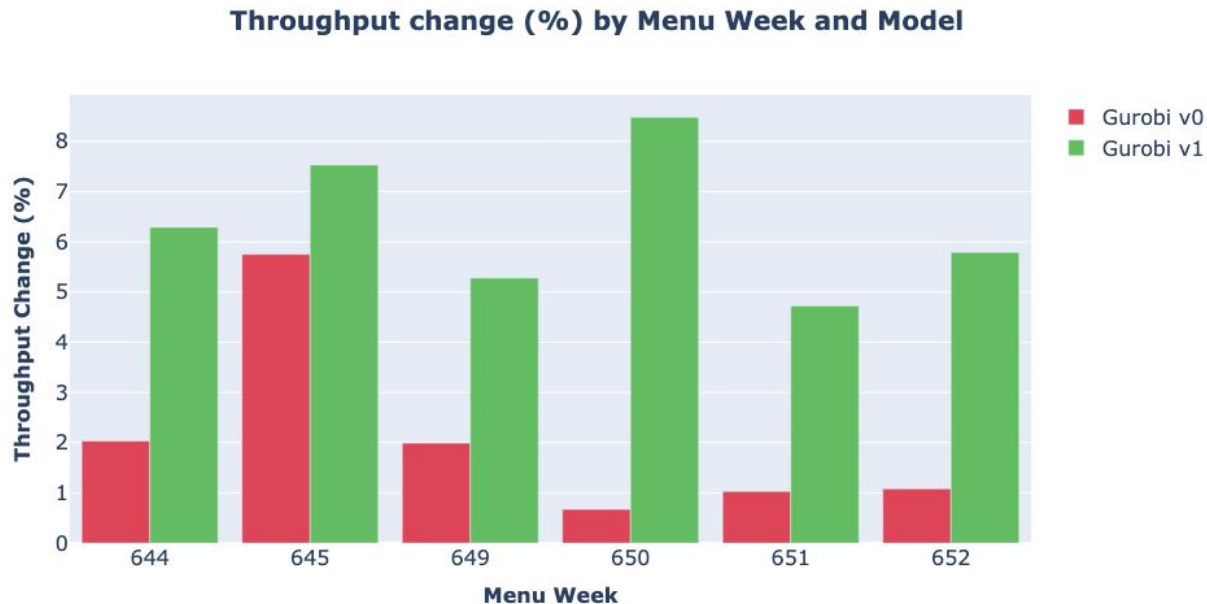


Fast iterative development



Theme - Facing Risk & Uncertainty

Proof of value




- Iterative improvements **enhanced** simulated throughput increases from **2% to 6%** on average across a range of menus
- De-risked to an **expected benefit of 3%**, which is precisely what was realised on the factory floor

Business outcome

- ❖ Success all the way
 - **Scaling** unlocked
 - Protected **Ops**
 - **Efficiency** added Iteratively
- ❖ Coming up next
 - Production **flexibility**



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Our playbook

1. Start with your **customer needs**, build your product accordingly,
2. Understand your **operational risks early**,
3. Simplify the math: prefer **robust objectives** to brittle proxies,
4. Pair optimisation with simulation to manage uncertainty,
5. Close the loop: measure → learn → reoptimise,
6. Own the change: process, roles, and culture matter.

Theme - **Challenging the Status Quo**



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VE-STAR F...
LL KEPT FRESH
BY THIS BOX
Pop 'em in the fridge so
they're ready for action

EDAM

DRAM

Thank you

