

Advancing Lean with AI

HELLOFRESH
GROUP



Agenda

- 1. The Problem**
- 2. Lean Principles**
- 3. AI Solutions to Waste**
- 4. Our 3 Operating Systems**
- 5. The Architecture**
- 6. FSQA & ICQA**
- 7. Infinite Menu**
- 8. 24 month Plan**
- 9. Metrics**

We're Operating a Push System in a Pull World

The problem:

1. Fixed-schedule sub-component production regardless of real-time demand signal
2. 500 kit types treated identically
3. 3.3 kits/box average masks the actual mix variation that drives shortfalls
4. Cold chain and allergen sequencing handled manually
5. At 1% overproduction: 15k waste portions per week

Lean Principles Don't Change. **AI Makes Them Faster and Smarter.**

Traditional Lean Principles:

1. Pull
2. Flow
3. Kaisen
4. Jidoka

AI-Amplified version:

1. Predictive Pull
2. Continuous robotic flow
3. Automated kaisen
4. Computer vision andon

3 Systems. 1 Operating Model.



Kitchen WIP Control

- 350 sub components
- pull based
- equipment-aware



Fulfillment WIP Control

- 500 kit types
- robot-intelligent
- cold chain + allergen enforced



Demand-Driven Planning

- customer x kit x hour forecasting
- BOM cascade
- 18 markets

1: Kitchen WIP

From Fixed Schedule to Real-Time Pull

- **5-step pull signal flow:** demand arrives → budder hours calculated → equipment lanes schedules → cook programs adapt → overstock hold triggered
- **Rational oven MPC:** adjusts program in real-time based on load weight, oven age, humidity — same recipe, consistent output
- Without the kitchen WIP system, 350 sub-components on an infinite menu is operationally unmanageable
- **+2-4% yield improvements** from adaptive cook programs = one of the highest-ROI applications in the stack





2: Fulfillment WIP

500 Kit Types, One Pull-Based System

- **Pull system plans to actual mix**, not average
- **AutoStore Grids 1 & 2:** AI pre-positions high-velocity bins before pick waves hit based on demand forecast
- **Locus Pods 1-3:** multi-agent reinforcement learning (MARL) eliminates congestion hotspots in real time
- **Cold chain** and **allergen sequencing** enforced automatically



3: Demand Planning - Weekly Guesses to Hourly Certainty

- Light GBM forecasts at **customer x kit x hour x market level**
- **BOM cascade**: customer order → kit demand → sub-component → ingredient
- Procurement sets a **2-4 week forward signal**
- 18 market in **one model**



The Architecture: **Six Layers, One Brain**

Build where the data is unique, buy where the problem is generic

1

Physical
Layer

2

Data
Ingestion

3

Storage

4

Orchestration

5

AI Platform

6

Operator
Interfaces



FSQA & ICQA: AI as a Food Safety Multiplier

- **Automated HACCP monitoring:** every CCP real-time, deviations auto-documented
- **Batch genealogy graph:** full trace in minutes for recall readiness across all 18 markets
- **-40%** quality escapes at pack station. **-80%** HACCP documentation time. **Near-zero** allergen incidents.
- At 1.5M RMM meals/week across 18 market - **a food safety event is essential.** AI doesn't replace FSQA expertise, it makes out teams faster and more consistent.

Infinite Menu: The AI Moat

The right meal for each customer



24-Month Build Plan

Phase 1 Instrument



*Kafka, OPC-UA
Gateways, Rational
Connected Cooking,
Delta Lake, HACCP auto-
monitoring, WIP Control
Towers c1*

Phase 2 Predict



*LightGBM demand
forecast, predictive
maintenance, computer
vision QA,
personalisation retrieval,
supplier risk scoring*

Phase 3 Automate



*Digital recipe twins, MPS
on Rational ovens, full
MARL robots, demand
BOM cascade, allergen AI
enforcement*

Phase 4 Orchestrate

*Digital twin, LP ops
querying, 18-country
control tower,
autonomous wave
planning, AI recall
simulation*

The Metrics That Matter: Compounding Returns at Scale



Kitchen

- +2-4% yield → \$2-4M/yr
- Overproduction <2% from current 8-12%
- Unplanned downtime -30%



Fulfillment

- +15% pick accuracy
- +10-25% robot throughput
- Cold chain and allergen incidents near zero



Planning

- Forecast accuracy 94% same-day, 80% 7-day
- Inventory cost -15-25%
- 2-4 FTE equivalent in compliance



The real prize

A self improving system that gets smarter with every order, every pick every batch

Lean Didn't Change. Our Speed Did.

3 Systems, 1 Model.

Kitchen WIP (pull, 350 components, equipment-aware) + Fulfillment WIP (pull, 500 kits, robot-intelligent) + Demand Planning (predictive, 18 markets, self-improving)

The principles are timeless.

The technology makes them operate at the speed and scale our business demands.

