Case Study

Manufacturing Production System

Problem

Operational Challenge

The client operates a small framing manufacturing workshop, producing custom frames for customer orders. Production was coordinated primarily through paper notes, printed order sheets, and manual tracking on the shop floor.

As the number of incoming orders increased, this approach began to break down.

A single operations coordinator was responsible for managing incoming orders, translating them into production work, and tracking progress across multiple manufacturing stages. With several new orders arriving daily, maintaining visibility over the production pipeline became increasingly difficult.

Common operational problems included:

- time lost locating and verifying the status of orders
- uncertainty about which production stage a frame was currently in
- difficulty coordinating sequential manufacturing steps across the shop
- occasional mistakes or delays caused by unclear production status

Because production tracking existed primarily on paper, there was no shared system showing the current state of work across orders and batches. As order volume increased, this made it harder to maintain consistent workflow and reliable production oversight.

The goal of the project was to design a structured operational system that connects incoming orders with production execution, enabling the team to track work clearly, enforce production step order, and monitor progress across all active orders.

Inventory management and commercial workflows were intentionally excluded from the initial scope by client decision. However, the system architecture was

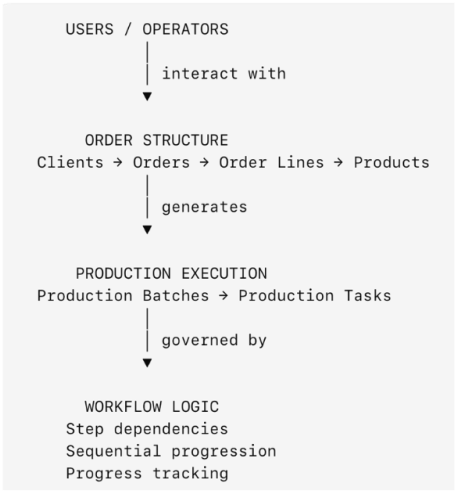
designed to allow these layers to be integrated later without structural redesign.

Tech Stack

Airtable

The portfolio version of the system was implemented in Airtable to demonstrate the underlying relational architecture, automation logic, and operational workflow. Airtable was used for database modeling, automation of production task generation, and building operator interfaces for order coordination and production tracking.

System Architecture



System Architecture Overview

The system is organized into four logical layers separating system actors, order definition, production execution, and workflow logic.

Orders are divided into order lines, each generating one or multiple production batches representing the fundamental production unit. Each batch automatically instantiates a sequence of production tasks based on predefined blueprints.

This architecture enables structured production tracking, automated task generation, and clear visibility into order progress.

The system is structured around **four functional pillars**, separating static data, operational information, and dynamic production execution.

This separation ensures clarity between **order management**, **production execution**, and **system operators**.

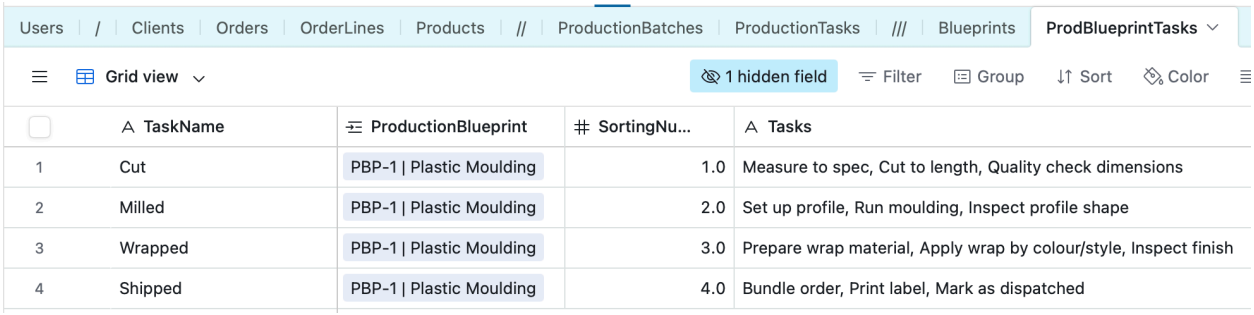
Key Architectural Decisions

1. Blueprint-Driven Production Logic

Each product is associated with a **production blueprint** that defines the required manufacturing stages.

Rather than hard-coding production logic into the workflow, the system retrieves these blueprints dynamically.

This allows production steps to be modified at the blueprint level without restructuring the operational system.



	TaskName	ProductionBlueprint	SortingNu...	Tasks
1	Cut	PBP-1 | Plastic Moulding	1.0	Measure to spec, Cut to length, Quality check dimensions
2	Milled	PBP-1 | Plastic Moulding	2.0	Set up profile, Run moulding, Inspect profile shape
3	Wrapped	PBP-1 | Plastic Moulding	3.0	Prepare wrap material, Apply wrap by colour/style, Inspect finish
4	Shipped	PBP-1 | Plastic Moulding	4.0	Bundle order, Print label, Mark as dispatched

	BlueprintName	Autonu...	Product	ProdBlueprintTasks
1	PBP-1 | Plastic Moulding	1	Plastic Moulding	Cut, Milled, Wrapped, Shipped

2. Hierarchical Production Model

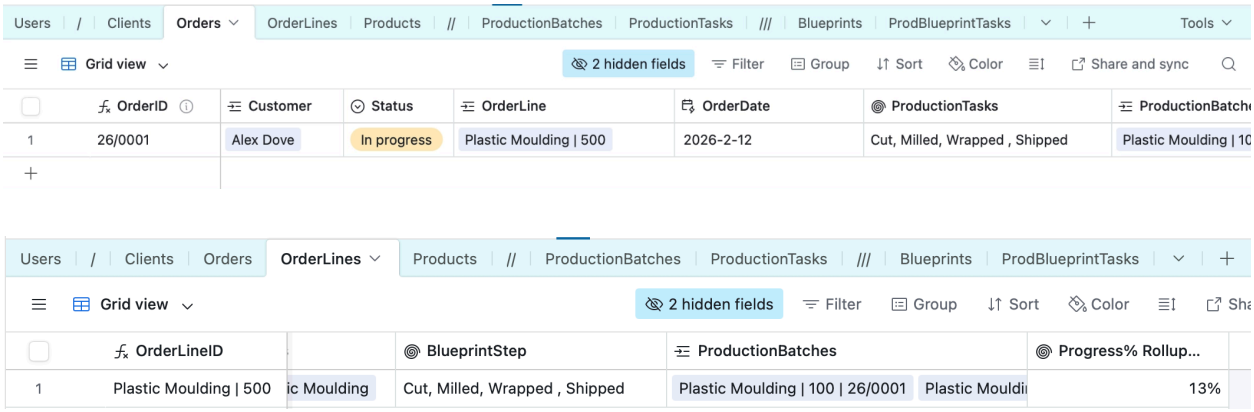
The system is structured around a hierarchical relationship between operational entities:

Orders → Order Lines → Production Batches

Orders represent the overall request, while Order Lines specify individual product requirements.

Each Order Line generates one or more **Production Batches**, which function as the fundamental production unit.

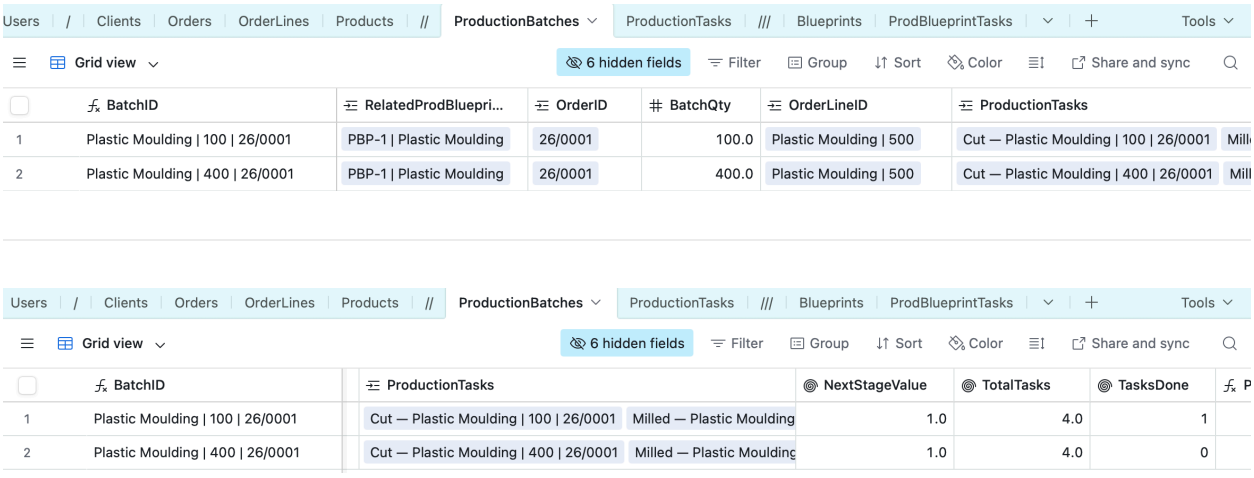
This separation allows production to be tracked and executed independently of the original order structure.



3. Automated Task Generation

When a **Production Batch** is created, the system automatically generates the corresponding **Production Tasks** based on the product blueprint.

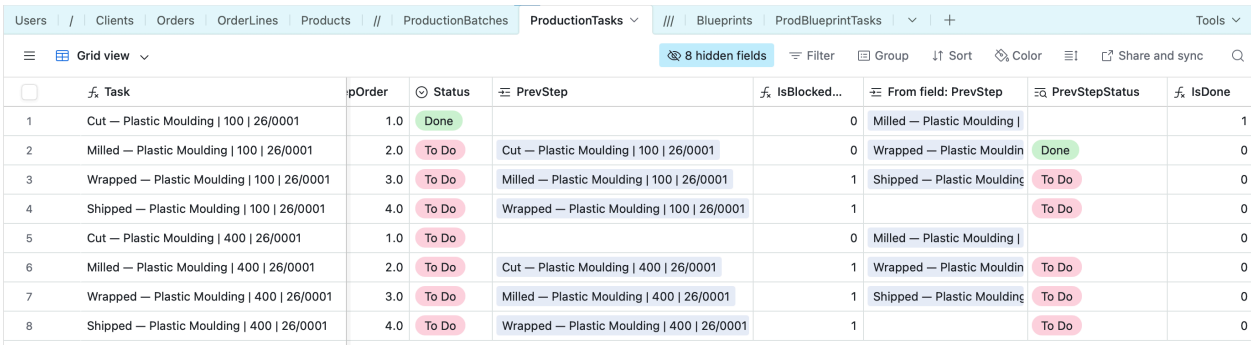
This automation transforms order information into actionable operational work, ensuring that all required steps are instantiated consistently for each batch.



4. Sequential Workflow Enforcement

Production tasks are linked through **step dependency**, enabling sequential execution of manufacturing stages.

This prevents operators from skipping required steps or moving backwards in the workflow, ensuring process integrity and predictable production flow.



Users | / | Clients | Orders | OrderLines | Products | // | ProductionBatches | ProductionTasks | /// | Blueprints | ProdBlueprintTasks | Tools

Grid view | 8 hidden fields | Filter | Group | Sort | Color | Share and sync

	Task	pOrder	Status	PrevStep	IsBlocked...	From field: PrevStep	PrevStepStatus	IsDone
1	Cut — Plastic Moulding | 100 | 26/0001	1.0	Done		0	Milled — Plastic Moulding |		1
2	Milled — Plastic Moulding | 100 | 26/0001	2.0	To Do	Cut — Plastic Moulding | 100 | 26/0001	0	Wrapped — Plastic Mouldin	Done	0
3	Wrapped — Plastic Moulding | 100 | 26/0001	3.0	To Do	Milled — Plastic Moulding | 100 | 26/0001	1	Shipped — Plastic Moulding	To Do	0
4	Shipped — Plastic Moulding | 100 | 26/0001	4.0	To Do	Wrapped — Plastic Moulding | 100 | 26/0001	1		To Do	0
5	Cut — Plastic Moulding | 400 | 26/0001	1.0	To Do		0	Milled — Plastic Moulding |		0
6	Milled — Plastic Moulding | 400 | 26/0001	2.0	To Do	Cut — Plastic Moulding | 400 | 26/0001	1	Wrapped — Plastic Mouldin	To Do	0
7	Wrapped — Plastic Moulding | 400 | 26/0001	3.0	To Do	Milled — Plastic Moulding | 400 | 26/0001	1	Shipped — Plastic Moulding	To Do	0
8	Shipped — Plastic Moulding | 400 | 26/0001	4.0	To Do	Wrapped — Plastic Moulding | 400 | 26/0001	1		To Do	0

5. Operational Progress Visibility

The system calculates **progress indicators at multiple levels**, including:

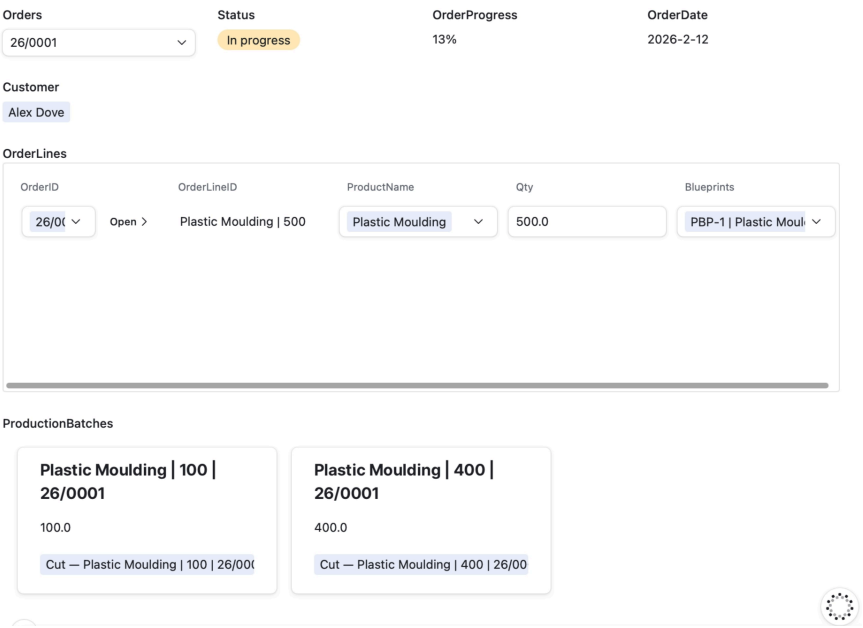
- Production Batch
- Order Line
- Overall Order

This provides managers with a clear view of production status and enables monitoring of fulfillment progress across the entire order structure.

Operational Interface

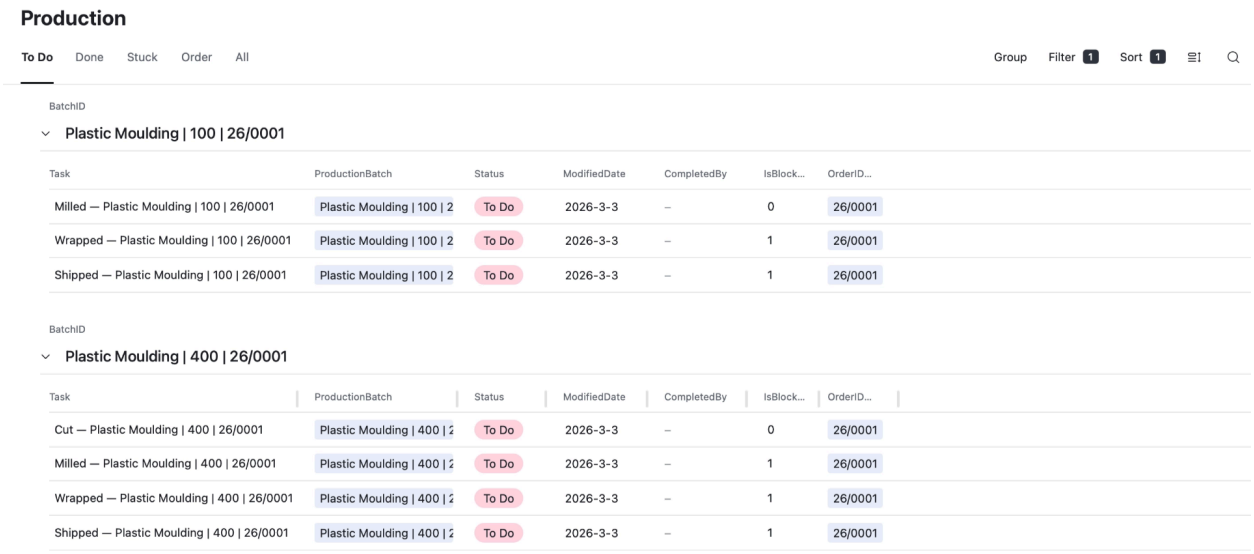
Order Coordination Interface

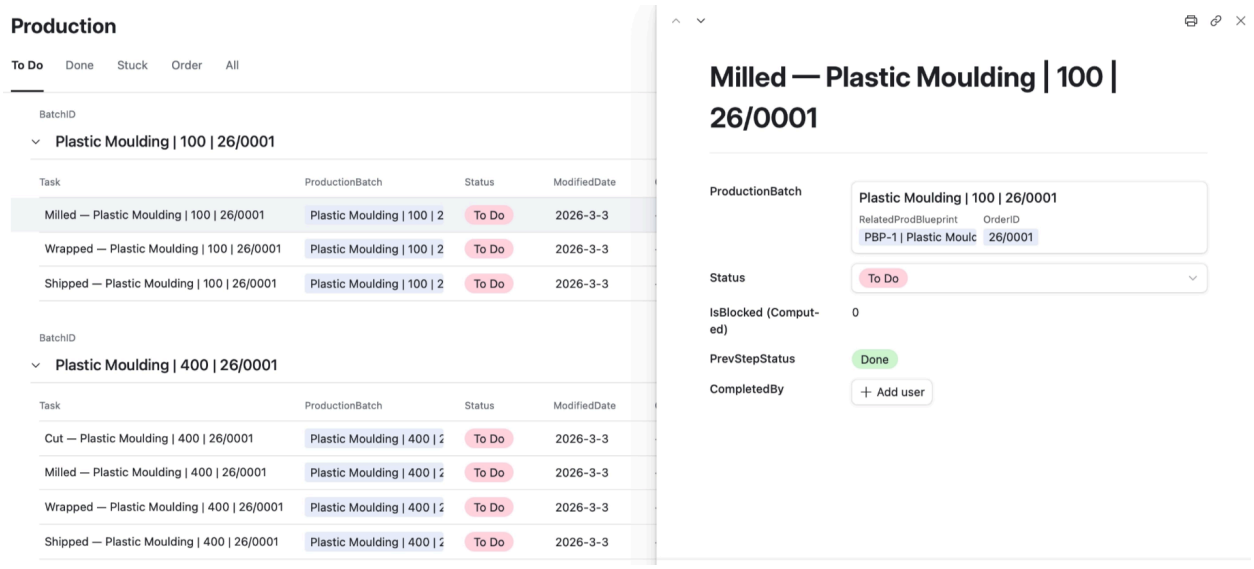
Built for operations managers, this interface provides a centralized view of order execution. Managers can track order status, monitor progress, and see how individual order lines are translated into production batches. By linking orders, products, and production units in one view, the system enables clear coordination between order requirements and ongoing manufacturing activity.



Production Operation Interface

Built for floor operators, this interface organizes production tasks by batch, allowing teams to track progress and move batches through each step of the manufacturing process. Sequential dependencies ensure that a task can only proceed once the previous step is completed, maintaining the correct production order.





Outcome

The completed system replaced paper-based tracking with a structured, relational workflow connecting orders, production batches, and sequential tasks in a single operational view.

Operations managers gained real-time visibility into order progress without chasing status updates. Floor operators gained a clear, dependency-enforced task queue that eliminated ambiguity about what to work on next and in what order.

The blueprint-driven architecture means production workflows can be updated or extended — new product types, additional stages — without restructuring the underlying system. Inventory management and commercial workflows remain out of scope by design, but the data model is structured to accommodate both without requiring a rebuild.