AI-04588 Push and Pull System

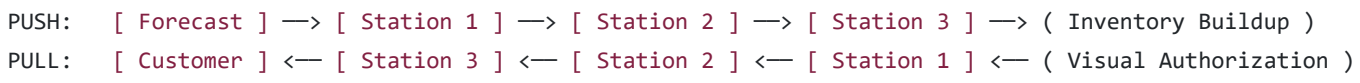
Explain the Push and Pull System and Kanban and efficient workflow. What are the BKM?

In modern operational engineering and Lean frameworks, optimizing throughput while eliminating waste comes down to understanding **demand flow**, **visual control**, and **standardization**.

Here is a breakdown of Push vs. Pull, Kanban systems, and the Best Known Methods (BKMs) to establish an efficient workflow.

1. Push System vs. Pull System

The fundamental difference lies in **what triggers work to begin**: target schedules (estimates) or downstream consumption (actual demand).



The Push System (Forecast-Driven)

- **Mechanism:** Work is scheduled based on historical data, demand forecasts, or fixed production targets. Items are produced and "pushed" to the next step or warehouse regardless of whether the next station is ready for them.
- **The Problem:** Small inaccuracies in forecasts lead to high **Work-In-Progress (WIP)**, high holding costs, large batches, long lead times, and bottlenecking.
- **Where it's used:** Long lead-time raw material procurement or seasonal, predictable mass manufacturing.

The Pull System (Demand-Driven)

- **Mechanism:** No station produces or moves a unit until the downstream customer (or internal downstream process) requests it.
- **The Advantage:** Limits excess WIP, reveals operational constraints immediately, lowers inventory risk, and minimizes cycle times.
- **Where it's used:** High-mix manufacturing, fab operations, software engineering, and Just-In-Time (JIT) environments.

2. Kanban: The Signaling Engine

Kanban (Japanese for "visual signal" or "card") is the operational tool used to implement and maintain a **Pull system**. It controls production through real-time feedback loops rather than top-down schedules.

Core Elements of a Kanban System:

1. **Visual Cards/Tokens:** Each card represents a discrete batch or unit of work, explicitly listing part numbers, specs, and source/destination locations.

2. **Strict WIP Limits:** Columns or bins have fixed capacities. If a downstream station's buffer is full, upstream stations **must stop creating new inventory**.

3. **Explicit Signal Flow:**

    - Downstream station consumes a part $\rightarrow$ Kanban card is detached and sent back upstream $\rightarrow$ Upstream station is authorized to produce *exactly* one unit/batch to replace what was taken.

3. Best Known Methods (BKMs) for Efficient Workflow

In high-tech, semiconductor, and automated processing environments, **BKMs (Best Known Methods)** represent the current standardized, optimized recipes or operational procedures documented to minimize variability and downtime.

To build an efficient, highly reliable workflow using Pull and Kanban principles, implement these core BKMs:

BKM 1: Limit Work-In-Progress (WIP Caps)

- **The Rule:** Match WIP limits directly to actual process capacity rather than theoretical maximums.

- **Why:** High WIP masks problems, increases queuing delay (Little's Law: $\text{Cycle Time} = \frac{\text{WIP}}{\text{Throughput}}$), and leads to context-switching overhead.

BKM 2: Manage Flow, Not Local Efficiency

- **The Rule:** Optimize the **total speed of the value stream**, not individual station utilization.

- **Why:** Forcing an individual station to run at 100% efficiency when downstream steps are blocked just creates massive inventory buildup (Push system trap). If a downstream bottleneck occurs, idle upstream capacity should be redirected to maintenance, cross-training, or root-cause analysis.

BKM 3: Establish Explicit "Definition of Done" & Quality at the Source

- **The Rule:** Defective units are never pushed downstream. Implement **Poka-Yoke** (mistake-proofing) at each process step.

- **Why:** Catching an issue 5 steps downstream exponentially increases the cost of rework and distorts downstream Kanban signals.

BKM 4: Standardize Process Recipes & Standard Operating Procedures (SOPs)

- **The Rule:** Lock in proven BKMs for process execution and tool setup, making deviations immediately visible.

- **Why:** You cannot reliably optimize or automate a workflow that exhibits high baseline variance. Standardization establishes the control baseline required for continuous improvement (*Kaizen*).

BKM 5: Measure and Control Takt Time vs. Cycle Time

- **The Rule:** Align step cycle times as closely as possible to the **Takt Time** (the pace needed to match customer demand).

$$\text{Takt Time} = \frac{\text{Available Working Time}}{\text{Customer Demand}}$$

- **Why:** Balancing line load prevents work steps from oscillating between starvation and overload.

Summary Matrix

Metric	Push System	Pull System (Kanban)
Trigger	Schedule / Target Forecast	Actual Downstream Demand
Inventory Level	High, variable, prone to excess	Controlled, low, capped by WIP
Bottleneck Visibility	Hidden behind queues of inventory	Immediately visible (work halts)
Flexibility	Rigid; hard to pivot production mid-stream	Dynamic; adapts quickly to demand changes
Primary Risk	Overproduction & obsolete stock	System starvation if supply chain breaks