OPERATIONAL FLOW AND INDUSTRIAL DESIGN

The Campus Effect: How Mega-Scale Planning Fixes Process Drift

Learning from ASML's semiconductor campus to optimize manufacturing flow.

Industrial Engineering · Lean Manufacturing · Process Flow · Capital Projects

> The newsletter for operations leaders who prefer physical system redesign over process mapping on paper.

The Operational Diagnosis: Where Flow Breaks Down

In many plants, we talk about process flow as if it's purely a matter of standard operating procedures or software logic. We assume that if the instructions are clear and the machines are calibrated, the product will move through the system smoothly. But on the floor, I've seen how physical distance creates a psychological and operational "drift" that no amount of SOP training can fix.

When you separate functions—moving R&D to one building, assembly to another, and testing to a third—you aren't just creating a commute for your people; you are creating a friction point for your data. Every time a part, a piece of information, or a person has to cross a physical boundary (a gate, a warehouse door, or even a long hallway), the "signal" weakens.

I call this **The Distance Decay**.

When an operator on Line A realizes they need a clarification from a technician in Building B, they don't usually walk across the lot and back to ask for it—at least not every time. They'll make a phone call. Then they'll send an email. Then they'll wait until tomorrow to "batch" their questions into one message. Each of those choices is a concession to the distance. By the time the answer arrives, the original context is often lost or slightly altered. The process hasn't just slowed down; it has drifted away from the real-time reality of the shop floor and into a delayed, mediated version of itself.

A layout that forces people to work in silos isn't just an inconvenience; it is a fundamental failure of flow design. If your physical space requires "handoffs" between different zones, you are building a system that rewards batching over speed and communication over collaboration. You aren't managing a continuous process; you are managing a series of disconnected islands joined by bridges that eventually crumble under the weight of daily demands.

Why Separation Costs Money (And Time)

The cost of these "islands" isn't always visible on a high-level P&L statement, but it bleeds out in the small, daily wastes that accumulate into massive inefficiencies over months and years. When we separate functions physically, we create what I call **The Batching Trap**.

Because moving something across a boundary is "hard" (it requires paperwork, transport, or coordination), people start to bundle work together to make it "easier." They wait until they have ten units before calling the forklift; they wait until they have five questions before emailing the engineer. This looks like efficiency on a spreadsheet because you are reducing the frequency of movements, but in reality, you are increasing the lead time for every single unit and creating a massive buffer of inventory that sits idle.

The Common Justification	The Underlying Reality
"We batch items to optimize transport efficiency."	We wait until we have enough work to justify the 'hassle' of crossing into another zone, creating stagnant WIP (Work in Progress).
"Specialized zones keep the technicians focused."	Physical separation allows teams to ignore problems on neighboring lines because they aren't "in their area" to see them.
"Standardizing locations makes inventory easier to track."	We are hiding the waste of movement behind a fence, making it harder for managers to see where flow is actually stalling.

The cost here isn't just the fuel in the forklift or the minutes spent on a phone call. It's the **Information Gap**. When an operator has to wait three hours for a "batch" response from another building, they lose their momentum. They move on to something else. By the time the answer arrives, they have forgotten the nuances of the problem, and the fix is applied with less precision. You aren't just losing time; you are losing the ability to react in real-time.

The Flow Factory Model (ASML's Playbook)

To counter this, we can look at how high-complexity manufacturers—like ASML in the semiconductor space—approach their floor plans. They don't view "space" as just a container for machines; they view it as an integral part of the process flow.

In many traditional setups, R&D is kept far away from production to keep the "clean" work separate from the "dirty" work. This creates a massive gap between what was designed and how it actually performs on the line. The ASML approach moves toward an integrated campus model where these functions are physically intertwined. When your engineers sit next to the people running the machines, the feedback loop is instantaneous.

The goal here isn't just "proximity"; it's **Co-location of Function**. Instead of a central warehouse that serves ten different lines (requiring everyone to travel to one point), you move the materials and tools to where the work happens. You eliminate the need for "travel" as a step in your process map.

In an integrated flow, if a tool needs frequent calibration or a part requires specialized inspection, those stations are placed within arm's reach of the primary assembly point. There is no "sending it over." There is no "waiting for the next truck." The physical layout enforces the logic of the work. If you can walk from one step to the next without crossing into a different zone or leaving your immediate vicinity, your flow is likely much more robust. You aren't just building a factory; you are designing a path that allows information and material to move as fast as possible with zero "friction" points at the boundaries.

Designing for the Edge Case: Beyond Standard Work

We cannot simply tell people to "work harder" or "communicate better" when the physical layout is working against them. We have to design out the possibility of failure by looking at **The Proximity Audit**. When you are planning your next floor expansion or redesigning a current cell, don't just look at how many square feet each machine needs; look at the cost of moving between those machines.

To do this effectively, use these three principles to guide your design:

1. **Eliminate Cross-Boundary Handoffs:** If a process requires a person or piece of material to leave "Zone A" and enter "Zone B," that is a failure point. You must either move the function into Zone A or automate the handoff so it doesn't require human intervention (like a conveyor rather than a manual cart).
2. **Integrated Utility Grids:** Don't let your team have to leave their station because of "infrastructure" needs. If they need specialized gas, power, or cooling that is only available in another building, you haven't finished the design. The utility must be part of the local footprint.
3. **The Two-Minute Rule:** No critical piece of information (a spec sheet, a tool change instruction, a safety alert) should ever require a person to leave their immediate work area to obtain it. If they have to walk more than 20 feet to get what they need to do the next step of the job, your layout is forcing them into "Decision Drift."

A good floor plan doesn't just support your standard work; it enforces it. It should be physically impossible for a worker to make the wrong choice because the right tools and information are always within reach.

Three Immediate Checks for Your Site Layout

You don’t have to wait for a multi-million dollar renovation to start fixing these issues. You can begin with your next Gemba walk by looking at your facility through the lens of "Flow Friction." Take three specific items from your current layout and evaluate them against these criteria:

1. The "Point of No Return" Audit

Identify every point where a part or piece of information must leave one department's control to enter another’s (e.g., moving from machining to assembly, or from the floor to the quality lab). Count how many "stops" occur at these boundaries. Every stop is an opportunity for data loss and delay. Your goal is to reduce these physical transitions by 50% over the next six months through better local positioning of equipment.

2. The Walk-Time Calculation

Pick three common tasks that require a worker to leave their station—getting a replacement part, getting a supervisor's signature, or fetching a different tool. Time how long it takes them to perform these actions and return to work. If the total "off-task" time exceeds five minutes for any of these frequently performed items, you have an opportunity to bring those tools/people into their immediate workspace.

3. The Information Gap Test

Ask your operators on the line: *"When was the last time you had to wait more than ten minutes for a response from someone in another department?"* If they can name three instances in the last week, it means your "Distance Decay" is actively hurting your production rate. Map out those specific moments—they are exactly where your layout is failing you.

Fixing these isn't about fancy architecture; it’s about removing the obstacles that force your people to compromise on speed and accuracy just to get through the day. Stop trying to manage "distance" with better communication. Instead, remove the distance from the equation entirely.

Call to Action

What single boundary (physical or procedural) does your process suffer from? Share your thoughts with us—and share this newsletter if it helped clarify a costly drift!

Newsletter replies: newsletter@sixsigmakaizen.com · X: @kaizen_6sigma

Stay curious, stay improving,

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References: ASML starts 350,000-square-meter campus to expand semiconductor equipment production (via interestingengineering.com)