

THE DRUMBEAT DOCTOR

Theory of Constraints + Predictive Maintenance + Overall Equipment Effectiveness (OEE)

1. The Three Frameworks Used:

THEORY OF CONSTRAINTS	PREDICTIVE MAINTENANCE	OVERALL EQUIPMENT EFFECTIVENESS (OEE)
Every system has one bottleneck that sets its pace. Improving anything else is wasted effort until the bottleneck is fixed.	Use sensor data to fix a machine just before it fails, instead of after it breaks or on a fixed calendar.	A single score combining availability, speed and quality — showing how much true output a machine actually delivers.

How the Three Connect (Fusion Logic)

Theory of Constraints tells you **which** machine matters. OEE tells you exactly **how** that machine is losing output. Predictive Maintenance keeps it from stopping. Fused, you protect the drumbeat of the whole factory.

2. Application: INTEL (USA)

Background — What Happened and Why

- A semiconductor fab costs billions; a bottleneck tool sitting idle burns enormous money per hour.
- In a fab, some lithography tools are extraordinarily expensive and set the pace for everything else.
- Unplanned breakdowns on those tools stop the entire line, not just one step.
- Fixing non-bottleneck machines makes the numbers look busy but adds zero real output.

What They Did

- Identified the true constraint tools that set the pace of the whole fab.
- Measured OEE on those tools to see whether losses came from downtime, slow running, or scrap.
- Instrumented them with sensors to predict failures before they happened, scheduling repairs into planned windows.

- Deliberately protected the constraint — never starving it of work, never using it for low-value jobs.

Applying the Fusion — Step by Step

1

Find the machine that sets the pace

In a chip fab, a few extremely expensive tools set the speed of the whole factory. An idle hour on one of them costs the profit of everything the fab would have made.

2

See exactly how that machine loses output

Intel measures that key tool's losses — time waiting, running slow, or making scrap — because each lost point there is a lost point for the whole factory.

3

Predict its failures before they happen

Sensors on the key tools spot wear early, so repairs are done in planned windows instead of sudden breakdowns that stop the line.

4

Protect the pace-setting machine

Spare parts and crews are kept ready at that tool, and it is never left waiting for work — everything else gives way to keep it running.

The Result

Output rose without buying more of the most expensive machines. By protecting and maximising the one tool that set the pace, the entire fab's throughput improved.

3. Key Takeaways

- Predictive maintenance ROI is not equal across machines — the constraint multiplies it.
- Price constraint downtime at the margin of the whole system, and budgets reorganize themselves.
- OEE at the bottleneck is a revenue metric wearing an engineering costume.
- Use in any asset-heavy operation where one expensive stage paces everything.