

CUSTOMER USE CASE

This semiconductor foundry needs to eliminate the risk of wafer loss from unplanned downtime in the SubFab





CHALLENGE

Uncertainty in the SubFab creates risk to wafer output and tool availability

The foundry's next growth phase set the Fab team in search of new channels for innovation. All areas of the manufacturing chain needed to increase their contribution to Fab yield.

Their vacuum and abatement systems had evolved over the years, concealing hidden variables affecting the potential performance of the wider fab. Unplanned vacuum system failures during wafer processing were a pressing concern. Advancing semiconductor manufacturing processes were also placing increasing demands on vacuum and abatement equipment.

Fab downtime

A pump "crash" during a batch process that causes the scrap of an entire production batch – up to 125 wafers – could be a huge loss in product and process downtime. Even in the single wafer processes, unplanned vacuum pump faults could cause significant losses as process tools require many hours or even days to requalify.



KEY PROBLEMS

New manufacturing processes placing increasing demands on equipment

Short term fix of increased maintenance

A loss of more than **\$836K** annual value due to unplanned SubFab events on a batch furnace

Increased maintenance Intervals

The foundry SubFab monitoring system was unable to provide insight on the occurrence of vacuum equipment faults. A time-based maintenance regime was in place on vacuum pumps supporting critical process tools. This interrupted valuable production schedules, where expensive process tools were often taken down too early or just as a precaution. Even on reduced maintenance intervals, pump faults still occurred, contributing to tool downtime and wafer loss.

In need of a solution, the foundry approached us to look first at a batch furnace application causing high value risk from a small number of unplanned events.



These assumptions illustrate the significant value that can be created by reducing unplanned down events.

+ UNPLANNED DOWN EVENTS COST ALMOST \$1M

REDUCED
MAINTENANCE
COSTS

\$14,800



VALUE OF
CHAMBER
UPTIME

\$72,000



REDUCED
WAFER
SCRAP VALUE

\$750,000



TOTAL ANNUAL VALUE

\$836,800



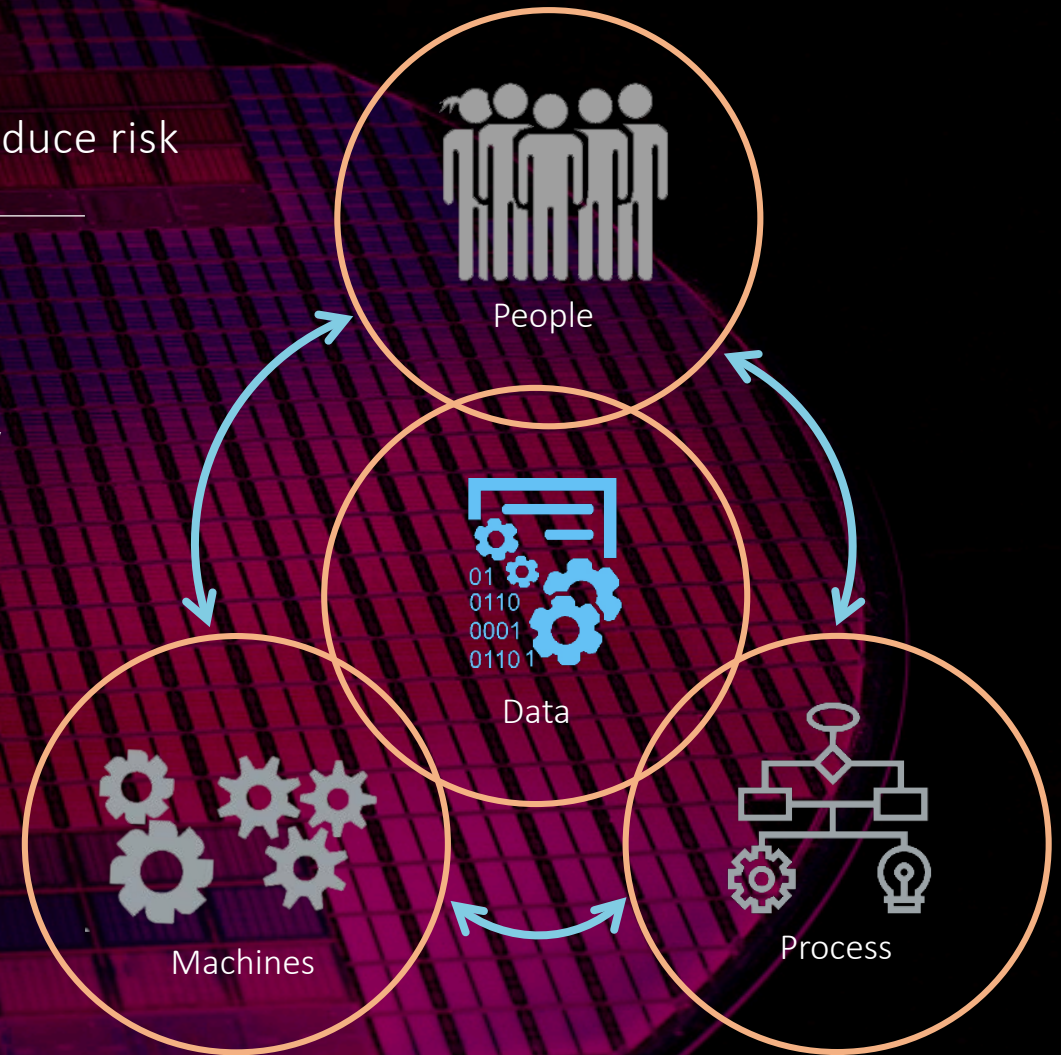
SOLUTION

Making vital changes in the SubFab to reduce risk

Both the Fab and the SubFab teams were open to discuss important changes, required for the SubFab to better contribute towards Fab value and success.

New conversations started to take shape between teams. They started to move their thinking from the traditional “break-fix” approach to how to optimise and align their service schedule to better support the process tools. This formed an approach of Operational Excellence, where the operation of people, machines, processes and data all worked together to achieve the best results.

Predictive Maintenance (PdM) and Remaining Useful Life (RUL) technologies were installed in parallel with the existing SubFab monitoring system. Leveraging our domain expertise to understand vacuum pump condition, our operational excellence specialists created a condition-based maintenance plan which centred around the objectives of the wider fab.






Condition-based maintenance in action

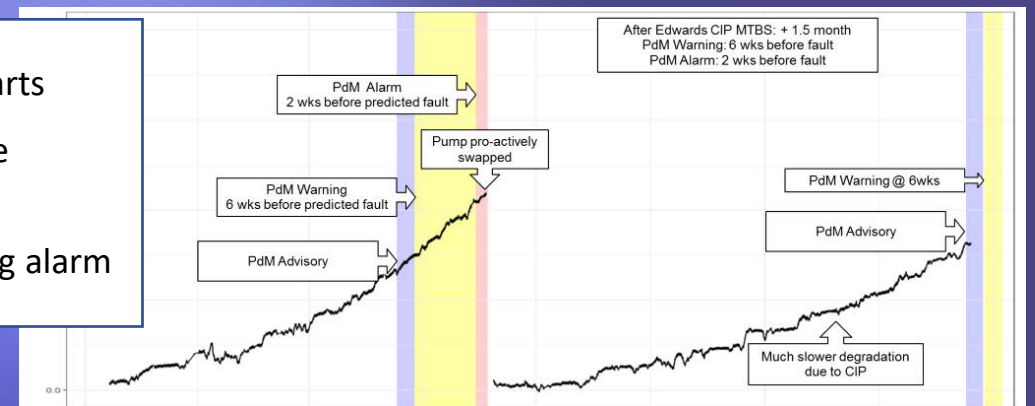
The plan identifies any developing pump faults in advance and in good time. It includes adjustments to the pump to improve management of process by-products and further decrease the likelihood of unexpected pump fault.

The accuracy of PdM and RUL insights were confirmed by post-mortem analysis and comparison to our global knowledge base. This proof gave the Fab the confidence to move from time-based maintenance scheduling to a proactive strategy, focused on operational excellence. A collaborative engagement allowed us to share actionable insight with process tool owners. Together we co-managed risks, agreeing maintenance schedules and adjustments to pump configuration to optimise service intervals.

THE 6 WEEK FAULT PREDICTION MODEL



-  Predictive advisory starts
-  Schedule maintenance recommendation
-  Do not start processing alarm





OUTCOME

25% more time between service intervals without the risk of unplanned downtime

The extended fault prediction horizon allowed the SubFab team to notify the process tool owners 6 weeks in advance of SubFab maintenance requirements. With this increased transparency, the tool owners saw a benefit of communicating their process tool schedules. Co-managing risk in this way meant the **SubFab** and **clean room maintenance** activities became better **aligned**.

Maintenance intervals extend by 6 weeks

With the advanced insight gathered on how changing manufacturing processes affect the deterioration of pumps, the SubFab team made recommendations to optimise pump configuration. With the confidence provided by verified RUL calculations, the Fab team agreed to **extend maintenance intervals by at least 6 weeks (25%), without any risk of unplanned downtime**.

The overall effect was to reduce the risk of wafer losses, and performance improvements continue to be visible across the entire Fab, as tool availability and Fab yield improve.



TEAM FEEDBACK

“This customer **extended tool operating time** significantly. A great example of how Operational Excellence in the SubFab can drive performance and get the best outcome and **support the wider Fab objectives**”



CONSULTANT,
OPERATIONAL EXCELLENCE TEAM
EDWARDS

NEXT STEPS?



READY TO REVEAL THE POTENTIAL VALUE
IN YOUR SUBFAB?

[Learn more with the Value Calculator](#)

VALUE CALCULATOR

Please tell us about your
operation

Process type

Number unplanned events per year

Chamber downtime hrs, unplanned

Chamber downtime hrs, planned

Your potential annual value

\$642,560

created through Improved wafer throughput and chamber availability

Reduced maintenance costs	Additional throughput for improved chamber availability	Additional throughput for scrap avoidance
\$10,560	\$32,000	\$600,000

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