Increasing Chip Availability Through a New After-Sales Service Supply Concept at ASML

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SLF Theme Meeting

Agenda

- Context
- Journey
- Summary of the changes
- New service concept
- Results after implementation

ASML TU/e

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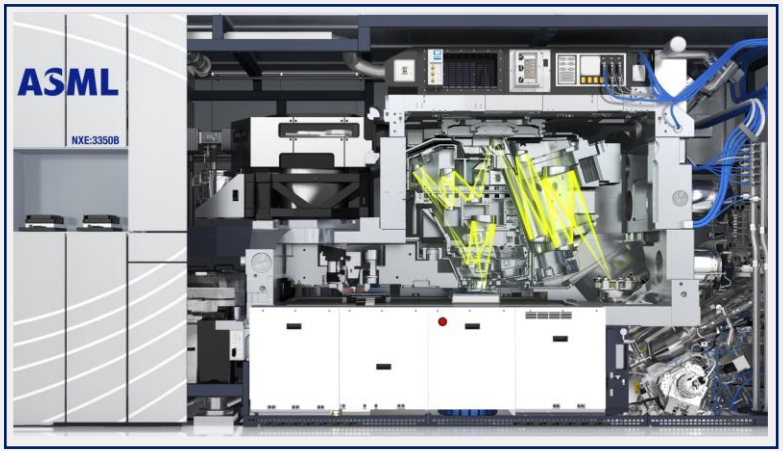
Context: After-Sales service contracts for spare parts

After-sales service

Original Equipment Manufacturers → **Asset Users**



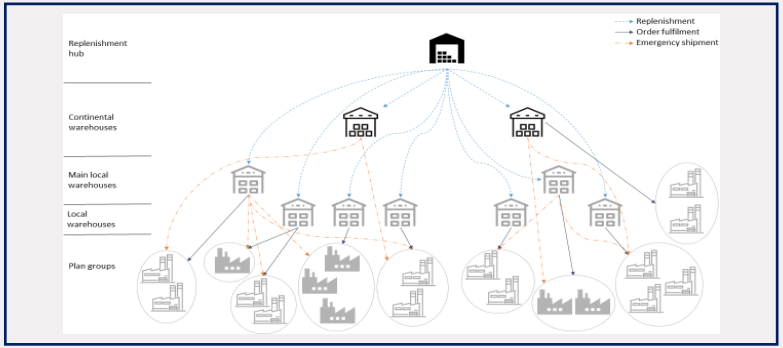
"Performance-Based Contracting (...) tying a supplier's compensation to the output value of the product generated by the customer (buyer)."

S.H. Kim, M.A. Cohen and S. Netessine (2007)

Context: ASML and its customers

After-sales service

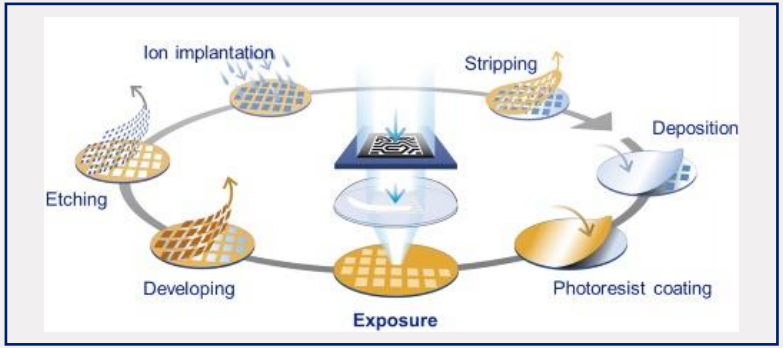
High Tech Equipment



High number of low failure rate components coupled with high uptime service commitments:

- > 10,000 spare parts and service tools
- > 45 locations worldwide
- > 3,000 systems serviced

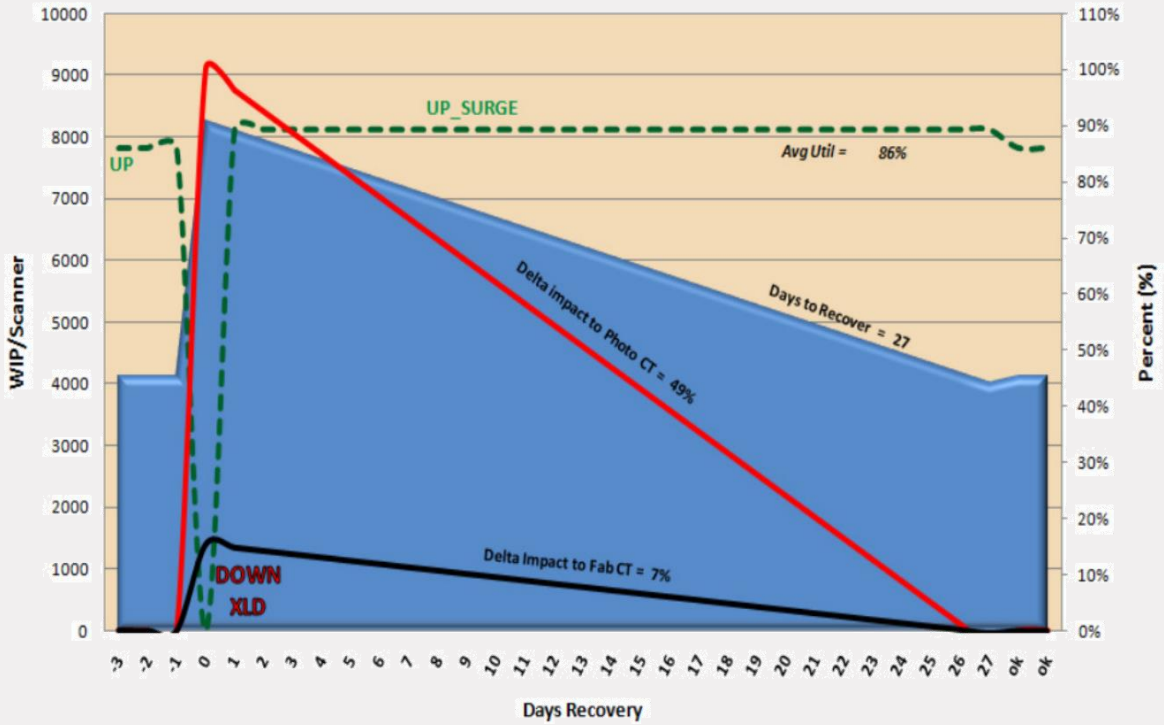
Chip Manufacturing



High number of process steps for one layer, multiple layers and expensive capacity extension:

- High utilization, bottleneck machine
- 72,000€ per hour of downtime
- 27 days to recover from a 24 hours downtime

Impact of extreme long downs on a modern fab



Context: Existing service measures

Customer Service Degree	No commitment on late deliveries
DownTime Waiting for Parts	Multiple fast deliveries can compensate for a very long one

Current service measures, including their variants, do not directly cover the need to prevent (extreme) long interruptions though they hurt the customer the most.

Focus on variability: next step for service

XLD definition	Time-to-repair longer than H consecutive hours (e.g. 24hrs)
Time-to-repair	Diagnostics, parts and tools delivery, swapping and recovery
O'Connor and Kleyner, 2012	Spare parts supply is the main source of variation
Our scope	Spare parts and service tools

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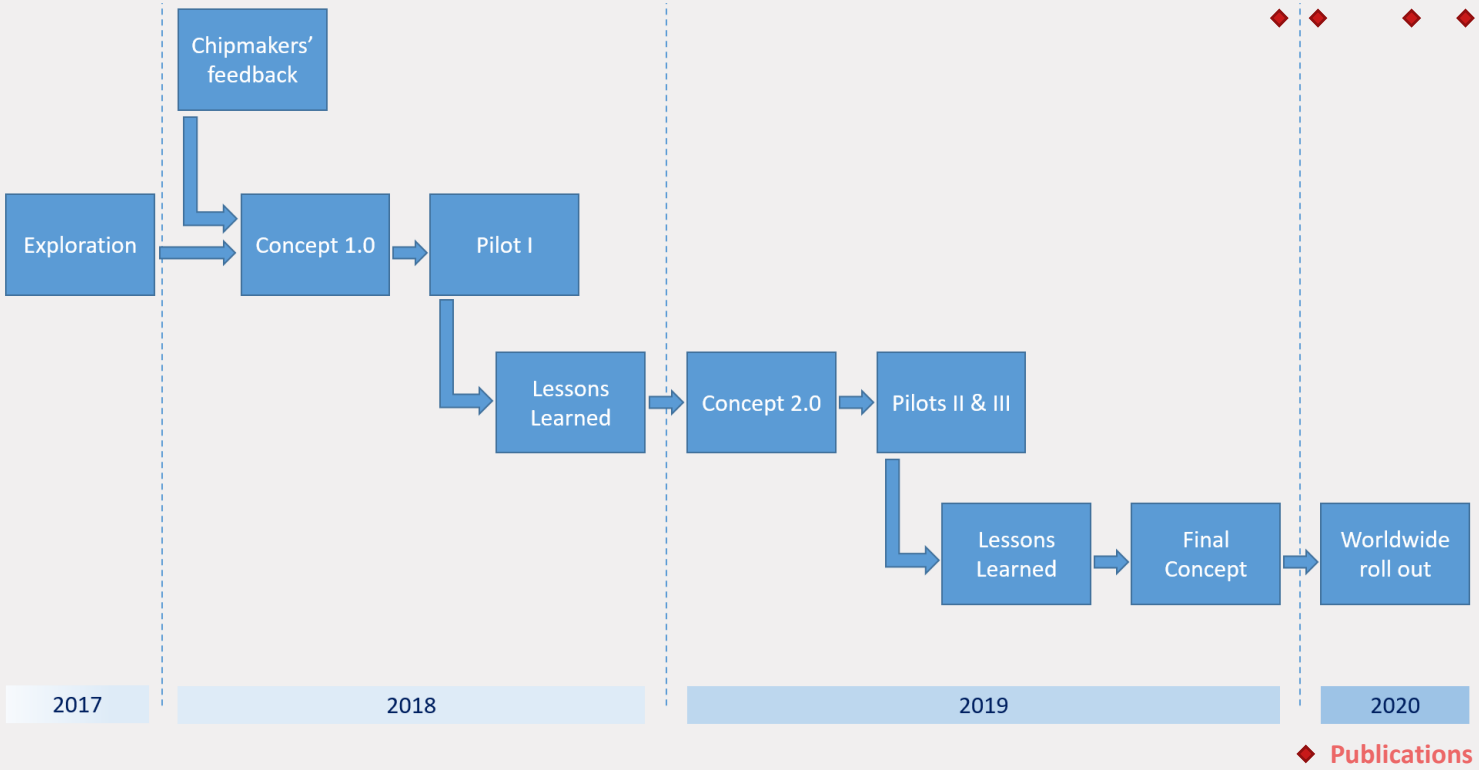
New service supply concept developed for ASML

Research question

How to modify a service supply concept to reduce the number of extreme long downtime events (XLDs)?

1. Create a new service concept that reflects better customer impact resulting in more transparency and better alignment
2. Develop and implement a new spare parts and service tools planning approach to support the new service metric
3. Use the key insights of our research on XLDs

High level plan



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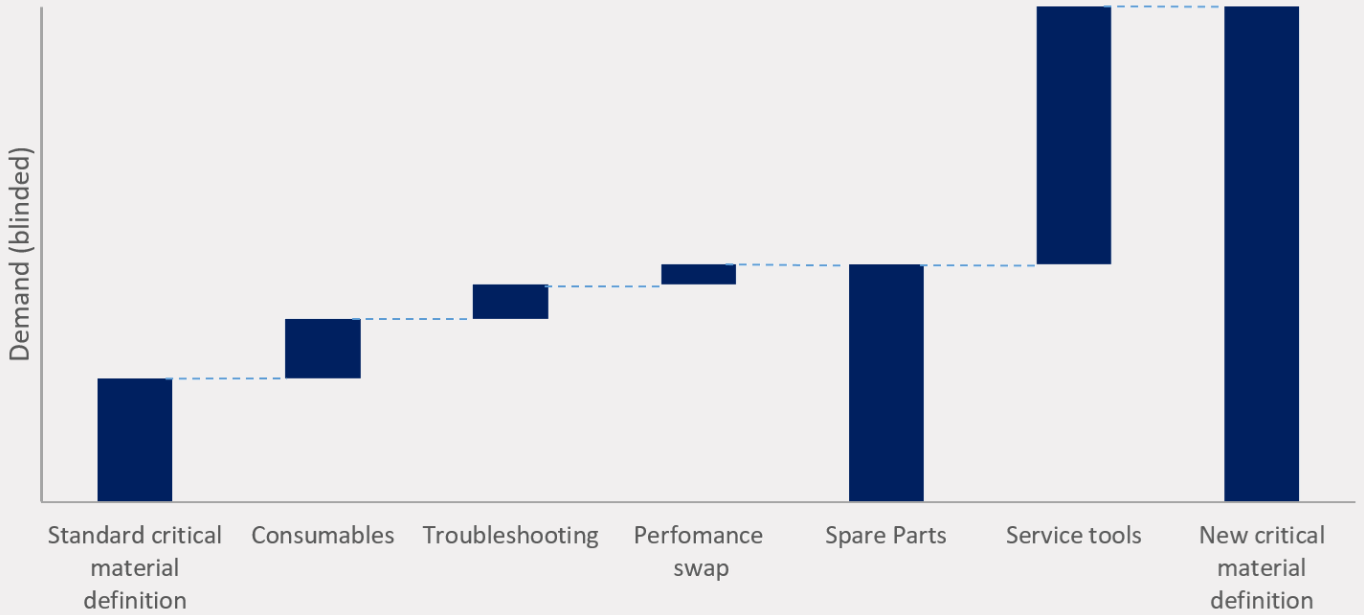
Summary of the changes implemented worldwide

Dimensions	Themes	Previous concept	New concept
Service measure	Critical material definition	▪ Spare parts used during a system down event	▪ All materials needed for optimal system performance
	Performance review period	▪ Measured over a quarter	▪ Measured over a month
	Performance metric	▪ Focus on average delivery lead time	▪ Focus on average delivery lead time and number of long downtimes
Planning Approach	Scope of the planning model	▪ Spare parts only ▪ Only demand for consumed spare parts is forecasted	▪ Spare parts & service tools ▪ All demand for materials sent to customers is forecasted
	Impact on fab operations	▪ Assumed equal for all spare parts	▪ Tailored using fab-specific focus materials
	Planning method	▪ System approach	▪ Combination of item approach and system approach
	Hold-back levels	▪ No hold-back levels	▪ Hold-back levels for focus materials
	Lateral transshipments	▪ All lateral transshipments allowed	▪ Lateral transshipments allowed only if within a target delivery time
	Emergency shipments	▪ Emergency shipments lead time assumed to be 48 hours	▪ Emergency shipments guaranteed within 72 hours

Example: New critical material definition



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New service measure developed: Hit Ratio

Demand	All requested items delivered to fab
Miss	Requested item not available within the SKU-specific target shipment time

$$\text{Hit ratio} = \frac{\text{One month observed demand for all SKUs} - \text{One month missed deliveries}}{\text{One month observed demand for all SKUs}}$$

Hit Ratio: Transparent delivery times per SKU

- Per site a stocking proposal is made based on new business rules

- Local (1) is further split in:
  - A. High usage materials
  - B. Dead-on-Arrival multi-hitter
  - C. XLD drivers

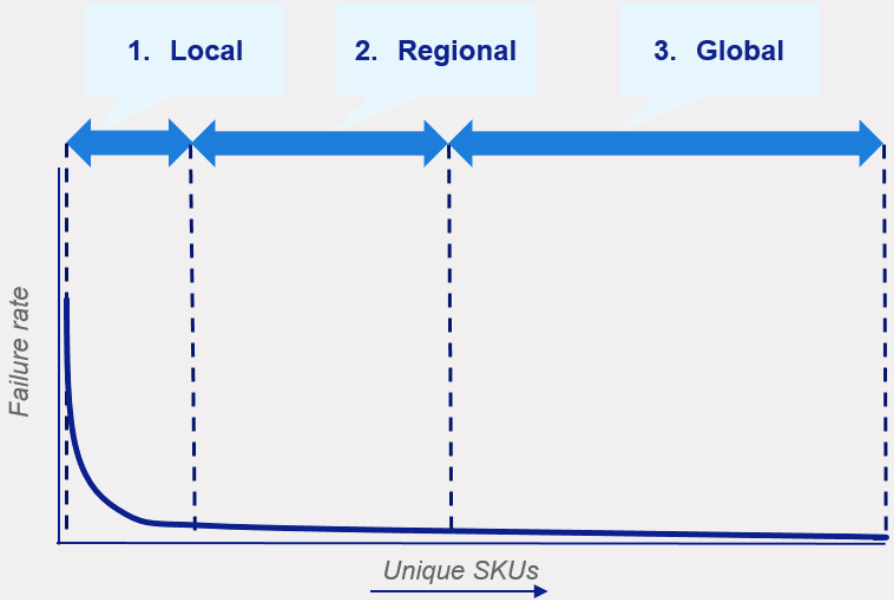
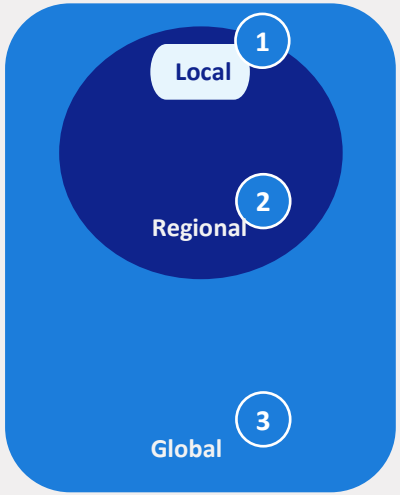


Illustration of the new concept for a theoretical fab

Support network



Planning per bucket depends on customer, Install base and local requirements/focus

High level overview per bucket

		Target shipment time	Performance Target
1	▪ Fab specific fast movers ▪ DoA multihitters ▪ Fab specific XLD drivers	Few hours	98% Hit ratio
2	▪ Medium / low request SKUs	12 hrs	
3	▪ Extreme low request items	36 hrs	
Emergencies	▪ All parts and tools not delivered as planned from bucket 1, 2 & 3	72 hrs	

New service supply concept implemented at ASML

Research question

How to modify a service supply concept to reduce the number of long downtime events (XLDs)?

Methodology

- Multi-echelon
- Multi-location: > 45 locations
- Multi-item: > 10,000 spare parts & service tools
- Heuristics

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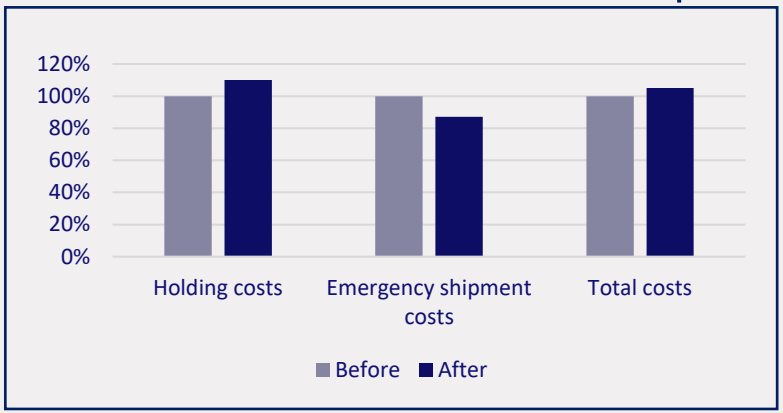
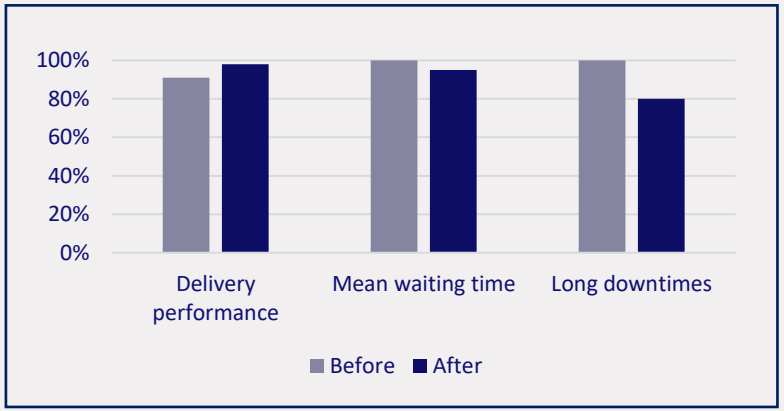
Results measured over the worldwide installed base

After-sales service

ASML



Chip manufacturers



The new service measure and planning approach have been implemented and resulted in:

- > 50% overall decrease of emergency shipments
- > 80% decrease in fast movers' emergency shipments
- ~ 5% cost increase

Helping chip manufacturers worldwide achieve more stable operations:

- ~ 20% reduction in long downtime events (XLDs)
- ~ 1.5B€ generated across the semiconductor industry
- Making the industry more sustainable

Summary

We designed a new service concept to reduce the number of extreme long system interruptions – Hit Ratio

Our new service concept resulted in a new optimization problem for the tactical planning, new algorithms and new business rules

We implemented the new service concept to the complete service network of ASML and analyzed its impact – 1,5 B€ generated

Thank you

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