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Service Supply Chains:

towards lifelong customer relationships

Henk Zijm

Industrial Engineering and Business Information Systems

University of Twente

IEBIS: Research projects & industrial collaboration

- **SLF-R**: service differentiation
- **IOP-IPCR**: spare parts & LORA
- **ProSeLo**: Pro-active Service Logistics and re-use
- **MaSelMa**: dynamic maritime maintenance/service
- **SINTAS**: Impact of 3D printing on maintenance & service logistics
- **QRF**: Optimal resource exploitation (parts, people, tools)

Service Supply Chains

Service supply chains encompass all stakeholders and activities required to deliver a desired functionality to her customers, through the sales of (the use of) technological products and through programs focused on maintenance, upgrading and safe usage of products during the entire life cycle, up to the final disposal, take back and recycling of these products.

Key developments in manufacturing and services

Technological developments

Internet of Things, Connectivity and (big) data, new materials, additive manufacturing (3D-printing), robotics, virtual and augmented reality, design for serviceability

Supply Chain Innovations

Cross chain collaboration centers, Physical Internet, Integration of product-information-financial flows

Changes in markets / economies

Servicization, vertical collaboration/synchronization, sharing economy, lead service provider, new business models between asset/function owner – service supplier - OEM

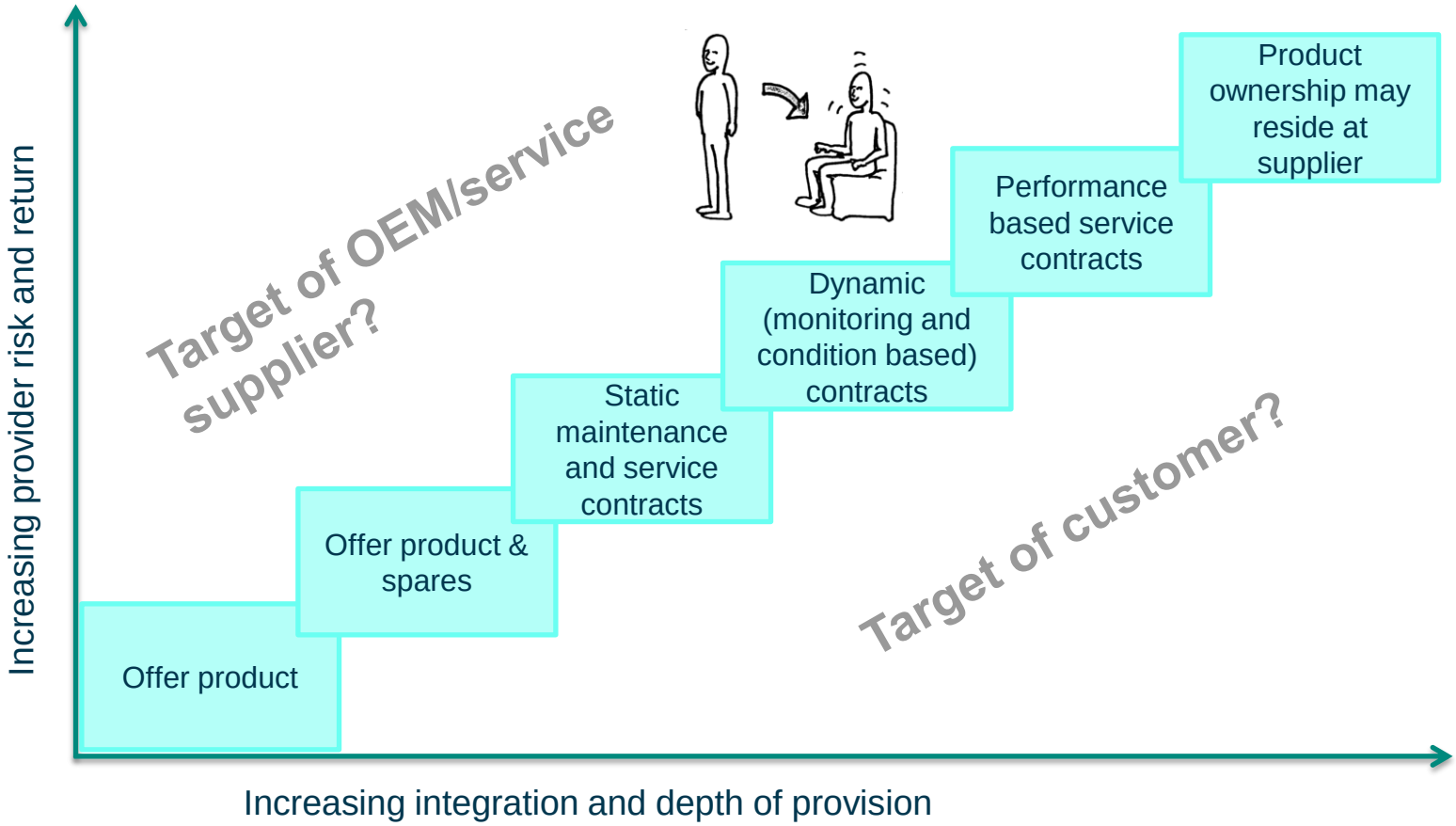
Sustainability

Lack of natural resources, circular economy (cradle-to-cradle) and re-use, product life cycle approach

Governance / legislation / society / culture

Safeguarding essential infrastructures, financial regulations, 24/7 economy, customer service expectations

Service Market Developments



Modified after Andy Neely, Cambridge Service Alliance, 2013

MaSelMa

Integrated Maintenance and Service Logistics Concepts for Maritime Assets

Asset owner

Fügro

Royal Netherlands Navy

Loodswezen

Smit Lamnalco

OEM (Original Equipm. Man.)

Thales

Damen Shipyards

Supplier

Pon Caterpillar

Alewijnse

KVSA / Seamar

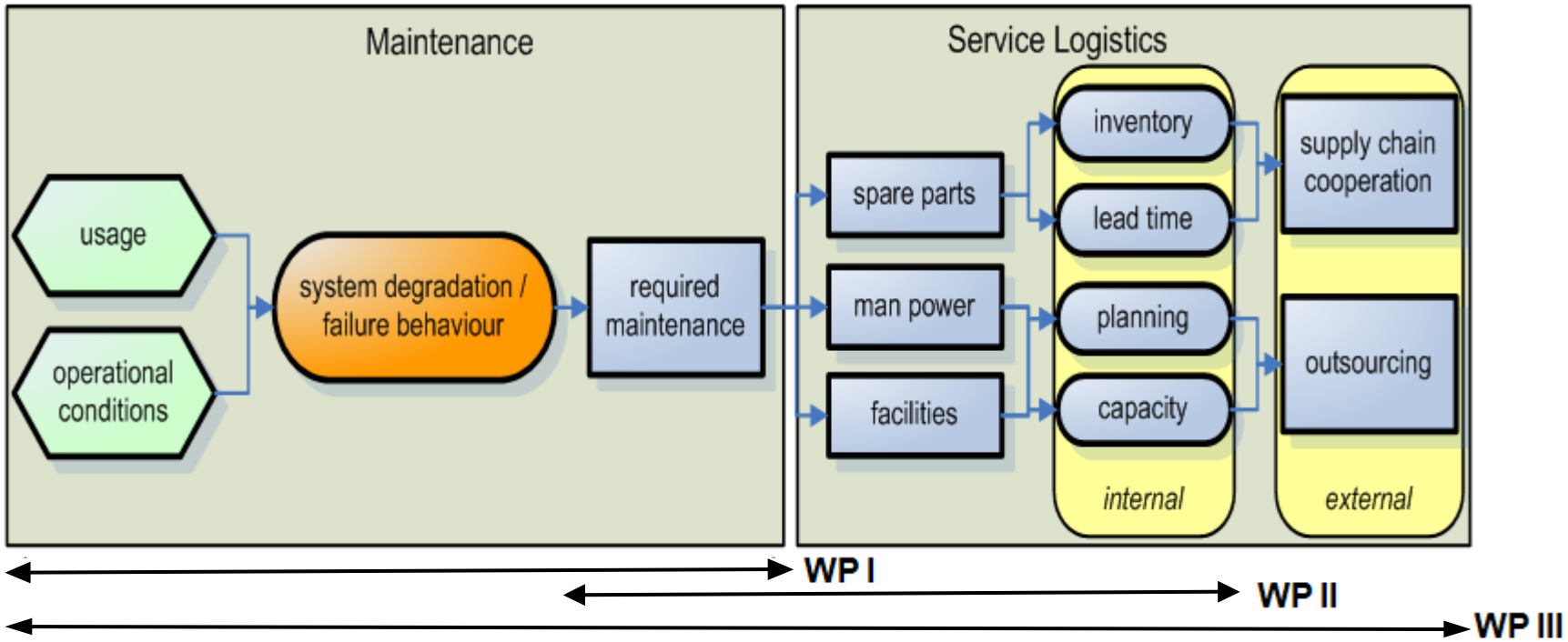
Imtech / RH Marine

Oliveira

Bolidt Maritime

Example project: MaSelMa

Maintenance and Service Logistics for Maritime Assets



WP I *Improve the predictability of maintenance (physics of failure, data analytics)*

WP II *Data driven service logistics planning and control models*

WP III *Improve/extend service supply chain cooperation; sound business models*

Clustering condition-based maintenance actions

1. Separate maintenance decision for each component according to (multi-threshold) control limit policy

2. system level: adjust former decision using opportunistic replacement threshold

3. determine next a priori scheduled intervention date.

Result:

Overall average cost reduction of 25 % of clustering policy, as compared with mono-component policy

Ref: Castanier et al. (2005)
Van Dijkhuizen (2000)

Information exchange between asset owner and service supplier: operations based maintenance

Repair and Maintenance costs represent a value of 60% of the initial purchasing value

Incorporating part conditions (the age of the parts in operation, e.g., flight hours) in an inventory replenishment policy (PABS policy)

Results:

On average a 20% inventory cost reduction

Ref: Deshpande et al. (2006)
Fleuren (2013

Preventive Repair Actions in Multi-Component systems @ DAF Trucks N.V.

DAF
A PACCAR COMPANY

Repair and Maintenance costs represent a value of 60% of the initial purchasing value

	Savings Compared with Corrective Maintenance
Component 1	17,69%
Component 2	0,00%
Component 3	16,64%
Component 4	18,80%
Component 5	0,00%
Component 6	8,09%

Rule of Thumb:
Costs incurred with one roadside breakdown are equal to the profit margin on a truck of one month

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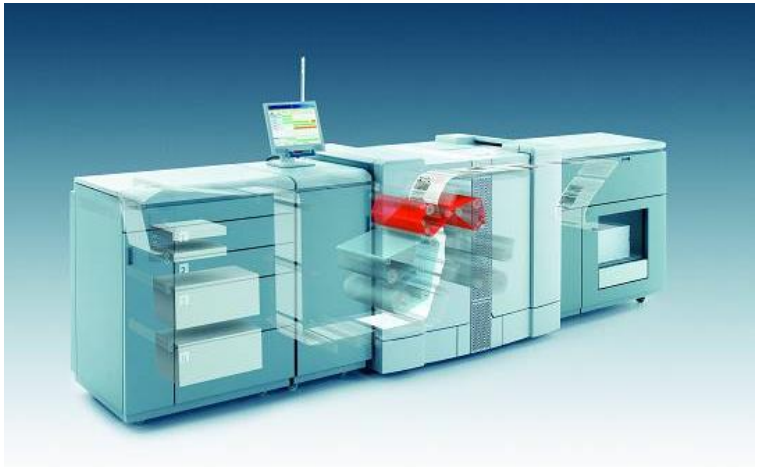
QATAR UNIVERSITY

Last-time buy decisions and return flows

Result: 22 % lower costs of LTB by dismanting former systems and re-use of their components



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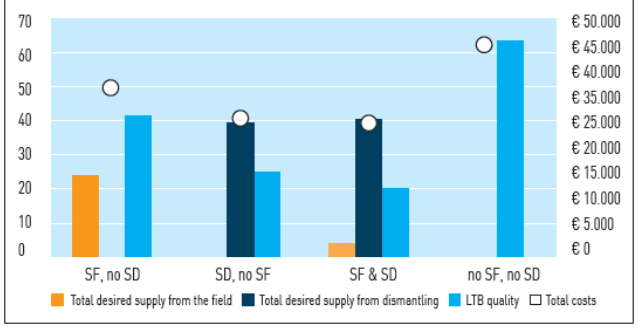
Scenario	SF, no SD	SD, no SF	SF & SD	no SF & no SD
Total desired supply from the field	24	0	3	0
Total desired supply from dismantling	0	40	40	0
LTB quality	41	25	22	65
Total costs	€ 36.290	€ 29.757	€ 28.853	€ 45.369



ASML: worldwide service provision

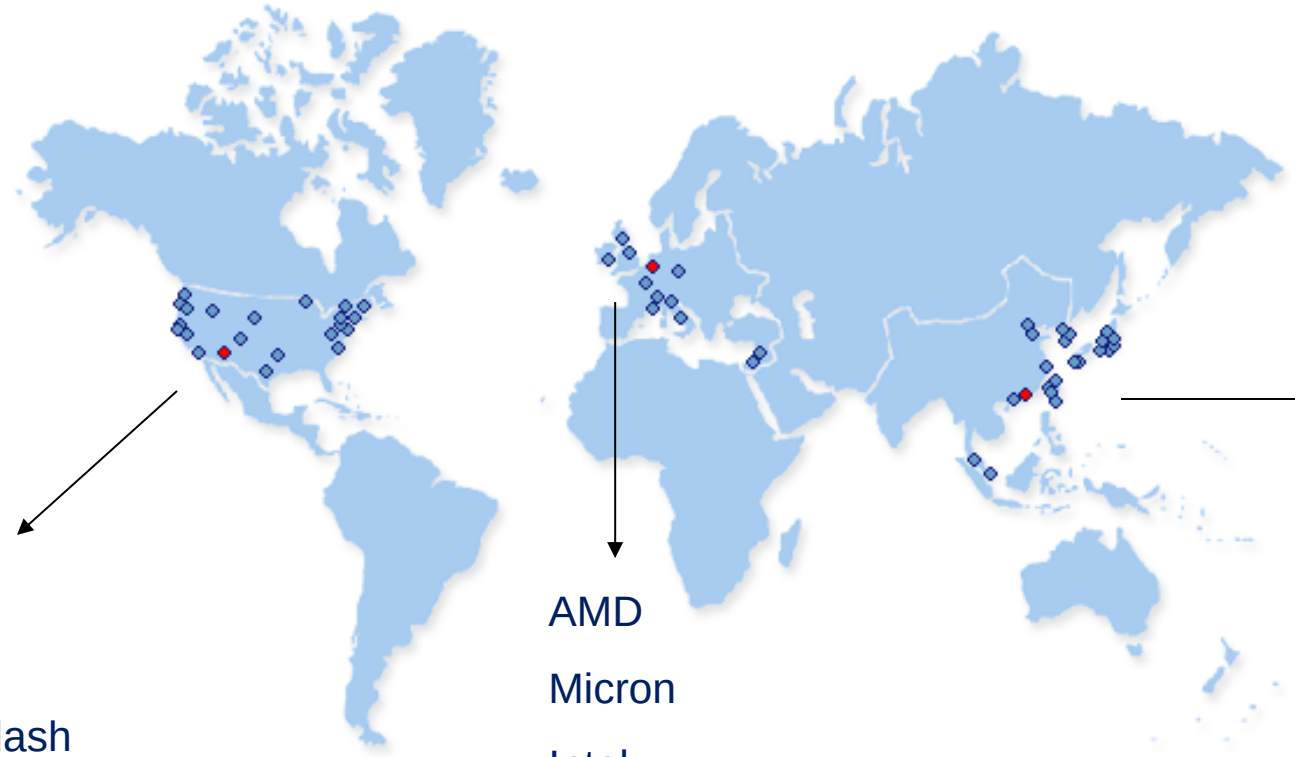
ASML is one of the world's leading providers of lithography systems for the semiconductor industry.

What is Service Logistics at ASML?

Connecting with customers and suppliers and strong focus on directly improving availability and cost of operations,
supplying spare parts through worldwide network and
commitment to outstanding customer support!

Worldwide Logistics: Different regions

Regional organized (USA, Europe, Asia)



Intel

IBM

TI

IM Flash

Micron

Samsung

AMD

Micron

Intel

Microelectronics

Samsung

TSMC

Hynix

Toshiba

UMC

Panasonic

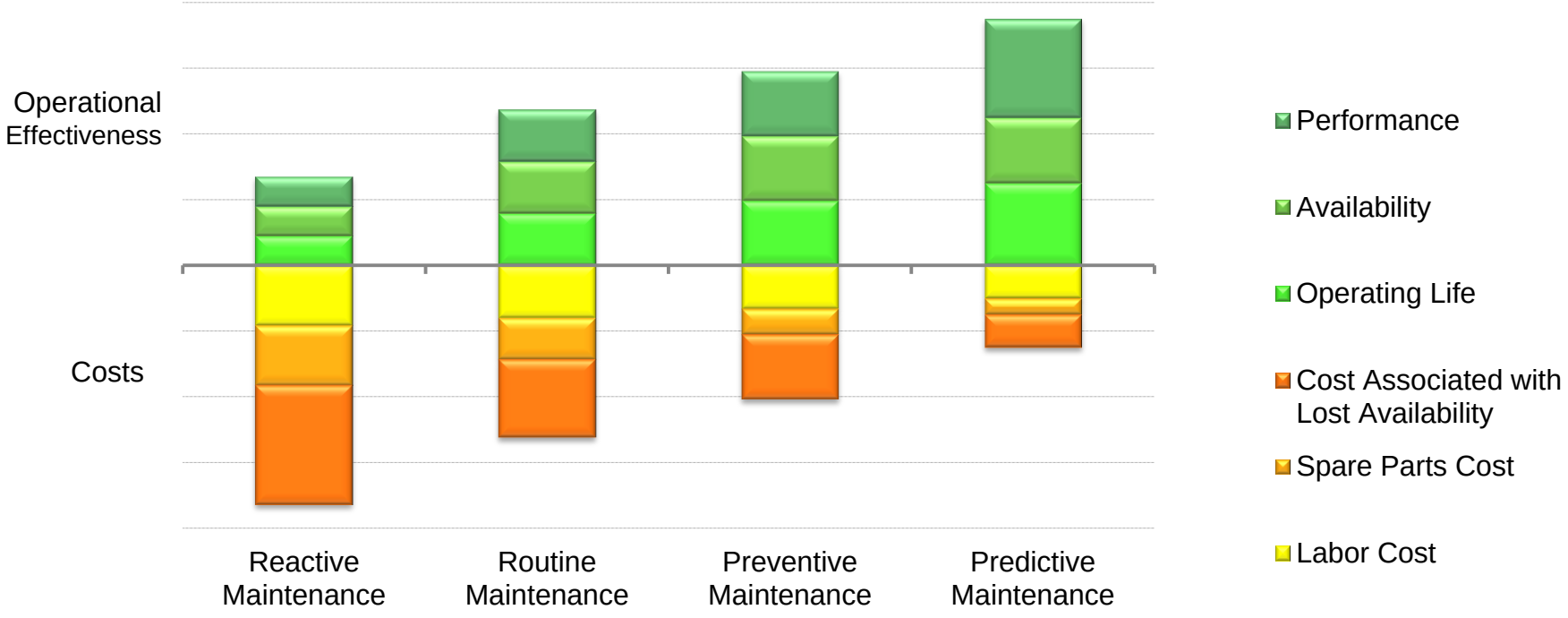
Remote condition monitoring to prevent unplanned maintenance

ASML

Impact at ASML:

- Based on data mining, algorithms were devised that predicted 70 % of breakdowns correctly, with no false predictions
- Preventive maintenance has gained significantly, leading to better planned maintenance and a severe reduction in spare parts stocks

Increasing the Operational Effectiveness and Lowering the Total Cost of Ownership of a client's Material Handling System



From Maintenance to Asset Management

- Maintenance of complex systems gets increasingly complicated for asset owners
- Asset owners require higher system availabilities (less downtime)
- Asset owners consider TCO as key performance indicator

- Maintenance is outsourced to OEM's or specialized service providers (pooling of resources, pooling of data, remote monitoring)
- More extreme: One sells the function plus system availability
- Feedback to design (better systems, improved sustainability)

Conclusions

- An increasing number of companies recognizes the potential of smart asset and service management to improve systems performance at reduced operating costs
- Implementation however is not easy and requires careful design of both methods, tools and infrastructure.
- Adequate data recording provides a starting point, while tools based on sound analytical methods are indispensible to reach quantifiable results. In addition, significant effort is needed to train employees / staff
- Impact of new technologies may significantly enhance service possibilities (remote sensing and diagnostics, 3D printing, etc.)
- Even more important is the design of sound business models that clearly demonstrate the win-win, and achieves a fair allocation of the benefits to both asset owners and service providers.

Questions/discussion?