From Supply Chain to Supply Network – Securing Supply in the Volatile World of Semiconductors





Eindhoven, 14 October 2015 Dr. Hendrik G. Seliger, Vice President Supply Chain Management Carl Zeiss SMT GmbH

The ZEISS Group Around the World Fiscal Year 2013/14





30 September 2014 *The values deviate from the published figures of Carl Zeiss Meditec AG as a result of different consolidation models.

Sites & Employees





Market Sizes & Market Players





Source: Gartner Dataquest (March 2015)

Revenue





*) Fiscal year start in January until 1995 incl., in October thereafter

Semiconductor Manufacturing Equipment from ZEISS





Lithography Optics Product Overview





What now does all this mean for the supply chain?



CHALLENGES

- Complexity of systems is increasing
- Fewer players lead to higher volatility
- EUV pending availability of entire ecosystem, keeping the supply chain in suspense



How to secure supply in the volatile world of semiconductors?

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No more "chain" – enter the network



Three generations of technology – two leaps in complexity

120,000





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120,000 parts, each in its own (shoe) box, go quite a way – 43km!



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Kits are a first step to reduce complexity – and capital employed

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The natural evolution of a kit is the module – if your design permits it



Modular sourcing comes with a number of challenges

- The design must allow a cut into modules
- Protecting core competencies will limit opportunities
- Shifting to more outside value creation challenges internal systems

And EUV is more complex than just a lot of pieces

Progu

INCOM

NOM

Pieces getting bigger and need more space

Machines bigger and better ... with higher invest

Throughput time going up

Specifications getting ... tight

Cleaning on a new dimension

TEAMWORKING

Ongoing project "digital assembly" will drive reliability of process

From EUV <u>manu-facture...</u>

- Extremely increased complexity and number of (different) parts
- No platform solutions available
 - Minor errors can lead to catastrophic failure
- Dramatically increased cost of quality assurance

Classical processes are not sufficient for highly-reliable assembly! Paradigm shift



...to 'Digital Assembly'

Intelligent Assistance Systems
for highly complex assembly

 Highest Quality (Zero Defects), Efficiency and Short Throughput Time

- Guiding Workers through digitized processes (Digital Fastening, 2/3D Visualization, Augmented Reality)
- Digital Linking of Process Documentation, Material Flow Control, Monitoring, KPI-Capture, and Order Tracking



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In addition, digitizing processes allows integrated process control

Critical nut ...



Despite tightening according to work instruction (5Nm), the nut is loose and can be removed by hand Digital recording of as-is data shows moment is too low (1.2 – 1.6 Nm) – further assembly can be stopped

...could have been identified earlier



Selection of suppliers will undergo a paradigm shift

Component focus

Mechanical parts fabrication

Build to print

Optical materials

Actuators & sensors

Module focus

Design to cost Supply Chain Management

Project management

Integration

Risk Management

Module Development

Systems Engineering

Requirements management

We adjusted the classification of suppliers to prepare for future needs



How to secure supply in the volatile world of semiconductors?

Backaround in

- Fotolia com

Cyclicity in market comes annually and with technologies. And then some...

Graph removed due to copyright limitations!

Industry consolidates – who can still afford to build a fab?

Rising costs of leading edge fab

Costs¹ of leading edge fab in bn USD

Leading edge chip manufacturing as a game of three

Capex¹ of top 4 chip manufacturers in bn USD

Graph removed due to copyright limitations!

Delays in EUV are holding our supply chain in suspense

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The Supply Network helps to stabilize

Strengthen relationships

Provide business opportunities

Share approaches, language, tools

Speed up joint response to new requests

Provide long-term perspective

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Transparency across tiers will be our next step

- Open books? Yet protect IP!
- Share data systems? Or minimize interfaces?
- Manage inventories together?
- Establish common processes?
- Build on existing platforms Industrie 4.0

We agreed a code of conduct with the network partners

Business Conduct Guidelines for the Carl Zeiss SMT Supply Chain Network

The network partners represent a wide range of industry actors pursuing a variety of business models and strategies around leading edge technologies in the field of the EUV and semiconductor business. It is part of the network's objectives to provide an adequate self-regulatory framework to its partners and as a part of that the network is publishing the following Business Conduct Guidelines:

> Be an **honest**, **reliable** and exemplary partner in the network Conduct business within the network in the best interest of all network partners

Commit to ethics and compliance

Act with integrity and in fairness, maintaining a safe, respectful and dignified working environment

Act in manner Serving the spirit of the network, regardless of whether or not there is a legal obligation to do so

Disclose conflicts of interest, they should be diligently identified and disclosed to all partners concerned

Maintain confidentiality and safeguard the interests of the network partners to protect information from inappropriate disclosure

Do no harm to the industry, society or environment. All business should be conducted in a responsible

manner and within legal and regulatory requirements

Improve the performance and support a **SUStainable** development of the network Respect and promote the Business Conduct Guidelines

Success in business requires the generation and analysis of options and the pursuit of competitive advantage. To this end,

all network partners are committed to act in care of a **prudent businessman** and to comply with ethical, commercial and legal requirements without any exception.



A NEW WORLD THAT ADDS (MORE) VALUE

YESTERDAY'S SUPPLIER, TODAY'S PARTNER*: THE CHANGING ROLES OF INDUSTRY PLAYERS



2000 2020 Component **Outsourcing of** Integrated Vinks in value outsourcing supplier THE FUTURE TRADITIONAL CHANGING ROLES: ROLE SPLITTING: Supply chains become IS NOW: Suppliers contribute more complex and OEMs are "lean". individual parts OEMs farm important suppliers share to production. production steps out responsibility for to specialists. complex systems

Sources: Brainport Industries, Roland Berger

1980

THINK ACT // COD INSIGHTS

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and processes.

* EXAMPLE:

CAR INDUSTRY From raw metals to sunroofs

COMPONENT PRODUCTION Metalworking Supplier: Brinks Metaal

Hydraulics

Customer: Power-Packer SUB-ASSEMBLY

So, is the network the future of all chains?

Or, to borrow from Winston Churchill: "It has been said that the supply network is the worst form of supply management, except all those others that have been tried."

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...and the goal of our work?

MADE BY CARLZEISS



The moment when the supply chain becomes a network and we all gain.

This is the moment we work for.



We make it visible.



We make it visible.