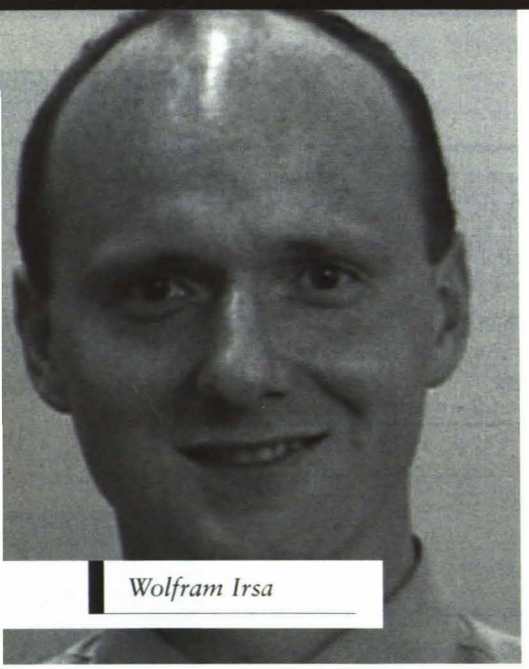

Wolfram Irsa

Since March of 2001, Wolfram Irsa has held Industrial Engineering responsibility for Business Unit Emerging Businesses at PHILIPS Semiconductors in San Jose, California. For two years prior to that, he worked in Supply Chain Management at PHILIPS Semiconductors in Hamburg, Germany. Other positions at Philips have included Business Line Identification in Gratkorn, Austria. He holds a Master of Science degree in Industrial Engineering from the University of Graz.
Further he holds certifications of APICS in Integrated Resource Management and Production and Inventory Control. He teaches Supply Chain Management classes for APICS since spring 2002. He is the past-president of the local Toastmaster club.

Lessons from the Semiconductor Industry – Supply Chain Management in a dynamic environment

Introduction

High-value products that quickly become obsolete, a far-flung manufacturing network, rapidly declining prices, and a demanding customer base. The supply chain challenges facing the semiconductor industry are complex. But they are not necessarily unique. In fact many companies will experience these very same challenges (if they haven't already). Here are three valuable lessons from the semiconductor industry.

Reference

APICS CPIM (Certification in Production and Inventory Management): Master Planning of Resources
Institute of Business Forecasting
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Semiconductor Industry – Facts and Figures

In 2002, semiconductor sales were $ 155 billion on 322 billion units shipped. These numbers sharply decreased from the 2000 boom year with $ 220 billion on 453 billion units shipped. Exhibit 1 shows the revenue roller coaster of the semiconductor market from 1998 to 2002; Exhibit 2 holds the top10 ranking of 2002.

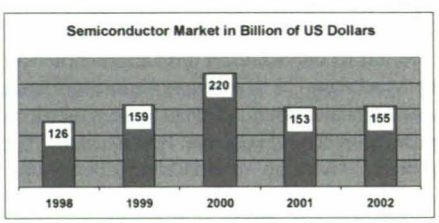

Exhibit 1

Top 10 Chip Suppliers in 2002 [Source: WSTS]		
2002 rank	Supplier	2002 sales
1	Intel	$ 23.47 billion
2	Samsung	$ 9.18 billion
3	STMicro	$ 6.31 billion
4	Texas Instruments	$ 6.20 billion
5	Toshiba	$ 6.19 billion
6	Infineon	$ 5.36 billion
7	NEC	$ 5.26 billion
8	Motorola	$ 4.73 billion
9	Philips	$ 4.36 billion
10	Hitachi	$ 4.05 billion

Exhibit 2

The industry experienced double-digit growth rates in 1999 and 2000. After the drop in 2001 the industry is back to the level of 1999. The major players are strengthening their positions for the next up-turn. The dominance of Intel is quite striking; Intel revenue is 2.6 times higher than the revenue of the following com-

pany Samsung. The Top10 Semiconductor companies account for 48% of the total market.

The Operating Environment

Semiconductor products are a fundamental building block of the information economy. Chips are small, extremely valuable, quick to become obsolete, and globally produced and distributed. Customers measure product life cycles in months. Inventory is precious early in a product's life cycle but its contribution to profit can drop by 80 percent in a year. The essence of the business is Moore's Law – that is, every 18 months performance capabilities double, putting continuous pressure on prices for older chips.
(Gordon Moore was a co-founder of Intel Inc, Santa Clara, California; the 'Law' is actually an observation that proved to be astonishingly accurate for the last 20 years and seems to continue valid for at least another 10 years.)
Faced with an absolute need for speed, chip manufacturers use airfreight as the default transportation mode, except where surface delivery is as fast or faster. Shipping across oceans, accommodating extraordinary growth, and supplying key customers overnight are routine challenges in the high-technology world of semiconductor logistics. Exhibit 3 shows the complex supply chain in semiconductors.

The lead-time from the start of the wafer to finally distributing the chip to the customer is typically 9 to 13 weeks. The dynamics within this long lead-time needs to be managed carefully to utilize the very expensive – a state-of-the-art wafer fab costs $ 2 Billion – assets as good as possible. A modern semiconductor operation needs at least 70% utilization of its equipment to be profitable.

The operating environment for semiconductor logistics is influenced by three elements:
- the increasing level of customer expectations
- the dispersed nature of the manufacturing network,
- and the sky-high costs of the operation as well as the inventory.

Understanding the interplay between these factors is fundamental to grasping the problems and potential of supply chain management for semiconductor manufacturers.

Lesson 1: Keep the inventory upstream as long as possible

In order to guarantee effective inventory and asset management follow a simple rule: Don't make what the customer doesn't need. In a day-to-day operation this means that only material gets started when a firm customer order is placed. This type of operation is called 'Make-to-Order'.
Nevertheless in some instances, e.g. for high-volume products with steady demand the type of operation can shift into 'Make-to-Stock'. Exhibit 4 shows the major difference of these two concepts.

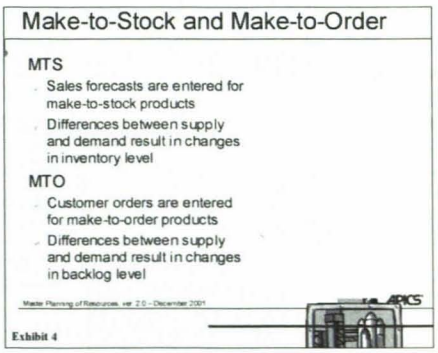

Exhibit 4

The further down the supply chain the material moves the less opportunity exists to change.
And because every added value step in the operation means substantial costs the work-in-progress material – in a broader sense the inventory – is kept as long as possible upstream in the supply chain.

Certainly this implies that as soon as a firm demand needs to be supplied the operation executes as fast as possible to satisfy customer expectations.

Some tailored programs with customers keep inventory in the middle of the supply chain. The manufacturing process is then completed when orders are received. This approach shortens the delivery lead-time by roughly 7 weeks. The term for this concept is called 'Assemble-to-Order'.

Lesson 2: Treat customers unequally

Although it is important to provide a consistent service to each customer, it is not necessarily required or practical to present the same service to all. Some high-volume, high-margin customer will need a closer relationship, while some

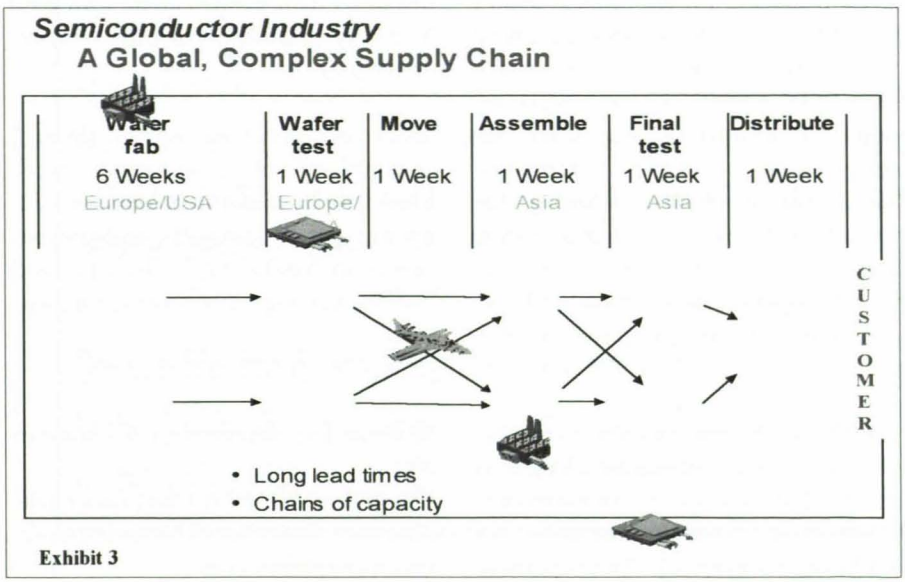

Exhibit 3

lower-volume, lower-margin customer may require less attention. This may counter the idea of having standardized business processes and procedures but actually it is not. Standardized processes and procedures allow decisions about service levels to be based more on business need, and less on the limitations of processes and procedures.
A useful tool is to define Time Fence Policies, see Exhibit 5.

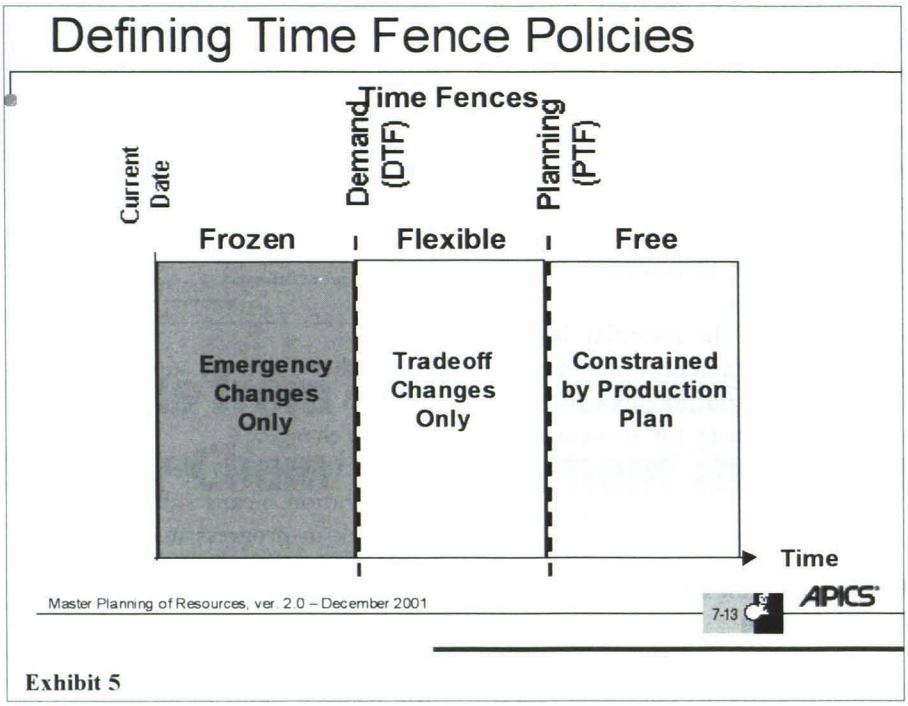

Exhibit 5

The Demand Time Fence (DTF) covers the period of actual customer demand; usually it is set to cover the production, assembly and delivery time. Inside the DTF the manufacturing plan is 'frozen'. Changes inside the DFT are costly and complicated. Only for very special customer changes will be authorized which requires generally higher management approval.
The Planning Time Fence (PTF) reflects a time span where the manufacturing plan is still flexible. Updates and changes are made by the assigned supply chain personnel as needed to fulfill the customers' requests. It covers a combination of actual demand plus forecasted demand.

Beyond the PTF – usually 18 months – limitations are only based on the overall installed capacity as derived from the strategic production plan.

Lesson 3: Inventory visibility throughout the supply chain does matter

The mismatch between manufacturing cycle time and customer planning horizons is a familiar problem for logistics professionals. There are two general approaches to „fixing" the resulting customer-service problems – holding higher inventories or operating on shorter cycle times. As noted above, holding more inventory/ safety stock is prohibitively expensive for the semiconductor industry. So the industry is working hard to shorten cycle time, and improve process flexibility. Fast transportation, improved information, and better processes are the only realistic alternatives. Semiconductor companies are striving to pattern themselves after high-profile success stories such as Dell's assemble-to-order operations and Hewlett-Packard's postponement program for printers.

„Don't give the customer time to go elsewhere." Another important element is the speed of response. A four hours time window to confirm customer orders is a wildly used benchmark. This is particular impressive knowing that in this time frame global operations and distribution networks are checked against feasibility to fulfill the order.

Important factors towards reaching these goals are:
1. State-of-the-art information systems.
2. Scheduling discipline at all points in the supply chain all the way through to the customer.

For short-lifecycle products that are manufactured and sold globally a well-trained work force with truly good understanding of the interplays is key.
3. Real-time information to depict the schedules in the systems as accurate as possible.

„Move information first, material second." Information can be moved more easily than material. Leveraging information well eliminates inefficient or unnecessary material movement, which lowers costs and improves service.

Summary

The semiconductors industry is a trend-defining field that determines directions for many other industries.

Semiconductors are almost as perishable as fresh food or designer fashion – a fact that makes inventory expensive. Smart inventory management along with good inventory visibility are an important differentiator.

Mass customization enabled through 'assemble-to-order', operational excellence by adjusting the processes to different types of customers, and fast execution are from a supply chain perspective the key ingredients for future success.

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