

# ISMI Global Economic Symposium sheds light on new business constraints

**A** debate over ramifications of the timing of the industry's move to 450mm wafers, as well as a rational business model for silicon suppliers, were among issues explored at the recent International SEMATECH Manufacturing Initiative (ISMI) Global Economic Symposium (Nov. 18, San Jose, CA).

Admitting that his views are controversial, Applied Materials' Iddo Hadar, managing director, corporate strategy, plunged right into his economic analysis. Data tracked by the Federal Reserve Board indicates that fab productivity added \$500 billion to the US economy in the late 1990s. By Hadar's estimation, these gains came about because of nearly \$40 billion spent on process R&D across the industry in the early 90s.

Hadar also noted that it was equipment suppliers—able to match R&D funding on the part of the semiconductor manufacturing industry—that enabled the two-year roadmap cycle. But now, "The ability of suppliers to match R&D funds has deteriorated," he argued, pointing to the broad array of alternatives being pursued by the industry for the 65nm and 45nm nodes, all per the guidance of the ITRS. For example, there are four types of substrates being worked, two different device structures, five different kinds of gate dielectric materials, two new gate electrode architectures (that in turn require more than six new materials), and two types of source/drains. All of these factors contribute to most of the industry going back to a three-year cycle.

Perhaps more ominous was Hadar's contention that any delay in going to 450mm wafer manufacturing will increase the development bill, just as happened during the delayed 200mm–300mm transition. According to Hadar, that delay caused R&D spending on 300mm to nearly triple, and resulted in redundancy of efforts. In one scenario, Hadar calculated that a \$20 billion investment (on the part of the total food chain) would take 30 years to recoup, assuming a

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30-year lifecycle and a peak at 50% of the silicon area processed. "That's a long time and many companies don't survive that long," said Hadar. He believes that if the industry moves to 450mm manufacturing the same way it did with 300mm, it would be worse off and would not come close to recouping its investment.

Hadar suggested that equipment suppliers and IC manufacturers must share the risk in going to 450mm wafers and avoid duplication of the start-stop-start experience with the 300mm transition. He held up the X-Initiative as one example of a successful collaboration between these groups. More fundamentally, however, he said the industry has to decide what its investment priorities should be: installed base improvement, future technology, or the next wafer size. Hadar tended to agree with a suggestion that some suppliers are increasing their support of the secondary equipment market and fab services in an effort to spend more on the installed base.

While equipment suppliers have had problems coping with recent market dynamics, materials suppliers have faced challenges as well. Karen Twillmann, director of market research at MEMC and representative from SEMI's Silicon Manu-

facturing Group, told attendees that semiconductor units—not revenue—drive the silicon market. She estimated that about \$6 billion of the projected \$15 billion of materials sales in 2004 will be in silicon.

According to Twillmann, since 1997, the 200mm silicon market has faced accelerated price erosion due to overinvestment in capacity. She pointed to the decision last year by SUMCO and Siltronic to take out some of their 200mm capacity as a response to this supply/demand imbalance. "No industry or company has survived over the long term with an inverted asset-turn model," she warned. "Today, everyone is cautious in making 300mm investments—the intent is to have a natural balance between 200mm and 300mm demand."

Reviewing some basic economics, Twillmann identified what she called a broken ROA model. If any company in the industry spent 25% of its revenue on capital expenditures—with its resulting 25% depreciation costs—it would take a 45%-55% gross margin just to break even, she explained (assuming 10%-15% cash costs and 10%-15% operating costs). For MEMC, the obvious solution is that silicon suppliers should spend no more than 15% of revenues on capital expenditures.

One bright spot is the diversification of semiconductor applications where long-term demand is expected to keep growth steady. Twillmann noted that applications such as SOI and strained silicon, along with high-quality wafer products such as low COP and COP-free wafers, and epi and annealed wafers, all help to de-commoditize silicon—she noted projections of 8%-10% CAGR between 2003 and 2009. Meanwhile, the 300mm segment is gaining share, from ~12% now to ~20% by the end of 2005, with 2008-2009 being the expected crossover point (see *Wafer-News*, V11n40, Oct. 4, 2004).

Despite the rosy outlook for the silicon market, however, Twillmann predicted consolidation will occur in the silicon industry within the next few years, as profitability and survival become key to winning in the materials sector. Currently there are seven producers of 300mm wafers; in 1993 there were 11 producers of 200mm wafers, and pre-1990 there were more than 20 producers of ≤150mm wafers. Answering a question about silicon suppliers in China, Twillmann noted that very little is known about them—it is very difficult to track them, although industry groups such as SEMI are trying to do so. — D. V.