

# How to Respond to Changes in the Semiconductor Value Chain

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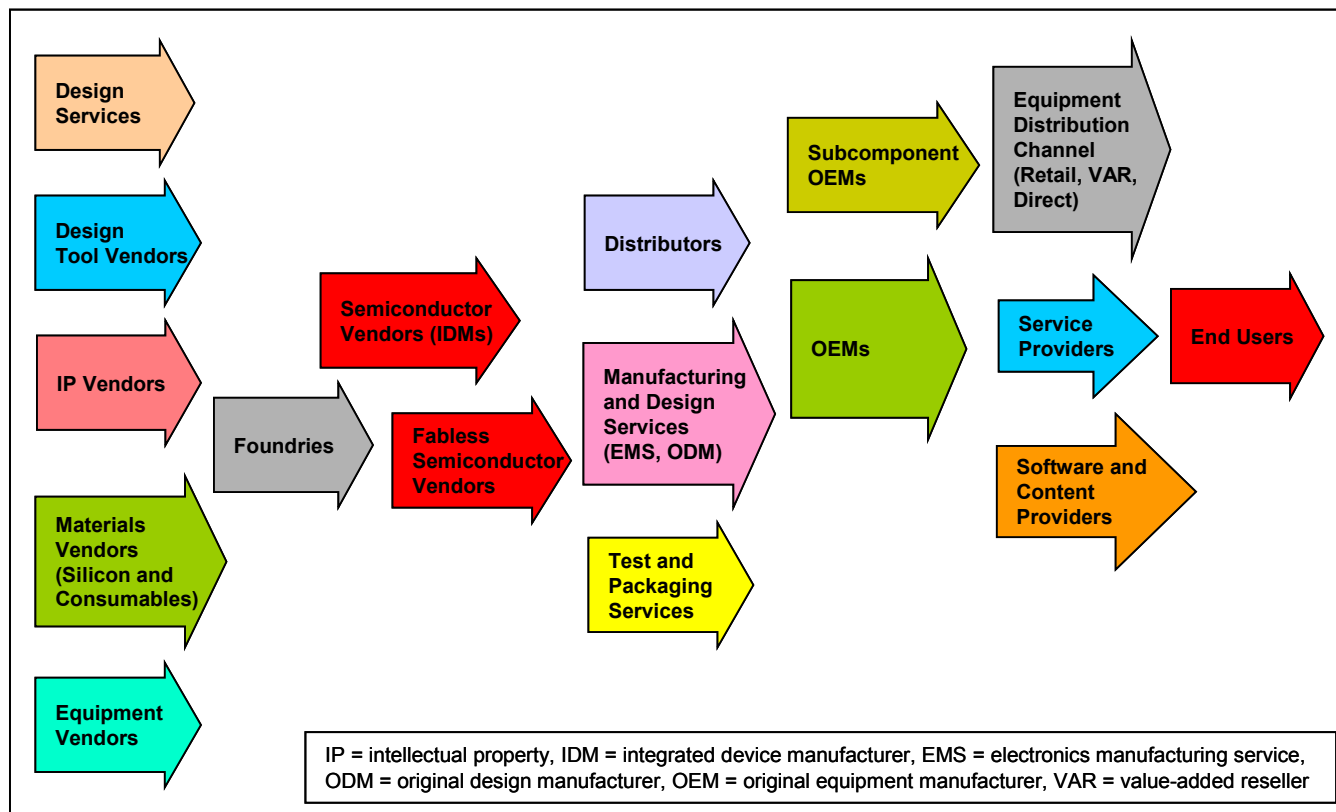
The web of relationships that forms the semiconductor "value chain" is evolving as a result of pressures on both the demand and the supply side. Chip vendors need to alter their business models in light of these changes.

## Analysis

This Spotlight focuses on the changes taking place in the semiconductor industry value chain, and what vendors should do to increase the value they add to raise profits, or even to survive.

According to Michael Porter's classic value chain model (published in his book, "Competitive Advantage" in 1985), the goal of each activity in a value chain is to add more value for the customer than the cost of carrying out the activity. The ability to add value depends ultimately on a cost advantage, on differentiation, or on the ability to reconfigure the value chain. Roughly speaking, the semiconductor value chain consists of materials and equipment suppliers, manufacturing and other service suppliers, semiconductor device vendors, distribution channels, original equipment manufacturers (OEMs), associated service and content providers, and equipment end users (see Figure 1). The structure of the value chain changes periodically, depending on the degree of vertical integration that maximizes profits at a given point in time.

Figure 1. Participants in the Semiconductor Industry Value Chain



Source: Gartner (March 2005)

Industry trends will likely cause a shake-up of the supply and demand sides of the semiconductor industry. Processes, or core competencies that led to success in the past, are now becoming commoditized. Also, the value in semiconductor devices is shifting away from manufacturing into design. At the same time, maintaining fab utilization is becoming more challenging. Lifetime semiconductor product volumes are decreasing — particularly relative to the growing scale of fabs — because of the proliferation of low-volume applications and of chips with greater levels of application-specific functions.

Meanwhile, the value of end-equipment is shifting from hardware to services, content or even brand and industrial design. As the industry matures and consolidates, understanding where the value and profits will lie becomes a survival issue. More than ever before, industry participants must consider the impacts of developments further up and down the value chain, and must prepare to deal with an increasingly complex group of stakeholders. They will undoubtedly have to adopt new business models, possibly involving outsourcing some operations to build new downstream competencies, closer to end-customers.

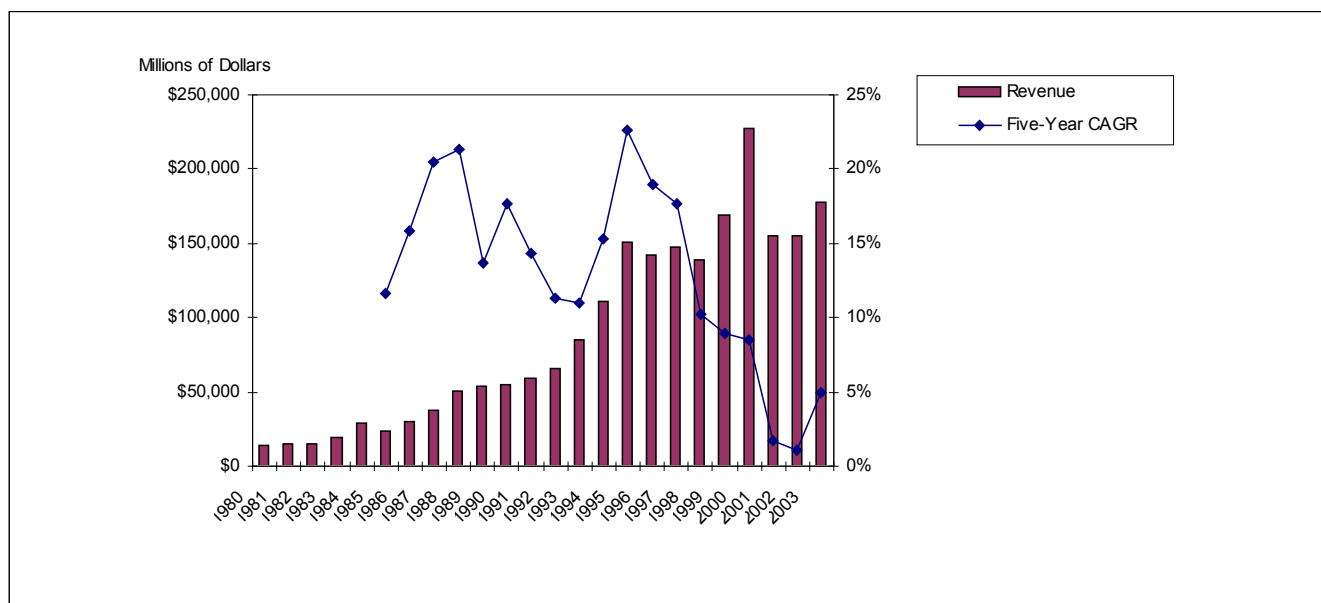
The major changes affecting the industry can be highlighted by considering downstream (demand) and upstream (supply) changes in the value chain affecting semiconductor device vendors.

## Demand-Side Changes

Through the 1980s and 1990s, the semiconductor industry grew in a fairly predictable way, thanks to steady growth in electronic equipment demand. During this period, the market grew at a five-year compound annual growth rate (CAGR) varying between 11 percent and 23 percent (see Figure 2). The market was driven by clear "killer" applications, most recently PCs and cellular phones.

Since 1998, the overall growth of the total available market (TAM) has slowed, and the five-year CAGR now hovers around 5 percent to 10 percent. We expect overall growth to remain at this level through 2010. As growth in key demand drivers such as PCs and cellular phones has slowed, the industry has been on the look out for new, market-dominating applications. None have yet emerged. Instead, demand will likely be driven by a large number of relatively low-volume applications, which makes it difficult for integrated device manufacturers (IDMs) to keep their fabs running at minimum efficiency levels and to support design and manufacturing costs.

Figure 2. The Five-Year CAGR of the Semiconductor Market Has Slowed Since the Late 1990s



Source: Gartner (March 2005)

At the same time, boundaries between application categories are dissolving. Convergence and pervasiveness now define the market. Instead of killer applications, the industry must design for killer functions, such as wireless connectivity, which span multiple product categories. This greatly increases the potential number of OEMs that semiconductor vendors need to sell to, and the end-markets they need to understand.

In addition, many applications are becoming commodity products, and the value and power on the demand side of the value chain are moving from hardware to service and content providers. As a result, semiconductor vendors must anticipate the needs of, design for and do business with a new,

heterogeneous group of clients far beyond the OEMs. As the number of value-chain stakeholders grows, margins will likely be squeezed because the value associated with electronic applications will be distributed among a greater number of intermediaries. To survive, vendors need to think beyond technology features. Usability and the ability to tie semiconductor features into content and services will play a key role in survival, as will turnkey systems solutions to clients that could be OEMs or even electronics manufacturing service (EMS) providers or service providers.

By themselves, these changes in the demand side of the value chain will have a significant impact on market dynamics. But semiconductor vendors must also take account of the growing power of consumers. By 2010, nearly 50 percent of the semiconductor TAM will be tied to products bought by consumers, a notoriously fickle, low-margin and time-sensitive market segment. Design will likely be driven as much, or more, by marketing factors than pure technology considerations. Meeting the demands of consumers will be a considerable challenge, given the increasing complexity, design-time and cost of future chips. To excel in this environment, semiconductor vendors will need to predict what consumers actually want from their gadgets. Success will require much more downstream marketing activity than before. And semiconductor vendors will need to recognize that time to market is a critical differentiator and will have to create flexible product portfolios — for example, by incorporating third-party intellectual property (IP).

### **Supply-Side Changes**

Given the enormous capital and operating costs involved in semiconductor manufacturing, semiconductor vendors have for years debated the relative profitability of various business models. Today, about 13 percent of the semiconductor TAM can be attributed to fabless vendors. Financial reality and industry maturity will likely continue drive consolidation IDMs into a few cross-industry "super-IDMs" and a few strong alliances, with a majority of remaining semiconductor vendors adopting the fabless model. This will inevitably lead to an increase in the power of foundries in the value chain. Semiconductor vendors will fight among themselves to get priority status with foundries, to ensure foundries makes the chips they need when capacity is tight. Vendors will also have to make high-risk decisions on which industry participants to form alliances with and share IP with.

As industry costs continue to increase, the most critical issue to resolve will be which players — if any — will be profitable enough to bear the burden of process and materials R&D. This burden has fallen further back along the value chain — today equipment makers and materials manufacturers have to take on major risks to stay abreast of technology. For them, lead times for new product development are long and the payback is uncertain. Thus, product development decisions — in effect bets that often tie into needs of specific customers — can have grave consequences. If a technology that a major semiconductor vendor is driving and demanding fails to achieve large-scale adoption, the investment in process R&D will never produce a return. Increasing costs are thus likely to further drive technology commoditization and industry consolidation because equipment and materials manufacturers will need the security of a "sure bet" in the form either of a "super-IDM" or of powerful alliance of many guaranteed clients.

## Semiconductor Vendors Must Respond to the Changed Value Chain

Faced with changes on both the supply and demand side of the semiconductor industry value chain, device vendors need a greater understanding of upstream and downstream markets. They must make strategic business decisions on business models involving outsourcing, IP strategy, partnerships, and target clients and markets. Maintaining the status quo is not an option. To survive, semiconductor vendors must adapt to the changed dynamics of the value chain.

### Features

The features in this Spotlight explore the issues arising from changes in the semiconductor value chain. We have grouped them into three categories:

- Overall changes in the semiconductor value chain
- Changes within specific segments of the value chain
- Tactics for dealing with changes in the value chain

### Overall Changes in the Semiconductor Value Chain

"Evolution of Semiconductor Value Chain Leads Vendors to Seek New Growth and Profit Opportunities" — We provide semiconductor companies with advice on how to create growth and profits now they have outsourced everything but design and marketing. **By Stan Bruederle**

"Semiconductor Outsourcing Vendors Capture Outsized Value in Electronics Supply Chain" — Semiconductor intellectual property providers and foundries have the highest operating margins in the electronics supply chain. **By Jeremy Donovan**

### Changes Within Specific Segments of the Value Chain

"Chip Vendors Face a Shifting Value Chain for Mobile Phones" — Suppliers of semiconductors for mobile phone constantly need to assess their position in the value system to maximize opportunity and profit. **By Alan Brown**

"Semiconductor Equipment Industry Must Face Realities of Change" — The semiconductor equipment industry will have to change the way it operates to ensure the necessary rate of new technology development can be maintained. **By Bob Johnson and Klaus Rinnen**

"Foundries Enhance the Semiconductor Value Chain" — Silicon foundries have captured a large portion of the semiconductor value chain, but their profit margins are under pressure. **By Jim Hines**

### Tactics for Dealing With Changes in the Value Chain

"Value Stack Reveals Profit Sources for Semiconductor Vendors" — Understanding the value stack, a methodology for decomposing the revenue of a product and understanding where profit comes from, can help to shape business and competitive strategy. **By Martin Reynolds**

"Semiconductor Vendors Increasingly Differentiate With Reference Designs" — Case study of how two leading semiconductor vendors, Broadcom and Intel, have moved up the value chain to provide production-ready reference designs complete with basic application software. **By Peter Middleton**

"Real Options Analysis Reduces Business Model Risk" — Semiconductor companies can use real options analysis, a mathematical technique, to make better decisions about sourcing. **By Richard Gordon**

### **Recommended Further Reading**

"Platform ASICs Will Foster Supplier-Distributor Partnership" **By Serena Hsu**

"Market Dynamics Affect Semiconductor Manufacturing" **By Dean Freeman and Bob Johnson**

"Southeast Asia Must Integrate Its Semiconductor Value Chain" **By Kay-Yang Tan**

"Semiconductor Design and Manufacturing Opportunities in India" **By Daya Nadamuni**

### **Sample Documents on Value Chain Evolution in Adjunct Markets**

"Market Focus: Search Continues for Mobile Data Revenue Drivers (Executive Summary)" **By Nick Ingelbrecht**

"Business Model Collision Looms Closer for Service Providers" **By Kathie Hackler, James Brancheau and Mike McGuire**

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