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Event Report

SAMSUNG: ON THE FOREFRONT OF SEMICONDUCTOR INNOVATION

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On March 13, 2007, the Operations Management Guest Lecture Series sponsored an address by Chang-Gyu Hwang, president and CEO of the semiconductor business of Samsung Electronics. Just one week earlier, Dr. Hwang had hosted a group of visiting Columbia Business School students at Samsung's headquarters in Seoul, Korea. Samsung is the world's second-largest semiconductor manufacturer after Intel, and Asia's second-largest manufacturer by market capitalization after Toyota. Although a large producer of televisions and memory chips, Samsung's semiconductor division is the company's biggest by revenues and profits, with a 30.6 percent operating profit margin in the fourth quarter of 2006. Dr. Hwang joined Samsung in 1989 and has been recognized as one of the "Top 10 Big Thinkers" by Newsweek *(2005) and one of the "Top Executives of 2005" by* Asiamoney *(2006). He addressed several hundred students, mostly from the Operations Management core course, in a discussion of IT trends and supply chain management. Professor Nelson Fraiman, who teaches the Operations Management core course, introduced the speaker.*

For the 150 days a year that Chang-Gyu Hwang spends on the road visiting customers and investors and giving lectures, he takes six items with him: his smart phone (with a memory size of 8 GB), an ultra mobile PC (64 GB), a USB drive (8 GB), a digital camcorder (16 GB), an MP3 player (16 GB) and, sometimes, a portable PlayStation (2 GB). As recently as 2002, he carried just 1 GB of memory with him. He used this information to show the veritable explosion in data-storage technology that has marked the early 21st century.

All of these devices are made possible because of advancements in semiconductors, the small electrically conductive chips in all modern electronic consumer devices. Although semiconductors are a small fraction of the electronics industry, since 1997 semiconductor growth has converged with the growth of the overall IT industry. Dr. Hwang expects this trend to continue.

Dr. Hwang described four trends that are leading the evolution in IT, all enabled by semiconductors. The first is content explosion, as seen in the expansion from one- to three-dimensional images in phones, cameras and PCs. The second is device convergence, represented in PDAs that encompass phone, TV and PC capabilities. The third is the storage revolution that has produced camera flash cards as large as 64 GB and PC disks of 32 GB. The fourth is the convergence of the aforementioned three trends into devices that are smaller, slimmer, lighter and more functional.

Semiconductors have evolved since the 1950s, when the first integrated circuits were invented. This phase gave way first to the PC boom of the 1970s and 1980s, then to the mobile/consumer boom of the 1990s and finally to the wireless "terabyte age" of today that features high-density fusion in a single chip.

None of this would be possible, Dr. Hwang argued, without Samsung. Now with $62 billion in annual sales, Samsung's semiconductors power some of the world's most popular and innovative electronic consumer products, including Apple's iPhone Nano, Microsoft's Windows Vista and Sony's PlayStation. Samsung's semiconductor revenues are also well diversified, with 45 percent coming from mobile phones, 31 percent from PCs and the rest from consumer products. The company is also closing the gap with lead rival Intel. While in 2006, Samsung had revenues equal to 65 percent of Intel's, in 2007 Samsung is projected to have revenues equal to 80 percent of Intel's. Furthermore, Intel's semiconductor customers are much less diversified, with 80 percent coming from PCs.

Semiconductors are becoming a higher-risk investment, as commoditization has recently reduced prices by 30 to 50 percent. Samsung has counteracted price pressures by making its semiconductor production more efficient. In a three-phase process from demand forecast to production—in which the company closely collaborates with customers—Samsung has improved its positive customer responses from 60 percent to 89 percent, and reduced production lead time from 60 to 46 days.

Another key to Samsung's efficiency was its decision in 1988 to use the "stack" method of semiconductor manufacturing, as opposed to the more commonly used "trench" method. Before deciding on the stack method, Samsung observed two teams using both methods for a two-year testing period. IBM, Siemens and Toshiba all use the trench method today.

In 2001, production improvements allowed Samsung to meet 100 percent of its customer demand and to supply the graphic DDR chips to Microsoft's Xbox game consoles. In 2002, Samsung became Nokia's leading supplier of the NOR flash memory component.

With respect to quality management, most manufacturers build a product to meet the product's mean capabilities. However, Dr. Hwang emphasized that Samsung places importance on pinpointing a product's variance against that mean and adjusting quality accordingly. Samsung also demands that employees be "specialized generalists" and encourages innovation through the rearrangement of existing concepts, rather than always starting from scratch.

The convergence of IT and biotechnology open potential semiconductor customers to nearly the whole world. Dr. Hwang predicts the invention of a virtual human brain by 2020. Should this happen, there is little doubt that Samsung will be at the forefront.

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