Chesapeake

Customer Story

Cut Price -- Cut costs -- Boost Service: The Semiconductor Conundrum

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The commodity semiconductor market is tough -- particularly computer memory. SRAM (static RAM) prices fall by about 50% per year after product introduction; product life-cycles continually shorten; customers switch suppliers in a blink. To reduce costs as prices decline, semiconductor suppliers continually reengineer products and relocate manufacturing sites. Cypress Semiconductor, an industry leader, is taking this process a step further. The company is *reducing costs and boosting customer service* by streamlining its supply chains, worldwide. "We've got to keep delighting our customers," says T. J. Rodgers, Cypress CEO, "while at the same time cutting costs. Better management of our supply chains allows us to do both."

Cypress is well along in this effort. The $600 million semiconductor company has significantly improved its forecasting and plant loading through the use of the "MIMI" supply-chain-optimization software from Chesapeake Decision Sciences, New Providence, NJ. "To date, the Chesapeake/Cypress partnership has shown excellent results, and there are many more to come" says Rodgers.

The company's on-time delivery performance has improved from the mid-eighty percent to the high nineties, through the use of this new decision-support software. Plant utilization has also improved, as has management communications throughout the organization.

Long lead-times, short life-cycles, quick deliveries --- a deadly combination

Cypress supplies integrated circuits to leading computer, networking and telecommunications companies worldwide. Products include static RAM (SRAM), program read-only memory (PROM), data communications devices, programmed logic devices, computer products (e.g. clocks), and modules for custom PCs and workstations. The company's global network of four wafer fabrication plants and ten assembly and test facilities produce 450 chip types and 37,000 SKUs, presenting a mammoth production planning challenge. Beyond that, semiconductor product life-cycles are notoriously short, sometimes under two years; plants must gear up for accelerating new-product demand from customers who expect shorter delivery times, minimizing their own inventory needs. To further complicate planning, new semiconductor plants come with long lead times and immense capital investment, so expansion planning is risky. "We had reached a point where conventional planning and scheduling methods fell far short of meeting our needs," says Steve Alexander (title).

This inadequacy surfaced in day-to-day operations. Though production capacity was being expanded, present plant and equipment utilization was low -- in some cases as low as 45% -- and customer deliveries

suffered. Root cause analysis showed that most times the bottleneck was in work planning and sequencing.

Cypress management recognized these problems in early 1995, and set out to improve performance by focusing on their supply chain. Supply chain optimization held the promise of closing the gap between customer demand and production capacity, while also improving customer service and return on assets.

Cross-functional team calls for new information tools

Supply-chain issues span many departments, so management assembled a cross-functional team to identify corporate requirements going forward to the year 2000. Representatives included fabrication management, inventory control, production control, assembly and test, MIS, finance, new product planning, sales and marketing and industrial engineering. "First we discussed the business issues, desired outcomes and management of the effort," says Steve Alexander (title). "Then we developed an unconstrained 'dream list,' from which we made trade-offs and set priorities for intended accomplishments."

It soon became clear that new information modeling tools were needed to enable the desired changes. Existing legacy systems were inadequate, and planners routinely spent days populating spreadsheets with scheduling data.

Alexander notes, "Our systems were fine for recording transactional activity, such as orders, shipments and backlog. But for planning and scheduling, they fell seriously short." New systems' objectives included:

(1) "Evergreen forecasting" - the forecast data is current and frequently updated.

(2) Improved order commitment - deliveries are made on time.

(3) More efficient plant loading - production resources are planned based on customer need.

(4) Higher plant utilization - production assets are efficiently utilized.

After defining specifications, the team contacted supply-chain software suppliers, and reviewed 40 different offerings. Six suppliers made the short list; each received a list of specific points to address, and a snapshot of Cypress logistical data (backlog, capacity, etc.).

Each vendor made a one-day presentation to the team, and was evaluated based on product offering and business risk posed to Cypress. "Chesapeake's MIMI tool was fully-integrated, and had the most power and flexibility to meet our needs," says Alexander. "Their people also related well to our business." Following a presentation to T. J. Rodgers, Chesapeake was chosen as the supply-chain partner. The key solution components chosen were:

- Demand Management (forecasting)
- Planning and Optimization (linear program modeling)

- On-line Order Commitment (Able-To-Promise)
- Local Area Scheduling (local shop floor)

With the selection behind them, the Cypress team moved on to a multi-week evaluation, focused on solving an actual Cypress business problem. Says Alexander, "Frankly, there hadn't been a lot of success with planning and scheduling tools in our industry. So, we wanted to see something up and running with our data." During this focused, short-term pilot program, Chesapeake and Supply Chain Consultants of Newark, Delaware (developer of the MIMI Demand Management Module), worked with Cypress to generate a first set of planning models. "We were quite pleased with these initial results," says Alexander.

Better forecasting needed

Good planning requires good forecasting, so forecasting market demand was at the core of the new planning process. "We can't afford lost capacity by underloading our plants," says Alexander. "But conversely, we can't afford to build lots of inventory. So, our forecasting system must look ahead and tell us what we need to build with minimal risk."

Departing from traditional wisdom, the team used actual shipment history as the basis for creating the new forecasts. "We had used historical customer orders to help predict future production requirements," notes Alexander. "But forecasts were perpetually low, since production capacity consistently lagged customer demand."

The new forecast data was staged in a relational database system, eliminating almost all manual spreadsheet-based effort. This automated process for loading data greatly reduced forecast preparation time. Also, the MIMI Expert Systems and Demand Management modules provided statistical forecasting models, heuristic rules, and reporting and graphics tools to provide better views of market demand. "These changes enabled our planners to stop being data managers and get back to their mission of analyzing demand and efficiently loading our production facilities" says Alexander.

As Cypress planners prepare their outlook, they look for opportunities in the data before they load the plant. According to Bob Fox, a consultant with Supply Chain Consultants, "The expert system rules can be readily reprogrammed, so when a Cypress planner says 'Hey, wouldn't it be great if we could look at the forecast this way?' they can quickly make it happen." Planners model the demand at various levels of aggregation – e.g. in quarterly or monthly "buckets," representing their conceptual view of the business. Product level data – i.e. 'Devices' (approximately 40 types), 'Packages' (approximately 250) and 'Marketing Part Numbers' (approximately 1000) -- must be forecast at every level of aggregation, in any combination, over any period of time.

Once the parameters are set and data is on-line, no user interaction is now required to generate a forecast. Using an "optimal selector" feature, MIMI chooses one of eight forecasting methods "on-the-fly" to pick the best performing method, and generate the forecast. Of course, the final forecast is left to the planner.

Fox says, “Planners told us that they wanted to view a MIMI forecast and be able to make changes to fit their knowledge of the business. Once made, those overrides must remain constant for subsequent views. MIMI’s expert system provides this capability.”

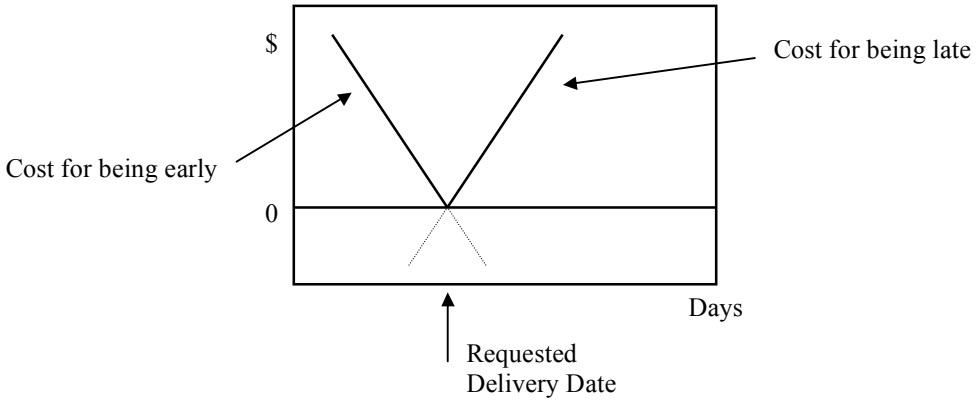
The demand forecast is now done more accurately, and in less time then ever before. Combining accurate forecasts with backlog and inventory data, the planners can then set about loading the plants to meet customer needs, cost-effectively.

Optimizing production for the customer

Customer orders frequently change (e.g. amount, product, date required), so the Cypress’ plan must load production resources daily. Though the company’s planning horizon spans a five month period, a 21-day production schedule exists for use in the plants. Every day, Cypress planners enter revised demand data into MIMI’s Linear Programming (LP) module, to determine optimal loading of the global production facilities. The LP optimization model runs nightly on two Sun™ UltraSparc® workstations. The next day, planners review the amended production plans and transmit them to each facility for execution.

For Cypress, optimal means meeting customer delivery requirements at the lowest cost – a key purchasing criteria. “The customer is our number one consideration.” says Alexander. “In the semiconductor industry, if you tell a customer that you can’t deliver to their cost, quantity and time requirements, you effectively lose the order.”

To create strong customer focus, the LP model assigns a cost to a projected missed delivery, which in-turn erodes the plan’s profit margins. The model also assigns a carrying cost for producing too early, to account for the risk of pending orders that might still be canceled. “We think this is a unique use of our planning tools,” notes Alexander. “We penalize ourselves for planning to be late, since we might lose the order. We also penalize ourselves for producing too early, and risking long-term storage.” The resulting cost-delivery curve is approximately as shown in Fig. 1.



Figuire 1

To get the right product to the customer at the right time at a fair profit, planners must manage thousands of marketing part numbers across an array of plants. Each production facility has its own unique timing, quality and cost structure. Some devices can only be used in a specific package, but can be made in multiple assembly locations. While packages are made in specific locations, they may require component devices to be shipped in from other facilities. Adding to the complexity, each manufacturing location has its own unique production cycle time. All of these constraints have been built into the LP model.

Conforming to constraints, the LP model seeks to load the plants in a manner that eliminates the backlog and enhances flexibility. Long-lead-time orders and produce-to-stock forecasts are assigned to longer-cycle-time facilities, leaving open short-cycle-time capacity for orders that must be turned around quickly.

The size of the planning problem is immense. "Conceptually, the planning process seems simple, but given the volume of data and detail, human planners consistently missed things" says Alexander. "Without linear programming tools we could never handle the complexities of our environment and make a profit. MIMI integrates all our planning data and analytical tools into a single package saving, us time and money"

Enhanced customer commitments

After the forecast is generated and a capacity tested production plan produced, Cypress uses its Able-to-Promise (ATP) capability to commit orders against future production. Normally, ATP would work in conjunction with the detailed plant schedule, but since a common finite capacity scheduling system has not yet been implemented in the plants, Cypress planners gain ATP functionality from the MIMI-generated production plan.

As customers make delivery requests, Cypress' order services people can accurately make commitments between three and sixteen weeks, using the ATP function. Shorter term requests are handled on an as-needed basis. ATP automatically checks the plan, and provides a delivery commit for the customer. "This allows our order services people to commit deliveries and take orders in one phone call, without having to call the plants," says Alexander.

Next... scheduling the facilities

Scheduling of the local manufacturing facilities will be addressed in the next phase of the project. "We phased the MIMI roll out to deliver the least-effort, high-payback functions early on," Says Alexander. "If we can understand demand and create a reasonable plan to load the facilities, we've made a giant step. Shop floor scheduling system can wait. Results achieved to date have confirmed the wisdom of this strategy."

The company plans to install MIMI's scheduling module at each plant to provide the production facilities a common set of tools to help run their business. The MIMI modeling tools can be tailored to each facility's requirements – enabling local staff to do a better job of scheduling and execution. Adds Alexander, "We don't want to control our manufacturing from half way around the world."

Results to date

The 1995/1996 period has been a tough one for the semiconductor industry, primarily because of overcapacity. Prices dropped significantly, putting heavy pressure on profit margins. To deal with this tough environment, Cypress has reengineered both its products and business processes. "This supply-chain initiative has helped us enormously to compete in these difficult times," says T. J. Rodgers. "Our ROI has been very high from our MIMI investment."

Customer service has been substantially improved. "Together, DM, LP and ATP have enabled us to move on-time deliveries from the mid-eighties to the high nineties. Utilization of production assets has also significantly improved. Says Alexander, "Savings are enormous, when you consider the capital investment that we don't have to make to meet future demand." In the process, the company has also changed several business practices that no longer added value.

The new manufacturing plans are now available for open discussion across the company. To facilitate discussion, Cypress has begun weekly supply/demand meetings that continue to bring the cross functional team together. Interdepartmental communications have substantially improved.

In the past, managers spent an enormous amount of time discussing the validity of their individual reports. "Another benefit stems from our people operating off of one common base of information during the meetings" concludes Alexander. He adds, "Five or six people would typically spend hours "negotiating" yield, cycle times or capacity based on their unique sources of information."–

Looking to future

Given the results, Cypress will continue to expand its supply chain endeavors. "Chesapeake Decision Sciences and Supply Chain Consultants showed us how to use new approaches in solving supply-chain problems. They have also provided the knowledge transfer that allows us to continue on our own." Says Alexander.

The company plans to move detailed scheduling out to the manufacturing facilities, through the implementation of the MIMI scheduling module. Customer orders can then be immediately committed against the schedule right from the order-entry terminal. "This is the kind of real-time customer response and operations agility that is needed compete in our increasingly competitive industry," says Alexander.

"New systems and new processes, combined with our enhanced focus on the cross functional team approach have made Cypress better able to serve our customers and stockholders," concludes T.J. Rodgers. "We have committed to a new way of doing business for the 21st century".