



Solectron: From Contract Manufacturer to Global Supply Chain Integrator

Most people think we're a manufacturing company. We're good at manufacturing, but we're really a service company.
—Koichi Nishimura, Solectron CEO¹

In mid-2001, Solectron Corporation was confronting issues that it had never before faced in its twenty-four year history. The company was the world's premier supply chain integrator, with \$18.7 billion in annual revenue.² Since going public in 1989, its stock had appreciated by a factor of 280 times by the time it peaked in October 2000.

The economic downturn of 2001 hit the company hard. While revenues for the first quarter of fiscal 2001 (ending December 1, 2000) were twice that of the same quarter in the previous year, quarter-to-quarter revenue decreased each quarter during fiscal 2001, with a 27 percent decrease from Q2 to Q3. The company had large amounts of excess inventory. Collections suffered, and receivables jumping significantly (Table 9-7).

By September, the stock had fallen 77 percent from its high, and market capitalization was just 40 percent of annual revenues (Figure 9-6).³ The company had laid off 20,000 of its 80,000 workers and closed facilities.⁴ What should they do now?

THE ELECTRONICS MANUFACTURING SERVICES INDUSTRY

The electronics manufacturing services industry (EMS, also referred to as contract manufacturing) grew out of a large number of small job shops that manufactured assemblies for clients. The clients,

original equipment manufacturers (OEMs), would often use these shops to supplement their own production capabilities, or to offload production that did not contribute to their competitive advantage, such as cables or simple printed circuit boards. In the 1970s and early 1980s, production was relatively low volume, as consumer electronic products did not require extremely high production levels.

As the personal computer became a mass-market product in the 1980s, a few contract manufacturers grew rapidly, led by SCI Systems. The rise in PC use also drove related markets, such as those for printers and memory devices. In the 1990s the industry continued its rapid growth, driven by the development of the Internet, with its demand for networking equipment such as routers and servers. The exploding demand for mobile phones and other wireless devices, as well as other electronic tools such as personal digital assistants, also contributed to the heavy demand for manufacturing capacity during this period. Solectron grew rapidly during the 1980s and 1990s, becoming the dominant company in the industry by the mid-1990s.

In 2000, the EMS industry was estimated to be \$103 billion, or about 13 percent of the total cost of goods sold of OEM companies. The penetration rate was forecasted to increase to 22 percent, or \$231 billion by 2005, for an overall industry compounded annual growth rate (CAGR) of 18 percent. The same forecast anticipated that the top tier EMS companies should grow at a disproportionately high rate, averaging 25 percent per year for the five-year period.⁵ The industry consisted of several large public companies, the largest of which was Solectron, and included Sanmina/SCI Systems, Flextronics, Plexus, Jabil Circuit, and Celestica, and hundreds of smaller companies, most of whom were privately held.

¹Bill Roberts, "CEO of the Year Koichi Nishimura, Contract Manufacturing Visionary," *Electronic Business*, December 1999.

²For the fiscal year ended August 31, 2001.

³As of September 10, before the terrorist attacks of September 11 that drove the stock price further down.

⁴Aaron Elstein and Scott Thurm, "Telecoms' Rout May Hit Firms They Hire," *The Wall Street Journal*, August 10, 2001, C1.

⁵Ellen Chae and Todd Bailey, "Annual EMS Industry Update," *Prudential Financial*, August 2001, 7. Forecasts from IDC, Technology Forecasters, and Prudential. These estimates incorporate the effects of the weakness in demand for electronic products in 2001, but were made before the events of September 11.

Source: Research Associate David Hoyt prepared this case under the supervision of Professor Hau Lee as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation. The case was prepared in cooperation with Solectron Corporation. The data presented is for teaching purposes only, and certain facts may have been changed to enhance the teaching objective. Before using any facts presented in this case for other purposes, the reader should verify them with Solectron. The case was edited by Mary Petrusiewicz.

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TABLE 9-7

SELECTED FINANCIAL DATA

(All dollar values in millions)

	2001	2000	1999	1998	1997
Revenue ^a	18,692	14,138	9,669	6,102	3,694
Cost of sales	17,206	12,862	8,733	5,436	3,266
Gross profit	1,486	1,275	936	667	428
Operating expenses	(1,585) ^b	(571)	(420)	(298)	(192)
Operating income (loss)	(98)	704	516	369	236
Taxes, interest, other	26	(217)	(166)	(118)	(78)
Net income (loss)	(124)	497	350	251	158
Total assets	12,930	10,376	5,421	2,411	1,876
Inventory	3,209	3,787	1,197	789	495
Accounts receivable (net)	2,444	2,146	1,283	670	419
Employees at year-end	60,800	57,000	33,00	22,000	17,000
Square footage at year-end (millions)	11	10	7	5.5	3
	Q4 2001	Q3 2001	Q2 2001	Q1 2001	Q4 2000
Revenue	3,595	3,983	5,419	5,696	4,736
Cost of sales	3,387	3,678	4,930	5,211	4,323
Gross profit	208	308	488	485	413
Operating expenses	(314)	(277)	(295)	(209)	(170)
Restructuring and impairment	(207)	(285)	—	—	—
Operating income (loss)	(313)	(254)	193	276	243
Taxes, interest, other	63	68	(71)	(85)	(72)
Net income	(250)	(186)	122	191	171
Ending backlog (\$ billion)	2.2	2.5	4.4	5.8	4.9
New orders (\$ billion)	3.3	2.1	4.0	6.5	6.5
Total assets	12,930	13,293	14,605	14,027	10,376
Inventory	3,209	4,201	4,882	4,584	3,787
Inventory turns	3.7	3.2	4.2	5.0	5.5
Accounts receivable (net)	2,444	2,391	3,188	2,688	2,146
Days receivable outstanding	61	63	49	42	38
Employees at period end	60,800	65,800	79,800	71,900	65,000

Source: Soletron Corporation.

Accounting calendar: Q4 2001 ended August 31, 2001

Q3 2001 ended June 1, 2001

Q2 2001 ended March 2, 2001

Q1 2001 ended December 1, 2000

Q4 2000 ended August 25, 2000

^aResults from 2000, 1999 and 1998 include acquisitions made during 2000 and accounted for by a pooling of interests. These acquisitions are not included in 1997 results. In 1998, they accounted for \$813 million of revenue and \$52 million of net income.

^bIncludes acquisition, restructuring and impairment costs of \$547 (\$207 in Q4, \$285 in Q3, and \$55 in Q2).

OVERVIEW OF SOLECTRON CORPORATION

Soletron Corporation was founded in 1977 to make solar energy products as part of the solar energy boom of the mid-1970s.⁶ The company struggled financially, and began to build assemblies, primarily printed circuit boards (PCBs) for other electronics firms. Located in Milpitas, California, Soletron was close to the fast-growing Silicon Valley electronics industry, and thus had ready access to a large

number of potential clients for its manufacturing services. Starting in the early 1980s, it focused its complete attention on contract manufacturing, and changed the PCB job shop business into an important industry, providing high quality electronics manufacturing services.

⁶The company's name is a combination of "solar" and "electronics."

Solectron's weekly stock prices and volumes for the ten years ended September 26, 2001 were:

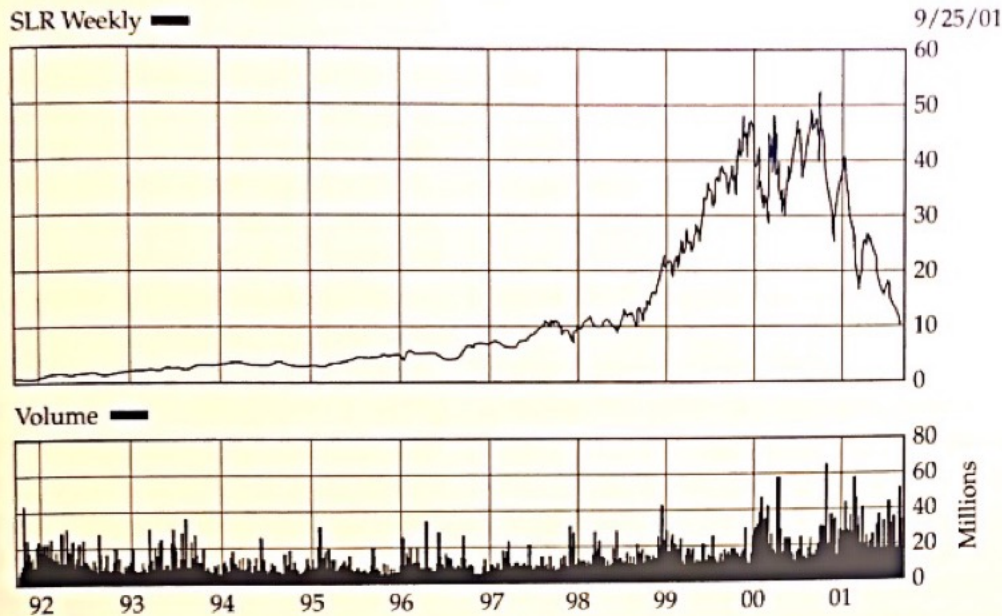


FIGURE 9-6 Solectron stock price.
Source: www.bigcharts.com; with permission.

An essential element of the company's strategy was an intense focus on quality and a company culture that reinforced this focus in all areas of business. Solectron won the prestigious Malcolm Baldrige National Quality Award in 1991, and again in 1997 (its first year of eligibility after the first win, making it the first repeat winner in the award's history), and by 2001 had won more than 250 quality and service awards from its customers. The Baldrige application process had been a cornerstone of the company's operations since 1989, helping focus the company's attention on quality and customer satisfaction.

In the early 1990s, the company began a program of strategic acquisitions, in which it purchased the manufacturing facilities of its customers, and received long-term contracts to supply those customers. Under Solectron, these facilities could also be used to supply multiple customers, increasing the plant utilization. The company made many such acquisitions fueling its rapid growth. In 1994, it passed \$1 billion in annual revenue. In 1998, it became the first company in the EMS industry to be added to the S&P 500.

Solectron manufactured a wide range of products for its customers in many business segments, including:

- Telecommunications (29 percent)—access equipment, base stations, IP telephony equipment, mobile phones, pagers, switching equipment, transmission equipment, video conferencing equipment.
- Computers (25 percent, PCs/Notebooks 16 percent, Workstations and Servers 9 percent)—docking stations, Internet access devices, mainframes, midrange servers, notebooks, PC servers, PCs, retail systems, supercomputers, workstations.
- Computer Peripherals (7 percent)—disk and tape drives, tax machines, laser and inkjet printers, projector engines.
- Others (12 percent)—avionics, consumer electronics, GPS, medical electronics, semiconductor equipment, test/industrial controls.⁷

The company was heavily dependent on its largest customers; 72 percent of sales in FY2000 came from the top ten customers, led by Ericsson at 13 percent and Cisco at 12 percent. Others in the top ten included Compaq, HP, and IBM.⁸

As Solectron grew, it expanded its services. In 1996, it began quick-turnaround prototype services as

⁷Solectron Web, site, <http://www.solectron.com/about/index.html>. Percentage shares from Solectron's 2000 Annual Report, 8.

⁸Solectron 2000 Annual Report, 20. In FY1999, the top ten accounted for 74% of sales, led by Compaq (12%) and Cisco (11%). In FY1998, the top ten accounted for 68%, led by HP (11%) and Cisco (10%).

the result of its acquisition of Fine Pitch Technologies. By the end of the decade, it had three strategic business units: Technology Solutions, which provided technology building blocks that helped customers minimize time-to-market for new products; Global Manufacturing, which provided design, new product introduction, and manufacturing and distribution services; and Global Services, which provided repair, upgrade, and maintenance, as well as logistics, return management, warehousing, and many other post-manufacture support activities. A Global Materials Services group supported all three business units by providing sourcing, procurement, and other common supply base management resources.

CULTURE AND QUALITY

Solectron's corporate culture, and its overriding emphasis on quality, was an essential element of its success. The company's core values and beliefs were thoroughly ingrained in Solectron's management and strategic planning processes (Exhibit 9-1, page 306).

Early Cultural Development

The cultural development started in 1978, when Dr. Winston Chen, a long-time IBM executive, joined the company as president. At the time, electronics companies that contracted their printed circuit board (PCB) assemblies to outside manufacturers chose vendors based on low price and fast delivery, and did not expect high quality. Dr. Chen challenged this practice, insisting that only by achieving the highest quality standards could one achieve the lowest cost.

Harkening back to his IBM days, Dr. Chen used two basic principles to run the company: superior customer service, and respect for the individual. In order to fully implement these principles, he established systems that provided rapid feedback of required information, and the freedom for employees to act in order to fulfill these objectives. For instance, he established a process for measuring customer satisfaction weekly, by asking all customers to provide assessments according to five criteria: quality, responsiveness, communication, service, and technical support. The results were reviewed by management every week, and posted weekly at each production line. Chen commented, "We don't tell people, 'You're good,' or 'You're bad.' We say, 'Here's what the customers say.' That's a very powerful tool."⁹

The company also developed weekly profit and loss statements for each production line, which were distributed to all line managers. Chen noted, "If you really want to respect individuals, you've got to let them know how they're doing—and let them know soon enough so they can do something about it. Ultimately, the measures that matter are customer satisfaction and profit and loss."¹⁰ In 1984, when Chen became CEO, his vision was to "revive American manufacturing competitiveness and become the best manufacturing company in the world."

Solectron's operations utilized a highly diverse group of employees, which the company called "associates." Many associates were recent immigrants. The contract manufacturing industry, Solectron included, typically paid relatively low wages to its production workers. Yet, the company could not achieve its vision unless these people were highly motivated and unified toward a common purpose. The Solectron culture provided that unification.

In 1988, Dr. Chen convinced one of his former IBM colleagues, Dr. Koichi Nishimura, to join the company as chief operating officer. By this time, the company had grown to \$93 million in revenue, with solid profits. Dr. Nishimura's approach was to never be satisfied, continually question existing practices, and strive for continuous improvement. This applied to all aspects of business, whether it was the time required to prepare financial reports, improvements in production quality, or increased customer satisfaction.

The Baldrige Award, and the Focus on Quality

Soon after arriving at Solectron, Dr. Nishimura learned of the Malcolm Baldrige National Quality Award, which had been instituted by Congress in 1987 to promote excellence in the nation's manufacturing and service sector. He decided that the award's evaluation process was similar to Solectron's principles, and that it could be a benchmark for continuous improvement. The company applied for the 1989 award, but did not receive a site visit, which is a required step for all finalists. However, it did receive a report from the evaluators recommending improvements in many aspects of the company's operations.

⁹Alex Markels, "The Wisdom of Chairman Ko," *Fast Company*, November 1999.

¹⁰Ibid.

Dr. Nishimura was delighted with this "free consulting," and implemented the recommended improvements. After failing to get a site visit again the next year, Nishimura commented, "We weren't trying to win the award, we were simply trying to build a quality company. And the award was the template."¹¹

In 1991, Solectron did get a visit from the Baldrige Award examiners. The company received a large amount of advice for improvement—and won the award. It was the first time the award had been given to a company in the contract manufacturing industry.

Baldrige Award winners are ineligible for the prize for five years, but Solectron felt that the application process was so valuable that it prepared internal evaluations based on the Baldrige Award every eighteen months. Nishimura noted that "[this] keeps us focused on continuously improving things for our customers. That's the only way to be the best."¹² In 1997, the first year it was eligible to reapply, Solectron again won the Baldrige Award—the first repeat winner in the award's history.

Day-to-Day Practice

Cultural practices at Solectron had several components, each of which reinforced the others, and most of which were directly related to the company's stated mission.

The emphasis on continual improvement, and the process of creating and reinforcing values, was institutionalized throughout the organization. For example, 7:30 A.M. meetings on Tuesday, Wednesday, and Thursday had been an institution since the early days of the company. The meetings were attended by about thirty to fifty people, ranging from engineers and program managers to site management personnel. Each meeting began with a site overview of the quality results from two days before the meeting (the most recent results available). Progress toward site quality plans objectives was also reviewed at each meeting. The remainder of the Tuesday meeting was devoted to an internal customer satisfaction review, or management training provided by a combination of company executives and external guest speakers.

The Wednesday meeting was highly focused on quality, and was a forum for process improvement

and knowledge sharing. The emphasis was on prevention of problems rather than correction, through the use of self-directed work teams (SDWT) and the company's Quality Improvement Process (QIP).¹³ SDWT members made presentations at the 7:30 A.M. meetings. The meeting also served as a forum for recognizing excellent performance. When a team received a recognition award from a customer, Solectron's president presented a check to be shared equally by the members of the team, and publicly recognized the team at the meeting.

The focus of the Thursday morning meeting was customer satisfaction and program management. Solectron asked each customer to grade its performance every week on quality, delivery, communication, and service. At the Thursday meeting this data was reviewed, problems discussed, and improvement plans presented. Decisions were made by consensus of the site management team. Consensus decision-making was intended to strengthen teamwork, which was a strong Solectron value, and heavily emphasized by top management.

Symbolism was also used to unite the workforce. For instance, all employees, from the CEO to a beginning assembler, wore identical white smocks with the company logo.¹⁴ While the smocks were justified on the basis of electrostatic discharge control, their larger purpose was to help all associates feel part of one family. Signs with the company beliefs and the "Five Ss" were also prominently displayed in Solectron facilities.

Culture and Acquisition Integration

Through the 1990s, Solectron's growth strategy included acquiring manufacturing operations from its customers. By late 2000, the workforce was over 80,000 people, many of whom had joined Solectron as the result of acquisitions. Integrating employees was essential to the success of the acquisition, since success was highly dependent on the ability of Solectron to harness the intelligence, know-how, and experience of the new employees. The company culture was an important part of that integration.

The company assigned an integration team to work with the acquired operation composed of four to eight

¹³QIP teams were cross-functional, and addressed specific problems or opportunities for improvement. They developed action plans based on the company's objectives for customer satisfaction, quality, and flexibility.

¹⁴Visitors are issued blue smocks, so that they can be identified.

¹¹Ibid.

¹²Ibid.

people representing the major functional areas (e.g., finance, human resources, operations, materials, and information technology). The team became involved in the early stages of the due diligence process, long before the acquisition decision was finalized. The business integration process utilized an extensive checklist, and included all major functional areas covering activities from just prior to the announcement of the transaction all the way through the first 100 days after the transaction closed (Table 9-8). When the decision was made to proceed with an acquisition, a detailed integration plan was created. The development of this plan included participation by the acquired operation, ensuring that it was a part of the process. The Solectron integration team worked with the acquired company for three to six months after the acquisition was finalized, training the new employees and acting as a Solectron resource.¹⁵

EVOLUTION FROM CONTRACT MANUFACTURER TO GLOBAL SUPPLY CHAIN INTEGRATOR

Solectron grew from a contract manufacturer into a global supply chain integrator as it increased the size and the scope of services it offered. The OEMs' vision for their use of outside services evolved concurrently, so that by 2001 they outsourced activities that they would never have considered only a few years before (Exhibit 9-2, page 307).

One Solectron executive described this evolution by comparing it to the change in bridge design as steel replaced wood.

At first, people duplicated the designs of wooden bridges, just replacing the material. As they learned more, they began to modify the designs to take advantage of the properties of steel. Bridges still looked like they traditionally looked, but the modified designs couldn't have been built in wood. Finally, engineers developed entirely new approaches to bridge design, which couldn't have been imagined previously. That's where we are today. The manufacturing and information technology that we have today allows a fundamental change in the way our customers operate.¹⁶

When it first offered contract manufacturing services, Solectron provided little more than substitution for

capabilities that its customers already possessed. Customers were driven by two forces: cash flow and resource allocation. They looked to outsourcing if they could cut costs, or if they needed extra short-term capacity to meet peak demand. Customers would often maintain a level of internal capability appropriate for ongoing needs, outsourcing when peak demand exceeded this level.

Because customers maintained some production internally, and might only outsource some assemblies, customers were often in a stronger position than Solectron when negotiating with parts suppliers. As a result, customers often consigned kits of parts that Solectron assembled. Solectron differentiated itself from other PCB assembly companies primarily because of its focus on quality.

As Solectron added more customers and took on more business from existing customers, its total volume increased. Eventually, it was in a stronger position to negotiate with parts suppliers than were its customers, and began to take on additional purchasing, parts inventory, and kitting responsibility. Solectron could then offer customers capability that they couldn't get themselves: reduced prices due to greater volume purchasing. Rather than outsourcing as a way to access relatively inexpensive, skilled labor, it became a source of tactical advantage. Tactical turnkey assembly meant that OEMs specified what was needed, and Solectron bought the materials, built the product, and shipped it to the customer.

Technological Developments

The development of surface mount technology (SMT) offered an important opportunity. In the 1970s and through much of the 1980s, PCB assemblies were constructed by inserting components into holes in the boards and soldering the components. Pin-through-hole (PTH) was an inexpensive method for low-volume assembly, but only a limited number of the relatively bulky components could be placed on a PCB, and they could only be placed on one side of the board. In 1983, Solectron began building a new type of PCB assembly, in which components were pasted directly onto the planar surface of the board. This surface mount technology used much smaller components, and enabled components to be placed on both sides of the PCB, greatly increasing the density of the circuit that could be placed on an individual board.

¹⁵"Solectron's Acquisitions Get Careful Attention," *Electronic Buyers' News*, July 24, 2000. Available online at <http://www.ebnonline.com/story/OEG20000721S0011>.

¹⁶Arthur Chait, corporate vice president of worldwide marketing, teleconference, July 30, 2001.

TABLE D-2

BUSINESS INTEGRATION TEMPLATE.

A small portion of the acquisition business integration checklist:

FUNCTION	ACCOUNT MANAGEMENT CORPORATE COMMUNICATIONS FACILITIES/ETIAS FINANCE HUMAN RESOURCES IT MATERIALS NIP/TECHNOLOGY OPS PROGRAM MGMT QUALITY PROCESS	PRIORITY L/M/H	SLR LEAD	(XXX) LEAD	DUE DATE	SOLUTION					LEGEND: R = R/D (Far below expectations, potential show stopper) Y = Y/L (On track, behind plan, needs more focus) G = GREEN (On target) X = Complete / = Not applicable	COMMENT	ACTUAL COMP DATE
						I D E D	V E R D D	D O C U M E N T E D	S I G N I F I C A N C E	I M P L E M E N T E D			
AM	Account Management												
AM	1. Cust. Acct. list review/comparison												
AM	2. New entity communication to cust.												
AM	3. SLR letter to all customers												
AM	4. Develop account structure												
AM	5. Review quotes												
AM	6. Review contracts												
AM	7. Review forecasting methodology												
AM	8. Prepare training materials												
AM	9. CSI Process training												
AM	10. Account management training												
	Facilities Tasks												
FAC	1. Establish facilities maintenance services (landscaping, maintenance)												
FAC	2. Establish services contracts as needed (security, mail, canteen, etc.)												
FAC	3. Lease contracts other than building lease												
FAC	4. Selectron address												
FAC	5. Road and building signage												
FAC	6. Selectron philosophy visual-local language (street banners map case)												
FAC	7. Transfer or set up Utilities contracts (elec, gas, vacuum, air, etc.)												
FAC	8. Insert insurance coverage set up as required												
FAC	9. Budgeting & facility access												
FAC	10. Transfer or execute building lease												
	Finance Tasks												
FIN	1. Accounts Payable												
FIN	2. Accounts Receivable												
FIN	3. Assignment of applicable leases												

The advantages of SMT came at a price. The capital cost of SMT equipment was much higher than the equipment needed for PTH assemblies. At the time, few products were needed in truly high volume. In the early 1980s, mobile phones were not yet in production, and even personal computers were not mass-produced. Most OEMs could not justify the capital cost of SMT, even though they could benefit from the technology.

Solectron, however, could amortize the cost of SMT equipment across the volume of many customers, providing capability that OEMs could not economically acquire. By 1992, most new designs used SMT, relying heavily on Solectron and other contract manufacturers for production.

New Business Model

In 1992, Solectron introduced a new business model when it purchased manufacturing sites from IBM. As part of the asset acquisitions, Solectron received long-term supply contracts. This approach enabled OEMs to make the strategic decision to concentrate their efforts and resources on their core competencies, generally product definition, engineering, and marketing, and to use Solectron to perform procurement and production, which were its core competencies. Since they no longer maintained internal production capabilities, this was a strategic, rather than tactical decision for the OEMs.

IBM's Bordeaux, France, plant, an early acquisition in 1992, was illustrative of the success of the model. The 27,000 square meter facility had struggled to be profitable, and IBM placed all the people it could think of, such as sales staff and software developers, in the plant to fill the empty space. Still, employee numbers had shrunk to 1,000, of which only 500 worked in manufacturing, and only half of those were making PCBs. By early 2001, under Solectron, the plant employed 4,200 employees building mobile phone switching gear for Ericsson, networking equipment for Cisco, bar-code readers, and medical instruments. Products built for IBM utilized only a small fraction of the plant's capacity. The IBM plant manager, who stayed on as a Solectron employee after the sale, noted that it was almost like working at a completely different factory. "It's unbelievable; it's booming."¹⁷

This model was repeated many times, and Solectron rapidly grew. It acquired manufacturing facilities from customers, and used those facilities to fulfill long-term supply contracts. It also used the acquired facilities to produce products for other customers. This allowed for risk pooling, as fluctuating demands from different companies were smoothed, and safety stock levels of common component inventory could be reduced (compared with levels required if stocked individually by each company).

Over the next few years, Solectron acquired facilities in such strategic divestitures from more than twenty companies, including Hewlett Packard, Texas Instruments, NCR, Nortel Networks, Sony, Ericsson, Cisco Systems, Philips Electronics, and Mitsubishi.

As Solectron took over production for several major companies in the same industry (e.g., Cisco and Nortel), the economies of scale escalated further, since these companies shared similar processes and many common parts. Solectron also increased its visibility of these industries through the aggregated forecasts of each major player. However, the demand projections made by each OEM were still subject to demand information distortion, and might not reflect the true demands of the ultimate customer.

Consolidation and Relocation In addition to acquiring facilities from OEMs, there was consolidation within the EMS industry in the late 1990s, driven by the increasingly close relationships between OEMs and their suppliers. OEM companies preferred to establish strategic relationships with a few top tier EMS suppliers, who could fulfill their worldwide needs. In July 2001, Sanmina, then the fifth largest EMS, acquired SCI, the fourth largest, and twice the size of Sanmina. Solectron acquired two top-ten companies, NatSteel Electronics in November 2000, and C-Mac Industries in August 2001, as well as the Bluegum Group, the largest EMS firm in Australia.¹⁸

There was also a trend for the top companies to move production of high volume, predictable products to low-cost regions such as Asia (excluding Japan), Mexico, and central Europe. By mid-2001,

¹⁷Michael J. Ybarra, "Vineyards and Surface Mount Technology," *Upside*, April 2001, 116-119.

¹⁸Petri Lehtivaara, "The Electronics Manufacturing Services Industry," Case GM 863, International Institute for Management Development, October 1, 2001.

Solectron had 30 percent of its production in such areas, with the goal of increasing to 70 percent.¹⁹ This had two benefits—decreasing production costs, and moving production capacity closer to future high growth markets.

Through acquisitions, Solectron had developed a global network of facilities located strategically close to its customers and to emerging markets. This enabled it to introduce products in its new product introduction centers and then rapidly transfer production to the facilities best suited to volume production, either due to the low cost structure of the volume production site or its proximity to the end user, depending on the needs of the OEM customer. Load could also be balanced across the network, and production of a particular product could be transferred between sites as it passed through different phases of its life cycle, in order to maximize profitability.

Information Systems The development of the World Wide Web and tools for communication between information systems in different companies allowed Solectron to use technology to improve its operation and enabled its customers to optimize their supply chain in a fundamentally different way. Internally, the company invested heavily in information technology for the management of its worldwide network of facilities and suppliers. Its Global Enterprise and Resource System consisted of an enterprise resource planning system combined with additional applications such as product data management, shop floor control, warehouse management, materials database, rapid “what if” tools, financial analysis and reporting, and human resources. The company established a Web-enabled extranet that allowed the sharing of information with customers, suppliers, and partners. This helped integrate the supply chain by giving all parties equal access to certain information for planning and decision analysis. This visibility of critical information helped to minimize the “bull whip” effect that often occurred when making decisions in an uncertain environment when demand signals were not aligned (Figure 9-7).²⁰

Supply Chain Management

For its customers who fully utilized this approach, Solectron took responsibility for end-to-end supply chain management. The customer was responsible for the basic research and development of products, but Solectron played an important role in the actual product design. Solectron did all parts procurement, assembly, and testing, and delivered the product to the location specified by the customer. Solectron also took responsibility for service and technical support, as well as for recycling the product after its useful life. In short, Solectron was responsible for the entire product lifecycle planning. The customer focused its efforts on research, product definition, marketing, and sales.

From the OEMs’ perspective, the major driver was no longer whether to make or buy a given assembly, but the larger question of where to get materials. The critical issue was the total cost of getting the item they needed, fully built and ready to go to the customer, when and where it was needed. This took much more into account than just procurement and manufacturing, as worldwide logistics became extremely important. If parts were sourced from one part of the world to be used in products for a customer in another part of the world, the transportation costs, tax, and duty for the parts might be greater than the labor cost of the assembly.

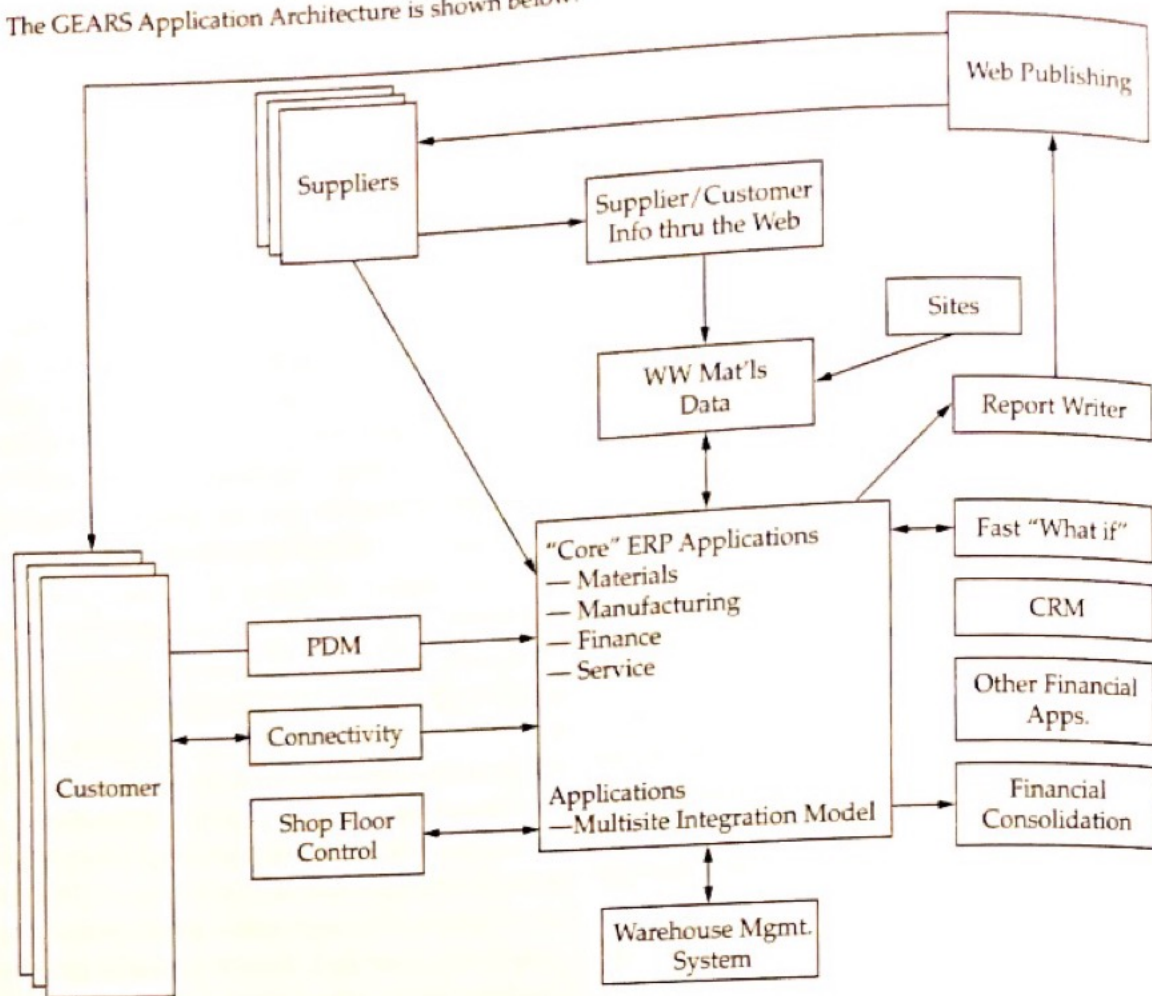
Previously the barrier to entry had been the capital cost of SMT equipment; now there were many companies with this equipment. Solectron’s competitive edge now resided in the ability to execute quickly and across international borders, using its global network of facilities. The expertise was now in more than manufacturing; it was also in developing a global network of suppliers, and in moving goods efficiently around the world. Often more time and money would be spent on logistics than on assembling components.

The company’s operations in Romania exemplified this situation. The Romanian operation had begun in 2000. The facility was used primarily to manufacture items destined for customers in central Europe, a region expected to grow rapidly due to pent-up demand for electronic products. Labor was inexpensive, at about \$.50 per hour, and Romania had an excellent workforce with a strong work ethic. However, it took a full day to get materials to the factory from western European countries, and two days to get completed products out of the country. Thus, there was a trade-off between labor and logistics costs due to infrastructure maturity.

¹⁹Chae and Bailey, 16.

²⁰Brian Fukumoto, corporate director of business transformation, e-mail communication, October 28, 2001.

The GEARS Application Architecture is shown below:



CRM — customer relationship management
ERP — enterprise resource planning
PDM — product data management

FIGURE 9-7 Global Enterprise and Resource System (GEARS).

Organization for Global Supply Chain Integration

To facilitate end-to-end supply chain management, the company organized into three business units: Technology Solutions, Global Manufacturing, and Global Services. The Global Materials Services group supported the business units.

Technology Solutions The Technology Solutions business unit provided modular and embedded systems design and manufacturing systems, offering a wide range of memory and I/O products, as well as embedded boards and systems that provided OEM customers with technology building blocks that could be used to quickly get products to market. This unit was built around the Solecron's largest wholly owned subsidiaries, Force Computers (acquired in 1997), and SMART Modular Computers (acquired

in 1999). In 2000, the Technology Solutions business unit had revenues of \$1.5 billion, or 11 percent of the company's total sales.

Global Manufacturing The Global Manufacturing business unit provided manufacturing services to Solecron's customers. This was the largest of the business units, with revenues in 2000 of \$12.4 billion, or 88 percent of the company's sales. In addition to the traditional contract manufacturing services, this unit provided new product introduction services and pre-manufacturing capabilities such as design for manufacturing, concurrent engineering, and prototyping.²¹

²¹Concurrent engineering is continual product development after the product is already in production.

Solectron's work with start-up companies, which was housed in the Global Manufacturing business unit, reflected one aspect of these services. In 1996, Solectron acquired Fine Pitch Technologies specifically to work with small emerging companies that required quick-turnaround prototyping and a high level of engineering support in order to launch products. Fine Pitch was designed to provide a level of support that was not available from larger EMS firms, and to provide a path to volume production. However, the company had to carefully choose which start-ups to work with, as there were many more that wanted to establish relationships with Solectron than the company could service. Each of these relationships was a strategic investment, as the payoff would come later as the start-up grew. Solectron evaluated the suitability of these relationships much as a venture capital investor would, and chose only those that had a good strategic fit and offered the potential for high growth. Brocade Communications and Juniper Networks were two examples of companies that based their operations around Solectron's services.

Global Services The Global Services business unit offered product repair, upgrades, and maintenance services through factory and service centers worldwide. It also provided services such as warehousing, logistics, returns management, engineering change management and end-of-life management. In 2001 this was a small part of the business, with 2000 revenues of just \$233 million—less than 2 percent of the company's revenues. However, it was growing rapidly and promised to be an important area of future growth. Its revenues in 2000 were nearly three times the 1999 sales.

Global Materials Services These three business units were supported by the Global Materials Services group, which interacted with suppliers, handled procurement, was responsible for optimizing inventories, prepared market forecasts, and provided worldwide logistics support.

SITUATION IN THE FALL OF 2001

The technology business boomed in the late 1990s and into 2000, particularly the telecommunications and networking sectors. Solectron benefited, as it supplied many of the leading firms. In the fall of 2000, the

company realized that a supply glut was likely, as each of their large customers, such as Cisco, Ericsson, and Lucent, expected explosive growth. Solectron added the forecasts from each competitor, and realized that they totaled far more than any realistic market size, even under the most optimistic scenario. It tried to restrain excessive orders from the OEMs, and went so far as to demand up-front payments with some orders. The OEMs insisted that their production plans be met, promising to pay for excess materials.²² The strong culture to be the best and to continuously improve, and the ingrained belief in "customer first," made it extremely difficult to resist the pressure to increase production.

The economy began to soften in late 2000, and by early 2001 it was clear that demand was falling, particularly in industries with important Solectron customers such as telecommunications. The business turned seemingly overnight from one of severe allocation and struggle to keep up with demand to one of extreme overcapacity and excess supply. New orders decreased from \$6.5 billion in the quarter ending December 1, 2000 to \$2.1 billion in the quarter ending June 1, 2001. Revenue peaked at \$5.7 billion in the quarter ending December 1, 2000, and declined 36.9 percent to \$3.6 billion in the quarter ending August 31, 2001. Backlog, which had been at \$5.8 billion on December 1, 2000, was just \$2.2 billion on August 31, 2001. The stock price fell dramatically.

The rapid change in the business environment led to large inventory increases, as Solectron was unable to stop the orders it had placed with its 4,000 suppliers. Inventory rose by more than \$1 billion during the six months ending March 2, 2001. The company was able to decrease inventory by more than \$1.6 billion from the peak level over the next six months, however, by returning excess material to OEM customers and returning to its previous JIT practices, which had not been followed during the buildup driven by its attempt to meet increased OEM production demands.

Solectron also announced a restructuring that included workforce reductions and facility closures. The company formed a high-level cross-functional team to validate the value proposition at each Solectron site, develop restructuring goals and plans, and monitor progress. The team evaluated new cost structures, more efficient organizational

²²Pele Engardino, "Why the Supply Chain Broke Down," *Business Week*, March 19, 2001, 41.

designs, and improved customer relationship management processes. By October 2001, the workforce had been reduced from its peak of 80,000 to less than 60,000. The number of SMT lines had been cut from 1,100 to less than 700, and floorspace had been reduced from 14 million to less than 11 million square feet.²³ Restructuring charges of \$285 million were booked in Q3 (May), and another \$207 million in Q4 (August). Two facilities acquired as part of the Natsteel acquisition, one in Hungary and one in Mexico, were closed and production moved to other plants.²⁴

Despite the short-term slow-down, and the painful steps that were taken, Solecron remained optimistic for the long-term. The use of outsourcing as an OEM strategy continued to accelerate. OEMs were increasingly attracted to Solecron's value proposition as a global supply chain integrator. The company believed that the economic and industrial climate favored the concentration of business in a small number of large suppliers of services to the OEM market. It expected dramatic growth in Asia

(excluding Japan), which it expected to grow from a very small consumer to one-third to one-half of the total worldwide electronics market. It also expected that pent-up demand, combined with a rapidly developing disposable income, would lead to large markets in central and eastern Europe.

However, it struggled with the question of how to weather the current storm and ensure that it was properly positioned for the future.

STUDY QUESTIONS

1. How has Solecron's value to its customers evolved over time?
2. How has global expansion contributed to Solecron's ability to move from a contract manufacturing supplier to a supply chain integrator?
3. How has the company been able to successfully integrate its acquisitions?
4. What was the impact of the company's culture on the success of the company, on the business downturn of 2001, and on its ability to respond to the business downturn?
5. What additional products and services should Solecron provide to its customers in the future?
6. What should the company do in the short term? In the long term?

²³Brian Fukumoto, e-mail communication, October 28, 2001.

²⁴Chae and Bailey, 15–16. Restructuring charges from company financial releases.

EXHIBIT 9-1 SOLECTRON'S VISION, MISSION, BELIEFS, AND "5 Ss"

MISSION^a

"Our mission is to provide worldwide responsiveness to our customers by offering the highest quality, lowest total cost, customized, integrated design, supply-chain and manufacturing solutions through long-term partnerships based on integrity and ethical business practices."

BELIEFS

Customer First	Strengthen customer partnerships by providing products and services of the greatest value through innovation and excellence.
Respect for the Individual Quality	Emphasize associate dignity, equality, and individual growth. Execute with excellence; drive to six-sigma capability in all key processes; exceed customer expectations.
Supplier Partnerships	Emphasize communication, training, measurement, and recognition.
Business Ethics	Conduct business with uncompromising integrity.
Shareholder Value	Optimize business results through continuous improvement.
Social Responsibility	Be an asset to the community.

VISION

"Be the best and continuously improve."

THE FIVE Ss

When traveling to benchmark Japanese companies in 1988, Dr. Saeed Zohouri, the company's vice president of technology, observed a sign at a Yamaha motorcycle factory describing the "Five S" practices.^b They were embraced by Dr. Nishimura, who felt that they were useful for achieving his vision of combining the best of Japanese techniques with American innovation.

Seiri (Organization)

- Distinguish between those things that are needed and not needed.
- Keep only needed materials at the job site.
- Throw away all unneeded items immediately.

Seiton (Orderliness)

- Put things in the right order in the designated area.
- Store all materials and information in an orderly fashion at all times.
 - Tidy
 - Ready to use
 - Organized according to frequency of use
- A place for everything and everything in its place.

Seiso (Cleanliness)

- Problems are more visible when everything is neat and clean.
- Find minor defects while "sweeping clean."

Seiketsu (Standardized Cleanup)

- Clean tools, equipment, and job site immediately after use.
- Equipment that is kept clean runs better.

Shitsuke (Discipline)

- Use and follow standard procedures.
- Follow company rules and regulations.
- Follow safety procedures at all times.

Source: Solelectron Corporation.

^aRevised 1997.

^bDr. Zohouri later became Solelectron's chief operating officer.

EXHIBIT 9-2 THE OUTSOURCING DECISION

The decision to outsource was a major strategic decision for an OEM, and one whose pros and cons had to be carefully considered to determine if outsourcing would really improve the OEM's performance and maximize its value. While outsourcing could bring strategic benefits, it had costs—the changes were traumatic and difficult to reverse for an OEM that had traditionally done its own manufacturing. Outsourcing affected thousands of workers, and it opened critical aspects of a company's business to the scrutiny of supply partners and other external forces, and potentially exposed them to disruptive intervention.*

Therefore, in making the decision to outsource, it was essential to understand how the true cost of internal production compared with the costs of acquiring the material from others. This involved three types of analysis:

- **Strategic.** Does owning or enjoying preferential access to the production asset have any strategic importance? How does the company's manufacturing strategy meet the needs of its overall business strategy? For instance, ownership of design and manufacturing assets gives Intel fast product ramp-up and protects the company's intellectual property.
- **Operational.** What are the performance targets and the needs of manufacturing and the supply chain (such as lead times and unit costs)? For instance, Dell configured its supply chain to meet its overall business strategy of delivering customized computers shortly after orders were placed.

- Organizational. How does the business achieve results? It is difficult for established companies to transform their supply chains.

Solectron identified three benefits that OEMs could gain by outsourcing.** The central theme was that outsourcing allowed OEMs to allocate their resources on core competences, such as research and development and marketing. These three benefits were time-to-market, economics, and technology.

TIME-TO-MARKET

The speed with which a company could bring products to market became an increasingly competitive issue in the 1990s. Early market entrants were able to command a dominant market share, and achieve the corresponding financial rewards. By working with an EMS company that could help get the product to market quickly, and rapidly ramp up production, OEMs were able to decrease the time-to-market for their products.

ECONOMICS

EMS companies were able to achieve far greater asset utilization than OEMs, since they could use the same assets to produce products for many companies. This resulted in significant cost savings for the OEMs. In addition, the risks of product changes, short product life cycles, and other sources of inefficiencies were reduced because the EMS company could balance the effect of schedule changes with production demand from other products and customers.

TECHNOLOGY

Manufacturing process became increasingly more complicated and expensive throughout the 1990s. The impact of SMT has been previously described, but the issue was continually present as product and manufacturing technologies rapidly developed. Access to the latest manufacturing technology might be impossible for most OEMs, because of both cost and complexity. However, an EMS would be able to offer the technology to meet the production needs of many customers, and develop the required skills to effectively utilize the new processes. Thus, outsourcing offered the potential for an OEM to access important new technologies without incurring high start-up costs (both economic and in training), nor paying excessive production costs.

*This section based on Brian Fukumoto, e-mail communication, October 28, 2001.

**Advantages from: <http://www.solectron.com/gscf/benefits.html>, September 12, 2001.