TUCK SCHOOL OF BUSINESS AT DARTMOUTH
WILLIAM F. ACHTMEYER
CENTER FOR
GLOBAL LEADERSHIP

no. 2-0003

Analog Devices, Inc. (B)

> *"You can't create long-term, sustainable growth just by sheer luck. You must capture the imagination and ideas of all employees by focusing them on specific goals. The purpose of a balanced scorecard is to translate strategy into action."*
> – Bob Stasey, Director of Quality Improvement

> *"You have to measure, and you have to hold people accountable."*
> – Fred Lee, Digital Signal Processing (DSP) Systems Division Controller

In 2001, Analog Devices, Inc. (ADI) was continuing to advance state-of-the-art practices in using corporate scorecards to evaluate performance. In the early years of scorecard development, their focus was on using scorecards to communicate strategy, to drive quality improvement and to emphasize cost reduction initiatives. By the 1990s, ADI was focusing on adapting the scorecard so that it increased emphasis on revenue growth in addition to quality and efficiency initiatives. By the late nineties, ADI was facing a new challenge – effectively utilizing the corporate scorecard in a faster paced, more dynamic, and more complex market environment.

ADI's Industry in 2001

Buckle your seatbelts; hold on to your hats. In 2000, ADI posted an explosive top-line growth rate of 78 percent, growing from $1.5B to $2.6B. (See *Exhibit 1* for comparative financial results.) There had been many strong years in ADI's history, but this was unprecedented. Because their products were at the heart of many Internet devices, such as PC modems and asynchronous digital subscriber line (ADSL) switches, the Internet boom drove much of ADI's growth. The company also manufactured components of mobile phones and wireless infrastructure equipment, and components for PC accessories such as flat panel displays, CD and DVD players, and digital cameras.

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Rapid growth can be very challenging to manage. Other changes in ADI's environment further complicated matters:

- ADI's new markets had very different demand characteristics.
- The supply chains that ADI participated in were de-integrating. (Production of any given finished good involved an increasing number of companies.)
- The traditional distinct separation between digital and analog markets had dissolved.
- The product design process required greater collaboration.

New product mix meant new demand dynamics

In the 1980s, applications for ADI components were primarily in the industrial and military sectors. Generally, end products would have long lifecycles so that once designed with an ADI component, that component would be in demand for many years. As a result, demand was reasonably predictable for many ADI products.

The technology markets that drove ADI's more recent growth, in the consumer electronics and communications sectors, had substantially shorter lifecycles, often as short as one-to-two years. Operationally, this was far more difficult to manage. Inventory management, for example, became dynamic and complex. It was important to have inventory early in the lifecycle when demand was difficult to predict. But towards the end of the lifecycle, excess inventory could kill profits if the inventory became obsolete. Lifecycles were so short for many communications sector products that a steady-state operating condition was never reached.

Further, ADI's evolving product mix included components for Internet-related capital equipment, such as fiber-optic routers, ADSL switches, and voice-over-network servers. ADI was supplying companies like Cisco, Nortel, and Lucent. Capital purchases are generally more volatile than the overall economy—all the more so in newer, more speculative markets, such as those related to the Internet. As many network suppliers' fortunes went in 2001, so, in part, did ADI's. By the third quarter of 2001 ADI's revenues had fallen back to $1.9B, annualized, from a peak in the fourth quarter of 2000 of $3.2B, annualized, a 40 percent drop. (Similar drops were suffered across the semiconductor industry. Over the same time periods, Intel dropped 28 percent, Texas Instruments 36 percent, Maxim Integrated Products 25 percent, and Linear Technology Corporation 14 percent.)

Supply chain disaggregation further increased operational complexity

For most of its history, ADI manufactured and distributed their own components, then shipped them directly to equipment manufacturers. By 2001, significant outsourcing was occurring to:

- Operators of chip fabrication facilities ("fabs")
- Global component distributors
- Contract equipment manufacturers

The manufacture of semiconductor chips has been one of the most complex manufacturing processes in the world. The capital investment required for new fabs was significant—already over $1B and projected to grow to $10B by 2015, roughly on par with nuclear power stations. In an industry as volatile as semiconductors, these investments were extremely risky. As a result, companies which primarily relied on design expertise, such as ADI, increasingly looked to partner with chip fabrication specialists—companies that were willing to take on these risks and could capture economies of scale across multiple designers. Though ADI still owned some fabrication facilities, "fabless" semiconductor companies were becoming the rule, not the exception.

Global component distributors were also growing in importance. It had long been ADI's practice to serve large accounts through a direct sales force and to use distributors only for smaller customers. However, some equipment manufacturers, such as Cisco, had essentially taken on global component distributors (such as Arrow and Avnet, which controlled nearly half of the global distribution market) as logistics partners. The logistics partner coordinated all of Cisco's component purchases, both from ADI and from other component manufacturers.

Cisco's component purchases would be delivered not to Cisco but directly to the third new supply chain player, contract equipment manufacturers (such as Solectron, Flextronics). These companies handled assembly and testing for Cisco and many other sellers of computer and networking equipment, and were taking on an increasingly important role as outsourcing of manufacturing became more popular in these industries.

The strategic implications for ADI were significant. With more links in the value chain, the total industry profit pool was spread more thinly among a greater number of players. And if any link in the chain became too powerful, that link would have the potential to control profits disproportionately. As a result, dramatic growth of a few distributors and contract manufacturers was increasingly of concern for ADI's senior executives. Among the disturbing possibilities: (1) contract manufacturers might start to merge with distributors, (2) distributors might be able to consolidate component purchases by decoding the product numbering schemes for ADI's nonproprietary products, and (3) distributors or contract manufacturers might succeed in building sophisticated e-business platforms that would make it all too easy for them to switch from one supplier to another—forcing ADI into a commodity competition. All three would diminish ADI's negotiating leverage.

Finally, the new structure of the supply chain had implications for demand management. With more intervening players and (despite the promise of the Internet) imperfect information flows, ADI was further removed from its end customers. This meant less accurate and less timely information upon which to base its demand forecasts.

The dominance of digital circuitry created new competition

As digital integrated circuits continued to decrease in cost through the 90s, component designers relied less and less on analog circuitry. However, interfaces to the real world, such as speakers, microphones, temperature sensors, pressure sensors and many other types of instrumentation, would always be analog because they were characterized by continuously varying information. As a result, in many applications, the process of converting analog signals to digital and digital signals back to analog was the most vital role for component manufacturers with analog expertise. Furthermore, to minimize the "real estate" associated with a product design, it was increasingly common to embed conversion and digital signal processing on a single chip.

As a result, manufacturers of digital integrated circuits, such as Texas Instruments, had an incentive to improve their analog competence so that they could offer complete solutions. Likewise, ADI had built strength in digital signal processing so that they could offer similar complete solution products. While the markets for analog and digital components were once fairly distinct, that distinction was beginning to shrink.

Products were developed collaboratively

Due to increased pressure of shorter product lifecycles, another trend in ADI's business is the increasing need for collaborative and integrated product development. For example, in competition with TI, ADI won a contract from 3Com to deliver components for a new 56K modem. ADI's proposal was viewed as superior because it integrated the function of multiple chips onto a single chip—one that handled analog to digital conversion, digital processing, and digital to analog conversion. In addition, ADI's design promised decreased size, better performance, and a faster time to market.

Time to market was critical because 3Com intended to release the product in time for the back-to-school sales surge. Under this time pressure, ADI had to design the new chip in collaboration with many supply chain players in addition to 3Com, including computer designers, software developers, and chip fabrication experts. Once a prototype was developed and accepted, a related set of collaborations was required to prepare manufacturing and logistics assets for the new component.

To handle the number and complexity of industry relationships, a traditionally skilled sales force, adept at selling components that met customer specifications, was inadequate. As a result, customer relationships were handled by "Field Application Engineers." FAEs strengthened key market relationships by assisting customers in the design of entire signal processing systems. For example, FAE proposals might increase functionality, enhance integration, or reduce board space.

ADI's Strategy in 2001

In 2001, ADI still perceived that their greatest strength was in innovation and product design. They sought to focus their efforts on "sweet spots" in the market for integrated circuits that promised the greatest growth. The Internet boom had created phenomenal growth in 2000. 2001 would not be a repeat, but the company believed that new product designs, which involved the integration of digital signal processors and analog-digital-analog converters on single chips, such as the 3Com application described above, were the most promising growth area.

ADI also planned to focus on improving demand for existing products. They planned to invest in better e-commerce applications and increase resources available to the sales force.

In addition, costs and quality continued to be a concern for ADI. To that end, the company had completed a reorganization which allowed for centralized manufacturing planning and intended to continue to progress on a variety of manufacturing initiatives. These initiatives included: standardizing production across sites, combining assembly and testing under one roof, finding off-shore sites for less expensive testing, and more efficiently releasing new product designs to factories.

ADI's Scorecard in 2001

By the late 1990s, ADI's pioneering efforts with corporate scorecards had spawned similar performance measurement efforts at many corporations. As a result, enterprise software companies had begun to develop customizable performance management solutions to support scorecard implementations. Like many other companies, ADI had installed an Executive Information System (EIS). The EIS supported the use of divisional, departmental, even individual scorecards. Managers at all levels could break down performance results by region, product, customer, or channel.

The EIS also supported ADI's use of three distinct planning horizons—quarterly, every six quarters, and every 3-5 years. Certain metrics were reported more frequently – inventory was reported weekly, for example. Because ADI now operated in a complex web of partners and suppliers, the company also was increasingly trying to include external metrics in the EIS.

Because their business was undergoing constant change, ADI kept their system as flexible as possible. They frequently introduced new metrics as business conditions changed—*Exhibit* 2 provides a comparison between the 1987, 1999, and 2001 scorecards. Typically ADI would not go to the significant expense of embedding their new metrics in the EIS until they were certain that the new metric was going to last for a while. Some metrics, in fact, were tracked manually on spreadsheets.

ADI was also leery of having too much information. At any given level, the total number of metrics one manager would be expected to monitor closely was kept in the range of 10-20. Any more than that, according to Bob Stasey, Director of Quality Improvement, and managers spent all of their time "looking for what's important, rather than working on improving what was important." Scorecard results were meant to inspire action, not provoke endless analysis.

In fact, CEO Jerald Fishman believed that 50 percent of the effort in any given quarter should be focused on no more than three most important issues and their associated metrics. In a quarterly videotape message and in a company newsletter, Fishman reviewed the past quarter's performance, using the balanced scorecard as a framework, and then identified the three critical success criteria for the subsequent quarter.

In the third quarter of 2001, the three areas of focus were:

1. **Revenue growth –** Mr. Fishman committed to putting more "feet on the street" rather than cutting sales force travel budgets, as some competitors were doing.

2. **New Product Introductions –** This metric was to be benchmarked to currently existing commitments to customers.

3. **Channel Management –** Mr. Fishman's objective was to improve quality of service through the e-business channel, rationalize the number of distribution partners, and improve sales processes and sales support so that the sales force could spend more face time with customers.

As of 2001, bonus formulas were still based strictly on financial metrics. ADI periodically adjusted bonus formulas—as often as the company felt changes in their strategy mandated it. Any changes were meant to increase focus on critical metrics. For example, in 1999, ADI added ROA to the bonus formula. Previously they had only included revenue growth and profit margins in the formula.

Goal-setting process

In their initial scorecard efforts in the 80s, ADI had set goals for many metrics through a half-life improvement calculation (i.e. time required to reduce defects or delays by 50 percent). While the half-life approach worked well for "weakness based" measures (e.g. production defects), it could not be applied to wealth creation metrics, such as revenue from new products. Furthermore, establishing appropriate half-lives takes some experience, and ADI's business was changing quickly as product lifecycles were decreasing. Many processes were new and innovative. Not only that, many of ADI's processes were now integrated with those of their supply chain partners, so it was even more difficult to predict realistic improvement timeframes. (It was also hard to impose goals for various scorecard metrics on other supply chain players—everyone wanted to be the "supply chain master.")

ADI used two approaches to setting goals in instances where the half-life calculation was inappropriate. The first was very similar to a traditional business planning process. This was common, for example, with sales and margin metrics. Senior management would ask for business plans from each division, which were subsequently broken down by segment, channel, and region. The plans were then aggregated and reviewed by senior management—and these reviews would typically be followed by a negotiating process between senior and junior managers. Ultimately, each Product Line Director was accountable for meeting budgets and forecasts.

In the second approach, scorecard goals were established top-down by senior managers using a combination of analysis and experienced judgment. For example, competitors would be studied to determine best practices for various metrics. Then, managers judged how relevant that standard was in ADI's unique business context and set goals over time for improvement.

Regardless of the approach, senior managers at ADI felt that they needed the buy-in of the employees who would be held accountable for meeting the goals. Otherwise, management's efforts would be wasted arguing about the appropriate goal instead of trying to improve the business. Ideally, employees would feel pressure to meet stretch goals but unconstrained in terms of *how* they sought improvements.

The goal setting process required cross-functional collaboration. For example, the distribution manager and the sales manager worked to set goals that didn't inspire excessively competitive behavior between divisions. Also, manufacturing managers would have to avoid "sub-optimizing." For example, too aggressive a throughput goal at a certain stage in production might simply create excessive work-in-process inventories. Each process in the company was related to other processes, and these interactions needed to be understood to set goals effectively.

Discussion Questions

1. How did ADI's industry change between 1996 and 2001?

2. How are targets set for the metrics on the scorecard? Who sets them? How rigorous does the method for setting goals need to be in order for the metric to be useful? Evaluate the goal setting process in light of the changing industry conditions as of 2001.

3. Is ADI's scorecard as useful today as it was in the 80s? What are the limitations to the scorecard? What can go wrong?

4. Would you make any changes to the way ADI manages its scorecard? What changes? Why?

5. Does the metrics/scorecard system have flaws? Can employees "game" the system? What are the dangers of the EIS?

Exhibit 1

Semiconductor Industry Statistics

ADI vs. Selected Competitors *

Sales ($M)	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Analog Devices	773	942	1,194	1,243	1,231	1,450	2,578
Intel Corporation	11,521	16,202	20,847	25,070	26,273	29,389	33,726
Texas Instruments	10,315	13,128	9,940	9,750	8,460	9,468	11,860
Maxim Integrated Products	154	251	422	434	560	607	865
Linear Technology Corporation	201	265	378	379	485	507	706
Industry, Worldwide	102,000	144,000	132,000	137,000	125,000	149,000	204,000

Sales Growth	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Analog Devices		22%	27%	4%	-1%	18%	78%
Intel Corporation		41%	29%	20%	5%	12%	15%
Texas Instruments		27%	-24%	-2%	-13%	12%	25%
Maxim Integrated Products		63%	68%	3%	29%	8%	42%
Linear Technology Corporation		32%	43%	0%	28%	5%	39%
Industry, Worldwide		41%	-8%	4%	-9%	19%	37%

Profit Margins	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Analog Devices	10%	13%	15%	15%	7%	14%	24%
Intel Corporation	20%	22%	25%	28%	23%	25%	31%
Texas Instruments	7%	9%	1%	19%	5%	15%	26%
Maxim Integrated Products	16%	16%	29%	32%	32%	32%	32%
Linear Technology Corporation	28%	32%	35%	35%	37%	38%	41%

Return on Assets	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Analog Devices		13%	14%	11%	5%	10%	18%
Intel Corporation		23%	25%	26%	20%	19%	23%
Texas Instruments		14%	1%	19%	4%	11%	19%
Maxim Integrated Products		18%	37%	28%	27%	22%	24%
Linear Technology Corporation		27%	30%	22%	23%	20%	23%

* Note: Intel and Texas Instruments traditionally have focused on digital devices, while Maxim and Linear Technology have traditionally sold analog devices. Not all companies use the same beginning and end to their fiscal years.

Exhibit 2
Comparison of 1987, 1999, and 2001 Scorecard Metrics

1987	1999	2001
Financial	*Financial*	*Financial*
Revenue	Bookings	Bookings
Revenue Growth	Revenue	Revenue
Profit	Gross Margin	Gross Margins
ROA	SMGA %[1]	SMGA%
	Profit	Profit
		ROA[2]
New Products	*New Products*	*New Products*
NP Introductions	6Q Window Sales[3]	6Q Window Sales
NP Bookings	6Q Window Gross Margin %	6Q Window Gross Margin %
NP Break-even[4]	# of Products to First Silicon	# of Products to First Silicon
NP Peak Revenue	Time to First Silicon	Time to First Silicon
Time to Market	Customer Sample Hit Rate[5]	Customer Sample Hit Rate
	# of Products Released	# of Products Released
	Tape-Outs per Product[6]	Tape Outs per Product
	New Product WIP	New Product WIP
		Time to Market
QIP	*QIP*	*QIP*
On Time Delivery	On Time Delivery	On Time Delivery[7]
Cycle Time	Cycle Time	Cycle Time
Yield	Yield	Yield
PPM[8]	PPM	PPM
Cost	Quality of Work Environment	Quality of Work Environment
Employee Productivity	Customer Responsiveness	Customer Responsiveness[9]
Turnover	Baldrige Score	Excess Lead Time [10]

[1] Sales, Marketing, General, and Administrative expenses as a percentage of revenues.
[2] Through the EIS, managers could also "drill down" beneath ROA to look at Inventory, Accounts Receivable, and Fixed Assets.
[3] Sales from products launched within the past six quarters.
[4] Cumulative sales of new products as a percentage of the break even sales volume for the new product (indexed to number of months since launch).
[5] Percentage of product sample requests that are converted to orders.
[6] This metric relates to the product development process, and the number of design iterations required to complete a design. It is closely tied to product development cost and time to market.
[7] In 2001, this was based on customer request date, rather than a date that the factory commits to.
[8] This is a manufacturing defect rate, in parts per million. The yield is equal to one minus the cumulative defect rates for all manufacturing processes.
[9] The time required to fill a request for a customer quote.
[10] The excess lead time is the delay time to fill orders in excess of the lead time required by the competition.