## *Viewpoint*

# Organizational Learning: The Key to Success in the 1990s

*Ray Stata*

*Ray Stata is chairman and CEO of Analog Devices, Inc. This article is based on a presentation Mr. Stata made to Arthur D. Little staff members in June 1992.*

I feel a bit intimidated talking to Arthur D. Little about organizational learning and performance improvement. What you've done and are doing here is really impressive. It's great to see an organization like Arthur D. Little both taking hold of this important movement in your own company and moving it out to your clients. I am certain that the kind of learning now occurring at Arthur D. Little and at our own company will be essential for success in the 1990s – and beyond.

To put in context some of the things we're doing at Analog Devices, I'd like to tell you briefly what Analog is all about. Our company focuses on what we call real-world signal processing. We got our start back in 1965 making linear amplifiers and various kinds of analog signal conditioning circuits. In the 1970s we were pioneers in the development of A-to-D and D-to-A conversion techniques. And then in the 1980s we saw digital signal processing on the horizon, and we became very involved with that.

Today we are world leaders in semiconductor integrated circuits for real-world signal processing applications. In about 75 percent of our product lines, including data converters, high-performance operational amplifiers, instrumentation amplifiers, voltage references, and analog signal processing circuits, we have the largest market share. We were recently named by *Dataquest* – for the second year in a row – as the best midsize semiconductor company in the United States.

That's the good news. In the grand scheme of things, Analog hasn't done badly in its 25 years of business, and we are still highly regarded by our customers. However, we have noted some sobering trends. For the first 25 years of our existence, right up to 1984, we grew at an average rate of 25 percent per year. Since 1984 there has been a noticeable flattening of the slope of that growth curve. We are not alone; our experience mirrors a pervasive slowdown in the growth of the electronics industry.

So the question is, what's going on?

### The Progress of Technology

Clearly, there is a tremendous amount of change taking place in our business. Most importantly, the era of very-large-scale integration (VLSI) has finally arrived in the linear and mixed-signal area.

Exhibit 1 shows the evolution of chip size for linear and mixed-signal ICs as these chips have increased in complexity. Today, some of our chips have a half million devices on them. We expect the trend toward increased complexity to continue for the foreseeable future. Our business is shifting toward system-level ICs. For most of our history, we've been making functional ICs such as operational amplifiers and data converters, and now we can put these together on a single strip of silicon and make system ICs. This is causing a major transition in the kinds of markets and issues we are tackling.

To illustrate the magnitude of the transition, Exhibit 2 is a diagram of a servo chip used in hard disk drives. Just a few years ago, each one of the little boxes in the diagram represented an amplifier, a multiplexer, a converter, or another functional circuit that we used to sell as an individual component to customers, who assembled them on PC boards. Today we sell all of those – plus a lot more – on a single chip of silicon.

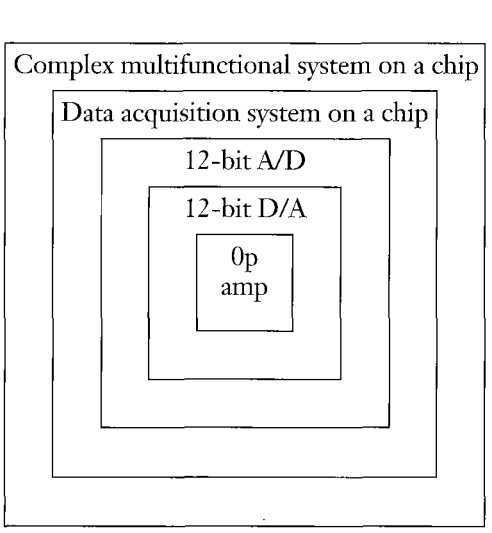
It's interesting to note that when we sold these functions as individual components, we would get between $8 and $10 per hard disk drive. Today, after millions of dollars and lots of sweat, we get around $3.50 for the same functionality. That's called the progress of technology. In the long term, I'm sure our investments will pay off, but along the way it hurts. Similarly, Digital Equipment is seeing the price of its VAXs go from $1 million to $50,000, and many other companies are seeing a drastic reduction in price due to technological advances. The galloping pace of technology has got ahead of market expansion, and so average selling prices are eroding faster than many markets are growing. Over the long term, technology will win; in the meantime, we're suffering through this transition. Future growth will come from new applications in consumer products, computer peripherals, and communication systems, where system-level ICs cost less when used in high volumes. $o we need to shift gears in terms of technology, markets, customers, and our whole approach to doing business. It's exciting, but it's also a tremendous challenge.

Along with the change in technology, we are seeing a significant change in the market for our products. For a long time, our business was driven by military, industrial, medical, and instrumentation applications, where high performance in modest quantities was key. Today, however, peace prevails, and the military market is on the skids. The market for standard function circuits such as operational amplifiers and converters, which grew at 10

to 20 percent per year for many years, has pretty much flattened, largely because of cutbacks in military-industrial markets and the migration of these components to system-level 1C solutions. Suddenly, we have to look for new places to grow.

### Exhibit 1

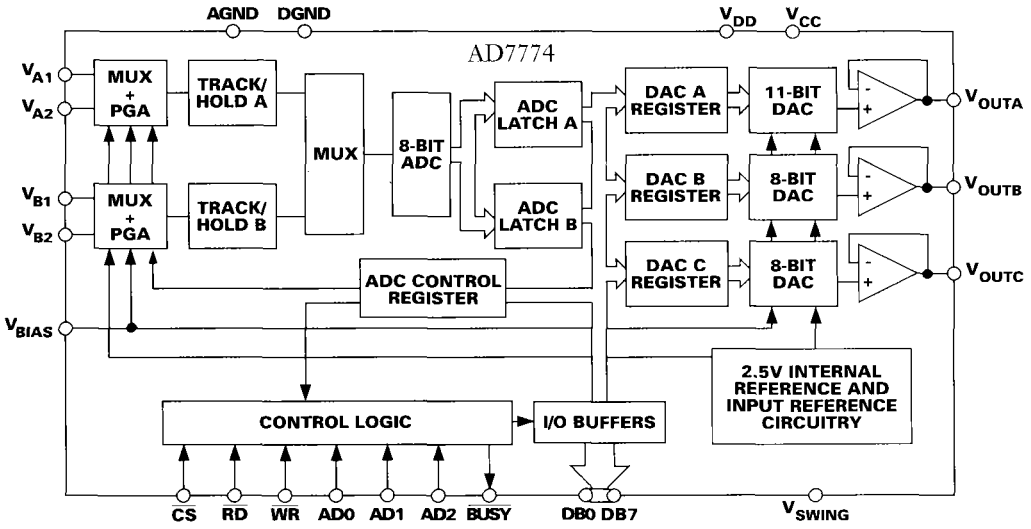
### Chip Size Trend




| | *Sq. mils* |
|---|---|
| Complex multifunctional system on a chip | 120,000 |
| Data acquisition system on a chip | 67,000 |
| 12-bit A/D | 30,000 |
| 12-bit D/A | 10,000 |
| 0p amp | 2,000 |

### Exhibit 2

### Hard Disk Drive Servo Chip




### The Escalation of Standards

What's happening at Analog Devices is happening to a lot of companies around the world, particularly in the United States. In my view, the underlying drive behind what has come to be called the management paradigm shift is the fact that the rate of change in technology and the markets is exponential. Future shock has arrived, and we're living it every day. That changes a great deal of what management is all about. At the same time, the standard for what constitutes successful performance in world markets has gone up by orders of magnitude.

I know this from our own experience. We used to think we were terrific managers and we had a wonderful company. We were considered to be world-class in what we were doing. But as I look back to 10 or 15 years ago, I see that our capabilities were pedestrian compared with what it will take to survive in the '90s.

Performance standards have escalated so enormously in the last decade largely because of developments in Japan. As Peter Drucker has noted in the -*Harvard Business Review,* Japan was the first industrial nation to rise to international power not on the basis of traditional technology innovation (as had the United States, England, France, and Germany) but through management innovation. For whatever reasons, the Japanese have been and continue to be extraordinary innovators in the management of complex organizations. And now we're all scrambling to understand what they've done.

In the last analysis, the challenge is to accelerate our rate of learning. I look at improvement and learning as two sides of the same coin. Back in the 1980s, we thought we were making reasonable progress in learning and improvement. But as I look ahead, it is clear that we must accelerate our rate of improvement significantly in comparison with the past.

We have to think of learning more broadly not just at the individual level, but at the levels of teams, organizations, and societies. My goal is for Analog Devices to become a learning organization. I believe that the capacity for rapid learning will differentiate the winners from the losers in the '90s. Our challenge is to deal with a future that's very different from the past, while at the same time preserving those fundamental values and beliefs that are still valid.

### Being the Best

Toward that end, we have been asking, „What are the core values at Analog Devices?" One answer is that we have always valued „being the best" at what we do. It's not a terribly innovative idea, nor unique to Analog Devices, but it's highly descriptive of what we're trying to do. We are committed to „being the best" at what we do not only in terms of business strategies and market leadership, but now, more importantly, in terms of how we do it – that is, the way we manage.

To define what „the best" means, we went back to the basics. W; followed a model similar to Arthur D. Little's High Performance Business model, which holds that the purpose of the firm is to meet the needs of its major stakeholders: the customers, the employees, and the stockholders. For each of those constituents, we have to understand anew what characteristics will make Analog Devices the best place to buy the best place to work, and the best place to invest.

Concepts that we have found very useful in thinking about customer satisfaction are „market in" and „product out" (Exhibit 3). These terms are widely used in Japan, where they are expressed in English to signify that the former is very different from the latter, older concept. Historically, the purpose of work was to get the product out in accordance with standard manuals and procedures. This approach was particularly relevant in the era of mass production and the consumer revolution, when the challenge was to crank out enormous quantities of a product to satisfy a huge demand. It didn't have to be very fancy, as Henry Ford noted.

The „market in" concept, in contrast, recognizes that on the other end of the work function is a customer, whether inside or outside the company. The real purpose of work is customer satisfaction. Therefore, you have to have increasingly sophisticated ways to measure customer satisfaction. And then you need methodologies and techniques to improve the work function, in order to stay ahead of your competition. After 200 years of industrial development, it's just in the last 10 or 15 that we have seen this fundamental shift in our understanding of the purpose of work.

This brings us back to the issue of the rate of change. What it takes to satisfy customers changes rapidly these days as a result of rapid changes in society. To me, „market in" is an elegant and powerful way to express what the management revolution is all about. And so, for ADI**,** a primary concern is changing the culture to get employees to take customer satisfaction seriously. Employees must be willing and able to change rapidly in response to customers' changing needs.

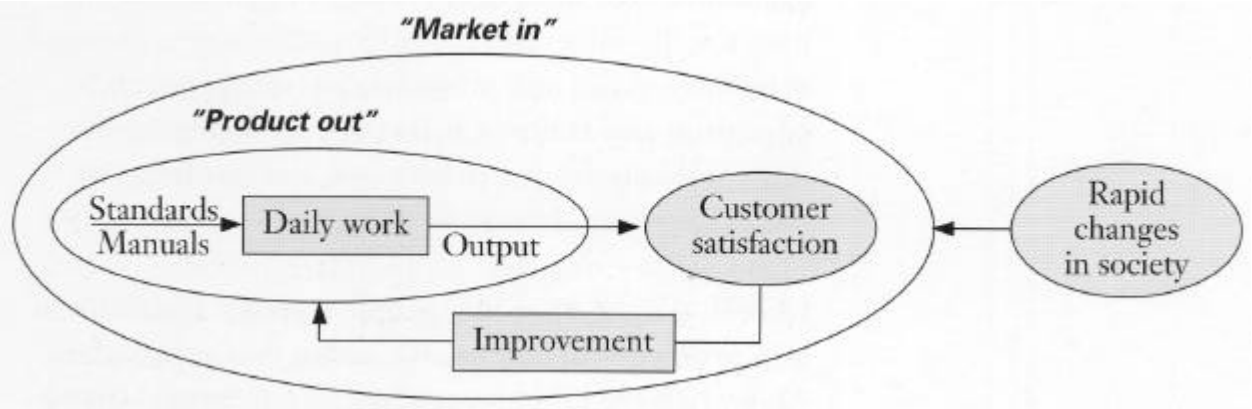
For more than 20 years, Analog Devices enjoyed a virtual monopoly in many of its product lines. We called the shots and our customers danced to our tune. To tell you the truth, we liked that arrangement. A lot of our people got used to it – and many don't want to change. It's hard for a company like Analog to accept the reality that we don't call the shots any more. You can say the words, you can draw the pictures, and you can talk about the concept, but actually making the cultural transition is a struggle. To do it, you must do a lot of learning.

### Learning to Learn

It's possible to think of total quality management (TQM) as a way to achieve customer satisfaction through continuous improvement in the way we work, especially by using scientific methods to identify and solve problems. But TQM is much more than this. As Professor Ishikawa of the University of Tokyo has said, „TQM is a thought revolution." Certainly, we must think this way as we strive to create high perfomance organizations. I like to think of TQM as a system for learning – a way to accelerate improvement in a rapidly changing world. This learning to learn takes place on four levels: individual, team, company, and society (Exhibit 4).

**Exhibit 3**

**„Market In“ vs. „Product Out“ Concept of Work**




**Individual Learning.** We're most familiar with learning at the individual level. My definition of learning follows the behavioral model. That is, learning hasn't really taken place until it's reflected in changed behaviors, skills, and attitudes. So our approach to education and training is focused on changing the skills and behavior of employees, and our focus is not on teaching, but on learning.

In 1991, we put some 900 people through a basic seven-step problem-solving course, using two approaches. About half the employees came to our central corporate training facility for standard classroom training.

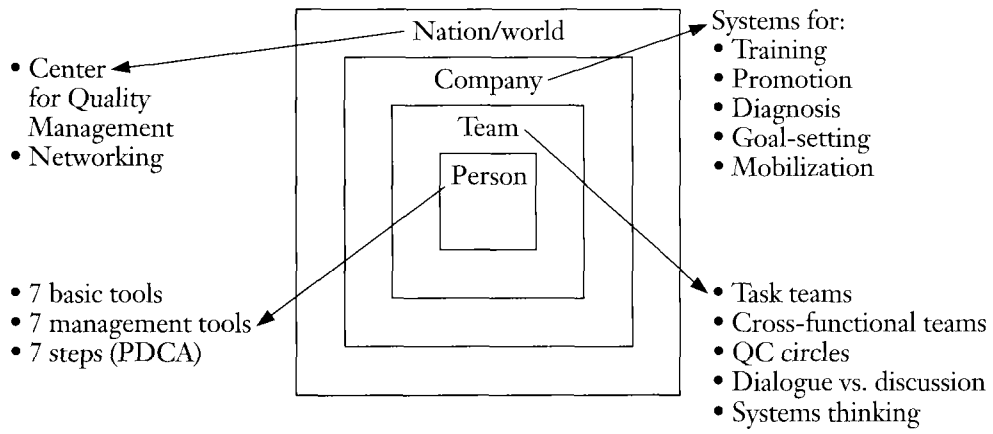
The other half were trained in teams, on the job. This group didn't get trained until they were part of a team that was working on a real problem. When they got to a point where they needed help, they called in a facilitator. First they learned Step 1 and applied what they learned. They didn't worry about Steps 2 or 3 until they needed them. You might call this just-in-time training.

Three or four months later, we surveyed the people who went through these two programs. Of those who had received just-in-time, on-the-job training, 80 percent said they felt they used what they learned. Of those who had received standard classroom training, only 30 to 40 percent felt they had actually put to use what they were taught. We think a lot differently now about how to do training.

**Team Learning.** Individual learning is the easy part. When you start to ask how teams learn or how organizations learn, you find yourself in virgin territory. At the root of team and organizational learning is conversational exchange – how do we accurately communicate to each other what's going on in our minds and what's going on in reality? The human tendency is to assess prematurely the meaning of what people are saying or not saying and why they are saying or not saying it. There is also a tendency not to be forthcoming about our own weaknesses and mistakes. These tendencies are powerful impediments to learning in groups.

**Exhibit 4**

**Four Levels of Learning**



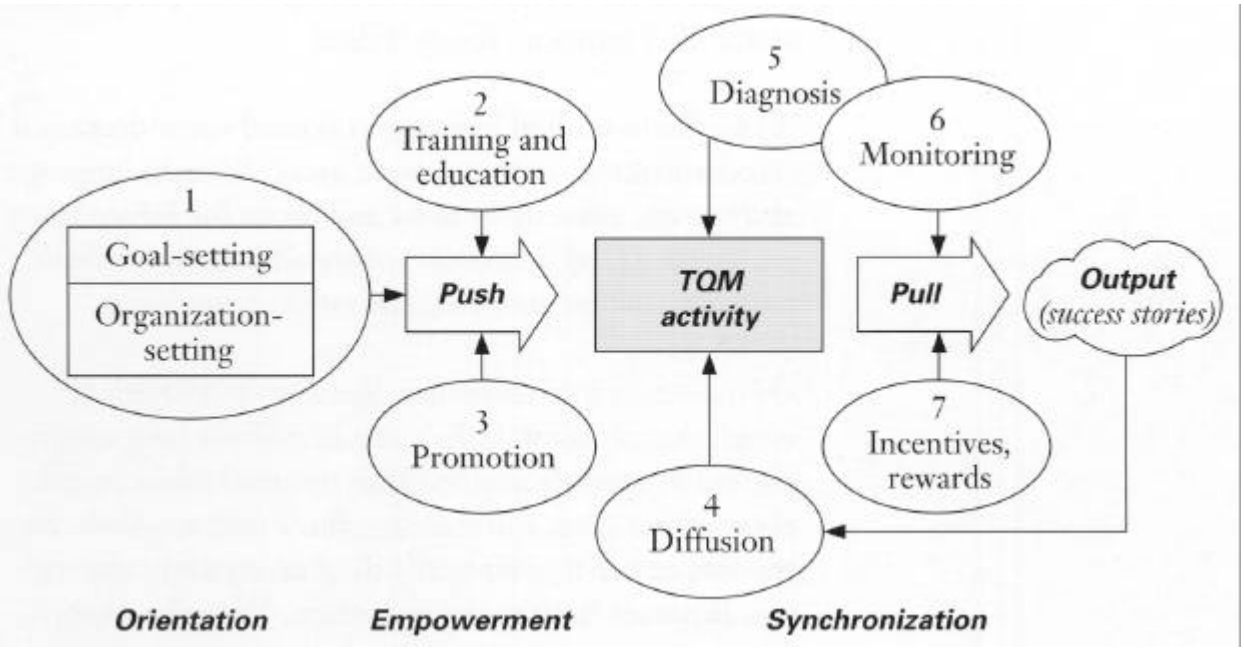
TQM puts a lot of emphasis on „management by facts." It teaches ways to ensure that facts, not opinions, are used to identify the root causes of problems – and to ensure that proposed solutions really work as planned. For example, the KJ Method, sometimes called the affinity diagram, is a TQM tool that facilitates a precise way of communicating in teams. It focuses on clarifying the meaning of written statements about what we see as problems. This approach helps people to distinguish between fact and opinion and to cite evidence at the lowest level of abstraction. It builds consensus by combining observations into higher-level abstractions that reflect a comprehensive, shared view of reality. With this and similar tools, people working in teams can be more productive and find answers that individuals working alone from a narrower perspective cannot see.

More generally, if people are to learn in groups, they must distinguish between reality and assessments of reality. At one level, this is the distinction between fact and opinion. But more deeply, this distinction influences our ability to understand and to trust each other. Most people walk around wearing labels that they acquired early in their work experience. The labels are based on assumptions that are often obsolete. If teams and organizations are going to learn, then the people in the teams must learn and change, often dramatically over short periods. The assessments and the labels are impediments to change. To create a learning organization, we need an environment in which we seek to understand each other for who we are today and for who we want to become – not for other people's assessments of who we were.

**Organizational Learning.** Exhibit 5 presents the infrastructure elements that are prerequisites for organizational learning. They are the concepts of Professor Shoji Shiba of the University of Scuba in Japan. We teach them at the Center for Quality Management, an organization of 35 Boston-area companies that are involved in TQM. The diagram refers to TQM activities, but the same framework applies to any kind of improvement or learning activity. A formal infrastructure like this accelerates a company's learning process. You start with goal-setting – that is, clarifying or envisioning where and how you want improvement and learning to occur. You need to decide on the organization and accountability for managing the change process. You need education and training, promotional activities, and systems for monitoring and diagnosing results and for providing incentives for success.

**Exhibit 5**

**TQM Infrastructure**




The output of TQM activities is success stories. Setting up a system to diffuse these success stories is the best way to get the organization to buy into TQM methods and try them. At Analog Devices, we hold QIP Fests (quality improvement program conferences) where people come together first locally and then company-wide to share their learning experiences. Of course, the most dramatic success stories are promoted at the corporate level. And we recently held a quality conference at the Center for Quality Management at which all the member companies shared their learning experiences.

Sharing success stories is an important element of organizational learning. It doesn't happen automatically – you have to deliberately put a system in place to make it happen. The system doesn't have to be elaborate or a QIP Fest, but somehow you have to get people across the organization to share what they are learning. For example, we have a semiconductor plant in Ireland and one in Massachusetts. For years and years, people on both sides of the Atlantic were separately learning new tricks in manufacturing semiconductors. But we didn't have an infrastructure that encouraged mutual learning, so it didn't happen. Today it does.

To facilitate mutual learning you need some degree of standardization, so that people speak the same language and use the same definitions and terms for information exchange. If the process is totally ad hoc, it's difficult to communicate across organization boundaries.

Of the seven infrastructure elements in Exhibit 5, which do you think is the most important in accelerating the organizational learning process? Most people choose education and training. But Professor Shiba has convinced me that it's really diagnosing and monitoring. It comes back to the old adage, „You can expect what you inspect," especially when it comes to managing change. A leader must have sufficient knowledge and skills to diagnose whether or not a desired change is occurring. He or she needs to be able to ask the right questions. This is why it's been so important for me to recognize that learning is not going to happen in the company unless I develop this knowledge and these skills myself.

**Societal Learning.** For some time I've been studying organizational leaming and how to make it work at Analog Devices. But the importance of a formal infrastructure to promoting societal learning completely escaped me. In Japan, according to Professor Shiba, there is an organization called the Joint Union of Scientists and Engineers. This organization pulled together business and academic leaders after World War II and asked them, „What are we going to do to rebuild our nation to a position where the world will again respect us?" This is the group that invited Demming and Juran to Japan to give them advice, and we all know the results.

For 40 years Japan has had an organization based on the tenet that there are no secrets in quality. Companies in Japan are committed to supporting each other in the discovery of new and better ways to manage, and then rapidly diffusing the best practices throughout their society. Without a similar infrastructure in the United States, Professor Shiba questions whether we will ever catch up with Japan's learning process.

The Baldrige Award has been an enormous step toward a national learning infrastructure. It has helped to create a common language about quality. Without a common language, it is hard to communicate within companies and between companies. Another great step forward has been the concept of benchmarking, or methodically going out and researching the best practices. I believe Xerox invented this concept in its modern form. And of course the consulting industry and the universities have been important contributors to societal learning and will continue to be.

But I think it's also important that corporations create their own learning infrastructure. We need ways to encourage people to really let their hair down and be frank about the difficulties of bringing about revolutionary changes in the way we manage. We need to establish networks through which people can freely share with each other – not the bright, shiny news about how wonderful we are, but the reality of how we are struggling with our various problems and challenges, and that if you've got any good ideas, we'd love to hear them.

We have created the Center for Quality Management in the Boston area to provide just such a network for member companies. We have developed a course that everybody takes, which establishes a common conceptual framework and language. We have roundtables, in which people in similar functions get together and share views. We have seminars and workshops. For example, Bolt, Beranek, and Newman wrote a manual based on TQM principles that we essentially copied, changing details where appropriate for Analog Devices. Why reinvent the wheel? Similarly, we create training materials and share them with other companies. This sharing of learning really does work. In Japan, they've been doing it for a long, long time.

### Feeling Important, Feeling Proud, Having Fun

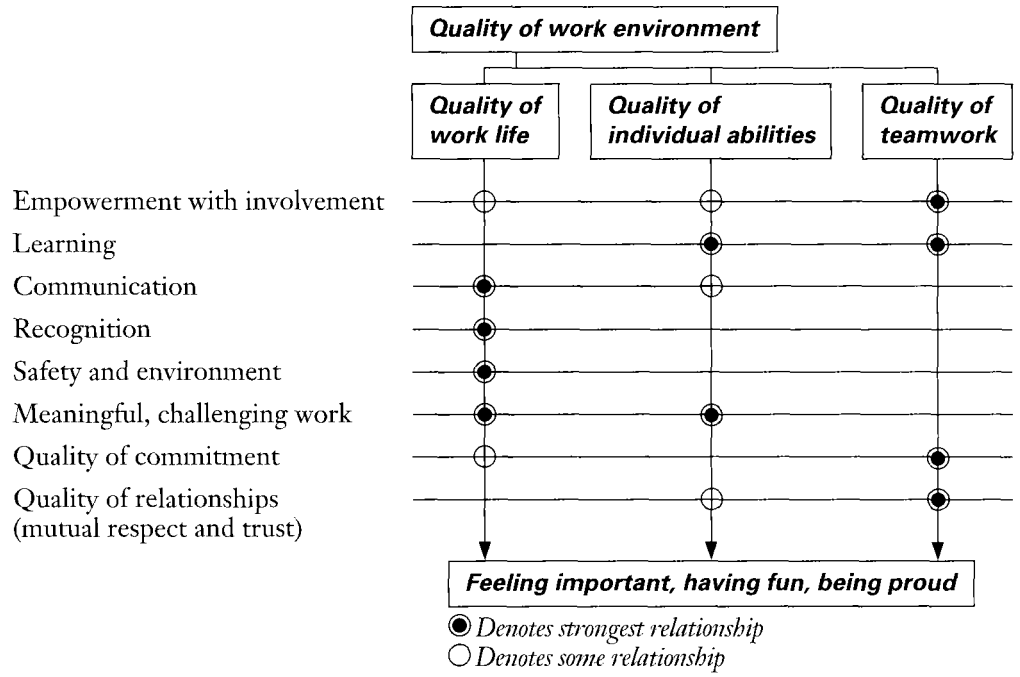
Early in 1992 we visited the Milliken Company, which is renowned for the spirit, enthusiasm, and commitment of its employees. Tom Malone, president of Milliken, reminded us of the saying, „The hard stuff is easy, the soft stuff is hard, but the soft stuff is more important than the hard stuff." According to Tom Malone, more than half of all improvement comes from the „soft stuff" – that is, the human, motivational side of the equation as opposed to the analytical, problem-solving side.

In the end, it all comes back to improving the quality of the work environment. Specifically, you need to improve the quality of work life, the quality of individual abilities, and the quality of teamwork (Exhibit 6).

Managing a company so that people feel good about themselves and about those around them is a lot harder than learning the seven tools of quality. We have to keep this in mind as we introduce TQM methods, and constantly remind top management of its importance – even in a company like ours, which prides itself on having a progressive human resource philosophy.

**Exhibit 6**

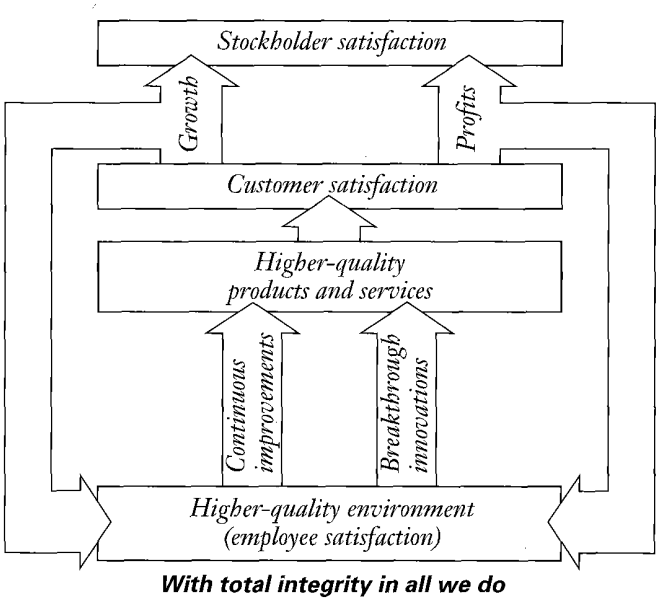
**Quality of Work Environment**




In the model that we put together for Analog, the cornerstone is a high-quality environment that addresses the whole issue of employee satisfaction (Exhibit 7). That's the platform on which to build the new methodology, both for continuous improvement and for innovative breakthroughs. If you're successful at creating that environment, you're going to get higher-quality products and services, which in turn will make the customers happier. And all the research that's ever been done says that if you have happy customers, they're going to give you more business, which means more growth and profits to keep your stockholders happy. The real trick is to create positive gain in the feedback loop between customer satisfaction and employee satisfaction, which will lead to exponential growth. That's what we're working on at Analog.

**Exhibit 7**

**Model for New Analog: „Being the Best"**



## From Management to Leadership

Finally, we come to the biggest challenge of all – the need to transform managers into leaders. The first time I heard of quality management was back in the early 1980s, when Analog was doing wonderfully. My motivation for learning TQM was the thought, „We're great, but we can do even better." This is a hard sell if your goal is to create revolutionary change. Also, my approach to managing change was naive – „Here are the books; you're smart guys, go read them and make it better. Quality's free; just do it!"

Three years after the speeches and slogans, of course, nothing had happened. So I said to myself, well, maybe we're missing something here. Maybe we need a vice president of quality. So we went out and got a very good one, Art Schneiderman. Art arrived in the mid-1980s, when things weren't looking quite so good and the environment was a bit more receptive to change. Art knew what he was talking about and, at the time, I didn't. So I said, „Hey, Art, would you please come in here and get this damn place on the road to quality?" The way I saw it, my role was occasionally to cheer-lead, give more speeches, and say how important this quality stuff was. Making it happen was Art's job.

Between 1986 and 1990, Art made incredible progress in convincing the organization of the value of TQM methods. This was what's called, in the language of Joseph Juran of the Juran Institute in Wilton, Connecticut, the period of „picking the low-hanging fruit." There were so many problems out there that you could do almost anything and make progress.

Then, in 1990, we began to hit the wall again. This time our motivation was fear and humiliation – far more powerful than earlier motivators. At this time I came to understand, through working with Professor Shiba, that making it happen was my job, not Art's. So I had to become knowledgeable enough and skilled enough to lead the process. This challenge started with me but would have to cascade down through every manager in the company. We all had to transform ourselves into leaders of the change process.

There are many dimensions to this transformation. The new knowledge and skills required to be an effective leader in the 1990s can be pretty daunting. The leader of the '90s will be a facilitator of change – a learner and teacher, a coach and counselor, a role model, a diagnostician, a designer of new systems and organizational structures, and a master of conversation.

A special role for the leader at the top of the organization is to be an iconoclast. The biggest impediment to change is your assumptions and beliefs; nothing fails like success. You have to identify the beliefs and assumptions that used to work but are now getting in your way. In companies with strong cultures, that's a hard knot to unravel. The leader must demonstrate through words and deeds that throwing out things that were once held sacred is not only OK but necessary.

I'm excited and challenged by how much I have to learn to provide the leadership Analog Devices needs. Every day I learn a little bit more, and every day I learn just how much more I have yet to learn.

*Ray Stata is chairman and CEO of Analog Devices, Inc. He was a founder and the first president of the Massachusetts High Technology Council and is a member of the Executive Committee of the Council on Competitiveness.*

*Erratum: On pages 8-10 of the third quarter 1992 issue of* Prism*, on „Rebuilding Eastern Europe," an editorial oversight caused several discrepancies between the text and the accompanying table. Please take the data in the table as more accurate. Our apologies for any inconvenience this may have caused.*