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THE NEW QUALITY PHILOSOPHY AND MANAGEMENT'S ROLE

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This talk is about leadership. Leaders are people at every level in an organization who believe in change and are energized by it. They understand the difficult realities of competitive existence. They motivate and challenge. They provide positive reinforcement--but are never satisfied with their achievements because opportunities for further improvement are never exhausted. Today, leadership is more important than ever because operating environments are changing at an unprecedented rate. The causes are geopolitical, economic, technological, etc. In fact, everything we know about nature tells us that change is inevitable. History shows quite clearly that human progress is not possible without change. Yet, humans crave stability and permanence. As a consequence, success often leads to complacency. But, demise is inevitable for those who protect the *status quo* (Figure 1).

There exists a growing national awareness that global competitive pressures are forcing on American industry the need for ever higher levels of performance. It came as quite a surprise to our nation to find that high-technology industries in countries such as Japan and Germany were challenging, and in many cases exceeding, U. S. productivity gains. It hurt our pride, but, as a result, the industrial sector of our economy is now placing renewed emphasis on performance improvements. And, similar forces are necessitating improved performance in DOE's nuclear weapons complex. The principles guiding these efforts are captured in the selection criteria of the Baldrige National Quality Award. The central idea can be described by the customer/supplier model (Figure 2) which is based on the obvious fact that everything that human beings do involves processes. Every process serves some customer and depends, in turn, on one or more suppliers. The key to sustained success is to maintain customer delight through continuous process improvements. Ultimately, the key *is to do the right thing right the first time every time.* It is an ideal we will never achieve, but it is one we must always strive for. Today, quality takes on a much larger meaning than it has traditionally. It is attention to cost, schedule and product performance that characterize the modern Quality ethic (Figure 3). It is quality spelled with a capital "Q", and Quality provides the true measure of customer satisfaction.

In recognition of the strategic importance of Quality in the context of national economic competitiveness, the Commerce Department some

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years ago established the Baldrige Award. It is illuminating to examine the Baldrige criteria. They begin with leadership! They also cover information analysis; planning; human resources; quality awareness; results achieved; and, the most important category, customer satisfaction (Figure 4). Scoring is based on very high standards (Figure 5). The Quality "novice" usually relies on anecdotal management methods, and the understanding of results achieved is also anecdotal. Formal management systems and measurement techniques (including competitive benchmarking) are essential elements in accomplishing rapid productivity improvements. Not surprisingly, it is only after such formality has been created that an applicant has a chance of scoring anywhere near the 100 percent range in any of the Baldrige categories. A year ago, I asked Larry Bertholf, Director of Sandia's Quality Organization, to score my leadership performance. My aggregate score reached only 26 percent. There is clearly room for improvement! The Baldrige Award thus becomes a challenging goal for all individuals in an organization. Attainment of performance levels in the award range marks a remarkable achievement.

Given Sandia's role in the nuclear weapons program, I want to note at this point that the improvements in overall productivity that can be obtained through the modern Quality approach are especially significant at the front end of any process sequence. Here I am referring, in particular, to R&D. We all realize that any mistakes in the design phase that are permitted to propagate through production and customer delivery usually have an enormous cost impact. It is self-evident that the earlier any mistake is corrected (or better yet--avoided!), the less scrap is produced, and the less time is required to complete the work and meet customer requirements.

It may be of interest to relate how I became a believer in Quality. It involved personal experiences extending over many years beginning in 1959 when I joined Sandia's research organization. Although initially preoccupied with my own basic research efforts, in time I became directly involved in the nuclear weapons program. I recall the decade of the 1960s as a period of dramatic progress in support of an urgent national security need. Many of us remember the heady experience of those earlier days. It created a special culture not only in the Laboratories, but throughout the entire complex. The central thrust became the accelerated introduction of advanced technology into the stockpile **at any cost.** Phase III engineering development projects tended to become scheduled exploratory development projects with their attendant high technical risks. Since financial resources were generally not limiting, we usually delivered on time, and the product tended to meet the specified military characteristics. Importantly, the government trusted us when we stated our resource needs. These conditions created within the Laboratories a state of relative isolation--we were a world to ourselves and tended to assume we were "the best". In short, we took excellence for granted. We hired the best people and

gave them the best facilities. We never questioned our belief that rugged individualism was the way to achieve the best results on behalf of the taxpayer. We explicitly trusted people to do the right thing.

That way of thinking came especially easy at Sandia because of our AT&T connection, and the dominant role played by Bell Laboratories in the evolution of the Bell System in the post-WW II era. In 1984, soon after the traumatic AT&T divestiture, I moved east and joined Bell Laboratories. I did so with considerable excitement. It was like a promotion to baseball's major leagues after many, many years in the minor leagues. It felt like being called up by the Yankees. Of course, I quickly discovered that, in relative terms, these were the struggling Yankees of the 1990s, not the dominant Yankees of an earlier era! The talent was still there, but the competition was suddenly much stiffer. My subsequent Bell Labs R&D experience in support of AT&T's Federal Systems shaped my views in very profound ways. I came to the realization that technical excellence alone is not enough. Rather, it is teamwork and the ability to adapt quickly to changing operating conditions that spell the difference between success or failure in a competitive environment. The Bell System had enjoyed a monopoly for many years, and "technology-push" rather than "market-pull" had become the focus. After divestiture, it soon became clear, however, that AT&T management processes lacked the efficiencies and robustness needed to satisfy the Quality expectations of increasingly demanding customers in the new, tough environment. Almost overnight, the corporation had to adopt a more sharply focused customer-oriented, market-pull approach. Speed of delivery and price competitiveness became as important as technical innovation. Given a choice of suppliers, it was the customer who now set the terms, not AT&T Bell Laboratories. This created demands that proved difficult to cope with, and I lived through a number of very unhappy experiences. As pressures mounted to accomplish more R&D in less time with fewer resources, performance tended to suffer initially. Development procedures and support systems were often inadequate to prevent costly mistakes in such an environment.

I like to tell the story of the STU III telephone development of the mid-1980s. The feature-rich AT&T secure voice and data terminal was a success from a technical point of view. However, in comparison with competing products from Motorola and RCA, it reached the market too late and was too costly both in development and production. From beginning to end--from market assessment through requirements definition and engineering development to manufacturing and sales--we left much room for improvement. It was not a "Quality" operation, even though technically, the product met all specifications. As a consequence, the financial results did not meet expectations! The story has a happier ending. A very recent design, executed by a much smaller, but highly motivated and empowered team employing improved development methods, succeeded in the course of only a year

in delivering a new generation of AT&T STU-III terminals that are better, smaller and less costly. This remarkable turnaround attests to the power of the "Quality Way"!

At present, AT&T is pursuing the Baldrige Award and doing it with great intensity. Although Bell Laboratories created much of the understanding that forms the foundation of modern Quality practices, AT&T Quality performance still lags behind companies such as Motorola and Xerox who have been successful in competing for the Baldrige Award. Following divestiture, Quality suffered initially due to the unaccustomed competitive pressures. It has taken several years to turn the culture around, but AT&T is beginning to make significant progress in its pursuit of Quality excellence. It understands that it has no other choice.

I want to return to a consideration of the weapons program of the 1990s. It is obvious that there exist striking similarities between the transition that AT&T is managing and the transition that we in the nuclear weapons complex are now confronted with. In particular, our customers are questioning our ability to function in a new, tougher environment in which the performance criteria are becoming very much as they exist in the private sector. What matters today is the timely delivery of products characterized by essential functionality at minimum cost, as well as high reliability, maintainability and other "...ilities". Moreover, our past performance in the areas of environment, safety and health is now judged to have been totally inadequate, and the remedies will be costly at best. Suddenly, our customers are finding fault with our performance. To make matters worse, we are facing these challenges at a time of shrinking budgets. As the pressures on us increase, I fear that our collective performance may degrade. It is often claimed that DOE's problems result from incompetence. This is no more true for the DOE family, however, than it was true for AT&T following divestiture. The DOE community is every bit as competent on average, perhaps more so, as comparable groups elsewhere. What is wrong, in my view, is that we are suffering frequently unrealistic and unsteady requirements, ambiguities in management responsibilities, poor teamwork and many other Quality deficiencies. Demoralization is widespread and fear of failure is impeding decision processes. In the meantime, the harder we force people to work, the more mistakes they are apt to make. The one thing we still do effectively when problems are encountered is to ask for more money. I am one of those who participates in the annual procession to the Congress where we complain about insufficient resources. In the private sector, such arguments are unlikely to achieve the desired result when the balance sheet is hurting. I believe the time has passed that we can expect sustained success in the nuclear weapons complex using this approach. The only way to assure more support in the long haul is to gain credibility through improved performance. First comes the respect of

customers and sponsors. Then we can make a stronger case for additional resources. For now, the answer lies in Quality!

When I returned to Sandia in 1989, I was struck immediately by the similarities in the challenges facing AT&T and DOE's weapon complex. I was delighted to discover that Albuquerque Operations had already launched a full-blown Quality thrust. Of course, I was pleased to see that Sandia was also becoming active. The Sandia commitment was still spotty at the time. But, in several places, for example, in Component Development on the technical side and in Purchasing on the administrative side, some rather vigorous efforts were under way to improve management processes. Shortly after, we got serious and created a strategic vision for Sandia National Laboratories. The three principal elements of that vision are **Quality, Leadership** and **Empowerment** (Figure 6). The importance of leadership is entirely obvious. By now, the importance of Quality as a measure of customer delight must also be obvious. Finally, empowerment is the only way I know to make it all happen. Quality and empowerment are inseparable concepts. Neither is possible without the other. On the one hand, even empowered employees cannot achieve positive results unless there is some formality of processes--the essential element of Quality (Figure 7). On the other hand, efficiencies cannot be mandated; they depend on a sense of ownership at all levels in the workforce, based on personal involvement, participatory decision making, effective teamwork, trust and so on.

At Sandia, we have established a set of near-term Quality goals (Figure 8). We intend to become a national leader in Quality. We are not eligible for the Baldrige Award but have set our sights on the AT&T Chairman's Award, which follows the Baldrige criteria. To win the AT&T Gold Medal requires a score in excess of 800 points on the Baldrige scale of 1,000--very tough. The ultimate objective of our Quality initiative, however, is not to win an award. The award only represents a performance milestone. Our true objective is customer delight in DOE and elsewhere! The elements of our Quality improvement process emphasize management commitment and leadership. I don't believe that a Quality ethic can be turned into a functioning reality in the absence of commitment. For such commitment to endure requires passion and superior support systems. The need for passion is self-evident. Unless leaders communicate strong convictions, Quality is likely to remain a slogan. The only way to make Quality real is for leaders to become passionate believers. It is also true, however, that passion without trained skills and formal support systems will not lead to our strategic goals. In recognition of that fact, Sandia is putting a lot of emphasis on developing systematic approaches to process improvement (Figure 9). In simplest terms, this revolves around an endless repetition of the basic improvement cycle: (1) **Assignment of process ownership** to ensure that someone is in charge and is supported by a team to carry out the day-to-day Quality management activities;

(2) **Assessment of improvement opportunities** to ensure that the process is defined and that customer requirements are understood; (3) **Selection of opportunities** to ensure prioritization; and (4) **Improvement** based on a formal, documented plan of action. After determining the results, the cycle starts all over again (Figure 10). Measurements are clearly a critical element in any Quality program. It is difficult to improve that which is not measured. We intend to focus on the cost of Quality as a fundamental metric.

Among the many processes affecting Laboratory performance, none is more important than the requirements process. Since we are a part of DOE, we think of DOE as our number one customer, and are intent on delighting this customer. This will necessitate that we negotiate DOE requirements in a more formal manner than has frequently been the practice in the past. In the future, we intend to improve that process, and then live up to the commitments which flow from that process.

I cannot leave the subject of Quality without touching again on the subject of ES&H. Our intent is to satisfy DOE's requirements (i.e., the achievement of ES&H excellence) through process improvements based on modern Quality principles. Meeting those requirements will necessitate a greater formality of operational conduct than we have applied in the past to this topic. It is often claimed that such formality is incompatible with a productive, creative R&D operation. I don't agree with that position. On the contrary, discipline and rigor are natural elements in any Quality approach. As alluded to earlier, the leverage of Quality improvement is especially significant in R&D. Because the ES&H requirements impact every Sandian, the ES&H challenge has afforded us an outstanding opportunity to practice what we have preached by focusing our Quality commitment on meeting a critical customer requirement. During recent months, the ES&H improvement and compliance effort has yielded other benefits. Struggling with a common set of problems has brought all of us much closer together. New communication channels have opened between management and non-management, between union and non-union. It has also strengthened Sandia's ties to DOE/AL. I see signs of a team spirit at Sandia which has grown stronger as a result of the ES&H burden. The link between ES&H and Quality has been forged. We are now prepared to engage the Quality challenge facing us on a broader front.

In summary, let me repeat my simple message (Figure 11). The role of modern managers is to set the course, coach, encourage teamwork and, above all, *live the quality ethic!*


In times of

change,

learners inherit the earth,

while . . .

the learned find themselves
beautifully equipped to deal with
a world that no longer exists.

Eric Hoffer


Fig. 1

The Customer - Supplier Model

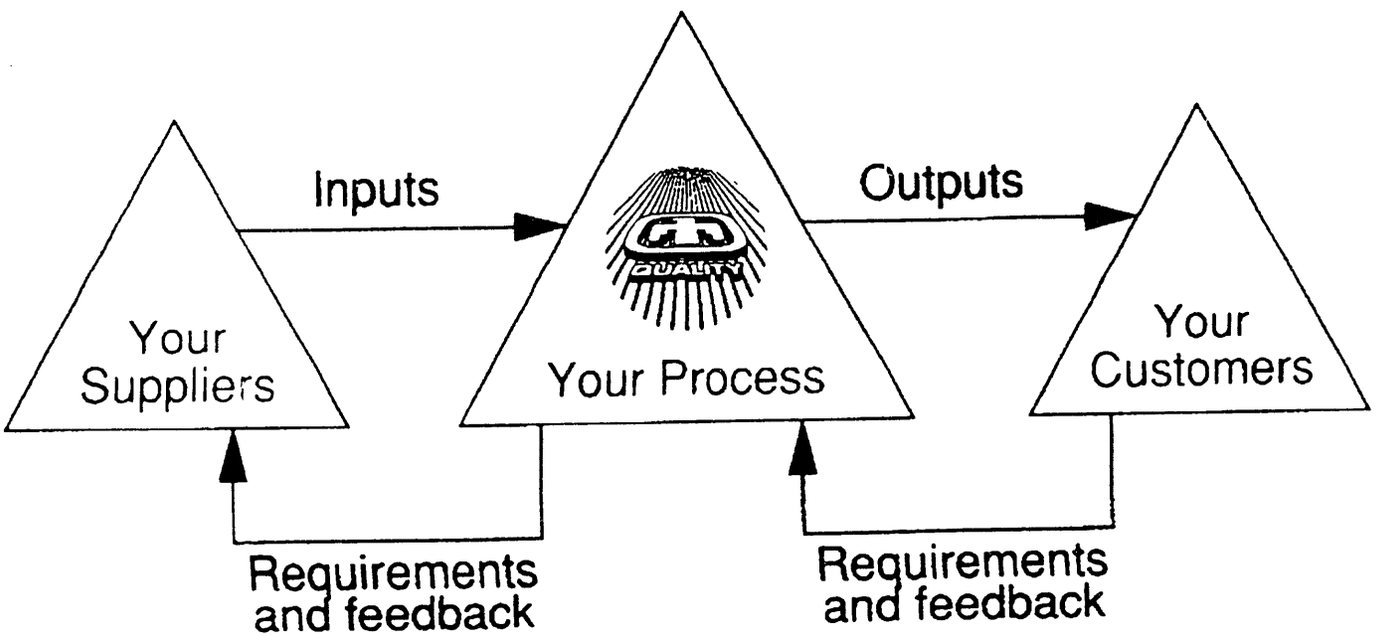

Fig. 2

QUALITY =

Performance (quality)

+

Cost

+

Schedule

Fig. 3

Malcolm Baldrige National Quality Award

	1991 Examination Categories	Maximum Points
1.0	Leadership	100
2.0	Information and Analysis	70
3.0	Strategic Quality Planning	60
4.0	Human Resource Utilization	150
5.0	Quality Assurance of Products and Services	140
6.0	Quality Results	180
7.0	Customer Satisfaction	300
	Total Points	1000

Fig. 4

Malcolm Baldrige National Quality Award

Scoring Guidelines

0%	10-40%	50%	60-90%	100%

Approach:

Anecdotal
No system

→

Sound, systematic prevention basis;

Excellent integration

Deployment:

Anecdotal

→

Major areas;

All operations

Results:

Anecdotal

→

World-class in most areas;

Sustained results;

Results traceable to approach

Fig. 5

Sandia's Strategic Plan:
Responding to the challenge of the 90s

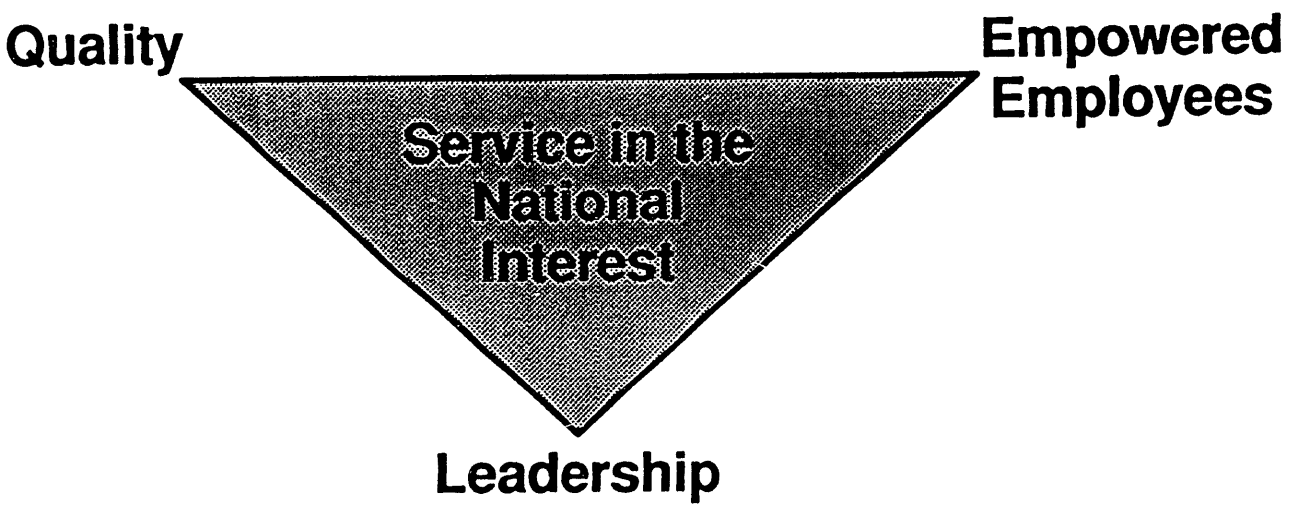

Fig. 6

The SNL quality improvement process elements

- Management commitment and leadership
- Process management networking
- Measurement
- Cost of quality
- Quality awareness
- Corrective action
- Education and training
- Recognition

Fig. 7

Sandia Quality Goals

#1 Demonstrate progress towards becoming a national leader in quality.

#2 Vigorously and persistently solicit customer evaluations of our work. Work with customers to make such evaluations as meaningful as possible.

#3 Increase efforts at process definition, establishing ownership of the processes, and the vesting of responsibility and authority for continuous improvement of these processes.

#4 Improve the job-related ability of all Sandians.

#5 Improve project management, including project reporting, control, planning, and requirement establishment.

Fig. 8

The SNL Quality Management System

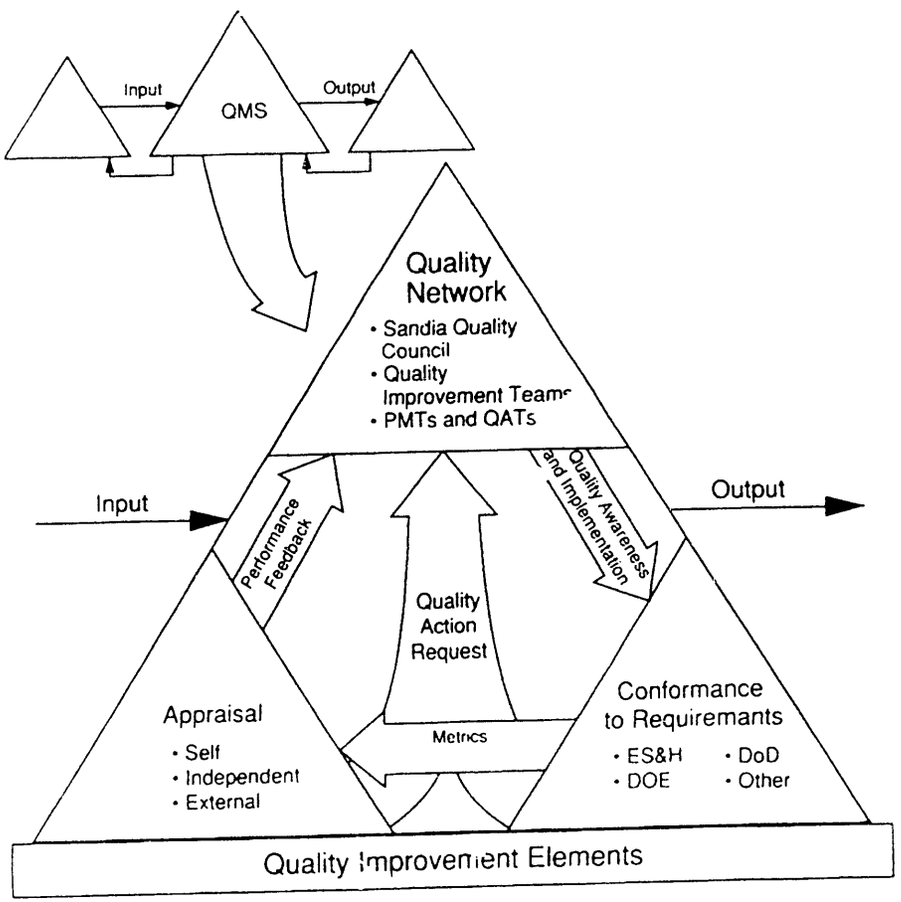

Fig. 9

The Process Improvement Cycle

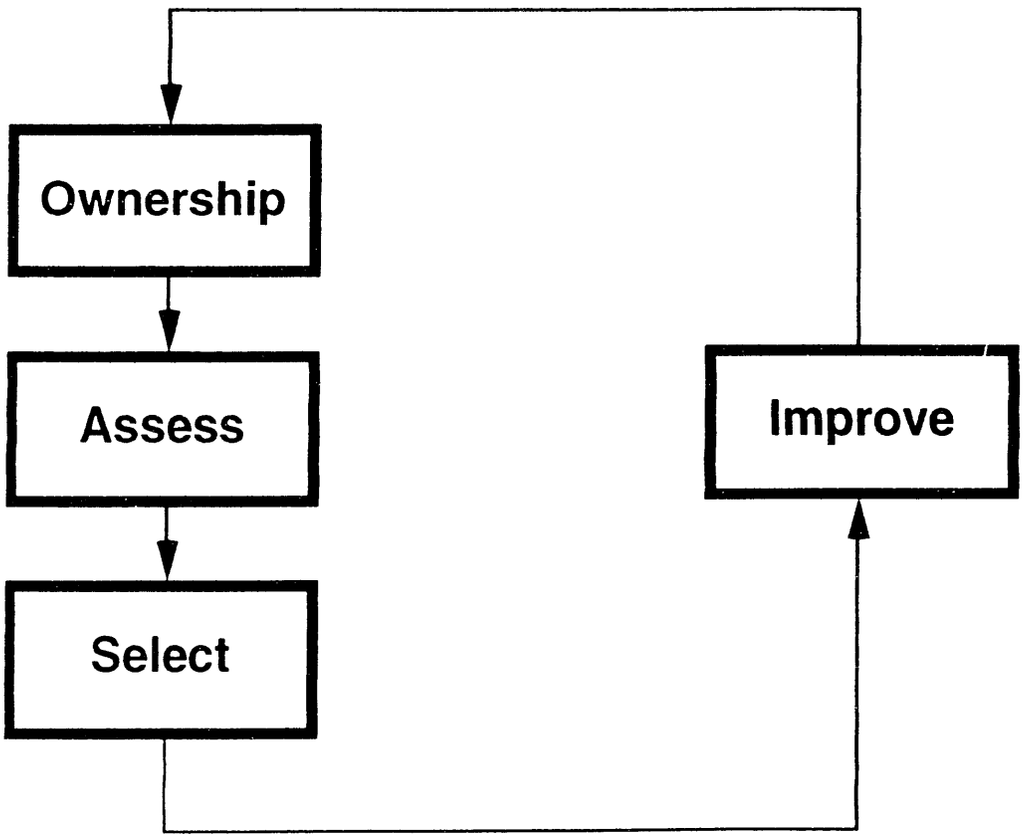

Fig. 10

Quality Management

Old Style	New Style
- Set Obectives	- Listen to customers for objectives
- Demand results	- Motivate employees to set stretch goals
- Blame employees when objectives are not met	- Establish process deficiencies
- Control employees	- Share information to permit employees to make decisions
- Measure employees	- Measure processes
- Reward fire fighting	- Reward fire prevention
- Distrust of employees	- Trust, support, empower employees

Fig. 11

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