Improving the way organizations run through participative planning and management.
Trident Precision Manufacturing: Malcolm Baldrige National Quality Award Winner, 1996

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Company Information

Trident Precision Manufacturing, Inc., is a contract manufacturer of precision sheet metal components, mechanical and electro-mechanical assemblies, and custom products, mostly in the office-equipment, medical-supply, computer, and defense industries. Founded in 1979, it is a privately held company with 167 employees. Trident is a preferred supplier to Fortune 50 Original Equipment Manufacturers. Major customers include: Eastman Kodak, General Dynamics, IBM, and Xerox Corporation. Operating from a 83,000 sq. ft. plant, Trident’s 1995 revenues were $14.5 million.

Leadership

Americans still care about quality. The country is full of intelligent, courageous people who would change it if they only knew how. — Dr. W. Edwards Deming

A customer-supplier relationship built on total quality management

Nick Juskiw, President & CEO — Trident Precision was introduced to the concept of Total Quality Management in March of 1988. It’s a long journey that never ends. I recall attending a symposium offered by Xerox Corporation — a meeting in which they explained their approach to leadership through quality strategy to their Top 100 suppliers. When I left the symposium, I understood the importance of implementing a Total Quality Management strategy at Trident, and firmly believed that in order to achieve my vision and goal of becoming a world class organization, the company would have to develop its own Total Quality strategy. I also believed that in addition to maintaining effective leadership, this strategy must be integrated with the company’s overall business plans and goals.
Creating our Excellence in Motion strategy

To accomplish this objective, I included everyone who had management responsibility within Trident. To reinforce their commitment, this team participated in 24 hours of Total Quality Management training. In conjunction with the training, and with the information gained from benchmarking expeditions to Motorola, IBM, 3M, Corning, Eastman Kodak, and Xerox, the team began to lay the foundation of Trident’s Total Quality strategy.

Fourteen months later, our strategy entitled, “Excellence in Motion” was fully documented. The team developed and implemented a six-month training cascade consisting of 21 hours of formal total quality training for each of our employees. The guiding premise of the training was to instill the concept of continuous improvement, so that we could create an environment within Trident that focused on customer satisfaction.

The cornerstone of continuous improvement, customer satisfaction, and our expectations of becoming a world class leader is summarized in my vision statement (see inset). The Senior Executive Team then defines the processes and strategies to help us achieve my vision.

These strategies included a leadership strategy, headed by our senior executive team. This team is constantly defining new roles and responsibilities for our managers. Another was a business strategy, with goals linked to our key business drivers. Another strategy was to define and document our key business drivers. We defined training, communication, reward and recognition processes—all part of our human resource strategy. We base our process management system on continuous improvement.

CEO communicates his vision for the company and a team defines how to achieve it

The Senior Executive Team is responsible for developing future opportunities for the company and all of its stockholders. It does this partially by developing and implementing plans to meet the current and future cost of our requirements. At our annual business meeting, we review company performance by evaluating the measurement results of our long and short-term goals for each of our key business drivers.

We defined our key business drivers as supplier partnerships, employee satisfac-

My vision for Trident is one in which each of us shares the responsibilities, growth, and benefits, of becoming a world class organization. How will we, as a team, achieve this? Through quality! Not just the quality of each individual part, but through total quality in everything we say and do.

I envision this program as an adventure that will make us stronger as a team.

Individually, as you know, we can do very little. As a team, we’ve already come a long way. As a strong team, with each person headed in the same direction, we can become the unquestionable leader for our customers, suppliers, industry, and for our community to look up to.

—Nick Juskiw, CEO

Setting responsibility for business development

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Setting responsibility for business development, continued

Triton’s team reviews the previous year’s results of each metric for each key business driver. Armed with the previous year’s history and trends, the team now can make an informal decision for the future. They establish new, aggressive goals for each of the five key business driver metrics, in areas of productivity, quality, cycle time, and turnover. Senior managers and supervisors are responsible for overall company and work unit performance. Supervisors and managers meet monthly with their team to review their departmental progress and also to plan and set new goals.

Progress to plan results are presented to the entire staff at our quarterly information meeting. In this meeting, the departmental managers present all the information and trend data for the metrics that they’re responsible for. Staff members have the opportunity to ask the manager any questions that they may have. If the manager is having a difficult time meeting the plan, he or she can ask other fellow managers for help. It also gives the senior executive a very good snapshot of how the company is progressing throughout the course of the year.

Pertinent aspects of the results for each of the key business driver areas are shared with the entire workforce at the next company-wide meeting. Charts for each key business driver metric are posted in our training room for everyone to review. In addition, individual departments meet to review results relative to their particular responsibilities. The departments identify needed improvements, which are then implemented and monitored by the departmental team, and the results are documented.

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Setting responsibility for improving leadership

The Senior Executive Team is responsible for evaluating and improving the leadership system, including their own leadership skills. They meet quarterly to review information from a variety of sources. These include our semi-annual total quality roundtable, employee satisfaction survey, and customer supplier satisfaction surveys.

Data from individual supervisors and managers is also obtained semi-annually. During the employee satisfaction and peer evaluation surveys, questions regarding the supervisors’ management style and use of total quality skills are asked of his or her direct reports and peers. The results of these surveys are used in two ways:

1. The overall state of the leadership system is reviewed by the management team. What skills, as a group, are we strong in? What areas do we need to improve? What action plans must be put into place to increase the results of the next survey?

2. The evaluation of the individual managers’ skills. In which areas does a manager or supervisor need to improve? In one-on-one meetings with myself, we develop a corrective action plan to improve the respective manager’s or supervisor’s skill. Together, we also review the individual manager or supervisor’s progress on a monthly basis.

This systematic evaluation and improvement process has enabled us to grow both as a group and individually.
To communicate our mission, vision, and values, the management team has documented a vision statement. Their statement, as well as my own vision statement, is posted throughout our facility. In addition, each departmental team has developed their own mission statements to effectively communicate their own values and vision. These are posted in their individual work areas. Our Human Resource manager explains these corporate values during each new employee orientation.

We further communicate our values, expectations, and directions through 21-hours of ongoing quality training each employee receives on a yearly basis. Each month, a different department’s mission statement is highlighted in The Trident Times, our award winning in-house newsletter. During monthly company-wide and departmental meetings, employees are encouraged to ask questions about the company’s direction and policies that they do not fully understand.

We use a variety of processes to reinforce our values. Each manager is a role model and coach for Excellence in Motion. As he or she must be consistent with the total quality message, he or she also actively participates in a process and uses quality tools. We have developed the reward recognition system to reinforce those behaviors which exemplify Excellence in Motion. Our performance appraisal system has become a documented two-way conversation between supervisors and employees, considering their individual performance goals.

Trident has taken a proactive stance when it comes to our public responsibility. We belong to a variety of professional organizations which keep us up to date on regulatory and safety issues within the industry. We have developed a safety team which is responsible for developing and implementing plans to meet or exceed all government regulatory reform requirements. In addition, our entire workforce is trained yearly in safety and health procedures. To reinforce this training, we grant rewards and recognition for safe behavior.

We’ve been evaluating all materials used in our manufacturing process since 1990, and with the help of our customers and suppliers, we have been able to either eliminate or replace all harmful substances. We also contract independent water and air safety custom agencies to evaluate the impact our manufacturing has on the environment.

I am very proud of Trident’s community spirit. I am personally involved in many community activities. I am especially proud of my staff who actively participate in a wide variety of organizations including the Industrial Management Council, the Strong Museum, local school districts, the Department of Labor, and the United Way.
Since winning the 1994 New York State Governor’s Excelsior Award, members of the executive team frequently serve on panels and are guest speakers sharing Trident’s total quality processes. Our outsiders events team began a Christmas sharing event in which money was raised to help needy families in our area. In 1990, our first event raised just over $500. In 1996, when we reapplied for the Baldrige, we raised $7,000 through bake sales, auctions, and by providing home cooked lunches at our facility. This money helped over 165 families who are less fortunate than us. This past year, we raised over $10,600 for this event.

In addition to participating in public forums, Trident has been the subject of many benchmarking expeditions. We have hosted hospitals, schools, teachers, manufacturing and assembly facilities, and even our own competitors to show them our quality practices.

As a result of our New York State Excelsior affiliation, we were the first organization to be contacted by the New York State Department of Labor to assist them in their federally funded work-to-school program. They were trying to determine what was being taught in the small business environment and whether those courses could be taught within a new manufacturing curriculum. Their goal was to link education with the needs of small and large business.

Joe Conchelos, Vice President of Quality—We live in the information age. Information is, of course, critical to any organization. But more important is the analysis of that information—what is it telling us?

Trident is a corporation driven by a commitment to manage by fact. When we began the quality journey, we collected data on everything. We had so much data that it was difficult for us to distinguish between the trivial many and the vital few. We have learned over the years that the data we collect must be realistic, measurable, actionable, reliable, quickly updated and easily accessible to all who require it. We discovered that in addition to meeting our criteria, the information we collect must be aligned with our key business drivers—supplier partnerships, employee satisfaction, operational performance, customer satisfaction, and shareholder values. And we strategically designed our performance measurement system to reinforce our customer focused philosophy.

Our key business drivers are linked to support one another and have become integral to our quality cycle (See Figure 1). In order to achieve our overall goal of total...
Information is linked and coordinated with key business drivers, continued

customer satisfaction, we must first have a stable relationship with our supplier base. We work with our suppliers and help them develop systems that increase their quality output. Their quality products, delivered on time, is a key factor of the cycle's next step.

Employee satisfaction comes from a job well done. It is management’s responsibility to provide the training and tools necessary to do a job correctly, including quality components from our suppliers. We can demonstrate the correlation between employee and customer satisfaction; therefore, we see it as imperative to strategically plan for the well-being of our employees. Once internal customers are satisfied, satisfying external customers naturally follows. Satisfied external customers leads to increased corporate value, which leads to shareholder satisfaction due to increased profits. This increased value allows us to pay suppliers in a shorter time frame. This gives us preferred customer status, which provides better quality and response time from our suppliers. This pattern of providing total customer satisfaction in each step of the process is the basis of our performance measurement system.

Key measures for each business driver are tracked and posted. For supplier partnership, metrics include supplier audit results and monthly quality ratings. Employee satisfaction metrics include turnover trend, team activity, reward and recognition trends, and employee survey results. Operational quality metrics include cycle time reduction results, corporate efficiencies, rework hours, manufacturing process reliability and our corporate quality rating. Shareholder value metrics include debt-to-equity ratios, return-on-assets, operating costs and trading investments. Customer satisfaction metrics include quality ratings, customer complaints and delivery performance.

We ensure the reliability and consistency of our data through the conscientious adherence to work processes by all who input and update the data. Our computerized data correction system relies on barcoding technology, and records all internal opera-
Metrics for all business drivers are carefully maintained and communicated, continued

This system, which is overseen by our computer team, tracks time, quantity, rework, efficiency ratings and financial performance. Employees can immediately access data through any of the 34 networked terminals on our IBM System 36. Based on employee feedback, we recently increased the number of terminals from 34 to 43.

The staff team evaluates the scope of information and data used to plan, manage, evaluate our key business drivers. Our quarterly information’s users meeting explores the appropriateness of the metrics used to monitor the process. Since each area of the organization is a vital link of our information chain, representatives from each area attend the meeting to assure their customer requirements are represented.

The information user meetings are for several purposes. First, it allows the entire staff to view the progress of the organization. Those areas of the company not performing to plan are readily visible and further plans are implemented to help. This quarterly meeting also serves as the organization’s opportunity to evaluate the information system. During this meeting we can add, delete, or modify our metrics and keep our systems current. The meeting offers the senior managers the opportunity to view the utilization of the information being collected. They are not just reviewing data; they are also looking at types of analytical tools used.

Benchmarking

Benchmarking has become a way of life at Trident, and it is a critical part of our strategic planning process. Our two primary benchmark drivers are the annual strategic planning meeting and our continuous involvement teams. The senior executive team uses benchmarking information to establish new world class goals for the organization. Continuous improvement teams travel to various world class organizations, seeking new and inventive methods to make us even more productive.

The quarterly information users’ meeting highlights those areas not performing to plan. Those areas become our benchmark candidates. Once a benchmark team has been organized, their first step is to identify whom to benchmark. The criteria used to select the benchmark organization is that they must be best in their class or world class; they do not necessarily need to be in our industry. We have visited L.L. Bean to benchmark their shipping processes. Our total quality roundtable, which is now a vital part of our culture, is based on a Corning Glass process. After selecting the benchmark organization, the team collects data, either through an on-site visit or through telephone calls.

Once the team has completed its investigation and developed a plan, a presentation is made to the staff. This presentation includes Trident’s apparent standing within the marketplace, a before and after process flowchart, proposed process changes to establish Trident as the industry leader, and an approximate time line with stretch goals to achieve leadership. This proposal is reviewed by the senior executive team for feasibility.

Following approval, the team develops the final document which is later expanded into action plans and then deployed. The results are tracked and evaluated to determine if positive gain has been attained and if we have achieved leadership position. The
team’s final meeting includes a debriefing process or a process check in which they are asked to identify the positive and negative aspects of the process they used. This information is then presented to the senior executive team at the quarterly information users meeting where changes to the benchmarking process, if required, can be made.

To evaluate the overall effectiveness of our strategy, the senior executive team aggregates and analyzes data relative to our five key business drivers at our annual business planning meeting. During this meeting, customer survey and complaint data is reviewed along with operational performance and service metrics to ensure that we are meeting our total customer satisfaction goals. Our financial performance is also reviewed against other trends. This correlation of quality initiatives and results allows us to agree with the experts when they say, “quality pays.”

The annual strategic planning process is overseen by our senior management team. Their strategic and business plans are based on the quality cycle to strengthen our customer related operational financial performance, as well as our competitive position. The process not only considers customer requirements but is actually based on them. Senior executives and customer contact personnel meet with customers regularly to review our overall performance, establish additional customer needs, and discuss future requirements. The senior executive team then develops plans to meet those new requirements and projects those through the year 2000. The plans are monitored for progress and effectiveness at monthly staff meetings. Using this process, we have been able to develop and implement plans to meet future customer requirements ahead of our competition and maintain a strategic lead within our marketplace. Our plans and strategies are developed utilizing several financial formulas, including: asset utilization, debt-to-equity, operating cost, gross and net profit, and payback recovery plans. Based on the information calculated by these formulas, plans and decisions are incorporated into our overall strategic planning process.

Several other factors are considered in the development of our plans. We consider market risks by focusing on diversification and new endeavors, which we develop with customer and general market feedback. Technological advances in our industry are researched to determine the benefit that would be gained by internal and external customers.

Our responsibility to our workforce, community, and the environment is a guiding premise of our strategic plans as they relate to societal risks. In conjunction with our customers, we have eliminated substances in our manufacturing processes identified as harmful to the environment and substituted non-harmful substances in their place.
As new human resource skills are required to meet the new guidelines, the Human Resource Department identifies the current skills available, the new skills required, and develops plans to eliminate the gap.

Our key strategy to success is to achieve improvements in each of our key business drivers. To achieve the goal, plans are developed by the senior executive team and then deployed to the entire organization through the departmental performance measures. The process begins at the annual business meeting where new goals are established for the upcoming year.

These plans are driven down to the individual work units and to the employees who are responsible for developing sub-plans and goals to achieve the overall goal. They monitor and discuss their progress each month at departmental meetings and report their progress to the entire staff at the quarterly information users meeting. Our top priority—increasing customer satisfaction—takes cooperation and improvement throughout every step of the quality cycle.

We’ve learned that strategic planning can be deployed in one of two ways:

1. In the “old days” when word came down from high atop the ivory castle that operational performance must be increased by 10%, the manager would set his plan in motion—he would tell each of his workers to work harder and faster! The result would usually be increased grumbling due to low morale, a drop in quality output, higher scrap and rework rates, and a generally lower performance. The final result—nobody was happy.

2. In the new days, the time of total quality, when a new stretch goal is established, teams of employees join together to meet the challenge. A goal to increase productivity by 10% resulted in a team’s plan to first increase training, then develop a certification process, and utilize statistical process control. This resulted in increased productivity, reduced cycle time, reduced scrap, increased quality and very high morale. The team and the entire company population not only saw the fruits of their labor implemented, but they saw the plans actually increase the overall output.

The final step of the annual business review meeting is to evaluate the overall planning process. The executive team conducts the process check and use customer, employee, and supplier feedback, in addition to their systematic review of performance-to-plan, to determine if anything can be improved in the planning process. Ideas for improving plans and/or planned deployment are solicited in monthly staff and company-wide meetings. Improved deployment ideas are typically acted upon immediately, with planning process ideas typically held for consideration at our annual meeting.
Human Resources Development and Management

April Lusk, Total Quality Administrator—In 1988 sales were up, we were successful, making money, and our customers loved us. What did we need? What drove Trident to need a Total Quality Management strategy, and to utilize the Baldrige assessment process?

Morale was extremely low. People were not involved with the business and felt no ability to make a change. Our turnover was 41%. We were losing people for as little as a dime. Crisis management was commonplace. Put out the fire of the day, the hour, the minute. No internal customer/supplier relationship. We understood what our external customers needed, but not what we needed from each other. We recognized the need, in 1988, to provide for the greatest resource we had—our people.

The focus of our attention as a management team needed to change. Eliminate the chaos before any more damage was done. Management had to take the initiative to turn this internal trend around. We discovered there were four key elements required from us to develop, to educate, and to recognize our people:

1. First and foremost was commitment by management to change the culture, to be students, and to be role models for change.
2. Linkage of the Human Resource plan to the business plan. Without a plan to develop and to enhance the ability to the workforce, the business could not flourish.
3. Feedback from all internal customers. It’s important in order to monitor our success and the commitment to our plans.
4. Continuous improvement, based on training and educating our entire population. A well-trained and educated workforce that has been truly empowered can solve the problems of today, reach for our goals of tomorrow, and see the future.

Our first key element is the commitment made by management to a process called LUSH (see inset). First we need to learn the tools, skills, and philosophies of problem solving, quality improvement, SPC, parts quality, tool trial process, and things of that nature. Then we need to use it—to walk the talk. Then we show it—show our new teammates and our existing teammates what we had learned. And finally, the key to being a true manager is to be able to help—to support your people as they learn.

Element 1: Building a culture based on learning and using good tools, then showing and helping others

### The LUSH Process

| Learn | The first step in any process is to learn how to perform the task correctly. |
| Use  | Once you have learned the process, you are ready to use what you have learned and perform the task. |
| Show | Now that you have put your training to use and mastered the task, you can show someone else how to perform the task. |
| Help | You have learned the process, you have used it and have shown or taught others how to use it. Now it is your responsibility to help others when they run into problems using this process. |
**Element 2: Linking the HR plan to the business plan**

The second key element is the linkage of the HR plan to the business plan. We accomplished this by defining both the short and the long-term plans regarding development of each employee, cross-training of our employees (their primary function and two additional functions), and education. These plans are designed to support the five key business drivers, which in turn promote high performance work, and job design.

HR plans support high performance activities through the use of: employee teams for problem solving, quality improvement, process development, and the reduction or the elimination of non-value added activity. Empowerment of the individual employee and teams creates ownership of the process and supports activity for change.

Cross training employees allows for areas of opportunity and internal growth. It takes them from one primary function to the ability of two additional functions at the journeyman level. We utilize cross-functional teams and meetings to create an atmosphere based on internal customer/supplier relationships and to reach our goal of total customer satisfaction.

To reinforce high performance and the reward/recognition system, it must be correlated to the five key business drivers. It has to support the endeavors of the business. This system needs not only to support the endeavors of the business, but behaviors of the individuals, the efforts of the teams, and the processes that leads to success in each. By accomplishing this, we further reinforce our company’s commitment to total customer satisfaction.

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**Element 3: Getting feedback from a variety of sources**

The third element required was to obtain feedback from everyone— not just management. Our employee satisfaction survey is done twice a year. Each team member can rate the overall company, their well-being, the senior management team, and their supervisor. Another feedback tool is the total quality roundtable that deals with two simple questions: What’s working at Trident and what is not?

By performing training and team process checks, we’re able to gather feedback on whether or not those processes, training activities, and team activities, are working.

Additional sources of feedback are our two-way performance appraisal system, departmental and plant-wide meetings, and utilization of an open door policy. Our people are encouraged, at any time from 6:00 AM, until we close the doors at 3:00 AM, to talk to anyone they wish to gain feedback, or further understanding, or to be a part of the team. Our doors are open! Whether I’m a welder, a janitor, a punch press operator, Nick Juskiw’s door is open. These sources provide intimations of potential problems, systems providing excellent results, and the means for the entire team to know the status of the overall business.

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**Element 4: Education and training**

Our continuous improvement efforts are based on a well-trained and educated workforce. This process begins immediately at employee orientation, involving a four
Element 4: Education and training, continued

-hour session with the Human Resource Manager.

Next is the Buddy System, where you are aligned with a mentor for approximately four weeks, two hour sessions a day. After that is TQM training—they turn you over to April. For the next 21 to 24 hours you’re in my classroom, and after that, three times a year we have review classes for everyone in our facility.

The curriculum of these courses are directly relevant to the key business drivers, and they can be suggested by employees, customers, and suppliers. It is a part of the HR plan to provide accessible training and education to our employees. We work with internal and outside sources to provide all the training we possibly can—on-site and at convenient hours.

The awareness of internal customer requirements reinforces our efforts in continuous improvement. Training is provided on how requirements are communicated, how they can be changed, and whether we are meeting the requirements of our internal and external customers.

We have adopted the approach to share this information by including them in standard operating procedures, ISO training, and defining the requirements and values of the reward/recognition system support. In addition, our people are instructed, as they go through these courses, to please bring to our attention anything and everything that we have not covered that they need.

Regular evaluations are aimed at improving

It is necessary for human resources to determine whether or not the plan is meeting the needs of the internal customer. The Senior Executive Team works with HR to evaluate the overall plan. The data is presented to the entire staff on a quarterly basis and input on the plan is sought from employees, customers, in assessment processes such as the Baldrige and Excelsior.

This data, plus the statistics regarding turnover, absenteeism, and training dollars invested (to name a few), provides the picture to the success of the plan. These evaluations are viewed as an opportunity for improvement to the HR plan and to the overall business.

In conclusion, everyone at Trident is a powerful means for us to continue to grow. We are a family. Our people have been the key to our success, and now we’d like to share with you a story of how the atmosphere we have created can work for each teammate.

Example

The Nguyen, Production Supervisor—In 1988, I joined Trident as a part-time machine operator. In June of 88, the CEO asked me if I knew how to improve the troublesome problems we had on the machine. In two shifts we could only make 100 and 50 percent of them were scrap. It took three operators to run the job. No one
Example, continued

Trident Precision Manufacturing, Inc. wanted to do the job. On top of all that, we were losing a lot of money. We had asked our engineers, our customers’ engineers, and the manufacturer of the machines to help us. They tried for hours, and couldn’t improve the process. They all walked out saying, “You have to do the job the way it is!”

Then, I was given the opportunity to try to make it work. First, I tried slowing down the process, which involved both turning and buffing. Each part now took 50 minutes, so, I could produce 64 pieces in two shifts. Then we tried turning one part while buffing another. This improved our production to 96 pieces with 30% scrap.

I told myself that this still wasn’t good enough. I wanted to add weight to the part to increase the speed of the cutting operation. I tried adding water, but the water moved too much. I then packed the part with a rag, and it worked! I could now cut the part with one pass of the cutter, and do 25 pieces an hour with no rejects or scrap. Needing only one operator, I could complete an entire order within four hours. My set-up went from three hours to five minutes, and from six operations to two.

Everyone at Trident has been given this chance. I have used my training in English and SPC to make more improvements. My efforts were recognized by being awarded the Employee of the Year and being promoted to the Production Department Supervisor.

I have taken what I learned at Trident, and have used it at my home, my community, and in my church. Trident has drastically helped me to improve not only what I do there but also in my home life. At Trident, I’m treated with respect as a person, not just an employee. We are a family at Trident. We work together, and we work for the customer.

Process Management and Business Results

Brian Salter, Order Entry Clerk—Trident is a contract manufacturer. We design and develop tools and processes to produce components, assemblies, and custom products which are designed by our customers. While each of our customers have requirements specific to their particular product, all of them have identified for us their core requirements of quality, cost, delivery, and service.

In the years before 1988, this was a difficult task within Trident. When sales received an order, it was placed within our system, but they were the only people who knew that the order existed. The engineering department would design the tooling with a process they thought would be correct with nobody else’s input. The tool room would be handed a tool design and be expected to build it. Finally, the tooling would be rolled out to the production supervisor. His usual question was: “What is this?” The tooling people would say, “This is for part #123456; by the way, the parts are due in two days; if something goes wrong, call me!” The atmosphere was pure chaos. We were always...
Building processes and systems to produce the results we need, continued

...scrambling and fighting fires to deliver our quality product to our customers on time.

What was missing? First of all, there was no teamwork. We were all working for our own causes. Sales would get the orders in— that's all that mattered. "We got it here, you get it out on time." There was no communication between departments, nor was there a single mission. Each area had its own agenda. Production got the parts out on time. Right or wrong, they got the parts out. Quality would not release the parts unless they were correct. It was hard to believe that we all worked for Trident. There was no plan to build quality into our processes or parts. We would inspect quality into it.

We now understand that as a contract manufacturer, we sell time, not components or assemblies, and as everyone knows, time is money. We needed to design efficient processes to deliver quality components on time. What was required to do this?

1. Complete cooperation between all areas of our organization.
2. An understanding of all customer requirements before we began to design the process.
3. Most importantly, teamwork between all of our departments.

A process with a purpose to satisfy all customers, internal and external

In 1988, our CEO Nick Juskiw held a company-wide meeting describing a process he had just learned about. It was a process where each of us would have a say in what we did. This new strategy was based on teamwork. It would help foster communications through the shop. The senior executive team then developed a corporate mission: Total Customer Satisfaction. But unlike the past, this was not limited to external customers. It included internal customers—us! He also talked about building quality into our processes. We really didn't know what that meant at the time, but it sure sounded good.

One tool that we developed very early in this process was our part quality meeting. This is the initial step in the integration of all phases of production and delivery. The part quality meeting is a cross-functional meeting bringing together all internal customers and suppliers. At part quality meetings, part assembly or process requirements are discussed by the entire team. Also, amendments and changes to the process can be defined to ensure that customer requirements are fully met.

The result of the meeting become the basis for our process detail sheet. This is the operator's instruction sheet for the job. We use a detailed process to insure a trouble free launch of manufacturing processes, called the tool tryout process. A tool is designed by our design engineers in conjunction with his internal customer, the tool maker. Once the design is delivered to the tool maker, and the tooling is built, it is the tool tryout team's responsibility to prove its process capabilities.

To do this, the team completes a 30 piece histogram. This insures that the design will be capable of producing a product that will continually meet Trident's minimum capability standards and will function with minimum upkeep for the life of the program. When the tooling has been proven to be capable, it is approved and certified for
CASE STUDY

Trident Precision Manufacturing, Inc.

A process with a purpose to satisfy all customers, internal and external, continued

Our operators use computerized data collection units to monitor critical process controlling dimensions. Frequency of measure is based on the stability of the process, utilizing CP-CPK values for components, sub assemblies, and custom products. Employees are empowered and trained to make adjustments in their process and correct the process from drifting near the control limits. If these adjustments are found ineffective, they’re empowered to stop the process, halt production, and initiate a non-conforming material report, otherwise known as a NCMR. The NCMR and the material review board process are used to identify process problems, determine root cause, brainstorm potential solutions, select and implement a solution, assign actions, and to monitor the corrective action results. If the corrective action and NCMR changes the process, a process change sheet is completed and incorporated into the process detail sheet.

One of the methods Trident uses to analyze and improve our processes is the continuous improvement process. Teams of employees perform an analysis of their work processes and must determine whether the steps are value-added or non-value-added. The teams brainstorm potential solutions to reduce or eliminate the non-value-added steps. The best solutions are then selected and implemented. Individual employees can modify their work processes through the process improvement sheet. External customers can also join continuous improvement teams—lending their resources and experience to help improve our processes.

Our key business and support processes use the quality improvement process to identify a specific departmental output, their customers, and the customer requirements. Once identified, the team must translate those customer requirements into supplier specifications. The team details the description of their output based on the customer’s requirements, with each specification being measurable.

From this point, the work process is documented—normally in a flowchart form. The measurement system is implemented with a work process to give the developmental team feedback on whether or not their process is capable. They review the results and recycle the process for further improvements.

The team must present its final result to the senior executive team at a monthly staff meeting. This is done prior to implementation so the changes in the work process which may affect other work processes or other areas can be modified and insure a smoother integration throughout the company.

Supplier metrics

Trident measures supplier product quality based on percent-accepted, using receiving inspection results. Supplier quality is monitored daily and recorded back to the supplier monthly. As receiving inspection data shows increasing capability, the sample selection plan is reduced until the process can be certified. At that time, parts can be delivered from our dock to the line without undergoing an inspection.
Supplier metrics, continued

Once parts have been certified, they’re delivered directly to stock without costly inspections. It is our goal to use the certification process to have long term agreements with these suppliers to reduce prices.

Trident conducts on-site audits of its supplier base to verify its quality systems. Supplier performance data is compiled and analyzed by the senior executive team to determine trends. We convey relevant feedback to our suppliers through phone conferences, continuous supplier involvement or CSI meetings, quality acceptance reports, and NCMR reports sent to the customer within 24 hours.

The basis of this strategy is to create and maintain partnerships with our best suppliers. In practice, we use continuous involvement meetings to establish productive communication with our suppliers. We then analyze their quality performance indicators and provide them with feedback.

Our future plans for managing supplier performance calls for us to contact our key suppliers and issue a proposal to them for total quality management training. By offering these suppliers TQM training we expect to help them to continuously improve and join in a full partnership with Trident in becoming a leader in industry.

Lisa Boulatnikov, Process Technician—Trident began working with customers to develop custom products in 1990. Custom products are complete electro-mechanical units designed by our customers with input from our product development team. Each unit consists of approximately 500 individual components. The units are assembled and tested at Trident, and shipped directly to our customer’s distribution point. Our custom product reliability has exceeded customer expectations. We have had no rejects since the third quarter of 1992 when the assembly was certified.

We have worked very hard over the years to increase our manufacturing capabilities. Yet, until we selected a metric which could be tracked, our efforts were in vain. In 1992, we selected Cpk values as our metric. The minimum value required by our customers is 1.5; we selected values of 2.0 or better as our internal goal.

In 1992, only 49% of our total processes met this goal. Today, thanks to our part quality meetings, tool tryout process, and process improvements, over 87% of all our processes meet our goal today. Our corporate quality rating is an important metric for us. It is the aggregate result of delivering quality to all of our customers. The results of this metric are based on many factors—including improvements in supplier quality, employee satisfaction, and process capabilities.

We began tracking our corporate quality rating in 1989. Then, 97% of all the product we delivered was accepted. Since then we have improved our rating to 99.997% (see Figure 2).
Delivering quality products on time is a major customer requirement. It takes cooperation and coordination of all areas within Trident. There must be precise coordination of all aspects of the manufacturing and support service cycle. That communication, combined with increased process efficiency and reliability, helped to increase our on-time delivery trend from 87% in 1990 to 99% in 1995 (see Figure 3).

As recognized experts in their respective fields, our operators have the responsibility to improve each process within their control. The metric we use is manufacturing efficiency: the results of actual time spent doing a job versus the estimated or planned time. This is tracked in real time through our barcoding system. With an average of 125 process improvements submitted each month, we’ve been able to increase our efficiency rating from 79% in 1991 to 100% in 1995 (see Figure 4).

An indicator of increased process proficiency is a sustained improvement of rework hours over time. In 1990 we were spending 8.7% of direct man hours reworking non-conforming products. As a result of the many processes we have developed and
Corporate efficiency and rework trends improve dramatically, continued

implemented we have been able to reduce those hours to 1.1% (see Figure 5).

Figure 4. Corporate Efficiency Trend

Figure 5. Rework Hours Trend

Turnover rates decline dramatically

The most dramatic improvement we have made over the years is in the area of human resource management. A key indicator used by human resource is our turnover rate. We were able to reduce our turnover from 41% in 1988 to a sustained 5% since 1992 (see Figure 6). The reduction was a direct result of management listening to employees and learning what was wrong with Trident, developing corrective actions, and then implementing them.

Figure 6. Turnover Trend
Employee satisfaction facilitates customer satisfaction

Improved employee satisfaction leads to improved customer satisfaction. How do we make this claim? During our annual business review meeting we utilize a systematic approach to evaluate and improve our strategy. During this time, we correlate all the data. We have since correlated employee satisfaction indicators to business results.

Figure 7 represents the correlation between the number of formal reward and recognition incidences, and our turnover trend. As the reward and recognition incidences went from zero in 1988, to over 650 in 1995, our turnover trend went from 41% to 5%. We then compared our turnover and our corporate quality trends. Turnover dropped from 41% to 5% and corporate quality rose from 97% to exceeding 99.99% for the last three years.

Customer Focus and Satisfaction

Knowing customer expectations

Jack Colern, Sales Representative—Trident considers each of its customers to be a unique segment of its business. However, all of our customers share basic requirements which we have established as our customer satisfaction key drivers: quality, delivery, cost, and service. In addition, each customer has individual requirements that are unique to their products. The primary processes we use to collect information regarding customer requirements is through corporate level meetings, conversations with customer representatives by our customer contact personnel, and our semi-annual customer satisfaction survey.

In Continuous Involvement Meetings, representatives from Trident’s engineering, manufacturing, quality assurance, purchasing, and sales departments meet with our customers’ engineering, quality assurance, and procurement representatives to hear from
Knowing customer expectations, continued

Trident determines future customer requirements and expectations by using several listening and learning strategies:

1. Our first strategy involves direct meetings held between customer executives and Trident's senior executive team to discuss major customer concerns and their strategic business plans.

2. The second strategy was developed in response to a general customer meeting. Each of our customers were asking for a reduced product-to-market cycle time, at a lower cost. To meet this need, we developed a product development team. Through this process, we have been able to help our customers launch new products in one-third the time, and with a substantial cost savings.

3. Trident also offers an open door policy to our customers which allows them direct access to any function within our company. We provide open lines of communications to all of our customers, offering them direct access to all of our customer contact personnel. For example, customers are provided with home and car phone numbers of the senior executive team, including the CEO, and of course all our sales representatives.

4. CAD/CAM networking capability provides direct lines of communication to our engineering staff. EDI allows our customer base to be directly linked to our order entry department. These processes allow our customers and Trident representatives to join together as a team to gain an increased understanding about customer requirements and Trident capabilities, so that together we can develop the most efficient process that will meet their requirements.

5. The customer survey provides a means for the customer to grade Trident management processes and offer comments. Our senior executive team has established a set of service standards for all our customer contact personnel. Our performance against these service standards is monitored, using direct customer feedback gathered from the semi-annual customer survey and daily contact with our customers.

Measuring our delivery on customer expectations

Early in our total quality management adventure, it was determined by a management team at Trident that our focus and our goals should be total customer satisfaction. Since that time, all the plans that we have developed were focused to achieve that goal. A few of the measurements which provide the data to our progress are: quality rating trend, on-time trend, customer satisfaction survey results, and sales value index.

Quality ratings are provided monthly, quarterly, or annually by the customer. Individual customer quality ratings are reviewed by the entire staff at the monthly staff meeting. This information is aggregated and presented to the senior executive team at the quarterly information user meeting in the form of our corporate quality rating. As mentioned earlier (see Figure 2), in 89 we were at 97%. In 1995 we exceeded 99.99%.
Measuring our delivery on customer expectations, continued

Another key customer requirement is on-time delivery. In 1990 our on-time delivery rating was 87%. By utilizing customer-involving meetings, by quality meeting process, tool try out process, and implementing an ISO quality system we have been able to increase our on-time delivery rating to 99.94% in 1995 (see Figure 8).

![Figure 8. On-Time Delivery Trend](image)

In order to find out how our customers rate Trident service, we developed our customer satisfaction survey. This was identified as a gap in our strategy in our 1991 Baldrige feedback report. This survey is sent to over 100 customer representatives twice each year. The average for the last three years has been a 93%. Our goal is 95%.

We tracked sales through these surveys because they measure repeat and new business with our customers. Repeat business covers the products that we are currently doing for them. New business not only encompasses work that has been awarded to us for new projects that they are developing, but also components of assemblies that have been removed from our competitors’ sites. Figure 9 represents our sales volume from 1988 to 1995. As you can see, our business has grown from $4.4 million 1988 to $14.5 million in 1995.

![Figure 9. Sales Volume Index](image)

Each major customer has initiated a supplier reduction policy. They have repeatedly stated that they will retain only the best suppliers. Three of our major customers have reduced their sheet metal and supplier bases by an average of 89%. Trident remains a preferred core-supplier to all three.
Face to face contact meetings occur daily with our customers. During these meetings, Trident representatives seek information concerning the level of our customer satisfaction and meeting service and quality requirements. Customer complaints have the highest priority. When a customer, either regional or local, calls with a complaint, we act! Each of our representatives are fully empowered to do whatever is necessary to resolve the situation. This includes revising production schedules when necessary to replace product to the customer. Then complaint information is aggregated and trends are analyzed by the senior executive team and discussed at the monthly company wide meeting and at management meetings, and then are posted throughout the facility.

In 1990 we had 70 customer complaints. In January of 1991, we developed a corrective action plan to address the number of customer complaints. This did not address the problems; as you can see in Figure 10, we had 88 complaints in 1991!

![Figure 10. Customer Complaint Trend](image)

We realized we were concentrating on the number instead of the root cause. We developed a tool tryout process, redesigned the suggested system into the process improvement system, and began looking at ISO 9000 as our quality strategy. As you see by the chart, these continuous improvement efforts have resulted as a steady reduction of the customer complaints. To determine our direct competitor's satisfaction rating, twice each year, our customer survey asks our customers to rate Trident's overall performance against our direct competition. The average rating of the past three years surveys resulted in a 93% satisfaction rate. Our goal in this metric is 95%.

Third party surveys are used, too

Another means to determine customer satisfaction against our competitors is the use of independent sources contrasting Trident with its direct competitors. We contracted RIT to conduct a profile study of Trident to identify our performance in 11
Trident Precision Manufacturing, Inc.

CASE STUDY

Third party surveys are used, continued

This profile shows our performance level and our position within the marketplace against 213 direct competitors, and 860 businesses overall. In addition, our customers sometimes commission studies, which include comparisons of Trident against its competitors, and they do share that information with us.

Recognition from customers

Trident’s customers have recognized our efforts over the years in numerous ways, from pizza parties for our employees to formal awards presented to us from their Vice Presidents. From Eastman Kodak company and its affiliates, Trident has received numerous plaques recognizing our quality efforts and performance. This fine customer has also recognized the efforts of our project teams in helping them to bring their products to market. In addition, Trident is the only General Dynamics land system supplier to have ever won its Supplier Excellence Award. This award has been available to all of General Dynamics 450 suppliers since 1990. Criteria includes maintaining 100% quality of delivery rating for at least one year prior to submitting a 50 page maximum written application. IBM has acknowledged our teams’ efforts through letters of appreciation, and pizza parties for the efforts of each team member of Trident. Xerox Corporation has bestowed numerous awards and recognition events over the years. Recently, Trident was awarded certified supplier status with an announcement in the Wall Street Journal.

Quality Journey and Lessons Learned

Joe Miran, Vice President of Operations—We were doing very well for a young company. We were prosperous and profitable. Our sales volume had gone from $68,000 when we started in 1979, to a little over $5 million when we started our journey in total quality. And we were building a reputation of delivering a quality product on time and at a competitive price. We had just built a new factory, and things were moving along very well. Why then did we need to change? Although our customers were happy and we were delivering a good product, they were not aware of the process we were using to manufacture their products. We were relying on quality control to inspect our work, which meant that sometimes at the very last operation we would find a defect and have to start all over again. Our motto on the shop floor, at the time was, “We make it nice because we make it twice.” In addition, although we thought we were doing great with turnover (10% better than our industry average) we were still at a whopping 41%.

Baldrige process enabled us to learn

In 1990 we selected the Baldrige process to assist us in assessing our processes. We
Baldrige process enabled us to learn, continued

quickly discovered that this criteria provided us with a roadmap to see where we were and where we needed to go. Our initial assessment identified that we were in the infancy of our total quality journey. We had gained very valuable information. We knew we were going down the right path, and the information gave us an opportunity to improve Trident.

We learned that we were not focused on our key business drivers. We were trying to measure and track everything. We were not distinguishing the vital few from the trivial many. We are often asked, what is the most important thing we learned from our first application? Two things: (1) By completing the application, we made a detailed assessment of our organization; (2) We discovered gaps in our system which we were able to eliminate, and we found other ways and opportunities to improve our processes.

Next, we sent in the application in for evaluation. The application is reviewed by at least five examiners who are recognized throughout the nation as experts in their field. This is something that very few organizations, especially small businesses, can afford to do on their own. The examiners uncovered gaps in our system which distinguish the organization from a world class organization.

Including leadership in continuous improvement

An area for improvement in our leadership strategy dealt with employee feedback. We developed a process for our employees to voice their concerns about what was and what was not working at Trident—our Total Quality Roundtable.

We did not, however, have any means for employees to comment on our personal leadership skills. We addressed this by creating the Employee Satisfaction Survey, which allows employees to evaluate the leadership skills of their immediate supervisors and managers, as well as the senior executive team. We also developed a peer review for all managers. All of the results are correlated by our CEO who holds a meeting with each manager regarding their performance. The CEO also shares his performance with his entire staff.

Learning about what data to collect

In the area of information and analysis, we've found out that the most important factor is that the data you collect should be:

- realistic—something that you can measure
- actionable, something that's reliable and accessible
- that the information be quickly updated.

The data that we were collecting lacked all of the above and was not linked to any key business driver. As a result of that assessment, we reevaluated our measurement system, we defined our key business drivers, and identified specific criterion goals for each metric.
Learning about what data to collect, continued

We had established goals and improvements for our key business drivers. However, we had not developed plans to achieve these goals. To eliminate this in our system, we developed a process to document a detailed business plan. This plan identified not only our projected goals but the plans we had developed to achieve those goals. This process is repeated and upgraded each year at our annual business review meeting.

We relied on turnover trend as a measurement of employee satisfaction. And at 41%, the trend wasn’t so good. However, our feedback report told us that we were not getting the whole picture. In addition, the examiners could not determine how the management team acted on employee feedback, and we did not have a formal system. Once again, the team evaluated this system and we came back to our employee survey. The survey asked very specific questions about the company in whole, and we now have quantitative information concerning our employee satisfaction. We eliminated the second gap in the system by forming quality improvement teams to address problems identified by our employees. This systematic approach to solving our employees concerns has played a major part in maintaining our 5% turnover rate for the past five years.

During one of the site visits, the examiners identified our quality system as being a strength. However, although it was a particularly strong point, we did not have a systematic process in place to assess the performance of this system. To address this issue, we began looking at ISO 9000. We began documenting our standard operating procedures, and work processes. In 1994 we were registered with ISO 9002 and we remain registered to this date. Our quality system is now audited four times each year. Twice by internal auditors and twice by external auditors. This systematic approach has helped us to make a strong point of our strategy an even stronger one.

Our customer satisfaction determination process was limited in 1990 to receiving quality reports from our customers. We felt that if the quality report was good, the customer must be satisfied. In addition, the only folks who could solve problems was the senior staff. Today, we have developed several levels of rapid access to not only the management team, but to the 47 members of our customer contact personnel. Our customer survey, which was developed with our customers, now covers nine distinct service related areas. Our customers have our car and home phone numbers. Our engineering department as well as our customer service department and accounting departments are all linked electronically with our customers. The empowerment of all customer contact personnel to immediately resolve complaints and issues is an indication of Trident’s focus on commitment to achieving customer satisfaction through its employees. Complaints received are discussed at company wide meetings and are posted throughout the facility. An award program has also been established for the entire plant if the company receives no formal complaints.

We now have a minimum of seven years of trend data for our metrics, and all are linked to our key business drivers. This enables us to determine if our plans are moving in the right direction.
Nicholas Juskiw, President/CEO, initiated “Excellence in Motion,” Trident’s Total Quality Strategy in 1988, and he continues to be its driving force. He is active in the community, serving on the Boards of the New York State Excelsior Award, Industrial Management Council, Monroe County Manufacturing Partnership, and the Rochester chapter of United Cerebral Palsy.

Joe Conchelos, Vice President of Quality, takes a leading role in educating employees in customer requirements and expanding their knowledge of customer/supplier relationships. He was a leading participant in writing the Baldrige applications submitted by Trident. Mr. Conchelos is also a judge for the New York State Excelsior Award and is a ISO Lead Auditor.

April V. Lusk, Total Quality Administrator, facilitates the team activities at Trident, conducts all TQM, safety, and SPC training. She has a BS degree from Brockport State University and teacher certification. Ms. Lusk has completed the Xerox Supplier Internal Resource training program, and has additional training from Motorola University and Rochester Institute of Technology.

The Nguyen, Production Supervisor, arrived in the United States in 1981, a refugee from Vietnam. He joined Trident in 1988 as a screw machine operator, became Employee of the Year in 1989, was promoted to Turning Supervisor in 1990, and now supervises three production departments: Turning, Turret, and Laser. He is active in the community, helping new immigrants assimilate into the Rochester area and promotes the support his Trident teammates have given to him.

Lisa Boulatnikov, Process Technician, joined Trident in 1994 producing subassemblies and other work in the General Assembly area, and worked her way to Process Technician. She is continuing her education in Business Administration at Monroe Community College.

Brian Salter, Order Entry Clerk, joined Trident in 1989 as an assembler. His organizational abilities and drive to learn computer skills has elevated him to an order entry position interfacing with customers daily. He also participates on numerous problem solving and quality improvement teams.

Jack Colern, Sales Representative, has been with Trident since 1990, with 10 years of prior sales experience and a background in purchasing. Due in part to his efforts on internal customer satisfaction and external customer satisfaction, Trident was able to open a sales office in North Carolina.

Joe Miran, Vice President of Operations, has been instrumental in Trident’s pursuit of a company based on TQM with the key goal of customer satisfaction. He has been trained as an ISO Lead Auditor and has worked extensively with the Rochester Institute of Technology in developing a Total Quality curriculum for their new master of science program in manufacturing management and leadership. Mr. Miran is a graduate of RIT’s Business Executive Program.
Armstrong Building Products Operations’ Innovation Journey


This article is about our use of process management tools to focus innovation, without restricting long term planning, and generate ideas that are focused on business information. I will review the lessons we have learned from our journey in transforming our innovation process into a business process. Specifically, I will focus on four sub processes of innovation, and provide examples of things we are doing in the areas of technology and concept management. I will then present the three stages of innovation, specifically discussing the first stage, or “fuzzy front end.” I will close the article with some conclusions we have drawn from our experiences.

Seven Key Lessons

There are seven key lessons we have learned from innovation process management:

1. Alignment to overall business goals.
3. Process focus and ownership.
4. Functional excellence.
5. Integration of functions.
6. Leadership within the business, including principles used.
7. Different microcultures in innovation.

Lesson #1: Alignment to overall business goals

It is imperative that the functions working within the innovation process work from the same page of key business drivers as every other function. At Armstrong, we key in on what we call our four non-negotiables of business strategy:

1. Increase market share profitably.
2. Become the best cost supplier.
3. Increase the flow of successful new products.
4. Improve the skills of our people and develop our human resource capability, which supports the other three.

The four non-negotiables of business strategy are the foundation for everything we do.
Lesson #1: Alignment to overall business goals, continued

It is important to communicate the high leverage strategies and the tactics consistently throughout the organization. For example, we use a series of templates (Figure 1) that divide our strategic plan into the four non-negotiables down the left hand side and the period of time within the strategic plan across the top. This template then becomes a single listing of high leverage strategies and tactics to which each function can align.

Figure 1. Global Strategic Plan Summary

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<tr>
<td>Gain Market Share</td>
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<td>New Products</td>
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<td>Best Cost Supplier</td>
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Lesson #2: Measurement

If it’s important enough to do, you should be able to measure it and track the results. But how do you decide what to measure? We decided to look at some of our key customer and financial measurements and relate the Innovation Group’s output to them. It was obvious to us that new products, in terms of the breadth of product line and percent of total product sales, was an important driver when positioned against the measures of customer satisfaction and overall financial results.

For example, we correlated our historical results in percent new product sales (past five years) to our net profit percentage on sales. We found an almost perfect correlation. For this reason, percent new product sales (past five years) is a key innovation measurement and we track this quarterly.

A second measure that we use is innovation payout. This combines effects from three of our non-negotiables (best cost supplier, consistent flow of successful new products, and increase market share profitability) by determining which operational projects implemented in a year originated because of work done in the Innovation Group. We then calculate this effect in a net present value model versus the investment we made annually in innovation, including pilot plant capital, people expense, and factory test expense to implement these changes.
Lesson #2: Measurement, continued

In the category of new product measurement, based on internal results and outside benchmarking, we set an aggressive goal to double our number. We have more than exceeded our goal in the past four years. We have tracked innovation payout for the last three years, and have reached levels greater than 30% internal rate of return and reduced the time it takes to recoup the investment in innovation by 50%. And to make sure that the entire organization knows the results we’re getting in these key measures, we publicize them through key management meetings and newsletters.

Lesson #3: Process focus and ownership

Before you can determine what your key sub processes are for the overall innovation process, you need some input. As we developed the framework for our overall innovation process, some key questions and development input were critical. A typical question was, “What kind of competencies do we have to have and how should the resources be allocated by sub process?” The development inputs consisted of internal customer satisfaction surveys, employee satisfactions surveys, some external benchmarking and the Malcolm Baldrige National Quality Award Criteria. As result of all that, we defined our innovation process as having four sub processes:

1. Technology management.
2. Concept development.
3. New product and process development.
4. Technical support.

Sub process #1: Technology management

The first sub process of innovation—technology management—can be more specifically defined as research, both basic and applied. One of the key things we did to better focus this sub process was to align all of the researchers directly to operations rather than have them work in a centralized group. There’s no question that this kind of focus can sometimes be a problem with long-term research. That is a pitfall that must be avoided.

Technology management is considered a key sub process of innovation, just like the more organized processes of product and process development and technical support. However, what happens within this process is different because the microcultures are different. We have individuals who work full-time on technology management so that we have a focus on the types of activities that are required.

The technology management group is divided into four core technologies important to our present business. This sub process is owned by a research manager who has organized a technology management team of researchers that regularly talks about the knowledge being generated and the potential long term implications to our business. Many of the things they use to create their portfolio of activity come from our 5-year strategic plans, outside research contracts, and technology search activities. It is important to emphasize that the main objective of this group is to create knowledge for the rest...
of the organization so that we can create future possibilities with a focus on our core business.

Sub process #2: Concept Development

The second sub process is concept development. I will discuss more about concept development, which can relate to both product and process, as well as technology management, when I get into the fuzzy front end. Suffice it to say that concept development and technology management must be given more free reign, for instance, than a technical support function, but they can still be defined and managed as processes.

Concept development is owned by the research manager and our design development manager. This collaboration brings together new technical knowledge that we find or develop, and market assessments followed by our industrial designers.

The following are some specific things we do with regard to concept development:

• RAFT

One of the forums used is a group we call the Research Applications For Tomorrow, or RAFT, which meets regularly to create product and process concepts from the knowledge gained from our current research.

• Three Year Marketing Calendar

We also use 3-year marketing calendars to help identify areas to create new product concepts. There are numerous frameworks that we use for external input into this process.

• Interiors 2000

Interiors 2000 is a program in which individuals from Innovation, Marketing, Sales, and Manufacturing make group visits to various cities. The group will meet with customer groups, such as architects, specifiers, and product installation contractors, to find out what’s important to them in building products. The group will then present concepts to them to get input for future development. This program allows many of those key people in various functions and with different responsibilities to hear the customer’s input at one time.

• Friday Meetings

Another program that we have is our monthly “Friday Meetings.” They are attended mostly by associates from our Innovation and Marketing groups, but are periodically attended by engineers, manufacturing personnel, and other visitors from our businesses around the world. We use these meetings to present any new idea or concept for quick evaluation, to determine if we should be pursuing it further. In other words, we want to know if it will meet our strategic fit and if it seems to have some potential against our customer outcomes. We try to create as many new ideas as possible and evaluate them quickly, given the overall business knowledge of our people in the meeting. We then vote on whether we like the idea or concept, and talk about these openly. Most of the ideas and concepts that come to a Friday Meeting are not pursued further...
but they serve as a rich source for future development.

- **F.I.T.**

  When we have specific areas in which we want to create ideas or concepts, we organize facilitated ideation sessions using a variety of tools. This is called “F.I.T.” (the Focused Innovation Technique). Figure 2 shows a typical agenda for a F.I.T. session. We have a group of trained facilitators within Armstrong who regularly help groups generate the ideas they need to improve our business.

  **Figure 2. The Focused Innovation Technique (F.I.T.)**

  1. Statement of Task
  2. Analysis
     - Why is this a task?
     - A brief history.
     - Why you have ownership.
     - What you have thought of or tried.
     - What would you like to get?
  3. Brainstorming (Round One)
     (Diverging)
     - I wish...
     - How to...
     - What if...
  4. Selection of Leading Ideas
     (Converging)
  5. Action Brainstorming (Round Two)
     (Diverging)
     - Ways to do it.
     - Components of the solution.
     - Variation of the theme.
  6. Selection of Ideas for Development
     (Converging)
     - One or more in combinations.
  7. Concept Development
  8. Report and Repeat
  9. Decision Making (By Task Owner)
  10. Next Steps (Who, What, When)

- **TIPS**

  We also have a process that we call “TIPS,” an acronym for Taking Improvement Processes Seriously, that allows any of our employees or even customers to submit ideas for consideration and further development. Some ideas from our customers have come up at Friday Meetings for evaluation. This is an important link to ensure that the entire organization understands that we need their support and their knowledge to grow our business.

- **Templates for Evaluation and Communication**

  One way that we make sure that we consider each idea in the same way is to use a
Sub process #2: Concept Development, continued

series of templates to communicate and evaluate them. These templates focus on what the outcome for the customer will be; not the feature that our product holds, but what the customer will experience.

Something that is just an idea, and not even “fleshed” out to a concept, might only have a general description page which starts with what the idea is and goes down to how it might be approached and when it could deliver (see Figure 3). Generally this is to help everyone understand what we're talking about. But as we get further in developing it into a concept, we'll start to generate a fact-based profile that includes market summaries and a ranking on those key outcomes that the customer wants against other potential competitors and competitive products. This could be products in completely unrelated fields not just those with which we directly compete. Again, the level of detail and how much of these templates we fill out will depend on whether it's an early idea or a fully developed concept. In any case we use the same basic framework so our communications are clear and consistent and it's all based on customer outcomes.

Figure 3. A Template for New Ideas and Concepts

<table>
<thead>
<tr>
<th>Preliminary Idea/Concept Proposal Overview: (Title)</th>
</tr>
</thead>
<tbody>
<tr>
<td>What it is... (Brief idea/concept description)</td>
</tr>
<tr>
<td>Where it applies... (Market application—usage, targets/segments/customers)</td>
</tr>
<tr>
<td>Why it's worth exploring... (Scale of opportunity, trends, fit to BPO)</td>
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<tr>
<td>Stage of concept/market investigation... (Preliminary, final)</td>
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<tr>
<td>How it might be approached... (Possible next steps)</td>
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<tr>
<td>When it could deliver... (Possible schedule to enter/launch)</td>
</tr>
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<td>Submitted by: (Name)</td>
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Sub Process #3: New Product and Process Development

The third sub process is new product and process development. More discipline is involved at this point—you must utilize multidisciplinary teams, project managers, and financial analysis. At Armstrong, we have also found it helpful to do extensive case studies after projects are over. These sessions are facilitated by an executive to make sure that all in the process know that this is important work. The purpose of the case studies is to help reduce cycle time and costs, and this information is shared throughout the organization.
Sub Process #4: Technical Support

The fourth sub process of innovation is technical support. We have found a large payoff for defining specific individuals who do all of the technical support for our Manufacturing, Marketing, Sales, and Advertising. We found through our Baldrige Award self-assessment in 1990, as well as employee satisfaction surveys done shortly thereafter, that we were not doing a good job of allowing people to focus on doing their jobs properly. Too often, people doing mid-to-long-range work were being pulled away to solve short-term problems, thereby stretching out the timelines on the major projects. By defining technical support as a specific function and sub process, and assigning dedicated people to that, we keep the load off the people who are doing the medium-to-long-range work.

Lesson #4: Functional excellence

Multidisciplinary teams and project management within new product and process development are key practices that help optimize the output and speed of our projects. However, a team is only as good as its members are competent. A team cannot make something out of nothing, and therein lies the importance of functional excellence. For Armstrong Building Products Innovation, we focus on two functions: (1) Design development, basically industrial designers and tooling specialists; and (2) Research & Development, which consists of chemical engineers, physicists, mechanical engineers and other scientists.

One of our non-negotiables is to develop our human resource capability. This is also supported by our overall human resource strategy for Operations, which includes the elements of safety, employee involvement and empowerment, people development, recognition and reward, and employee well-being and satisfaction. We have key measures under each of these, and our emphasis on these strategies assures our people that we really want them to be skillful and challenged. As with any other good human resource focused organization, we have several ways of developing the skill and knowledge of our employees. Any organization would certainly focus on the areas of continuing technical training and application of technology tools. But it is also important to blend in outside research, not just focus on what your own people are bringing to the table. That outside research needs to be coordinated by somebody inside who can then help the rest of the organization assimilate it into their knowledge base.

A key positive area cited by the Baldrige Examiners in their feedback report was the area of information sharing. This is not an area that is distinctly an innovation capability within Armstrong Building Products. This is something that we do throughout all our functions, and this information sharing helps to keep our knowledge bases fresh throughout the organization.

One additional practice that we have started is a definition of best practices within certain key sub processes. For example, our project management group recently completed a four month long review of their individual and collective practices. They then created a best practices document which can now be used for their ongoing training, as well as any new project managers’ initial training.
At Armstrong, we know that new product development is not just an innovation function. It is a system that cuts across all functions. As you can see in Figure 4, the chart of our Quality Leadership Team includes all the value-adding functions and the support functions, each reporting to the President of the Operation as one team. We are indeed trying to integrate at the very highest level.

**Figure 4. Armstrong’s Quality Leadership Team**

Product development is a system, not just involving people from R&D and the Design Development group, but also Marketing, Logistics, Manufacturing and Finance. We have learned, as evidenced by the chart of the change process within our business excellence process (see Figure 5), that focusing on systems or capability development is much different than the past focus on things such as process improvement or corrective action. The speed, scope and impact of organizational change are all much greater when you focus on the system, and that requires an integration of all the functions.

**Figure 5. The Change Process**
Lesson #6: Leadership within the business, including principles used

Does innovation participate as an equal partner within the business or is it just a function that happens to kick out something good every once in awhile? Does the innovation function use the same basic operating principles as the rest of the organization? Innovation is one of the value-adding functions along with Sales, Marketing, Manufacturing, and Logistics for our business. It is an equal partner among those functions on our Quality Leadership Team. But beyond having that equal footing, the leader must apply the same principles to getting the job done, so that those in that functional organization, as they interact with the rest of the business, have the same grounding.

Our fundamentals of quality management are simple, powerful and cut throughout the business. It involves all employees in process improvement, with an outward focus. It says a lot and yet it’s easy to remember to act on. We have the same leadership system. It is applied consistently from the Quality Leadership Team down through the Quality Improvement Teams that help manage each function. We all use the same templates and process to manage our activities. As we change our processes and our operating systems, we must consider the same support mechanisms for change to help reinforce and sustain that culture. These systems range from elements of the human resource strategy, such as recognition, reward and employee development, to benchmarking and measurement systems.

Lesson #7: Different microcultures in innovation

We have defined our innovation process in terms of technology management, concept development, new product and process development, and technical support. Because of the broad range of activity that must inevitably occur within this process, those various sub processes in innovation require different microcultures. We cannot have exactly the same disciplined, orderly process in the front end of innovation as we do in the stages related to product development, commercialization or operation. For example, in the fuzzy front end, there’s a willingness to consider the unreasonable versus the order that is sought in commercialization. While those who work in the front end enjoy the quest, there’s more urgency in product development and somewhat of a resistance to new and radical change in commercialization. The activity that occurs in the front end is much more spontaneous versus the orientation to rules and organization that occurs in commercialization.

The Three Different Stages of Innovation

Figure 6 summarizes the stages of innovation. All three of these stages must coexist for innovation to be effective. With our business orientation, it’s not hard to perform the tasks required in the second and third stages of innovation. That is why a lot of us have gotten into trouble over the years, forgetting about the importance of the first stage. The senior leadership of a business, both the innovation leadership and the business leadership, must actively spend the effort to make the front end work. It takes time, but the
whole organization must believe in and support the effort if it is to be truly effective. And that will not occur unless the leadership is passionate and involved. By promoting new ideas and experimentation, and conspiring to create interactions with customers and internal groups of people, the leaders of an organization can learn to love the fuzzy front end, because of the business results and long term growth it can generate.

**The challenges of the first stage of innovation**

There are several issues that make managing the fuzzy front end difficult, especially for business leaders who are normally focused on next quarter’s results:

1. The front end of innovation tends to be a serial rather than a concurrent process. The targets may change because of the length of time needed to gain that knowledge.
2. Informal networks are more important than the process.
3. Individual activity is important in this first stage of innovation. Many of these individuals are thought to be crazy or maniacs with obsessions by the top business leaders. These are not the kinds of people that they want negotiating a contract with a key supplier or a joint venture partner. However, these maniacs are certainly passionate about what they do, and if you have them focused properly, they can deliver.
4. The reality of the front end is that most efforts will not result directly in a finished product or easily identifiable opportunity. However, it is important to reach an end point in these losing opportunities and do it in a reasonable manner. If we can screen out those losing opportunities more effectively, our overall resources will yield more payback. There’s no question that anything that is discontinuous to our core or current business is scary. Most of us would have no problem managing

### Figure 6. The Three Stages of Innovation

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<tr>
<td>Willing to consider the unreasonable</td>
<td>Discipline</td>
<td>Seeks order</td>
</tr>
<tr>
<td>Enjoyment of the quest</td>
<td>Urgency</td>
<td>Slow to change</td>
</tr>
<tr>
<td>Unpredictable</td>
<td>Commitment to a goal</td>
<td>Financial orientation</td>
</tr>
<tr>
<td>Much individual activity</td>
<td>Teamwork</td>
<td>Oriented to rules; highly organized</td>
</tr>
</tbody>
</table>
something concrete, and be able to improve it over time. But it's the order of magnitude increases in product performance, process improvement, and completely new product category that keep us all awake at night as we think about both the necessity of doing them and the uncertainty of picking the right one.

5. Finally, there is the funnel from the fuzzy front end down towards the more disciplined and orderly parts of the innovation process of new product development and commercialization. It takes 100 ideas to produce one success. The 99 that don't turn into commercial success are not failures, they're just what we had to do to get the one success. If you do not believe that most ideas come from previous projects, and that the storehouse of ideas created through this activity doesn't payoff in the long term, I believe you are leaving part of your potential success on the table.

Conclusion

In closing, I want to pose a question to you that my previous boss Henry Bradshaw posed to me when I was going over reasons for continued emphasis on the fuzzy front end. Hearing that there is a tendency in mature organizations to eliminate fuzzy front end processes because they appear unbusinesslike to senior management, he said, “How do we make sure that we're going to be able to do this in the future? How do we make sure that the top executives of Armstrong aren't going to just say to us ‘you have to eliminate it because it's unbusinesslike?’”

My answer was that we need to focus on the total innovation payback. Don't worry about any individual effort and whether it pays off financially. We need to focus on whether the total innovation resources applied result in positive growth and a substantial internal rate of return to the organization. Our knowledge of that payback along with leadership's courage and conviction to not just support but be involved in this important process will be what keeps it alive. But, if we as business leaders do not remember that innovation played a major part in creating our company’s value in the first place, and we allow this important value-adding activity to be eliminated or minimized, we need only to look in the mirror to see who is responsible for our organization's lack of growth.

Notes

1. F.I.T. framework provided by Innovation Focus, of Lancaster, Pennsylvania.
2. Figure adapted from “The Spiritual Nature of Innovation,” a presentation by Sheldon Buckler, former Vice Chair of Polaroid Corporation, at the Industrial Research Institute's Annual Meeting in Colorado Springs, Colorado, in May, 1996.
3. Points 1-5 adapted from “Special Interest Session on Discontinuous Innovation,” by Joseph Morone, Dean, Lally School of Management, Rensselaer Polytechnic Institute, at the Industrial Research Institute's Annual Meeting in Colorado Springs, Colorado, in May, 1996.
Author information

Stephen Senkowski was the Vice President of Innovation Process for Armstrong Building Products and a member of their quality leadership team at the time this article was written. In July of 1997, he became President and CEO of WAVE, a joint venture between Armstrong and Worthington Industries, based in Malvern, Pennsylvania.

Stephen's primary responsibilities for Armstrong World Industries have included technology management, product concept development, new product and process development, and technical support (including product testing) for their worldwide operations. Some of his past work with Armstrong includes industrial engineering, production planning, and manufacturing management with five Armstrong businesses in six locations. He introduced quality management to a subsidiary operation in Canada, was project manager for operational warehouse process reengineering, and was a member of the corporate reengineering team on innovation. He earned his bachelor's degree in industrial engineering from Lehigh University.
Teams, Taxes, and A Few Other Things Better Not Left to Chance

Authors

Suzanne Rast, Quality Coordinator, South Carolina Department of Revenue
Nancy Wilson, Training and Development Director, South Carolina Department of Revenue, Columbia, South Carolina

Introduction

Imagine that you are sitting next to someone at a social gathering, and you ask, “Where do you work?” And the person says, “I’m from the state department of revenue.” What would be your gut reaction? How many people really look forward to the April 15th deadline to pay taxes every year? On the other hand, what would you say to that person if they said, “Our job is to enforce and administer the revenue laws of our state. What kinds of things do you expect from us?” You might respond with, “Accuracy, efficiency, and do it the cheapest way possible.” These are the things that we hear. We have gone out of our way to solicit our customers’ expectations.

Any time an organization goes through a transformation from a traditional hierarchical culture into a team-based culture, there will be all kinds of unexpected twists and turns down that road. Sometimes we felt like we were in a void, while other times we felt like we had learned a lot. We do not feel that we have arrived; we feel that we will always be learning.

In this article, we will tell you what we’ve done with teams, how we’ve done it, some of the results we’ve gotten and some lessons we’ve learned.

The Total Quality journey

Through our involvement in the Total Quality process over the last seven years, the South Carolina Department of Revenue has learned some valuable lessons in the use of teams to accomplish our mission and drive us closer toward our vision. We have aligned our strategic planning, Quality processes and performance measures, and continue to use both project and work teams throughout the organization. Put quite simply, our strategic plan tells us what we will do, our Quality processes are how we do it, and our performance measurements are the way we gauge our progress.

The realities of doing business in the 1990s have shaped the way we approach our job of administering and enforcing the revenue laws of the state of South Carolina. We are forced to be more accountable, eliminate waste and duplication of services, and adjust to blurring jurisdictional boundaries. Customer expectations have dramatically increased, together with workloads. As with most governmental agencies, resources have at the same time remained flat or in most cases have declined.
The Total Quality journey, continued

In 1989, we knew that we had to change the way we approached business to be able to meet the demands of the future. We also know that no one looks forward to paying taxes. However, our goal is voluntary compliance and we think taxpayers will voluntarily comply if we administer our processes in a fair, understandable, efficient, courteous and professional manner.

The mission of the agency

The mission of our agency is to administer the revenue laws of the state of South Carolina. We administer 35 taxes, the largest two of which are individual income tax and sales tax. We have approximately 2.5 million people in South Carolina. About 1.9 million of those people file individual income tax returns every year. The majority of these people receive refunds. So, think about the processes involved with that! We have $5 billion in collections, and over a million face-to-face or telephone customer contacts each year. We have approximately 800 employees in nine locations around the state, and additional auditors in larger metropolitan areas across the country.

Rapid progress since starting TQM in 1989

Our organization began the quality venture in 1989, when we started learning, studying, and implementing those processes. In 1995 we became the first state agency to win the governor’s Quality Achievement Award, which is based on the Baldrige Criteria. Today, we are recognized as leaders in the field of tax administration and in state government.

We have had some experience with Quality at the state government level. However, government is not on the cutting edge of quality implementation. So, we were looking for models. When we began this venture, there was a lot going on in manufacturing, but in terms of service and government, there were very few models to examine. We learned many lessons from trial and error because there were no other models for us to go by or to learn from.

Changing business environment

We will now discuss the environment that we’re in (see Figure 1).

Taxpayer expectations:

No matter what business you’re in, customer expectations have soared over the last twenty years. Government is different than private businesses in some ways, especially because capturing market share is not an issue with us. We do have some privatization issues, but there is no risk of going out of business next year or the year after that. However, our customers continue to demand more and more from us.

Workload:

We have had a 15% increase in workload over the past five years, and since we can project changes and because of population demographics, our workload continues to go up. Therefore, in some years government resources were increasing. But in the last five years we have had a 12% decrease in staff and other resources. If you just do the pure
teams, taxes, and A Few Other Things Better Not Left to Chance

Changing business environment, continued

math, that's a 28% gap. We knew in 1989 and 1990 that if we didn't do something differently, we would drown in a sea of paper. We would have customers screaming at our doors, and so we began the process of doing things differently.

Government in the 1990s:

There will be fewer dollars available to government in the coming years, higher customer expectations, and greater accountability. These are justified facts; we do not argue with them. We will face greater accountability and must eliminate duplication of services.

For example, if you wanted to start a business in South Carolina, you would have to go to the Secretary of State's office to get your charter, then go to the Department of Revenue to deal with any state licensing or withholding issues, and then go to your local government to take care of some other business license issues. Could we possibly have one-stop shopping for this? We have had some experience with combining jurisdictions. One thing that we know is that citizens don't care whether it's federal, state, or local government— they just want the system to work for them and be customer friendly.

Figure 1. Graphic Representation of Business Trends in the 1990s

Early stages of the strategic plan

Before we began quality training, we had a strategic plan that was not very functional. It was not used, and our employees didn't see, on a day to day basis, how their work contributed to the big picture. When we began implementing some of the quality processes in 1989, we saw that we needed to tie these pieces together. That is probably one of the major learnings from our venture— tying the pieces of the puzzle together. So,
Early stages of the strategic plan, continued

we began a strategic planning process four years ago, a revisiting of the strategic plan. The strategic plan is our compass that shows us what we're going to do, Total Quality processes are how we're going to do it, and the performance measures are those tangible results.

We began the strategic planning process with a fairly typical model in terms of getting lots of input (see Figure 2). We used teams and focus groups within our agency. We also went to the state legislature, and we went to professional groups. We talked to everybody that we could find, and asked them what they thought we needed to be taking into account.

Figure 2. Strategic Planning Model

All of that input lead to identifying five key issues that were important for us (see Figure 3).
**Figure 3. Key Issues and Strategies**

<table>
<thead>
<tr>
<th>Issue 1. Improve Compliance</th>
<th>Strategies:</th>
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<tbody>
<tr>
<td>A. Educate customers on their legal requirements.</td>
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<tr>
<td>B. Ease the burden of compliance for customers.</td>
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<tr>
<td>C. Take an active role in the review of legislation and recommend improvements for simplicity, understanding and ease of compliance.</td>
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<tr>
<td>D. Identify and address areas of unintentional noncompliance.</td>
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<td>E. Discourage willful noncompliance with focused enforcement action.</td>
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**Issue 2. Provide Quality Customer Service**

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<tr>
<th>Strategies:</th>
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<tbody>
<tr>
<td>A. Determine the needs and expectations of customers.</td>
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<tr>
<td>B. Demonstrate our department’s values to all customers through our actions.</td>
</tr>
<tr>
<td>C. Establish media and marketing strategies for services provided.</td>
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<tr>
<td>D. Simplify and consolidate processes that affect customers.</td>
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<tr>
<td>E. Improve the quality of written communication to our customers.</td>
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<tr>
<td>F. Reduce the burden of compliance for customers through cooperative agreements with other governmental agencies and industries affecting the customer.</td>
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**Issue 3. Make Effective Use of Resources to Support the Department’s Activities and Responsibilities**

<table>
<thead>
<tr>
<th>Strategies:</th>
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<tbody>
<tr>
<td>A. Evaluate facility needs and make the best use of our space.</td>
</tr>
<tr>
<td>B. Evaluate and make proper staffing allocations.</td>
</tr>
<tr>
<td>C. Determine tools and equipment needs and make proper allocations.</td>
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<tr>
<td>D. Maximize use of resources to support delivery of services without regard to jurisdictional boundaries.</td>
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</table>

**Issue 4. Provide an Environment that will Promote Attracting, Hiring and Retaining the Highest Quality Employees**

<table>
<thead>
<tr>
<th>Strategies:</th>
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<tbody>
<tr>
<td>A. Actively recruit the best employees.</td>
</tr>
<tr>
<td>B. Promote an organizational culture that helps employees function to the best of their abilities.</td>
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<tr>
<td>C. Improve the classification and compensation system to appropriately recognize employee contributions.</td>
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<tr>
<td>D. Provide appropriate and timely employee training.</td>
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**Issue 5. Continuously Improve Department of Revenue Processes**

<table>
<thead>
<tr>
<th>Strategies:</th>
</tr>
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<tbody>
<tr>
<td>A. Use Total Quality Management as the basis for improvement.</td>
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<tr>
<td>B. Focus on processes that add value.</td>
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<tr>
<td>C. Use measurement to determine progress on improvements.</td>
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<tr>
<td>D. Take advantage of technology to improve processes.</td>
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<tr>
<td>E. Continuously improve the planning process.</td>
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**Setting objectives**

Our vision is to be world class in tax administration (which is our business). In order to achieve that goal, we focus on doing a good job with the five key issues. We set objectives on two levels: Our operating divisions set objectives, and all of our natural work teams set objectives. We define a natural work team as a supervisor and the team that works with him or her.
The planning cycle

The planning cycle is such that divisions and teams set objectives, and they all fit into our annual business plan (see Figure 4). We have quarterly progress reports, and each year we publish all of our accomplishments. Last year, we had about 600 team objectives with accomplishments, and 100 agency level objectives. Those were the more visible items.

Figure 4. The Planning Cycle

Natural vs. cross-functional teams

Natural teams seem to work very well, because the teams will get together to build or maintain a system. They are a great way to begin implementing TQM principles and the process improvements within that set of principles. At least in our organization, we've been able to make that part of the culture. When it comes to cross-functional teams, there's more difficulty in getting the mindset in place. You need to prevent people from just protecting their own turf, and get them to really work on the problem that needs to be solved.

Results and Lessons

We will now discuss some of the results, the types of teams we've used, and lessons we've learned that might help other teams be successful.

Natural Work teams

Natural work teams include the supervisor and his or her direct reports—folks that work together on a long-term, day-to-day basis. We don't have much turnover in our organization, so these teams are pretty stable. This is where we get our biggest gains.
Natural Work teams, continued

One particular team recently had some wonderful success. We have a section in our individual income tax area that does nothing but error correction. Talk about rework! About 1.9 million people file individual income tax returns in South Carolina each year, so you can imagine the volume we go through. The team's job is to correct taxpayers' errors and send notices letting them know what kind of errors they've made.

Out of that 1.9 million, the majority of people get refunds in our system. When people file their tax returns, they have the expectation that they're going to get some money back from the state—which we hope will delight them, but they won't be delighted if they don't get it in a timely manner. The error correction team was looking at reducing our workload, and making our customers happy by getting their refunds out faster. They determined that simple math errors were causing 45,000 returns to be examined by this group, but that these errors did not affect the bottom line of their refund. The money amount would be the same; it was simply the fact that these people either added or subtracted incorrectly or put numbers in the wrong blocks. The team, through their analysis, was able to eliminate these errored returns. In the old system, the returns came in and our data entry area would enter the information. Then, the system would kick out an error list; these returns would go to the file room. The error correction section would have to retrieve these files, work on them, and then finally once they're reworked, the taxpayer would get their refund. The whole process took somewhere in the neighborhood of 79 days, from the time the return was entered on the system until the time it got corrected and was back into our file room. Now, they have a turnaround time of three days.

Project Teams

Project Teams are cross-functional, within or across division lines and they are generally short term in nature, because there is a specific project to work on. They get in, they work on it, they come up with their solutions, they implement, and they're done.

One example is our “STREAM S” Team, our sales tax coupon booklet mailing process team that was created because we had a terrible process of reordering booklets. Taxpayers would be on our system, and for some reason or another they wouldn't get the booklets. They would call in, and we would reorder. This team analyzed the system, and we eliminated 70% of the reorders for an annual savings of about $20,000, which was pretty significant.

Another one is the “Return to Senders” Team, who looked at undeliverable mail. We are now promoting and publicizing the requirement of change of address forms to our taxpaying public. We also put address correction postage on mail so that when it did not get to the proper address, the post office would send it back to us with the correct address and we would be able to update our systems. We can match our files against a software package from the U.S. Postal Service to make sure that the addresses that we do have are, in fact, addresses that you can deliver mail to.
CASE STUDY

Teams, Taxes, and A Few Other Things Better Not Left to Chance

Project Teams, continued

The “Squeeze Play” Team looked at our systems availability. We have systems that need to have data processed into them as well as being able to update taxpayers files. The team was looking at the availability of those systems, so that the folks that worked during the day could have that system available to input the data, update files, etc., and not be bothered with having to do the massive updating in the evenings. The team was able to figure out a time schedule for when these things could be done, so folks during the normal working hours would not be interrupted, and they could continuously input data.

The “Postage Cost Busters” Team looked at cost savings in terms of postage. We knew the postage regulations were changing and that the price of postage was increasing, so we had to address that problem in some fashion. One of the biggest gains that team made was in collections. We have to enforce collections for a small percentage of taxpayers, but it’s a big amount of money. We were sending multiple collection letters to a single taxpayer. Maybe a taxpayer was getting a collection letter for sales, for withholding, maybe their corporate tax. We were able to identify that problem so that we could combine the letters. To date, we’ve had $142,000.00 worth of savings in just postage alone.

The “Booklets R Us” Team looked at our sales tax and withholding areas, and the mailing schemes of how we got these booklets to our taxpayers. We currently mail them annually. We thought that if we went back to a monthly mailing, taxpayers would send them back in a more timely fashion. But first we surveyed a statistically valid sample of our customers, and we were surprised to find that they were overwhelmingly satisfied with the annual mailings of the booklet as long as we got them there on time. So we went on to identify and map the process, which enabled us to identify tasks that needed to be accomplished, when they need to be accomplished, and who is accountable for them.

Some lessons learned

Leadership from the top is critical. We’ve said, time and time again, that it is essential to have those leaders at the top supporting us and supporting the teams.

Clear mutual focus. The teams need to know where their boundaries are.

Skills and training. We need both their technical skills to do the job as well as team skills and problem solving skills.

There needs to be a balance. Sometimes teams think that “this isn’t part of their job.” One of the things that we’ve tried to instill is that being timely, doing team objectives, and working on projects, is in fact the way we do business around the Department of Revenue.

Time and patience. Sometimes we do projects that are too big. We want to get it 100% perfect, and maybe sometimes 80% is O.K. But it does take time, particularly in the cross-functional teams when people don’t work together on a day to day basis. The team building process takes patience.
Figure 5. Results from Survey on Satisfaction with Service Provided

Asked Only of Respondents Who Had Contact with the South Carolina Department of Revenue in 1996.
question, they would have to go to the sales tax division. If they were registering a new business, they would have to go to every individual division for each tax that concerned them. We needed major reorganization within our agency. In 1989, people felt like they had lost power, and in many cases they had lost positions. Therefore, the excitement over the new quality process was not shared by all members of our organization. We made some fairly substantial mistakes going into this process; I hope that you can learn something from our experience.

- Our biggest mistake was not recognizing the ways that our organization was successful. Not everyone shared our excitement about this new way of doing things. We named our process “The Quality and Productivity Improvement Process.” Employees saw management as trying to find a new way to squeeze more work out of them, and they didn’t particularly like that. We started from the top down. However, we were impatient. We trained our top managers and the executive level managers, but we did not do a good job of involving our supervisors and getting their buy-in.

- There were also some turf issues that we did not anticipate when we started. We changed when we found that we were actually perpetuating some “us versus them” thoughts with our first team. Our executive management group took the lead to solve this problem—each team now has a liaison on our guidance team, which is the executive staff who helps them clear obstacles. It has helped us tremendously.

- When we started this quality process, we found all kinds of team consultants. But we could not find out how to integrate database decision-making with teams with the problem solving tools that quantify those kinds of things. So, if you’re implementing teams, be smart when you’re choosing a consultant. The data driven part of problem-solving tools is just as important as the soft skills.

- We threw teams at everything when we first started. We overloaded people on teams. We tried charters that were way too big. Consequently, teams lasted too long and some people got burned out on them.

- We’ve probably done as good a job of training as anything. Most of our training, at this point, is done internally. But in our early stages, we did not do enough training. Particularly for those hard skills, versus the soft skills.

- There will always be plateaus, and at times, enthusiasm has waned in some places. It’s not a sign of doom, at least from our experience. It’s looking at new and creative ways to find and foster enthusiasm. Recognition is one thing that has helped us.

- Beware of the person in your organization who says, “I’ve always managed that way. I’ve done this all my life, ever since I’ve been in this profession.” The one thing that we’ve seen, in our case, is that the people who say things like that don’t have a clue as to what you mean.

- There are a lot of leadership challenges. I guess one of the biggest things is that it’s not a democracy. All decisions are not made by teams, nor are they made at the top. There are still times when decisions must be made at the top, and you can’t get all the
Mistakes that were made, continued

input that teams think is needed.

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Conclusion

Intertwining three key elements has been our greatest tool in making teams work:

• Our strategic plan is our compass. It tells us what to do.

• Quality and teams is how we do it.

• Performance measurement is how we assess our results.

By continuing to focus on these elements, we are confident of our future successes.

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Author information

Suzanne Rast has been with the South Carolina Department of Revenue for 10 years, the past eight as Quality Coordinator. She is an instructor in the various quality courses offered by the agency, teaching the tools of the process. Suzanne serves as chairwoman of the Executive Board of the South Carolina State Government Quality Network Association. Its purpose is to promote the applicability of quality management principles in government. She also serves as member at large program chairwoman for the Association of Quality and Participation (AQP) which is an organization offering networking and educational opportunities for those involved in quality improvement efforts. Suzanne is a graduate of Orangeburg-Calhoun Technical College with an associate's degree in business and Limestone College with a bachelor's degree in management science.

Nancy Wilson has also been with the South Carolina Department of Revenue for 10 years. She has been a leader in their transition to a culture that actively uses teams and teamwork at all levels in the organization. In this role, she has not only trained team leaders and team members, but has also facilitated many teams. For the last seven years, she has facilitated the executive management team's process of implementing TQM in the agency, establishing the strategic plan and performance measures. Prior to 1987 she worked as a team advisor at Westinghouse Nuclear Fuels Division in Columbia, was on the staff at General Electric Institute, and taught at the University of South Carolina. In addition, she has consulted with a number of companies on leadership development and teamwork issues. She received her bachelor's degree from Presbyterian College and her Ph.D. in educational psychology from the University of South Carolina.
Great customer satisfaction comes from knowing your customers and delivering solutions that satisfy customers' needs. Finding those solutions can be a difficult task, with enormous consequences. The loss that occurs by selecting a poor solution early in the design process may never be fully recovered by subsequent development.

In this article, we will discuss the emergence of a new paradigm in dealing with the customer/concept interface, based on axioms or principles. Two approaches have been developed with this new paradigm: (1) Axiomatic Design, and (2) TRIZ.

To better understand the applicability of this paradigm, consider the history of quality engineering from the perspective of design domains. Figure 1 shows a model of design domains (originally developed by Nam Suh) in new product development. Essentially, a product or service begins with understanding customer attributes (the "voice of the customer") and translating these customer needs/wants/delights into functional requirements, design parameters and process variables. Consider, for example, a refrigerator door [1]. Two basic customer attributes for a refrigerator are to keep food preserved and to do this at low cost. Functional requirements for the door might be: provide an insulated enclosure to minimize energy loss, and provide access to the food in the refrigerator. The physical domain consists of physical parameters that determine the design of the product or service. In this case, we might choose to mount the door horizontally and open it vertically. The mapping from the physical domain to the process domain involves selection of process variables to manufacture and assemble the refrigerator door.

It really does not matter what type of product or service you are working on. This concept of design domains is applicable to whatever you do in your situation (Figure 2).
The early history of quality engineering, continued

The next step: algorithms

A new paradigm of principles or axioms

Figure 1. The Four Design Domains

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The early history of quality engineering, continued

In the early 1950s, Dr. W. Edwards Deming, Dr. Joseph Juran and others spearheaded the use of process control (in Figure 1, this involves controlling the process variables in the process domain). Quality improved as manufacturers began making parts to strict specifications. Nevertheless, many customers were not happy with certain products even though they met all specification requirements.

In the early 1970s, Ishikawa proposed building quality into the initial design, and called this New Product Development Quality Assurance. Since then, many algorithms have been developed to aid designers in product development efforts that involve mapping one design domain into another. These algorithms, or step-by-step procedures, include: Quality Function Deployment, Taguchi’s methods of Robust Engineering, Design for Assembly, Reliability Engineering, Systems Engineering, and Pugh Concept Selection. These algorithms or rules are very helpful, but occasionally you can find exceptions where teams used these algorithms or rules and did not design a satisfactory product.

So there must exist an underlying set of principles, another layer or structure, that provide a foundation associated with algorithm effectiveness. These are the fundamental structural elements, or axioms, that exist behind the scenes— the algorithms work when the axioms are satisfied, and do not work or do not work well when the basic axioms are not satisfied.

After careful consideration and research, Nam Suh developed an initial set of axioms, and then winnowed them down to only two, which are now the basic principles of Axiomatic Design. Similarly, Genrich Altshuller in the former Soviet Union classified patent applications in terms of degree of difficulty. He noticed that inventions on what he called the fourth and fifth level are very few, and began to draft principles for a Theory of Inventive Problem Solving (in Russian, the acronym is TRIZ) based on what
A new paradigm of principles or axioms continued

The advantages of a principle-based approach

Axiomatic design

The basic assumption of an axiomatic approach to design is that there exists a fundamental set of principles that determine good design practice. The key concepts in axiomatic design [1,2] are as follows:

- THE CONCEPT OF DOMAINS: The world of axiomatic design has four domains: customer, functional, physical, and process. The domain structure, illustrated in Figure 1, essentially moves from “whats” to “hows” in a series of sequential maps. The concept of domains applies to many fields (see Figure 2).
- FUNCTIONAL REQUIREMENTS: The first step in the axiomatic design process is to establish the Functional Requirements of the product, process, or service in a solution neutral environment. The Functional Requirements are defined as the minimum set of independent requirements of the functional domain.

Axioms are a set of generalized principles that govern underlying behavior. These principles cannot be proven to be true. They are believed to be true because no examples have been found to show that the principles are incorrect. Algorithms represent a series of step-by-step instructions or rules that are to be followed in specific situations. Algorithms differ from principles in that they are true most times, or under specific situations, but are known not to be true at all times and in all situations. An axiom or principle-based approach to quality is attractive for the following reasons [2]:

- Generality: An axiomatic approach would have total applicability. The axioms would apply whether you are designing a product, a service, an organization, or anything.
- Absolute Referent: The axioms can be used to evaluate the quality of a design when the design is still on paper, in the concept stage.
- Expansion of Knowledge: An axiomatic approach deals with the creation of a set of self-consistent logic that yields correct solutions to all classes of problems. Thinking in this way deepens our current understanding and establishes a scientific base for the field of quality engineering.
- Simplicity: Current Product Development practices are extremely complex. An integrated approach to design will greatly simplify the task of understanding and implementing key actions that make huge differences in customer satisfaction.
- Speed: A better understanding of how to produce a great first-instance design will significantly reduce product development time.
- Historical Precedent: The history of science and technology is closely intertwined with the development of axioms. Euclid developed his geometry from a set of fundamental postulates. Axioms were proposed by Newton and Einstein, and are utilized in many fields of science including thermodynamics. 

he felt these inventions had in common. These two sets of methodologies based upon axioms or principles have ushered in a new phase in the evolution of quality engineering.

The advantages of a principle-based approach continued

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that completely characterize the design goals. Note: Functional Requirements are, by definition, independent.

- **MAPPING**: Design may be defined as the creation of synthesized solutions that result from mappings that take place between the various domains. This mapping process is non-unique; there are an infinite number of plausible design solutions for any given set of Functional Requirements.

- **DESIGN AXIOMS**: The design axioms are the principles that the mapping technique must satisfy to produce a good design, and provide a basis for comparing and selecting designs. Although there are numerous theorems and corollaries, only two design axioms have been found to date. They are:
  
  **Axiom 1**: The Independence Axiom—Maintain the independence of the functional requirements.
  
  **Axiom 2**: The Information Axiom—Minimize the information content.

- **ZIGZAGGING DECOMPOSITION**: Zigzagging is utilized in a system environment when moving between domains from one system level to another. In such a situation, one would, for example, begin at a high level in the Functional Requirement domain. Functional Requirements at this high level are then mapped to matching Design Parameters at the high level. These design parameters then enable identification of new Functional Requirements in the Functional Domain at the next lower level, etc. This process is illustrated in Figure 3.

- **HIERARCHY**: A tree diagram showing the decomposition from high level to low level details within each domain is the result of zigzagging through each design system level.
The Independence Axiom

One way to think of the independence axiom is to consider a matrix of variables from one domain to another. A two by two matrix of Functional Requirements versus Design Parameters is illustrated in Figure 4. There are three distinct matrix possibilities: uncoupled (diagonal matrix), decoupled (triangular matrix), and coupled.

Figure 4. Design Categories of Axiomatic Design’s Independence Axiom

Coupled Design
\[
\begin{pmatrix}
FR1 \\
FR2
\end{pmatrix}
= \begin{pmatrix}
X & X \\
X & X
\end{pmatrix}
\]

Implications of Independence Axiom:
Design optimization difficult

Decoupled Design
\[
\begin{pmatrix}
FR1 \\
FR2
\end{pmatrix}
= \begin{pmatrix}
X & O \\
X & X
\end{pmatrix}
\]

Needs proper sequence for optimization

Uncoupled Design
\[
\begin{pmatrix}
FR1 \\
FR2
\end{pmatrix}
= \begin{pmatrix}
X & O \\
O & X
\end{pmatrix}
\]

Ideal Design

Only uncoupled and decoupled designs are easily optimized! When any design is coupled, changing one of the “hows” to improve one of the “whats,” changes all the other “whats.” Genichi Taguchi has embedded this thought into his practice of Robust Engineering. Taguchi is commonly criticized for not considering interactions between
The Independence Axiom, continued

...factors. His point is that if you do have interactions between factors, you have a bad design, go back and fix it. This is Axiom 1. The design parameters must be chosen in such a way that the functional requirements are independent. All designs in which the number of “hows” do not equal the number of “whats,” are coupled.

Decoupled designs are characterized by triangular matrices. They may be optimized if the factors are adjusted in an appropriate sequence. In Figure 4, the decoupled design will work if DP2 is optimized first for FR2, then DP1 is optimized for FR1. The sequence is critical. If DP2 is adjusted after DP1, DP2 will change FR1 as well as FR2. Many coupled designs may be decoupled by adding or modifying Design Parameters. Uncoupled designs are ideal, and should be the goal of any design.

Axiom 1 may be used to evaluate designs, even when the design is only on paper. The performance of a decoupled or uncoupled design will beat the performance of a coupled design. This has profound implications for all quality algorithms, including Hoshin Planning or Policy Deployment. The quality algorithms will only work well if independence is satisfied. Perhaps this is why, in Hoshin Planning, that most companies only work on one breakthrough objective at a time. If two or more breakthrough objectives are chosen for an organization, the matrix of “whats” and “hows” for these objectives must be uncoupled or decoupled in order for the plan to function well, as per Axiom 1.

The Information Axiom

...The second axiom, the information axiom, is useful in comparing designs when all the designs under comparison satisfy the first Axiom of Independence. Information is inversely proportional to the probability of success. In other words, a design that requires little information to manufacture and operate, also is a design that has a maximum probability of success. Axiom 2 is satisfied when the system capability meets design intent. The concept is similar to well-known ideas associated with process capability (see Figure 5).

Figure 5. Axiom 2—Information Content
The Information Axiom, continued

A system is considered complex if the probability of success is low. In other words, a complex system requires more information (e.g., machining precision, controlled environment, etc.) to make the system function. Therefore, in Axiomatic Design, the notion of complexity is tied to the tolerance around the design intent.

An introduction to TRIZ

TRIZ is a Russian acronym for “Theory of Inventive Problem Solving.” It is a result of over 45 years of research by Genrich Altshuller and associated colleagues in the former Soviet Union. Altshuller began with a study of many thousands of patents, and identified five distinct levels of invention, as shown in Figure 6.

Figure 6. Altshuller’s Levels of Invention

<table>
<thead>
<tr>
<th>Invention Level</th>
<th>Relative Proportion</th>
<th>Number of Required Trials</th>
<th>Magnitude of Change</th>
<th>Required Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>Common</td>
<td>Few</td>
<td>Little or None</td>
<td>Within Speciality</td>
</tr>
<tr>
<td>Second</td>
<td>Less Common</td>
<td>Dozens</td>
<td>Some</td>
<td>Within Technology</td>
</tr>
<tr>
<td>Third</td>
<td>Ten Percent</td>
<td>Hundreds</td>
<td>Object Changed</td>
<td>Multiple Technologies</td>
</tr>
<tr>
<td>Fourth</td>
<td>Three to four percent</td>
<td>Thousands</td>
<td>Essentially</td>
<td>Within Science</td>
</tr>
<tr>
<td>Fifth</td>
<td>Fraction of a Percent</td>
<td>Millions</td>
<td>Technical System Changed</td>
<td>New Science</td>
</tr>
</tbody>
</table>

The key concepts of TRIZ

Altshuller’s goal was to create a method that makes difficult problems easy (effectively moving the degree of difficulty from a high to a low level). He said, “The process of solving technical problems is accessible to anyone, important to learn, and very exciting to work through ... We can teach everybody to invent.” [5] TRIZ is a mixture of algorithms and principles. The key concepts of TRIZ [4,5,6] are:

• IDEALITY: Ideality is defined as the ratio of the sum of a system’s useful functions over the sum of the system’s undesired effects (such as cost, noise, etc.). An outcome of this principle is that TRIZ always encourages a low-cost solution by utilizing existing resources to resolve system issues. The perfect system is one which performs a function without actually existing. All technical systems evolve toward increasing system ideality.
The key concepts of TRIZ, continued

• **ARIZ**: An acronym for Algorithm for Inventive Problem Solving, ARIZ is a structured method of thinking so that higher level problems are transformed into a lower level of difficulty, making the solution more apparent. The structure of ARIZ is shown in Figure 7. Specific analytical tools and databases exist to assist in implementing the steps of ARIZ.

Figure 7. Structure of ARIZ: Algorithm for Inventive Problem Solving

• **CONTRADICTIONS**: In TRIZ, contradictions are both technical and physical. Technical contradictions are situations where the improvement of one system characteristic results in the deterioration of another system characteristic. Physical contradictions result when a physical attribute should be increased to improve one system function, and decreased to improve another. Traditionally, contradictions are handled by a trade-off or compromise. TRIZ doesn't like compromise. The methodology seeks a win/win solution.

• **SUBSTANCE-FIELD ANALYSIS**: Sufield or Substance-Field Analysis is a systems modeling language developed by Altshuller. It consists of combinations of three standard elements (Field, Substance Object, and Substance Tool) and is used to describe the simplest workable engineering system. Since many problems are described by the same sufield models, a database of standard solutions has been developed to aid in analysis and problem solving. Complex problems are often combinations of different types of standard sufield models.

• **LAWS OF SYSTEM EVOLUTION**: Based on a study of the development of thousands of products and technologies, Altshuller discovered a number of patterns or trends associated with system evolution. By studying the past and present for the super-system, system, and sub-system of interest, these laws can be used to antici-
The key concepts of TRIZ, continued

- **KNOWLEDGE-BASE OF INVENTIVE PRINCIPLES AND EFFECTS:** Derived from a study of 40,000 patents, TRIZ contains a database of inventive principles that can be used to resolve contradictions. Altshuller has cataloged which principles are most likely to apply in situations dictated by categories of contradiction-type and desired final result. TRIZ also contains a database of physical, chemical, and geometrical effects that are useful references in innovative applications.

Applicability of TRIZ

TRIZ, and Axiomatic Design have been used at Ford and other places to suggest alternative design options for purposes of design, problem solving, and process improvement. For example, at Ford the use of Axiomatic Design has resulted in a new design for a transmission parking pawl, and several patents to improve transmission performance. The use of TRIZ has resulted in three patent applications to improve vehicle idle quality and numerous design improvements associated with problem solving. It also has applicability in product planning (system evolution and S-curve concepts), in the design process (concept selection, breaking QFD bottlenecks, and anticipating problems for FMEA development), and manufacturing process improvement.

Relationship of Axiomatic Design and TRIZ

Axiomatic Design is to TRIZ (in the world of structure), what QFD is to FMEA (in the world of algorithms). QFD or Quality Function Deployment seeks to improve a design by defining what is a “good” product or service. From a customer perspective, QFD asks, “what could go right?” FMEA or Failure Mode and Effects Analysis improves a design by asking, “What can go wrong?” and “How can the design of the product or service be modified to keep this from happening?” Both QFD and FMEA are necessary. Each provides a valuable, unique perspective. In a sense, one is the shadow of the other.

In terms of principles, Axiomatic Design and TRIZ also improve designs from two different, but related, perspectives. Consider Axiom 1, the Axiom of Independence. Axiomatic Design tries to improve the design by asking, “How can the Design Parameters be chosen, up front, in such a way that the Functional Requirements remain independent?” In other words, what can be done from a principle perspective to make sure the design is right? TRIZ, on the other hand, assumes that the design is not right. TRIZ assumes that the Functional Requirements are already coupled. This coupling, where optimization of one Functional Requirement results in degradation of another, is a contradiction. TRIZ then begins to work with you to examine other possible Design Parameters that may be utilized to resolve the contradiction. This resolution of the contradiction (not trade-off or compromise) results in Functional Requirements that are independent. Therefore, Axiomatic Design and TRIZ work together in the world of principles, the way that QFD and FMEA work together in the world of algorithms. Each
Relationship of Axiomatic Design and TRIZ, continued

...contributes a uniquely valuable, but related perspective.

Consider the second axiom, the Axiom of Information. Axiomatic Design seeks to minimize the information content required to achieve design intent. This is equivalent to maximizing the probability of success. TRIZ utilizes the principle of Ideality, where Ideality is defined as the ratio of the sum of desirable functions over the sum of undesirable functions. Undesirable functions include factors such as cost, noise, energy, and physical size. When TRIZ seeks to reduce the sum of the undesirable functions, the probability of success increases. Similarly, as the sum of the desirable functions increase, the probability of success increases. Therefore the second axiom of Axiomatic Design and the principle of Ideality in TRIZ are highly correlated, if not identical principles.

TRIZ contains a knowledge database of physical effects and innovation principles to assist in resolving contradictions. Similarly, Nam Suh is developing an Axiomatic Design “Thinking Machine,” able to draw on a database to suggest creative solutions based on the design axioms. Axiomatic Design and TRIZ are complementary, and extremely powerful when used together to improve a product or service.

In the design process, the interface between the customer and the design concept; the movement from the domain of “what” to the domain of “how,” takes a deceptively small amount of time. Nevertheless, poor design decisions in this interface can rarely be recouped by subsequent development efforts. The impact of this event in the design process is enormous—80% of the potential customer satisfaction may be determined by the quality of design decisions made early in the product development process.

The development of principle-based approaches to make better decisions in mapping one design domain to another has tremendous implications in the evolution of quality engineering. Principle-based methods such as Axiomatic Design and TRIZ have the potential to work synergistically with other quality algorithms in producing unprecedented customer satisfaction.

References

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Author information

Larry Smith has extensive experience applying statistical and quality methods for improved customer satisfaction. He has worked at Ford as a design engineer, statistical specialist, manufacturing quality supervisor, casting operations manager of quality systems and training, powertrain manager of quality strategy and planning, and powertrain reliability new methods manager. Larry has published several case studies and papers in the area of designed experiments, quality function deployment (QFD), and culture change. He currently teaches courses in statistical methods and designed experiments for Wayne State University and Cast Metals Institute. Larry has master’s degrees in physics and metallurgical engineering from the University of Michigan and in industrial engineering from Wayne State University. He is also a member of GOAL/QPC’s Board of Directors.
The Challenges of Leading Successful Change:
A Cross-Industry Executive Panel Discussion

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Donna Lencki, CEO, Healthsource New Hampshire, Inc., Concord, New Hampshire
Robert Peixotto, Vice President, Total Quality & Human Resources, L.L. Bean, Inc., Freeport, Maine
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David Garvin, Professor, Harvard Business School, Boston, Massachusetts (Moderator)

Editor's Note

The following is a cross-industry executive panel discussion, which was conducted on November 19, 1996, at GOAL/QPC's Annual Conference in Orlando, Florida. The panel discussion, moderated by David Garvin of the Harvard Business School, focused on issues raised by members of the audience.

Organization and topics of the discussion

David Garvin, Harvard Business School: There are two broad categories of issues that we will be discussing. The first are issues around people. In particular, there is a shift that's now underway from parental dependence to a new model of adult commitment. We will first talk about the new competencies that are required at three different levels:

1. The issue of hiring
2. The issue of how to develop people
3. The issue of appraisal, feedback, and performance review.

We will then turn to the second category of issues, which involve changing the culture, and in many ways revisit the three steps of the change process. We will look at:

1. How to create a shared vision
2. How to overcome resistance and that valley of despair
3. How to hold the gains—if you've made progress, you want to continue being an adaptive organization.

First question: How do you hire for potential?

David Garvin: We'll open with this question:

In the context of new competencies and new skills, how do you deal with the hiring and promotion process based on potential rather than on simple experience?

* See author information on page 78.
Robert Peixotto, L.L. Bean: When we got involved in our accelerated attrition program (a voluntary approach to workforce reduction), we developed a hiring for potential philosophy. We didn't have a lot of time to consult with the experts and figure out exactly how that's done, so we relied on the way we have looked at quality in our organization over the years. We go out and listen to our customer, identify what attributes they're looking for in quality, and then rigorously test against those attributes. We applied the same methodology to the hiring for potential. We spent some time with a manager, talking about what attributes, not experiences, they were looking for in the people that work for them. At that time, we were also able to develop some attribute focused questions that could be used in interviews. We had just completed a reengineering of our hiring process, and we are putting a new process in place. We began using panels of three or four people conducting an interview at one time. It has had two major benefits: 1. It cuts down cycle time in the process. 2. One person can focus on the question and ask for the content, while the other people can be utilizing and testing the attributes as we move along. That’s the process that we trained our managers to use, in about a month, and it has worked well.

In these turbulent times, hiring for potential is absolutely critical. One of the things we've had to learn is that in the old days (only about a year ago!), a person was their job. Yet, today there is a difference between a person and a job. The jobs are going to come and go, but we make our commitments to our people. So you have to have them hired for their full potential, to staff the organization for the future. Thereby, we can all be more flexible in meeting the changing needs.

Patricia Wallington, Xerox: When we restructured back in 1992 we had a whole organization to staff at multiple levels. We identified 23 leadership attributes that range from strategic thinking to personal consistency and maturity, knowledge of the industry, and some more traditional things in between. We did some benchmarking and held focused interview groups to establish those attributes. Then we profiled all the key jobs and people through self-assessment, managerial assessment, and a negotiated process to close the loop. We put the two assessments together and if there weren't direct matches we picked the best ones we could, so there was hiring on potential in a sense. We continued to use that process as a self-assessment combined with the managerial assessment. Once a year managers have a discussion with each of their employees around those 23 characteristics, and they try to close the loop on any differences between the employee's and the managers assessments.

When we hire from the outside, we place much more weight on attributes rather than specific knowledge they are bringing into the company. We focus very much on hiring people who can develop to become the kinds of employees that we need. We also have a psychological assessment done at the time which we share with the employee when they're hired. That helps us all focus on the things that they need to do in order to develop their competency in areas that we feel they need to work on.
Question: What do you ask potential hires?

David Garvin: What kind of questions do you ask people in order to get at these underlying attributes? I would guess that if the competencies are so different, and we keep hearing that, you can't be asking the same questions you used to ask of a prospective hire or when evaluating somebody. Can you give us examples of the kinds of things you ask people to address?

Robert Peixotto: The questions we ask during interviews are very behaviorally focused as opposed to experientially focused. We might ask a person when they were involved in a change process and whether they were resisters or leaders in that change. Then we might ask how they managed any resistance within the organization, or what did they do to help sustain the changes. We try to pull out specifics and then ask a lot of behavioral questions around that to get a sense of what kind of person they are and what kind of things they will bring to the job.

Patricia Wallington: The key tenant of the connected organization is the person who is the job. We ask questions around how they would handle particular scenarios. We ask them to answer questions from two perspectives—from a leadership position and from an affected party position. People can readily handle something if they are in a lead position, but their response when they are the affected party can be very revealing in terms of understanding some key attributes around behavior.

We have a variety of people who do the interviewing, but it focuses on that kind of a process and segmentation.

Donna Lencki, Healthsource, New Hampshire: Culture is different than structure and organizational behavior. In the hiring practices we look for people who are absolutely going to be able to adapt to the culture within Healthsource. We believe that the inherent culture of our organization will prepare us for the fast pace of the future. We don't necessarily look for people with HMO experience or an insurance background. In order to continue moving from traditional insurance to where healthcare is going in our environment, we need people who can shift and aren't used to a big bureaucratic culture.

We look for people that can work within the organization and they have to understand that they're getting into an organization that is different. It's fast-paced, it's flexible, and it's not structured. When we're looking at a candidate, it's not just the HR folks who do the interviewing, but also the hiring manager, and key managers from other areas. We have multiple customers and we've got to make sure that people can adapt within the different functional areas within the company.

William Glavin, Babson College: We use core competencies. When we have our teams formed, the teams hire. There is no management hire at all anymore. It's a team...
We’re focused on core competencies, continued

David Garvin: There are three interesting themes here:
1. Experience seems to matter less than certain behavioral characteristics: The ability to learn, the ability to adapt, the ability to work together as a group.
2. The way you get at these characteristics is by posing a range of hypothetical questions and putting people through scenarios to see how they have behaved or might behave in the future. You probe for the underlying reasons.
3. Hiring is no longer an HR activity. Hiring is an activity of the line and it may be conducted by teams, it may be conducted by peers, but it is certainly conducted by a much broader spectrum of individuals than has historically been true.

Summarizing three themes

Second question: How do you develop people?

William Glavin: We're interested in having the team develop themselves by working together and understanding what they're good at and what they're not good at. They figure that out in different ways, and they hear feedback from different places, but certainly one way is from the reaction of their customers. In many cases, the internal customers are just as important as the external customers because many people don't have external customers. There is somebody that they pass their work on to. There's a lot of feedback and we're testing an on-line capability where people give immediate feedback to either a team or individuals. A lot of the development we have is within the group. However, we also have a person who is responsible for group education, and group things that they can improve upon. Then we will customize particular programs for particular groups depending on where they think they are in this total process of change. One of the people in our quality office will help them create programs for the development of their own team. They are assigned to two or three particular teams, but they will obviously share across teams.

It's important to have an open and questioning environment, vertically and horizontally

Donna Lencki: I think it's critical that the people have to like working at the company. If they like working there, they will be committed, and you can continue to foster their personal growth. There are a couple of things that I think are absolutely critical. First of all you have to give them exposure to the talented individuals in the company and to other operating areas within the company. People don’t just by their own nature fit into boxes on an organizational chart. So don’t keep them in that box. Give them exposure to the different functional areas.
Two more absolutely critical things: (1) Make them ask questions. By getting them to ask questions they feel as though they have a part within the company. (2) Get them to challenge our thinking. By getting them to challenge our thinking we will continue to challenge our own thinking processes, and all the systems and services we've put into place.

Town meetings are another avenue of communication, but it has to be at the roundtable and it must relate to their day-to-day job. An employee should not be afraid to challenge the thinking of their manager or their team leader. I think one of the issues that we face is making sure that the managers don't think there's a problem with employees challenging their thinking.

Patricia Wallington: We have a very open environment at Xerox. The biggest thing you can do is be a role model in development. One really strong attribute that I find at Xerox is that at the very senior levels, there's an expectation of learning and development. There's no assumption that you know it all just because you happen to have a senior position in the company. We are all continuing to learn, grow and acknowledge the gaps in our knowledge. I have absolutely no concern about standing in front of my entire organization and saying that there's something I don't do as well as I would like to, and I'm working on that this year, and if any of you see me doing it wrong, help me by telling me.

We also encourage them to have learning partners. Sometimes it's very difficult for people to acknowledge their weaknesses and do it in a feeling of safety. It is really important to create an environment that allows people to grow and develop and feel safe in the acknowledgment of those gaps. One of the ways we do that is to have learning partners—a colleague that they can work through problems with. We provide coaches, at the senior levels in the corporation as well as in my own organization, who work individually with people and with the organization. It's largely behaviorally focused. Those are the areas that we're all struggling with, because these are critical success factors for the future.

David Garvin: I can imagine readers thinking: “That sounds great. Create an environment of challenge. Question your superiors, where you tell them they're wrong. And I think maybe I’ll start filling out my resume while I’m doing that.”

What do you do to create that environment? Obviously part of it is role modeling.

What are some of the specific things you can do within a work group or within a department to begin to create that kind of environment where challenge is not only acceptable but is actively supported and encouraged?
Patricia Wallington: I think you need to reward challenging the status quo, so that it's not just accepted and tolerated, but it's a valued part of the environment. For example, our quality process includes presidential reviews around major launches, major business events and other activities. It is a way to assess valuable lessons to pass on to other teams. When I was new to the company, there was another senior person who had been there less than a year. We attended our first presidential review, and one vice president stood up and talked about all the things that they had done wrong—the following week he was made a corporate officer. My new coworker later said to me, “You know, it’s the strangest thing in the world. He stood up and told them about all the mistakes, and then the next week he became a corporate officer. I went back to my office wondering how they can give credit for past mistakes.” It is alien to people who come from the outside and see that kind of an environment where people don’t worry about losing their jobs because they’re identifying lessons learned. It’s important to have a formal assessment at the end of every critical event, to identify the lessons learned, and internalize what those lessons are and build some actions into your organization's plans or into the teams. Make sure that everybody gets the information they need to benefit from the lessons.

Donna Lencki: It’s critical that people see how questions and challenges are translated in the way that the business operates. They need to see that the recommendations or suggestions for change or criticisms have been acknowledged, and translate into results for the organization. Then people will say, “Look, we did it all wrong and they had to change things as a result.” When people see the changes, they are even more committed to the organization because they have a voice.

Robert Peixotto: It’s important to think about the way people learn in an organization. At Bean we do it in two ways. One is from a leadership standpoint, where every day a leader will informally go around and ask for feedback. For example, they might finish a presentation and ask somebody in the hallway about how it went, and maybe spend some more time asking for more substantial comments.

The second way is to publicly acknowledge the feedback and how much it has impacted whatever your practice is. Our Feedback For Improvement process is essentially a climate survey based on the attributes of a total quality climate. The results go back to everyone who supervises three or more people, and they’re required to sit down with their work group and review the results, both good and bad. The teams then develop action plans for how to continue the improvement in the climate. The first year we did that, in 1990, it was very hard for managers to sit down with their people and acknowledge weaknesses in the climate they were trying to create. But after doing it year after year, one of the questions in our survey that has increased the most, and is sustainable even in tough times, is “I feel free to tell my boss when I have a new idea or when I think things aren't going the way they should be.”
David Garvin: Let’s summarize the three major common themes just discussed in answer to the two questions about people development:

1. The first is the importance of creating an environment that encourages active questioning, active challenging, and active discussion for learning. You do it in various ways. You do it by modeling the behavior you want. You do it by showing that the particular recommendations have been acted on. And you do it by public acknowledgment. But you need first to create a climate for an environment in which development can take place.

2. The second clear theme is around feedback. You need to provide mechanisms that somehow close the loop. These would include both formal and informal mechanisms. You actually go around and ask “how did it go” as well as a more formal mechanism, such as survey forms, employee climate surveys, and feedback for improvement surveys.

3. The third is you actually create a learning environment by assigning people roles where they have some responsibility for development. In one example, the people in the quality office are responsible for helping teams learn. In another case, there are learning partners and very much a spirit of coaching that is encouraged. Coaching can also be within your work group so that you help each other grow.

David Garvin: An additional part of the equation is appraisal. You’ve brought these people in, you have a new set of competencies, and you’ve begun the process of development. How do you measure their progress? What kind of tracking measures do you use? We’ve touched on this to some extent when talking about providing feedback but let’s go deeper.

What are some of the particulars of how you track the employee’s performance against the new behavioral competencies several of you have discussed?

Robert Peixotto: One powerful but simple thing that has worked for us is the integration of formerly disparate programs. I emphasize feedback surveys for improvement. It provides a hub for a lot of what we do. That same survey is part of the managers’ performance review at the end of each year. They are held accountable for developing a climate that contributes to total quality, and their pay is based on that.

For individual employees, we have put together a brochure that provides a series of prompting questions for each supervisor or team leader within the organization. They are appraising performance that is built around that feedback for improvement mechanism. We’re using the attributes of quality that we identified for climate assessment, appraisal, and hiring people.

For example, one item on our survey is: “I get regular coaching and counseling that helps me improve my performance.” People can respond to that on a seven point scale. It
Integrate the elements of a quality environment with internal and external feedback, continued

Align company values with customer and employee satisfaction

Patricia Wallington: We employ 85,000 people in 100 countries, so we use a variety of mechanisms to measure progress. The one consistent thing we do is our employee satisfaction survey in which we ask almost identical questions to what Bob just mentioned. We start with the business values and ask if they feel aligned with them, and how empowered they are to change the work process. We ask: “Does your manager focus priorities on those things that satisfy customers?” We focus on how customer satisfaction is managed internally. We ask: “Are you encouraged to learn things that help you to be successful in your job?” We have a number of vehicles for feedback, and one that we're currently focused on is the four quadrant approach. The model has behavior on one axis and performance on the other, and people are assessed on those two dimensions. If their performance is high and behavior is high, they are role models to the organization and they are considered for a promotion. If behavior is low and performance is low, the implications are obvious. If performance is high but behavior is low they are definitely eligible for coaching, but nobody wants to stay in that box very long. Low performance and high behavior is also eligible for coaching.

A two-way appraisal system

Donna Lencki: Our appraisal process is two-way, in that the manager or team leader is doing an appraisal of the employee, but at the same time the employee is doing an appraisal or some feedback for the manager. And those two have to go together when they go to human resources. That's important because we are reinforcing the feedback on the part of the employee.

The other critical point in appraisal is an employee's individual commitment, not only to their own role or responsibility but also to the overall success of their team or functional area. Finally, there is the ability on the part of the manager to give discretionary rewards or recognition, which is critical through the appraisal process.

Merging administrative perspective with faculty members and focusing on goals

William Glavin: On the academic side, our vice president of academic affairs decided that he would like to write an annual review of everyone in the faculty, through the department chairs. He did that the first year, and the day it hit the street two people came into my office and were ready to kill him. So I calmed them down, and sent them...
to see the VP to try to resolve some things. They came back to me two weeks later and said that they really sat down and talked things out, and were very happy with the meeting. They created an action program so that next year there wouldn't be a zero increase. That has now permeated throughout the whole faculty, where they now get this review every year. But the more important thing is that the Chairman, the Vice President, and the faculty member review what they want to do next year to move forward and develop.

It's a very involved and detailed process with 130 faculty members, but the academic affairs vice president writes them all himself and he has a chairman review them. It's a very difficult thing to do, but it can and should be done.

David Garvin: Again, let's review the themes we just covered about appraisal:

1. Most importantly, an appraisal process should be positive in tone, not punitive. That's a fundamental shift in the way performance appraisal is regarded. Historically, it's viewed as the big stick. This new tone conveys something useful to me, the employee, because somebody understood me better and helped me develop.

2. The second theme I heard was simplicity. You're not looking for 100,000 questions. You're looking for a relatively small set around which you can build the development process.

3. The third theme that we heard from all four panelists was that what you're after in an appraisal process is measurable assessable behaviors that can translate into action. You're not asking, “Is somebody a good person?” You're not even asking, “Is somebody a good manager?” You're asking a much more precise set of questions, such as, “Do I get an opportunity to express my viewpoints or not? Do I get coaching which leads to personal improvement or not?” Those are questions which are measurable and if the answer is no, can translate into concrete action pinpointed by group.

4. We heard that these reviews are not longer the simple top down. We heard about bi-directional, and 360°s. So they are more than just the supervisor evaluating the supervisee. They go across the organization in may different dimensions.

5. Finally, it should be stated that ultimately, the appraisal process has to be translated into the reward system. People do what they are rewarded for. Not simply because it's stated as a good thing. And you heard all of the panelists say that in some way their organizations linked appraisals to performance.

David Garvin: The second broad set of topics will be around the general issue of changing culture.

How exactly do you create a shared vision? How do you know it's really shared?
I will break up our panelists into two groups: (a) When the organization or the people are already effective, like at L.L. Bean or at Xerox, how do you develop a new shared vision? (b) How do you develop a new shared vision in an atmosphere where strongly held, deeply felt values (in Donna's case among physicians and in Bill's case among faculty) have to be altered? We'll start with how do you do it in an effective organization and then talk about it when you have to change deeply held views.

Robert Peixotto: When we first started total quality, we applied for the Baldrige Award. We didn't win, but we got a site visit, and were rated highly as a service company. We were also getting financial returns that put us in the top percentiles of the S&P 500. So how did we get our people to really undertake this fundamental change in the business? By appealing to people's values. People care an awful lot about the company, and they believe in treating people like human beings. With total quality, people were saying in essence "we can be better." Top management helped with this. There were some very compelling remarks from our president and senior management that began to paint a picture of how much better it could be. What was standing in the way? We weren't getting feedback on performance, so it was hard to have a sense of contribution. We had to appeal to the positive as opposed to saying that the platform was burning and we needed to jump or else.

Patricia Wallington: One of the things that drive people to adaptability is survival, and we had to do that in the 1970s. The other is opportunity, which is something that we've been struggling with over the past five years. When you have come through the survival phase to achieve your goals, how do you motivate people when there is a need for radical change in the organization? Our president and CEO, Paul Allaire, calls that the crisis of opportunity. He seeded the organization with outsiders, because we had many long-tenured people at Xerox with the same set of experiences and values. He also tried to bring people in from the outside who had been effective in different environments, so we could use those different experiences as change agents. It challenges the environment to see itself differently and to think about itself differently.

The other way to motivate is to create the opportunity for the new ways to flourish, separated from the old, until they become a positive image that people want to be a part of. When you have a company with a strong set of values, people want to participate in the success of the company. They will be dedicated to excellence. When the changes first start, you can't recruit anybody into it. But when it becomes successful, people will be knocking on the door wanting to become a part of it.

Robert Peixotto: I regard our journey as having two sides, the people side and the process side. We started the people side first. We did get people to move, but it was hard work. We did it person by person, group by group, to develop disciples over time. When
we got into process improvement, we ran a pilot that was enormously successful. I couldn’t keep up with the demand from people who wanted to do business process improvement. In fact, one problem we had was doing too many, because everybody wanted to do it right away and we had problems of integration. There’s a real power in doing something tangible that people can see, and then selling it in the organization.

Patricia Wallington: One way to motivate that I use personally—but you have to use it in an area where you don’t have the whole future of the company in your hands—is to blow up the old and create chaos. Just put the walls up so you cannot go back into the old and people are forced to go forward. After the grieving period, which people will go through and think we’re out of control, they then begin to participate in creating the new. You just have to use that method selectively.

David Garvin: Before we go on to Donna and Bill, let me underscore these two quite different themes which actually work together in a surprisingly complementary fashion. You heard about both push and pull. Push is the challenge. It can be pushing ourselves to be better as Bob described it. It can be push in terms of new people coming in and saying, “Wait a minute. You’re not doing this as well as you think you are.” Or it’s pull. Create the protected pilot. Create the protected green field and then have it become so successful that the demand materializes out of nowhere. These are complementary strategies. Push creates the demand, and it will pull suddenly if we have a pilot that shows us what we can do, and how to do it. We have a model we can build on and integrate throughout the organization. So those are some of the challenges in already effective organizations.

Now let’s tackle the problem in a different setting. Donna and Bill, what do you do in environments where you have to really take on deeply held values and get people to think, act and work differently?

Donna Lencki: A challenge for us as leaders is that the healthcare delivery system around us is changing dramatically. It’s interesting that there is a sense of negativity around the HMOs and yet people inside are asking: Why does our system have to change? So every day we go and talk with the members and physicians who are in the health plan about why this change is occurring.

We recognize the need to create a shared vision and it’s critical to our future. It’s one thing to manage the employees but we also have to listen to the customers. The customers are the people receiving medical care and the physicians providing that care.

We embrace the physicians and the shared vision by ensuring that they are liaisons to the company. We use community physicians to tell us how we’re doing in individual areas. They’re the first people to tell us about how health care is delivered, both good and bad.
Another example is to ask a company to come in and talk with us about how we should provide services to their employees, our new customers. Whether it’s our own employees, physicians, patients, or members, we have to listen to them and act on their suggestions.

William Glavin: When I first started at Babson, I had a meeting with a group of professors and asked them, “What’s going on around here, where do you think you all are headed in terms of the academic side of things?” One professor finally said, “The problem is this: We’re in a boat, and we don’t even know what ocean we’re in, never mind which way we’re trying to row.” I saw an opportunity there to create a shared vision. We took a long time to do it. It took a lot of work over eight months. We came out with a shared vision that said we wanted to be an international leader in management education and we wanted to graduate leaders that were entrepreneurial managers able to identify, initiate, manage, and implement change.

The question then was how to change the values and how to actually get there. Fortunately we had a group of core faculty that wanted to change our MBA program. They did a lot of testing for two or three years and in 1993 we announced that we were going to change our program. We got a lot of international recognition on this. I was asked to speak all over the world, and we had three or four people coming every week to look at what we were doing. It was such a revolutionary thing, but we had people telling us about how good it was and how much was done. A few publications started giving us some recognition for the things we were doing.

All of a sudden the faculty that weren’t involved started to see the value of what these people had done. They had changed their values to being recognized beyond their colleagues in their disciplines. We were able to use that so others would want to be part of change. That drove us to bring 65 faculty members together in August of 1994 to look at how we could change the undergraduate curriculum.

David Garvin: Let me just summarize the three major themes we heard from Donna and Bill because they’re related to but a little bit different from what we heard from Patricia and Bob in an environment where goals have already been achieved:

1. The first is active listening. Where there are deeply held values at stake you’d better be listening to those critical constituencies on an ongoing basis so you can feed their comments into the process.
2. The second is that you build on the base of a core group of leaders. Bill didn't try to get the entire Babson faculty to change simultaneously. There was a core group that led the redesign process.

3. The third piece, a critical step, is to strongly leverage positive recognition and feedback. This actually closes the loop back to Bob and Pat because it's very much like their pilots, their experiments. Once you have a success the resisters and those who don't quite buy into the values are suddenly a lot easier to bring on board.

David Garvin: Now that brings us to our second question. The change process has been launched, you're in the process of working through the shared vision, and now the question has two parts:

(1) How do you lead people through that difficult time of despair so that you overcome resistance? (2) How do you then ensure that you hold the gains, and maintain the momentum? What are some of the things you do as you're leading this process to ensure continuous renewal and continuous adaptive change?

William Glavin: The real key to getting through resistance was (1) the participation of other leaders, and (2) we had a lot of time. We were not, as we were in Xerox in 1982, on our way out of business when we made the decision we needed leadership through quality. When I took over as president of the group at Xerox, we had forecasted that we would be out of business by 1988 unless we dramatically changed what we were doing. I'll tell you, when you've got an $8 billion business, and you can forecast your way out of business in a seven year period of time, you realize that it's a major problem, and you really focus your energies.

But we didn't have that kind of problem at Babson. We simply had an opportunity to do things differently. I used to go around and say, "I want to try to create a crisis," but everybody said, "No, you don't want to do it that way. Find another way." That's when we really began to look at it as an opportunity. We had several groups that really got into quality and realized we could do things differently with continuous improvement. They knew the kinds of things that could happen.

People ask me what are the differences between being in corporate America for 34 years and being in education. I tell them that there are two. The first one has to do with time. You can't become Vice Chairman at Xerox if you don't work hard, and I worked very hard, but I never spent as much time then as I spend now in education.

The second one is patience. You really need to have to have a lot of patience in education. When I tell that to Paul Allaire and all of my colleagues back at Xerox, they laugh at me and say, "There's a man that had no patience whatsoever in his whole life. How did that happen?" And I say, "I don't know how it happened, but I guess I learned or something."
In short, leading the process of change clearly was one of overcoming resistance by using other leaders and pockets in the organization and not having to do everything all at the same time.

Donna Lencki: People within the organization who have responsibility for other employees can lead by example. But so can the other constituents that we provide services to. If people know that we have listened to the advice of a physician and taken their recommendation, it helps us in the process. It's critical to lead by example. I also think that it ties back to the culture, because it's got to be embraced. Someone asked me, "How do you get people to open up and talk to you?" For some reason, people know that I'm approachable, and the other executives are approachable, and it's okay to speak up. That is critical to achieving the end result. Another critical thing is to acknowledge, recognize and reward people. You also have to communicate to keep the momentum going.

Patricia Wallington: The whole point is don't get stuck in the valley of despair, and this offers a wonderful example of why you need to communicate to people. There are those who are the purveyors of change and those who see themselves as victims of change. In any change, you have to expect a decline in productivity that should be temporary. Any change that you make to the status quo causes a disruption and that's just the natural effect of some kind of disruption. But you can make the slope smaller and shorter. It might sound trite but I think you just have to keep communicating in every forum—roundtables, one-on-one discussions, walking the floors, large town hall style gatherings, communication meetings, memos, talking, videos. One of the things that I learned is that during times of anxiety and stress, people need to hear things six times before they even begin to listen. So tell them six times and maybe even tell them six ways and then keep it up. Paint that picture of the future. Communication is critical. I can't say that enough.

It's also important to empathize. When I talk with my people about the change curve I actually show them a picture of a roller coaster, because that's what it feels like. At the same time, I'm saying, "Why are we doing this? This is crazy. We're going to go out of control. We're going to ruin the business. This is the worst thing I've ever seen." And then you hit the valley of despair. "We're never going to get out of the dumps. I'm never going to learn the new thing. How can I be successful? All my skills were successful in the past and now they've wiped out everything that's good about me." It is vital, during this time, to acknowledge the fears that people will have, because that is what's making them resist the changes. They're worried about where they're going to fit and what's going to happen to them.

Celebrate the successes. Any time a positive element of the vision appears on the horizon, you have to point it out, acknowledge it, tell people about it and reward it. Make it extremely visible no matter how small.
Communicate and empathize with your people, and celebrate successes, continued

Find your champions, informal leaders, and make a little cadre of them. Solicit their help and their partnership to help you to move this strategy through the organization. Do all of that and it will make the decline as shallow as it can be. Make sure you don't get stuck in the valley of despair and you can use those levers to really accelerate coming up to the top of the platform. Because that's when people are saying, "Well this wasn't such a bad idea, I think I can be successful anyway." And then when they get up there, they will say, "Hey this was a fabulous idea I had. Don't you think it was great?" That's when they start taking credit for your ideas. So you let them take credit for it.

Another thing is wherever possible, give people as much choice as possible, so that they feel they have some control and some options over the things that they do. Move as quickly as you can. Don't over analyze it, don't wait till it's perfect, don't wait till you have it planned to every gnat's eyelash before you take the first step.

Robert Peixotto: I have two key lessons that I've learned in leading change in the last three or four years. One is acknowledgment and the other is authenticity. You've got to acknowledge the fact that people are going through a period of despair. You can't stand in front of people as a leader and say that there's no problem and that despair is not an issue. You've got to acknowledge their pain. At the same time, you can't let them wallow in it. And that's where your authenticity comes through. As a leader you've got to be willing to share, whether you personally are experiencing pain or not. And you must also let them know there's no turning back. You've burned the bridge behind you. You're going forward towards that vision. Reiterate for the umpteenth time, here's where we're going, and just keep driving ahead. Being authentic and acknowledging people's feelings has been the key success factors that I've learned over the last couple of years.

David Garvin: Let me summarize one more time and then wrap up the article. There are three themes here—two of them are stated and I want to underline them. The third is implicit.

1. The first is the need to provide forums or outlets for expression. People will be feeling despair. People will be feeling the need to talk. You need to provide them the opportunities, the places, and the spaces to have those conversations and give voice to what they are feeling.

2. The second is to empathize and be authentic. Change is not something that you are doing to the organization, it is something that all of us in the organization are going through collectively. Make sure they understand that you as well as they are feeling the difficulty and the pain.

3. There's a third thought though that I think has been left unstated by each of the panelists, but I want to end on it because I think it's an important message. None of the panelists fully understood all the dimensions of the change when they started. They didn't know exactly how it was going to work. The undercurrent here
Summary of three themes and concluding remarks, continued

is one of continuous learning. Yet there’s something more, and it’s expressed beautifully in a quote from James Joyce’s book *Ulysses*. Joyce said, “To learn, one must be humble.” In many ways, you heard that from each one of the panelists. They didn’t have all the answers. They listened to their constituencies. They made adaptations as the process unfolded, and that’s one of the main reasons they’re each here today to tell you a success story.

Author information

William Glavin was the President of Babson College from 1989 until his retirement in 1997. Prior to his time at Babson, he had spent 34 years with Xerox Corporation and IBM. He joined Xerox in 1970 as the Executive Vice President, and in 1974 moved to London, England where he became Managing Director and Chief Operating Officer of Rank Xerox. He presided over that organization’s most significant volume and earnings increases in its history. After six years with Rank Xerox, Bill returned to the U.S., became President of the Business Equipment Group, then was named Vice Chair in 1985. Before joining Xerox, Bill held a number of executive positions with IBM. He received his bachelor’s degree from The College of the Holy Cross, his MBA in Industrial Management from the Wharton School of the University of Pennsylvania, and was presented the honorary Doctor of Law degree by Holy Cross. He serves as a board member for INCO Limited, Reebok International Ltd., Caldor’s Inc. and John Hancock, Mutual Funds, Inc.

Donna Lencki, CEO of Healthsource New Hampshire, Inc., has played a leading role in that company’s success. She was hired in 1985 to direct Healthsource’s fledgling marketing efforts. During that time, she introduced managed care alternatives to New Hampshire employers (over a seven-year period) that resulted in annual revenue growth from zero to $260 million. Prior to being named CEO in January, 1994, Lencki served as Vice President of Marketing for Healthsource, overseeing the company’s marketing, sales, underwriting, advertising and public relations efforts. Donna holds a master’s degree from Boston University and is one of New Hampshire’s youngest chief executives.

Robert Peixotto is Vice President of Total Quality and Human Resources at L.L. Bean, Inc. In his 14 years there, he has also held positions as Director of Human Resource Operations, Director and Manager of Strategic Planning, Budget Manager, and Financial Analyst. Bob has been associated with L.L. Bean’s total quality effort since 1988 when the company applied for the Malcolm Baldrige National Quality Award. Divisions of the company have won the Margaret Chase Smith Maine State Quality Award and the Quality and Productivity Management Association’s 1993 North American Leadership Award. Bob’s own department was honored by Personnel Journal with its Optima Award for excellence in managing change in its total quality effort.

Patricia Wallington is responsible for providing leadership in the planning, integration, implementation and operation of information technologies. She is also responsible for the reengineering of business processes to support the achievement of Xerox business goals and priorities worldwide. Prior to joining Xerox, she was Senior Vice President and Chief Information Officer at Massachusetts Mutual Life Insurance Company. She also held a number of
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Professor David Garvin of Harvard Business School is a three-time winner of the McKinsey Award, given annually for the best article in Harvard Business Review. He has been at the Harvard Business School since 1979 and has taught courses in general management and operations strategy. Currently, he is faculty chairman of the Baker Library. Professor Garvin's research interests lie in the areas of general management and strategic change. His most recent articles include “Leveraging Processes for Strategic Advantage,” and “Building a Learning Organization.” He received an A.B. summa cum laude from Harvard College and a Ph.D. in economics from the Massachusetts Institute of Technology, where he held a National Science Foundation Graduate Fellowship and a Sloan Foundation Fellowship.