PART I

THE CASE FOR MVT

CHAPTER 1

The Power of MVT

Practical, Fast, Cost-Free Solutions to Any Business Problem

Over the past 23 years, my company, QualPro, has helped over 1,000 companies (including half of the Fortune 100) conduct over 13,000 business improvement projects using a secret weapon called *Multivariable Testing* (MVT). The business results have been hailed by major companies in every industry and our clients have seen billions of dollars of positive financial impact. MVT has been praised in almost every leading business publication including *BusinessWeek, Forbes,* the *Economist,* and the *Wall Street Journal*. Over time this work has produced a huge repository of business improvement data and case studies. This book explains what MVT is, why it is so powerful, and how leading companies are using it.

The Executive Dilemma

Every executive wants the same thing—improved results: more profit, less cost, better quality, higher customer satisfaction, and so on. And people throughout every organization, including executives, have ideas to improve results. Unfortunately, there is no agreement as to whose ideas are the right ones, which ideas are cost effective, or which ideas will make the biggest impact on the bottom line. For lack of a better way, most executives, in business areas ranging from marketing and

sales to production and operations, make key business decisions using their judgment, intuition, and gut feeling based on their experience. They may receive suggestions and recommendations from experts and other departments in the organization and may even hire consultants for advice. Finally, they cross their fingers and hope that the solutions they implement will prove to be worth the time and money spent.

QualPro has tested the real-world impact of over 150,000 business improvement ideas over the past three decades and discovered that most business ideas do not work. Our work with over 1,000 companies shows that no matter the source (executives, technical experts, front-line workers, customers, vendors, janitors) 75 percent of their ideas will not improve results, and nobody can accurately predict which 25 percent are the most powerful ideas. Believe it or not, front-line employees are just as likely as CEOs to suggest ideas that make measurable impacts on the bottom line.

The only way to avoid making seat-of-the-pants guesses at which ideas and solutions will make the biggest impact on your organization's performance is to test them. The only way most of us know to test ideas and solutions is to test one idea at a time, measure the results, and hold all other conditions constant. Do this for each idea that you think might improve your business, and you will know with certainty which idea produces the best measurable results. Unfortunately, this method has some severe shortcomings in the real world:

1. *It is highly inefficient.* Testing ideas that could improve any and every area of your business requires significant time, money, and resources. Testing all the reasonable-sounding ideas that you and your organization might generate to solve a business problem or improve performance is just not practical.
2. *It cannot identify synergies.* In the real world, ideas often act differently when they are implemented together than they act separately. If you test only one idea at a time, it is impossible to uncover these synergies between ideas.
3. *Test results often cannot be consistently repeated in the real world.* During one-idea-at-a-time tests, you attempt to hold all conditions constant. Because conditions continuously change in the real world, the tests can not accurately represent reality.

These problems pose such hurdles that most executives, even though they would like to make more rigorous, data-based decisions, do not think they have the time or money to test lots of creative ideas and solutions to key business problems. So they fall back on seat-of-the-pants decision making. Is there any alternative? The answer is MVT.

MVT offers a powerful, inexpensive, efficient way to use statistics to test dozens of business improvement ideas, discover the synergies between them, and prove with certainty which ones are the most powerful and profitable under real-world conditions. Businesses that use MVT regularly generate millions of dollars in cost savings or new revenues as a direct result.

WHAT IS MVT?

MVT basically means testing a lot of different variables/solutions/business improvement ideas all at the same time. When applied to a business problem, it is a 12-step process that starts with dozens of practical, fast, cost-free ideas for improvement and uses advanced statistics to quickly sort out the ideas that will help from the ideas that will hurt or make no difference. Using the MVT process, you can tackle your biggest business problems, test dozens of practical, fast, and cost-free improvement ideas at once, and discover which combinations make the greatest impact on your bottom line.

The essence of an MVT improvement project is *rigorous, quantifiable, accelerated learning*. You do not need to guess about whether a new ad campaign will impact sales or hope that a change to a production line will boost output by 50 percent. You can know, with certainty, which changes will help any area of your business, and you can statistically quantify how much the changes will help.

This knowledge allows organizations to focus their energies on only the actions that matter and to make breakthrough improvements in a short time. Here is how some clients describe MVT:

> Dennis Harris, president, SBC/Ameritech: "Some of the ideas that intuitively we'd think would help, didn't; and some that we didn't think would help, did . . . and that's the way it's always been when I get into an MVT project."

Jeff Wells, senior vice president, Circuit City: "The MVT Process . . . What did we learn about ourselves? That our gut stinks."

Carl Bouckaert, CEO, Beaulieu of America: "Learning occurs when an informative event is combined with a perceptive observer. MVT accelerates the occurrence of informative events. . . . I had no idea such a powerful tool existed. . . . If your competition is regularly using MVT and you are not, you are in trouble."

MVT Makes a $1 Billion Bottom-Line Impact at SBC

From 1989 into the 2000s, Neil Ismert was one of several people throughout SBC who were involved in quality improvement in the organization. Neil focused on applying the MVT process to improve quality. At QualPro's Leadership Symposium in October 2000, Neil described to over 300 executive attendees how SBC had achieved over $1 billion worth of improvements in the first 10 years of using MVT.

In 1989, Southwestern Bell, now a part of SBC Communications, was a very successful result of the breakup of "Ma Bell" (the original AT&T) into regional telephone companies. New services, new consumer-driven competition, and the opportunity for rapid growth fueled enthusiasm within the company for innovation. Southwestern Bell had more than 66,000 employees and $9 billion in revenue from service offerings in five southwestern states.

Each of the five states acted as a separate organization with its own president, marketing and sales departments, installation and repair operations, and so on. Each state had started internal quality groups with the common goal of improving things—all kinds of things, and each quality group worked independently, applying various techniques that were in vogue at the time, including total quality management (TQM), and other variants of statistical process control (SPC). The results were fragmented and frustrating and eventually led to the decision to implement a single, corporate-wide approach, headed by a Quality Advisory Committee, that could be leveraged across the states. The Quality Advisory Committee took on the mission of finding the best improvement approach or methodology to apply across the entire

organization and solicited proposals from the top 10 consulting organizations in the quality improvement field. The committee sought a methodology that could produce immediate breakthrough successes that would help promote future improvement projects around the company. After lively discussion and analysis, the committee chose to work with QualPro because of QualPro's MVT process. The committee liked the fact that MVT was objective and rigorous yet could be learned and applied by internal company resources and, most importantly, that MVT could be applied to any kind of business process, which is exactly what Southwestern Bell proceeded to do.

The Results of MVT

MVT requires an openness to change, and that openness was evident in the support that Southwestern Bell was giving. After training senior managers in the process and selecting a few pressing problems for initial projects, the committee and the QualPro consultants began to implement MVT. By 1992, Southwestern Bell had used MVT to tackle all kinds of improvement challenges. The results were magical. In the first two years, MVT projects generated an estimated $100 million in reduced or eliminated expenses and in increased sales, and Southwestern Bell was just getting started. Over the next eight years, Southwestern Bell and its parent SBC trained thousands of employees and ran hundreds of MVT projects on every aspect of its business. Here are some examples:

- A massive backlog in repairs and installations at SBC/Ameritech was rapidly cut by more than half, slashing customer response time.
- An MVT project focusing on sales in four metropolitan areas in Texas increased sales by $11 million while reducing associated expenses by $4 million.
- A California MVT project, aimed at increasing Caller ID revenues, increased the direct-mail response rate from 3.7 percent to 6.9 percent, with a revenue impact of over $7 million per year.
- An MVT effort in Oklahoma was directed at reducing a $40 million inventory of plug-in circuit boards. The result was a 25 percent reduction, a savings of $430 thousand per year in carrying charges.

- On-time installations were improved from 84 percent to 98 percent through an MVT project completed in less than 90 days for SBC's industrial and inter-exchange business at Pacific Bell.
- An MVT project in Kansas and Missouri saved over $16 million per year on detecting and recovering telephone lines that were incorrectly labeled "defective."
- A Pacific Bell MVT project optimized the communication process associated with the introduction of a new voice-mail service. Over $1 million in marketing costs was saved.
- The timeliness of installation of high-speed Internet access was improved by an SBC MVT project. Orders filled within two days without manual intervention increased from less than 50 percent to over 95 percent.
- An MVT effort that achieved a 19-percent reduction in late installations of high-capacity circuits was valued at $11.95 million annually by SBC's Industry Markets operations.

Neil Ismert summarized SBC's experience with MVT:

> The projects we've done touched all areas of the business . . . installation, repair, dispatches, sales, churn, repeat calls, productivity, cable cuts, once a cable is cut how we restore it, outages, blocked calls, billing, plug-ins (a big part of our inventory and costs), direct mail, and new-product introduction. Literally hundreds of MVTs; we worked with thousands of factors and saved millions of dollars. In fact, the bottom-line impact for the first 10 years is approximately one billion dollars.

This is an amazing story, but it is not at all uncommon. Over the years, MVT has made a significant impact at over 1,000 companies from every industry. The rest of this book, especially Part III, contains many more detailed case studies from a wide range of industries and business functions.

THE ROOTS OF MVT

The core ideas behind MVT were developed during World War II by British statisticians who were devising ways to shoot down German

bombers over London. When the Germans began attacking London, the British quickly realized that their antiaircraft artillery were inadequate. The British desperately needed to improve the accuracy of their artillery, but the training and testing required to develop better targeting techniques and artillery were extensive, time consuming, and error prone. The challenge of solving this problem was given to a special British military unit called SR17 that specialized in operations research and reported directly to Prime Minister Winston Churchill. George Barnard, the head of SR17, asked two brilliant mathematical statisticians, R. L. Plackett and J. P. Burman, to find a way to quickly test not only different types of projectiles but also multiple variations on 11 different components in order to find the most accurate and deadly combination. The statisticians devised screening experimental designs that allowed them to test 30 or 40 variables at a time. The net result was a projectile design that greatly improved the English's ability to shoot down German planes. After the war, Plackett and Burman published an influential paper describing their new system ("Multifactorial Experiments," *Biometrika 33,* 1946).

I first heard about the concept of screening designs in 1964 while working for Union Carbide as a statistician in the Nuclear Weapons Manufacturing Division in Tennessee. While attending an American Society for Quality Control (Chemical Division) Convention, I heard a presentation by two chemists who had read the Plackett-Burman paper and developed a way of implementing screening designs in a factory. After listening to their presentation, I was fascinated by the power of the idea. Excited and challenged by my discovery of this powerful tool, I looked for ways to apply screening designs to nuclear weapons development and production.

A Nuclear Weapons Manufacturing Crisis

During the Cold War, the development and production of the U.S. arsenal of conventional and nuclear missiles were national priorities. Enormous sums of money were invested to develop the production facilities and techniques necessary to produce these weapons, and many knowledgeable and influential people thought that the safety and security of the United States was contingent on its ability to produce sophisticated and superior weapons.

I had the opportunity to use screening designs on several weapons manufacturing processes. The tests were done on low-visibility projects involving mid-level personnel, but each one required extensive internal selling to get agreement to even try it. The results were encouraging. We experienced dramatic improvements in the manufacturing process, with increased output and reduced defects.

In 1969, I finally had the opportunity to use screening designs on a very important, high-visibility problem. Despite the efforts of the best engineers and experts in the field, the production of a key component in one of the nation's vital defense programs was failing. Eighty-five percent of the carbon-foam parts produced at the weapons plant in Oak Ridge, Tennessee, were failing to meet quality requirements and were unusable. As a result, the plant simply could not keep pace with production requirements. This problem was stalling the production of the entire weapons system and threatened to become a national security problem. Something had to change soon.

In a meeting to decide what, if anything, could be done, the best minds from Union Carbide's operations, engineering, production, and management departments, and military representatives were gathered in desperation. There was a wide variety of suggestions, including changing the materials involved, retooling parts of the machinery, and other system-level changes. Most of these suggestions entailed high costs and long delays. One of the Research and Development (R&D) engineers who had been involved in the original process development recommended a completely new process and estimated the cost at $48 million. The managers were anxious and frustrated.

I was a statistician working in process control and improvement, and I wanted to get into the debate. My people and I had achieved some previous success in improving complex processes, and we knew how to make fast, cheap improvements with the materials and processes already in place. To make my case, I focused on the time required for the other solutions under consideration. The program could not wait months or even weeks; the security of the nation was at risk. Improvement had to come quickly, and no other quick solutions were being considered.

Fearful that there were no quick or good solutions, the vice president of the nuclear division of Union Carbide, a bright and capable fellow who was highly regarded, decided that, although the company

reluctantly had to proceed with the planning for expensive, long-term improvements, there could be no harm in examining what practical, fast, cost-free improvements a statistician might wring out of the current situation. Using a good bit of personal influence, he convinced the others to go along with some limited testing of the existing production process. Unknowingly, he had accepted one of the fundamental tenets of the MVT methodology: *Use practical, fast, cost-free ideas to get more out of what you already have.*

The Birth of the MVT Process: A Practical, Fast, Cost-Free Solution

To begin the testing process, we reviewed all control charts and analyzed the historical data using multiple linear regression and various multivariate methods. Unfortunately, the past data revealed no clues. Next, we collected suggestions for improvement from everyone who touched the process in any way, regardless of level or position. No proposed solution was rejected at this point; most solutions focused on changing the materials or equipment used. About 60 suggestions were identified. Because we had so little time, we reduced the list to 19 suggestions that could be done simply and immediately. *What can be done simply? and What can be done right now?* are still two of the three main questions asked when assessing ideas for change in the MVT process.

Most of the remaining 19 suggestions were for simple changes to the process, such as the mixing time for the chemicals that made the foam (30 seconds or 60 seconds), the position of the blade in the mixing can (high or low), and the speed of the turntable during mixing (10 rpm or 40 rpm). Each of these ideas was easily controlled and could be tested immediately.

Our next step was to arrange testing time, which I estimated would require two full shifts for two days, just for the screening experiments. The production manager, already so far behind that he had no time for experiments, was adamant. "No way! You can have one shift, one day." And he wasn't happy about that. At this point, the frustration and anger were mutual. There was no way to test effectively with so many restrictions and limitations. After consulting with my colleagues, I was struck by another reality of business improvement: When a process is this bad, there must be ways to get substantial improvement

with just a few simple changes, because almost anything is better than a consistently failing process. If we could increase the acceptance rate of the foam castings from the current 15 percent to a mere 30 percent, we would be considered heroes or magicians and would certainly get more testing time.

So I agreed to proceed into what might be considered the worst possible experimental situation: Our primary variables produced only attributes measurements; we had very limited test time; and, at least in the minds of the experts, we had eliminated all of the best suggestions because they cost too much money or could not be implemented right away.

The Results

The screening experiment involved 16 production runs to test 11 different factors. For each of the 11 factors, two levels, or conditions, were measured: (1) the status quo and (2) the change. To my great relief, the screening experiment identified factors that yielded a reliable increase in the acceptance rate of foam castings from 15 percent to 50 percent—and after only a single shift of testing! The experiment also identified five of the 11 factors that merited further investigation: heating of the mold, distance of the mixing blade from the bottom of the mixing can, time taken for mixing, turntable speed, and speed of pouring the mixture from the can into the mold.

We were heroes and much smarter heroes as well. The vice president of the nuclear division could breathe again. The engineer who had recommended a $48 million overhaul of the production line was suddenly quiet. The shop-floor operators were ecstatic that people were actually listening to their ideas and recognizing their contributions. (Thirty-five years later, these are still common reactions to an MVT implementation.)

After our first big success, senior management admonished the production manager to be cooperative and announced that this process was in experimental mode until we had accomplished all possible improvements. We raised the rate of acceptable foam castings from the manufacturing process to 85 percent, which was formerly the rate of rejection! Without spending any money, changing anything compli-

cated, or changing any of the major steps in the process and using the same people who had always made the castings, we had turned the acceptance rate completely around. This was far beyond what anyone had hoped for when we started using MVT techniques. Additional refining experiments led to a greater than 95 percent rate of acceptable castings, and some fine tuning of the lessons we had learned further raised the rate of acceptable castings to more than 99 percent. During the last five years of the manufacturing line, no bad castings were produced at all.

This effort, which solved a critical problem in a vital weapons system at the height of the Cold War represents the birth of the MVT process. Although we published a white paper on the project for the Atomic Energy Commission, years passed before I formalized and refined the 12-step MVT process described in this book. Nevertheless, most of the 12 steps were utilized in this monumental accomplishment.

Beginning in 1969, we used MVT extensively in production and in research and development at the Nuclear Division of Union Carbide. We also applied MVT to areas such as training effectiveness, maintenance, product certification, and laboratory service. Eventually, I became the head of quality for the nuclear weapons facility in Oak Ridge, Tennessee, a 7,200-person organization.

MVT Undermines Conventional Business Wisdom

The MVT process begins with the idea that you can do better with the people, equipment, and processes you already have and you can do it quickly, without spending any money. In the course of going from 15 percent acceptable castings to 100 percent acceptable castings, we debunked the myth that you have to spend money to make money (or make improvements or progress).

Another common (albeit wrong) rule of thumb for solving critical business problems is to "gather the opinions of the best experts in the field and follow their advice." In this case, the best experts (the design engineers, the production managers, the materials experts) had ideas that would have taken time which we did not have and would have

cost much more to implement, and we had no real guarantee that we would realize improved results. We did listen to the experts; but we also listened to everyone else involved in the process, right down to the front-line operators. In an MVT process, good ideas are just as likely to come from front-line employees as they are from experts, managers, or senior managers.

W. EDWARDS DEMING HELPS LAUNCH AN MVT TRAINING COMPANY

In 1982, W. Edwards Deming was the leading quality guru in the United States and was trying to educate American management about the power of statistical process control. I met Dr. Deming at one of his seminars and we became friends. I traveled to his home in Washington, DC, to discuss his philosophy of quality, and we carried on a regular correspondence. Dr. Deming was an intimidating figure, but I engaged him in many discussions on statistical thinking and enjoyed our dialogue. He convinced me to help spread his "gospel of quality" starting with the auto industry, because he felt that it was the most visible and influential industry and that ideas adopted there would be most likely to spread to the rest of the world. On Dr. Deming's recommendation, Ford employed me to train managers and suppliers in statistical thinking and quality improvement methods.

In late 1982, I developed a thick packet of statistical training curriculum that I hoped would be the foundation of a new training company called QualPro and that would allow me to teach statistical thinking and MVT to the business world full time. I drove to Washington, DC, with a friend to show the material to Dr. Deming and get his feedback. We sat nervously in his office on a Saturday morning as Dr. Deming thumbed through the pages. I remember the sinking feeling when he began reviewing the MVT material and his smile turned into a frown. He shook his head and said, "It's too complex." We left, and I worked day and night for six weeks to make the statistics as simple as possible for my future clients and trainees. Dr. Deming approved of the revised materials; he smiled, and QualPro was born.

For the first two years, Dr. Deming's referrals accounted for 90 percent of my business. The first seminars had about 20 attendees; but

before the end of 1983, I was holding seminars in ballrooms with 120 to 150 attendees. It was more than I could handle alone, so I hired other process improvement experts who had worked with me at Union Carbide, including Art Hammer. We began teaching the methodology to many manufacturing companies. But, at the end of 1983, we surveyed participants from the seminars and were very disappointed in the findings. We found that while most seminar participants rated the seminars highly and left the seminar full of excitement and good intentions, few actually used the technique when they returned to their companies. Those who did try the technique applied it incorrectly and did not get good results. This was painful because I thought that I had done a good job in teaching these seminars. I knew that the technique was great; how could people not use it? And how could those people who did try to use it fail to succeed?

By the middle of 1984, I had decided that MVT training was not enough. I had to go out and help people use MVT. In 1985 and 1986, I spent at least 48 weeks per year on the road, helping people use the MVT process. I hired more people and trained them to teach the seminars, but I went directly to companies, showing them how to use MVT and generating one success story after another. First, I helped parts manufacturers including many automobile suppliers. I worked with small companies such as Associated Spring and Faber-Castell, and larger companies such as Ford and Boise Cascade. Our client roster later grew to include chemical companies such as Monsanto, Union Carbide, Rogers Corporation, and Copolymer (now DSM).

During this time, I found that it was much easier to train a person to teach a seminar than it was to train a person to improve a real-world process. In fact, I discovered it took years to train a person with a strong quantitative background to improve real-world processes.

Applying Multivariable Testing to Service Businesses

While we were working in the manufacturing plants, we learned that people in service organizations also wanted to improve or the manufacturing people felt that their service organizations needed to improve. We began using the MVT process in service organizations within manufacturing plants and even on human resources projects,

logistics and transportation projects, and billing projects. One company's CEO, who had been a long-time friend, said, "You have helped us make better stuff, can you help us sell it better? And how about accounts receivable, can we make that better?" We showed that MVT could work on those processes as well. By 1990, we had many examples of dramatic process improvement on nonmanufacturing processes. In the mid-1990s, we had fantastic successes in the hospital industry. In 1997, we expanded into the retail industry. We now do more business in retail than in any other field. Our business is about 50 percent manufacturing and 50 percent service. Many of our service efforts involve marketing and sales processes.

Over the past 35 years, I have built on the basic concepts and have added many enhancements to the 12-step MVT process. The result is a practical problem-solving technique that is suited for today's dynamic business environment and results in superior business performance. In short, we have demonstrated that MVT can bring practical, fast, cost-free improvements to any process in any organization.

MVT, Taguchi Methods, and Design of Experiments (DOE)

The MVT process that grew out of the Oak Ridge Nuclear Division has proven to be a breakthrough improvement methodology, but other statisticians and quality improvement experts have done important related work. In the 1980s, I gave many joint seminars at Ford and for Ford suppliers with Shin Taguchi, the son of Genechi Taguchi who developed a form of MVT called the Taguchi Method. Dr. Genechi Taguchi deserves a great deal of credit for getting a lot of experimentation done and producing results. The Taguchi Methods work because experimental design, even if applied inefficiently, is extremely powerful. However, the Taguchi Methods do not work nearly as well as the MVT process. The Taguchi Methods omit key steps that are in the MVT process, such as involving everyone in generating suggestions for improvement, creating the right environment, controlling the measurement system(s), performing the refining experimentation, and implementing the results. Also, what Taguchi presented was so complex that most managers and engineers could not understand the

powerful implications and had trouble implementing it in real-world conditions.

Other good work has been done in an area of statistics called design of experiments (DOE), which is related to MVT but is much less powerful. DOE is the term usually used to describe small experiments with five or fewer factors. DOE methods are, in fact, used in one of the 12 steps in the MVT process, and DOE by itself sometimes produces good results. However, because only a small number of factors are investigated and 75 percent of them are likely to hurt or make no difference, the improvement is likely to be small or nonexistent.

BREAKTHROUGH IMPROVEMENTS

The MVT process typically yields dramatic breakthrough improvements—often beyond what anyone imagines. Using the MVT process to redesign one of our retail clients' catalogs produced a 60 percent improvement in sales. Applied to a call center, the MVT process generated a 25 percent increase in revenue per hour per sales representative. In many manufacturing situations, yields and throughput improved 50 percent or more—usually with little or no new money invested in the process. When one retail client utilized MVT on a sales process, it improved so dramatically that the client's stock became the best-performing stock on the New York Stock Exchange over a two-year period.

In more than 13,000 projects involving more than a thousand companies, MVT has never failed to identify actions that measurably improve results. As a famous nuclear scientist, Dr. John Googin, noted in the 1970s, "The only way the MVT process can fail is if there is not a single good idea in the whole organization." Fortunately, our experience indicates that this is never the case.

RAPID SUCCESSES

MVT successes often can be generated in very short periods. In the carbon-foam process mentioned earlier, the initial screening experiment required one shift, one day. Several manufacturing-process improvements in which the work was done in less than a week have been

presented at QualPro MVT Symposiums over the years. Even in complex chemical processes, the MVT work can be done within a month.

A GREAT MORALE BOOSTER

Our experience over 22 years indicates that, in general, MVT does wonders for the morale of the organization. The fact that the process allows everyone who could possibly have worthwhile suggestions to make those suggestions is the key. Even if a person's idea is proven not to work, the person still feels as if he or she had a say and is much more likely to support the new findings.

In the 1980s, I utilized MVT in several companies that had militant unions. In every case, once we considered the union workers' suggestions for improvement, their attitudes improved and their interactions with management improved. Many times I have heard from front-line workers, "Well, this is the first time they've ever listened to us around here." In many instances, these employees would not speak up or make suggestions for improvement when management and technical people were present. When I met with them privately, however, they would make suggestions, eagerly await the test results, and invariably support the findings. Many times their ideas proved more effective than those coming from management or engineering. If everybody is allowed to make suggestions for improvement, we always get improved results, and the morale of the people in the organization always improves.

Surprising and Counterintuitive Solutions

We often find that surprising, counterintuitive suggestions provide the biggest sources of improved performance. For example, when we were working with a large chemical company, the workers on the production line said that they got better yields when they had more catalyst in the feed tank. The PhDs from R&D laughed at this, declaring it impossible. Nevertheless, we used the production workers' suggestion in the experiment. The amount of catalyst in the feed tank turned out to be the most important factor in increasing yield. A few months later, I saw the R&D people and several of their colleagues making a

presentation on the theoretical reason that increased catalysts in the feed tank improved yields.

We have had hundreds of such examples.

Meet Every Important Business Challenge

The MVT process has worked in every organization on every process that we have encountered. We have improved processes such as emergency-room customer satisfaction, corporate Political Action Committee (PAC) contributions, foster-home availability for a state, corporate sales, corporate profits, manufacturing product characteristics, and billing errors using the basic MVT process. Our experience proves that the results of any process can be improved using MVT if two criteria are met: (1) the process has a measurable output and (2) the people in the organization have ideas about how to improve results.