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LEARNING FROM TOYOTA'S TROUBLES

VOLUME 43/NUMBER 4

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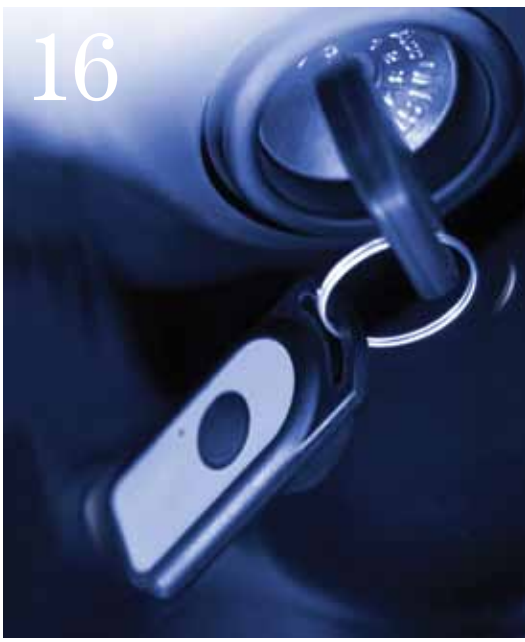

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Car Talk

Experts discuss recall implications

RECALL ANNOUNCEMENTS come as no surprise these days. But no recall in the past decade has been more widely publicized, debated and analyzed than the recall of 8 million Toyota vehicles that began late last year. Media scrutiny—now delving into why it happened—continues.

The company's president, Akio Toyoda, has said quality control lapses in the face of rapid growth are to blame. With quality at the root of this rash of recalls, QP editors reached out to experts to collect insights into the lessons that can be learned from Toyota's travails.

For the cover story, "Where to Start," p. 16, QP assigned a different quality-related topic to five experts in product safety, quality and risk prevention. We asked them to share what they believe everyone can learn from the situation and how those lessons can be applied elsewhere. Topics included customer loyalty, product design, social responsibility and risk prevention. The final piece in the package asserts that the significance and impact of the Toyota recalls will propel quality back to "top priority" status among the world's companies.

"Lessons Learned," this month's Career Corner column (p. 56), also focuses on the Toyota recalls and their impact on the quality profession. Henry Lindborg wrote: "In the Toyota story, there are warnings and opportunities for quality professionals. While many practitioners have applied the company's lessons intelligently—with systems perspectives and full awareness of the perils of knowledge transfer—others have not."

Lindborg goes on to suggest how those in the quality profession might use what they've learned to their advantage.

Randall Goodden echoes some of that sentiment in the Keeping Current article, "Wake-up Call for All?" (p. 12). "It's going to be a real learning opportunity for every corporation to pay attention to this [situation] and ask themselves, 'What could possibly go wrong with our product that could get us into serious trouble and knock us out of business, and how do we prevent this from happening?'" Goodden said.

In this month's Perspectives column ("TPS Troubles," p. 8), Steven Leggett asks whether it's Toyota or its world-renowned Toyota Product System (TPS) that's to blame for the problems.

"Is the system the problem? If not, what were the real problems at Toyota? If so, where did the TPS go wrong? And, perhaps most importantly, should organizations that employ a version of the TPS be concerned about their systems?" Leggett wrote.

ASQ offers many ways to continue this conversation: Check out Quality News Today headlines at www.asq.org; visit the Product Safety and Liability Prevention division page at www.asq.org/pslp; go to the discussion boards at www.asq.org/discussionBoards (case sensitive); or post a comment on any article's page at www.qualityprogress.com.

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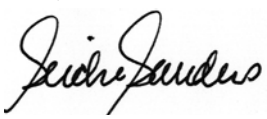

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INBOX

Remembering Russ

Thank you for publishing Gregory Watson's excellent tribute to the late Russell L. Ackoff ("Breaking From the Pack," March 2010, pp. 26-31). As a student of his for more than 45 years, I have not read a better short description of Russ's themes.

Those who knew him will miss his amazing powers of explanation, of storytelling and of challenging students (often to their dismay), and his ability to engage deeply with people at all levels of rank and status all over the world.

Professor Russell L. Ackoff, a fine man and an amazing teacher, will be missed.

Martin F. Stankard
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Reliable source

In the article "Quality 3.0" by Kreg Kukor (February 2010, pp. 41-47), part of the focus seems to be on the increased emphasis on the supply chain, as well as the control and management of quality.

During the 1980s and 1990s, many companies implemented internal quality control and improvement programs. The International Organization for Standardization and the Malcolm Baldrige National Quality Award continued the focus on process improvements and quality management. As the article correctly points out, much of the development in supply-chain logistics focused on cost and delivery, and quality lost priority.

The other element that requires attention is product quality over time (reliability). Increasing the focus on product quality and process control is not sufficient to achieve the desired goal of customer satisfaction. While the focus on quality across the supply chain will certainly help, all elements across the supply chain contribute to product durability.

A few years ago, the electronics industry experienced a widespread increase in hard-disk failures due to a screen-size change within the process of a supplier of flame-retardant material. The impact was not evident until the materials were used in electronic components and installed in hard drives and computer systems. The simple process change resulted in system failures after a few months of operation.

Every product has durability expectations that are often part of the design intent. They are difficult to translate into concise component and material specifications. While it is relatively easy to measure the dimensions and electrical properties of supplied components, the detection of latent defects and adverse process changes is difficult and often overlooked.

The design intent for product durability requires articulation in the design and supply documentation that the critical factors of control and management include a long-term quality perspective. While the supplier of flame-retardant material may not have fully understood the end application of its product, the simple process change had significant customer impact.

Satisfying the immediate customer in the supply chain is important, and one way to do that is to meet the design intent objectives, including quality over time.

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 BY STEVEN C. LEGGETT

TPS Troubles

Is Toyota or its production system to blame for recalls?

TOYOTA HAS long been synonymous with world-class quality. If you look at its history, you don't see the major recalls that plagued other car companies—at least you didn't until recently.

The automaker's world-renowned Toyota Production System (TPS) kept quality at the forefront. Even when recalls occurred, they were relatively minor, and Toyota took the time to contact its customers directly, instructing them to bring in their vehicles for inspection and repair.

That focus bred loyalty between Toyota and its customers. It helped the automaker build trust with its suppliers. It was a major reason why Toyota became one of the world's biggest automobile manufacturers.

That success is why the TPS has been implemented at a variety of organizations around the world. Now, after the recall of more than 8 million Toyota vehicles, those organizations may wonder whether the system is everything it was built up to be.

It's only natural to link the TPS to Toyota's safety problems. Just about every aspect of the automaker's business processes has been questioned, so why not the TPS?

But is the system the problem? If not, what were the real problems at Toyota? If so, where did the TPS go wrong? And, perhaps most importantly, should organizations that employ a version of the TPS be concerned about their systems?

Pulling the cord

Toyota has gone through a series of theories about its safety issues—gas pedals that stick on floor mats, materials in the accelerator friction lever, and condensation and corrosion caused by heaters. Regardless of the problem, it's obvious Toyota has been in crisis-management mode. At first, it tried to hide the problem from customers and the government. It didn't take immediate action when the problems were first reported, and this allowed the problem to persist.[1]

In the TPS, there is something called the *andon* cord, which can be pulled by anyone at any time to halt the production line. When the problem is resolved, the line is restarted. Put simply, Toyota did not pull the *andon* cord in time. Someone should have noticed the problem and stopped everything until it was resolved.

The lesson we should take away from this is that **even the best quality system can fail.**

But that didn't happen. Why not? Some analysts say Toyota had its eye on becoming the world's largest car manufacturer and lost sight of the foundation that put it in position to do so.[2] In that situation, it's easy to let profit obscure everything else, especially when it comes to supplier partnerships.

Most original equipment manufacturers (OEM) give their contracts to suppliers that can produce the parts they need at the lowest cost. As a result, suppliers need to save money where they can, whether it's the materials that go into the products, the labor used to manufacture them or the standards that ensure the finished products meet certain requirements.

For example, all parts require traceability if they adhere to the requirements of ISO/TS 16949. Cutting that corner means parts don't need to go through the Automotive Industry Action Group's Production Part Approval Process requirements with full material traceability.

Or the supplier may be tempted to cut back on testing, statistical process control measurements or something as routine as cleaning the materials that go into the finished product.

A complex problem is bound to have complex causes. Ultimately, however, Toyota is responsible for any safety shortcomings.

The lean coaches, consultants, instructors, practitioners, leaders and others using the method upon which the TPS is based need to understand lean is not the cause of these safety defects, which serve as further proof of the importance of continuous improvement. But what are the next steps for the TPS? How does it evolve as a result of these events?

Do we change how we institutionalize the TPS and lean methods into every OEM and supplier? Do we complete a lessons-learned document that outlines how to avoid these problems in the future? Why not go back to the basics of the TPS and retrain every employee from top to bottom?

Dealing with the problem

Toyota has said it will become more transparent. An individual who works for Toyota

told me the company "plans on hiring more quality control and quality assurance personnel, who will be deployed globally." And recently, some of the Toyota quality staff members already in place were transferred to other business units.

There are also plans to appoint chief quality officers (CQO) to each principal geographic region. The CQOs will also be part of a newly established Committee for Global Quality, which will be led by Toyota's president and will spearhead quality-improvement activities.[3]

The automaker also announced an initiative to streamline the process of conveying customer input directly to its quality and product-development groups. As a result, Toyota hopes to conduct on-site inspections of its facilities within 24 hours of a reported nonconformance or product malfunction.[4]

The bottom line is that Toyota slipped and needs to find what will get it back on its feet. What the automaker needs to do is very simple: go back to the basics—become students of Quality 101, keep lean in mind, and take a few basic steps:

1. Find out what the gap is between the old and new TPS. Start with an internal implementation and execution plan, institutionalize it with all suppliers, and take steps to guarantee they will follow the "new" TPS.
2. Make sure there are countermeasures for each nonconformance.
3. Institute a workplace organization process (such as 5S).
4. Add a layered process audit for verification.
5. Institute a rapid-response process to all problem areas.
6. Add a problem-solving process for each nonconformance with irreversible corrective action.
7. Add a verification process to validate the corrective actions.
8. If *andon* cords are in place, everyone should feel comfortable using them. And when trouble is found, make sure the proper individual is made aware of the problem.

The importance of improvement

In this instance, Toyota's error-proofing systems must have missed something. Some of these same concerns were identified years ago, and it is possible Toyota thought it found the root causes. As a result, it may not have completed a proper failure mode and effects analysis.

Toyota needs to review all of its failure modes, look at each interaction and try to predict the outcome. It should develop a process control plan based on those failures and implement a new process.

"Quality managers must be ready to completely overhaul their existing quality systems and ensure the current system is adequate," said a quality manager at one OEM. "We must monitor the systems and convey any and all corrections that must be made."

A plant manager at another OEM who is responsible for production quality said, "The systems that corporate management has put into place are not adequate and have many holes in their lean TPS-based system." He also said, "There is no money to update the current system, and they have to improve what systems are already in place."

What does this mean for other OEM plant and quality managers? Does this mean there will be more failures in other quality systems? Does this mean the Tier 1 and Tier 2 suppliers will have the same problems?

Speaking with two quality managers at Tier 1 suppliers, they both said they fear for their jobs. Both have updated their resumes and are considering looking for other positions. One quality manager said he would be "the fall guy for the company."

The lesson we should all take away from this is that even the best quality system can fail. The TPS can and will have more failures. But all problems have a solution. Every quality system demands throughput, accuracy, effective error proofing and manufacturing to the design record, all while staying within its own tolerances.

Maintaining a quality system is just one part of the overall business plan. The challenge is how to handle poor quality management. Was it Toyota's quality management system (QMS) that put it in this situation, or was it the company's deviation from its QMS? Regardless, it needs to get back to quality's roots: do it right the first time, every time. The time is now to dust off the quality manuals and put what it says in the documents to work. QP

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3. Graeme Roberts, "Toyota announces new quality measures," www.just-auto.com/article.aspx?id=103215, Feb. 17, 2010.
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NOTE

Sources for this article—including current and past OEM employees, as well as individuals at Tier 1 and Tier 2 suppliers that provide parts for Japanese automakers—asked to remain anonymous.

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YOUR PERSPECTIVE

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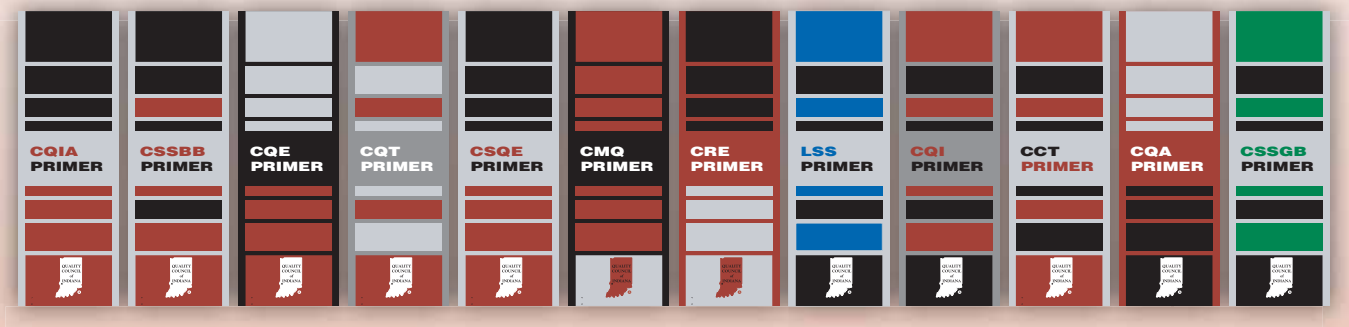

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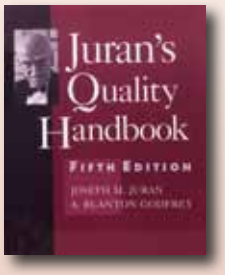

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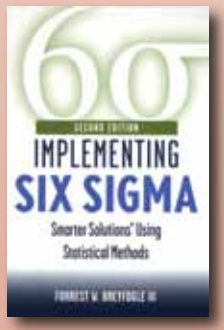

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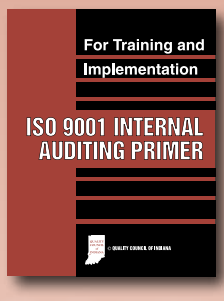

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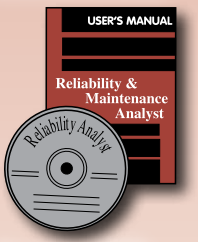

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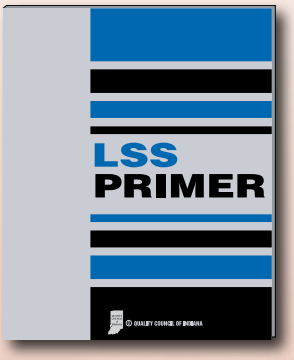

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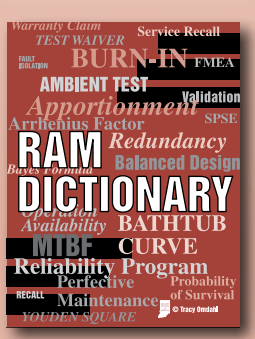

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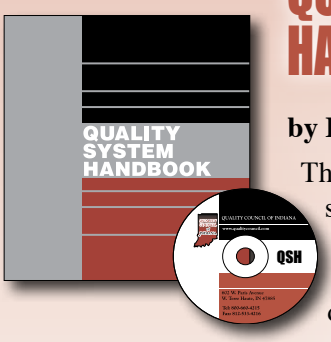

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RECALLS

Wake-up Call for All?

ASQ experts: All organizations can learn from Toyota's troubles

Recent auto recalls by Toyota and others will—it is hoped—encourage more organizations, not just carmakers, to reexamine how they do business, become more sensitive to customer concerns and sharpen their focus on quality, a group of ASQ experts said during a recent discussion on the topic.

"It sometimes takes a disaster for companies to wake up and make all of us better in doing what we're doing," said Randall Goodden, the president of Goodden Enterprises LLC, who participated in the session. "Now, there is so much opportunity for quality to get involved in a number of areas—more than ever before."

Five ASQ members with experience in product safety and liability, the automotive industry, manufacturing, engineering and quality systems addressed a variety of topics related to risk and recalls—and what other organizations from any industry can take away from Toyota's situation.

Toyota was contacted but declined to participate in the discussion. QP's attempts to include comment from Toyota were unsuccessful.

"It's going to be a real learning opportunity for every corporation to pay attention to this [situation] and ask themselves, 'What could possibly go wrong with our product that could get us into serious trouble and knock us out of business, and how do we prevent this from happening?'" said Goodden, also the chairman of ASQ's product safety and liability prevention interest group for more than 10 years.

Recalls large and small occur on a regular basis across virtually every business sector and affect almost every type of product.

Last year, the National Highway Traffic Safety Administration said that 16.4 million vehicles were part of 492 recalls from automakers.[1]

In addition to the 8 million vehicles Toyota recalled last year and this year, recent automotive recalls include:

- General Motors (GM) recalled 1.3 million Chevrolet and Pontiac models in North America for power-steering failures.[2]
- Nissan recalled 539,864 cars for fuel gauge and brake-pin problems.[3]
- Ford issued a "nonrecall recall" of about 18,000 Fusion and Mercury hybrids to update brake software.[4]
- Honda recalled 410,000 Odyssey minivans and Elements for braking problems.[5]

Discussion participants said that because of the intense scrutiny of Toyota's recalls and how they were handled, perhaps more companies will pay extra attention to customer concerns and the consequences of recalls.

Because there's more sensitivity and attention toward being proactive by preempting problems, maybe more corporations—even with what seem to be minor concerns or doubts about a product—will delay a product's launch to address an issue instead of risking a recall.

And it's possible that additional organizations and consumers will think more about business and products in terms of quality and reliability.

"For me, it's a paradigm change; it's a different game now," said Don Smith, a senior consultant at Harbour Results.

"The rules have changed. It really allows each of us to rethink what we're doing. There are very important roles that quality professionals can play, particularly up front, working with customers and making sure we really understand their needs—basic and safety and others that end up" delighting the customer, Smith said.

Professional organizations such as ASQ must take the lead in promoting discussion and sharing knowledge and lessons learned from the problems Toyota experienced with its recalls, Smith said.

"When you have a professional organization like ASQ, because of the [connections among] different sections and divisions, when we get together at conferences, there's a lot communication that goes on. Ideas spawned in one industry can be shared with others," said Smith, a retired

(continued on p.14)

NT

ASQ

INNOVATION, RECESSION TO BE AT FOREFRONT OF WORLD CONFERENCE

As the economy shows signs of recovering from the recession, organizations must constantly innovate to keep pace with more educated and savvy customers looking for the best product or service at the best price, according to one of the keynote speakers scheduled to appear at ASQ's World Conference on Quality and Improvement (WCQI) next month in St. Louis.


Jones

"One of the most important reasons for innovation right now … is that customers have changed so much, both in the business-to-business world and in the business-to-consumer world," said Terry Jones, founder and former CEO of Travelocity.com, one of the largest online discount travel services. "We have a very empowered customer today because of the World Wide Web and because of the amount of information and interaction the customers have. Customers are changing fast, and we are going to have to innovate to keep up with them."

Business leaders must also create a culture in which innovation can exist, Jones said during an interview with ASQ.

"I think it's up to the leader to make sure that everyone understands that he or she solicits new ideas to create a culture where those new ideas can actually be tested and implemented, where people can experiment and where failure isn't punished. If you can do these things, then you'll start generating the ideas," Jones said. "Of course, the next step after that is to implement it, because innovation is about implementing ideas, not just having ideas."


Mulally

Other keynote speakers scheduled for the WCQI May 24-26 are:

- Alan Mulally, president and CEO of Ford Motor Co., who has been credited with keeping the company out of bankruptcy and on an innovative path of growth in a challenging economic environment.
- Robert Stephens, founder and chief inspector of the Geek Squad, which has become North America's largest technology support company.


Stephens

WCQI activities

In addition to listening to keynote speeches, conference goers can attend workshops, concurrent sessions, career development

(continued on p.14)

Who's Who in Q

NAME: Imran Ahmad Rana.

RESIDENCE: Lahore, Pakistan.

EDUCATION: Master's degrees in total quality management (TQM) and public administration specializing in human resource management from University of the Punjab, Lahore, Pakistan.

INTRODUCTION TO QUALITY: In 1998, Rana started his career as project coordinator at MQS Ltd. Pakistan. Later, he became a project manager and completed training in TQM and became a Six Sigma Black Belt (BB). Since then, he has completed four BB projects.

CURRENT JOB: Manager of the quality management system at Treet Corp., one of Asia's largest razor blade manufacturing companies. Rana is responsible for conducting on-site audits and managing customer focus surveys. He also performs continual improvement and Six Sigma projects, TQM training and system control documentation to support external accreditation and certifications.

ASQ ACTIVITIES: Senior member since 2007. He became a certified quality engineer in 2009.

OTHER ACTIVITIES: Certified as a Six Sigma BB by SQI Singapore, an ASQ global partner. Project leader for the Joint Quality Publications World Alliance for Quality, a board member of Asian Network for Quality and chief editor of *Quest for Excellence* magazine. TQM faculty member at University of the Punjab, Superior University in Lahore, Pakistan, and has spoken at several conferences.

RECENT HONOR: Rana received the professional achievement award from the Islamic Countries Society of Statistical Sciences (ISOSS) in 2009 for his joint work in developing and implementing Stat Way, a module to accompany Six Sigma in manufacturing and services organizations.

PUBLISHED: Rana has created and published several animated games and puzzles related to effective TQM tools implementation in organizations. He has also had many papers and articles published and presented at national and international conferences.

QUALITY QUOTE: Tools soon get rusty if they are left in the toolbox. Ideas are useless unless used. There cannot be improvement without new ideas, and there cannot be new ideas without the participation of all.

CAREERS

LEAN TOPS SIX SIGMA IN TALENT SEARCH

When it comes to being a force in continuous improvement activities, there's no question that lean outperforms Six Sigma.

That's what one recruiting firm said after it studied nearly 3,000 job postings and found more organizations looking for lean talent instead of Six Sigma talent. The Avery Point Group said this suggests companies are increasingly relying on lean as the core foundation for continuous improvement efforts.

In its sixth annual study of internet job postings, the Avery Group said demand for lean talent has surpassed Six Sigma by a substantial margin as the more desired skill set, "accelerating an already growing shift in talent demand toward lean."

In addition, of the companies seeking lean in job postings, 41% required candidates with Six Sigma skills. Of the companies seeking Six Sigma talent, 55% required candidates to have knowledge in lean.

"For companies seeking lean practitioners, these results may be signaling a possible trend toward a decoupling of lean and Six Sigma, or at the very least a de-emphasis of Six Sigma as a core job requirement for lean talent," said Tim Noble, managing principal of the Avery Point Group.

For more on the survey, visit www.averypointgroup.com.

ASQNEWS

NEW ENTERPRISE MEMBERS Ford, General Electric, Becton Dickinson and Booz Allen Hamilton are the latest high-profile corporations to join ASQ as enterprise members. There are now 29 organizations that have joined ASQ as enterprise members. To find out more about this membership category, visit www.asq.org/enterprise.

QMS WEBINAR Experts will talk about transitioning to ISO 9001:2008 in a free webinar later this month. The webinar will be held at 1 p.m. CST Wednesday, April 21. To register, visit www.asq.org/webinars/iso-9001-2008-explained.html.

Wake-up call *(continued from p.12)*

Ford engineer with 45 years of experience in quality, advanced automation, manufacturing engineering and process engineering.

"We need to take these lessons learned and figure out how to make sure we minimize recalls in all industries and actually make quality an integral part of our lives," said Ron Atkinson, another member of the panel, a past president of ASQ and a retired 35-year veteran of GM. "It's going to be complex and take time. There will be no finish. It will be an ongoing race—forever."

—Mark Edmund, associate editor

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World conference *(continued from p.13)*

sessions and "After 5" sessions; visit with exhibitors and sponsors; and view live presentations from the International Team Excellence Award finalists.

The International Team Excellence Competition, held every year at WCQI, allows teams from global companies and a broad spectrum of industries—including manufacturing, service, education, healthcare and hospitality—to present how they used quality tools and methods to solve problems, improve processes and save money. This year, 27 finalists will present at WCQI. For more information about the competition, visit http://wcqi.asq.org/team-competition/index.html.

Additionally, three mini conferences, sponsored by different ASQ divisions, will take place concurrently with WCQI:


Jarzombek

Software: Joe Jarzombek, director for software assurance in the Department of Homeland Security's National Cyber Security Division, and John Towns of the National Center for Supercomputing Applications, will be keynote speakers at the Institute for Software Excellence conference, hosted by ASQ's Software Division. The software conference will include presentations geared toward software purchasers and builders. Areas of focus include: applying quality principles to software, software quality management principles and software process improvement.

Sustainability: The Quality in Sustainability conference sessions will tie together environment, energy efficiency and quality with principles and practices of social responsibility and discuss useful tools to help implement these concepts in organizations.

Continual quality improvement: The first Institute for Continual Quality Improvement conference will highlight efforts behind organizational continual quality improvement programs. ASQ's Quality Management and Statistics divisions have developed sessions that emphasize hands-on learning and the application of basic and advanced quality improvement methods.

One registration fee covers admission for all conferences. For more on WCQI activities and links to each mini conference, visit http://wcqi.asq.org/index.html.

—Nicole Adrian, contributing editor

QP ONLINE ONPAPER

QUICK POLL RESULTS

Each month at www.qualityprogress.com, visitors can take an informal survey, and we post the results.

Here are the numbers from the most recent Quick Poll:

"What is at the crux of Toyota's recent troubles?"

- Losing sight of quality 45.2%
- Rapid expansion 29%
- Poor leadership 14.5%
- Supplier issues 11.2%

Visit www.qualityprogress.com for the latest poll question:

"What's the best way to avoid a product recall?"

- Good internal communication
- Identify potential sources of risk
- Listen to customer feedback
- Strong social responsibility focus

CAPITOL Q

AN ASQ TASK FORCE met with the Office of the National Coordinator for Health IT last month to present a draft of its Baldrige-based self-assessment tool that could be used by healthcare organizations and physicians to help implement new health IT.

ASQ continues talks with officials from the Office of Management and Budget (OMB) to explore ways ASQ can assist OMB in forming communities of people interested in advancing performance improvement in the federal government. Additional meetings were scheduled last month.

DIFFERENT ASQ DIVISIONS have been huddling to propose lean methods to state lawmakers in California to help the government streamline its operations. A business plan is currently being developed through efforts by members of ASQ's Six Sigma Forum and its government, lean enterprise and quality management divisions.

Capitol Q is a regular feature of Keeping Current that highlights ASQ's advocacy efforts with government leaders. More information on these activities can be found at ASQ's Advocacy Room at www.asq.org/advocacy/index.html.

HEALTHCARE

SURVEY: MERGERS AFFECT QUALITY

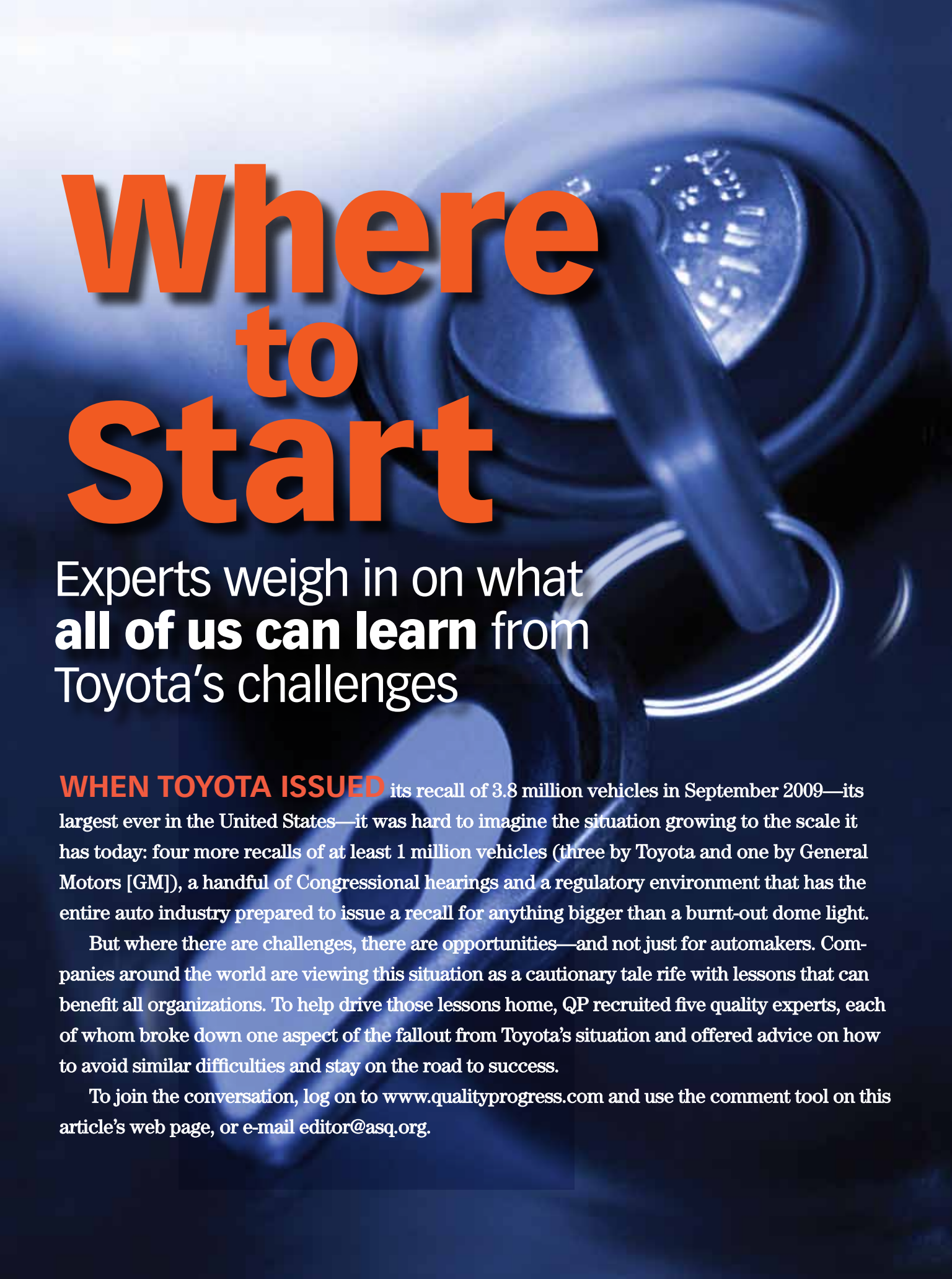
More mergers and acquisitions in today's marketplace, as well as compliance issues, are the top challenges faced by life sciences organizations, according to a recent survey.

More than half of the survey respondents, including professionals in pharmaceutical, biotech and medical device industries, said different supply quality standards and mandates across countries or regions are the greatest obstacles to managing quality and compliance.

More global supply chains and greater industry consolidation have caused companies to re-evaluate practices and find ways to adapt, respondents said.

The survey was conducted by Sparta Systems Inc. More survey details can be found at www.spartasystems.com/templates/press-template.aspx?id=2147483760.

Mr. Pareto Head BY MIKE CROSSEN



Where to Start

Experts weigh in on what **all of us can learn** from Toyota's challenges

WHEN TOYOTA ISSUED its recall of 3.8 million vehicles in September 2009—its largest ever in the United States—it was hard to imagine the situation growing to the scale it has today: four more recalls of at least 1 million vehicles (three by Toyota and one by General Motors [GM]), a handful of Congressional hearings and a regulatory environment that has the entire auto industry prepared to issue a recall for anything bigger than a burnt-out dome light.

But where there are challenges, there are opportunities—and not just for automakers. Companies around the world are viewing this situation as a cautionary tale rife with lessons that can benefit all organizations. To help drive those lessons home, QP recruited five quality experts, each of whom broke down one aspect of the fallout from Toyota's situation and offered advice on how to avoid similar difficulties and stay on the road to success.

To join the conversation, log on to www.qualityprogress.com and use the comment tool on this article's web page, or e-mail editor@asq.org.

Brand Loyalty

Feedback, best practices keep customers coming back

BY BOB E. HAYES

TOYOTA'S RECALLS—and the subsequent media blitz surrounding customer reaction, the automaker's handling of the recall and the Congressional hearings with company executives—have deleteriously affected the company's reputation for delivering high-quality vehicles. As a result, customer loyalty has taken a hit.

Toyota's U.S. sales dropped 9% in February 2010 compared to the previous year, while Ford, GM, Nissan, Honda and Hyundai reported double-digit growth in the same time period.[1] Toyota now faces a monumental task: regaining the trust and loyalty of existing customers and potential new ones.

Regardless of the cause (or causes) of its problems, Toyota needs to shore up customer loyalty. Recent findings regarding best practices for customer feedback programs show it's possible to mitigate the fallout of situations such as this.

There are specific reasons why some companies experience high levels of customer loyalty while their competitors do not.[2] When comparing business practices of companies that are loyalty leaders and companies that are loyalty laggards, it was found that leaders adopted specific business practices based on their customer feedback program.

Emphasizing feedback

Customer feedback programs refer to customer programs in which formal customer data are collected on customers' perceptions and attitudes about their experiences. These programs—sometimes referred to as customer loyalty, customer satisfaction or voice of the customer programs—provide a deeper, customer-centric understanding that helps companies identify ways to increase customer satisfaction and loyalty, consequently improving business performance.

Table 1 shows a model of customer feedback programs, which can be broken into two major areas:

1. **The managerial area** encompasses strategy, governance and integration of the customer feedback program into business systems.
2. **The operational area** includes components that are directly responsible for the daily operation of a customer feedback program, including methods, reporting and applied research. These three areas at the base of the customer feedback program model support strategy and help sustain the integration of customer feedback throughout the business processes.

Although I'm addressing best practices of customer feedback programs, the principles extend to general aspects of business practices, and the rules of engagement apply to all types of customer feedback mechanisms.

Strategy and governance

Strategy reflects a company's overarching, long-term plan that is designed to help it attain a specific goal. For customer-centric companies, the strategy is directed at improving the customer experience.

Elements of a customer feedback program / TABLE 1

Strategy		
Vision, value and culture		
Governance		
Executive ownership, decision making, accountability and compensation		
Integrated business processes		
Automated, closed loop, customer relationship management and business intelligence integration, life-cycle management and communication		
Method	**Reporting**	**Research**
Data collection, contact management, sampling method and survey questions	Analysis, benchmarking, micro and macro improvements, and dissemination practices	Business impact; financial, operational and constituency links; and use of customer information

Governance is a system by which companies are directed and controlled. By establishing governance around a customer feedback program, the company provides the structure through which the objectives of a customer feedback program are set and the means of attaining those objectives and monitoring performance toward those objectives.

The strategy and governance of a customer feedback program provide high-level direction that creates an atmosphere in which the company's attention is directed at customers and their needs. Corporate strategy and governance of a customer feedback program are exhibited in a variety ways by loyalty leaders, from resource allocation in supporting customer initiatives to the use of public forums to communicate the company's vision and mission to its constituents.

There are reasons why some companies experience high levels of **customer loyalty.**

Executive support and use of customer feedback data, as well as communication of program goals and customer feedback results, help embed a customer-centric culture into the company. Loyalty leaders' use of customer feedback in setting strategic goals helps keep them focused on the customer from the top down. Additionally, the use of customer feedback in executive dashboards and for executive compensation solidifies the importance of customers as a key business metric.

Integrated business processes

The area of integrated business processes addresses the extent to which the organization embeds elements of a customer feedback program (including processes and data) into the daily business operations. Doing so facilitates management and operational processes to support the needs of the customers.

The integration of a customer feedback program into the business processes ensures customer feedback is used at all levels of the organization, from top management to front-line employees. It also helps provide support for the company's strategy for addressing customer concerns and improves adherence to the governance model.

This integration helps ensure customer feedback is delivered to top executives so they can monitor the success of their strategies and modify them if needed. It also helps operationalize the governance of the program and ensures employees adhere to the guidelines and rules surrounding the program itself. By incorporating key elements of a customer feedback program directly into the daily business processes, the organization is able to ensure customers' needs are met.

Loyalty leaders' adherence to the policies of a customer feedback program is accomplished by regularly communicating the goals and processes to all employees. Additionally, loyalty leaders integrate a customer feedback program into the company's customer relationship management (CRM) system. Executives need to understand how the company is meeting its customer-centered objectives. Including customer feedback data in the executive dashboards is an effective means toward that end.

The advent of technological advances (such as CRM systems and the internet) has influenced the extent to which customer feedback programs can be integrated into the daily business processes. Effective integration improves the customer experience by helping the company more effectively manage the customer relationship across the customer lifecycle. Loyalty leaders incorporate their customer feedback programs into their CRM systems and are able to use objective data (sales or service history) and attitudinal data (satisfaction) to get a comprehensive picture of the quality of the customer relationship.

Method acting

The success of a customer feedback program does not rest solely on the management processes that support the program. In addition to corporate strategy and business process integration, the method of customer feedback data collection is crucial to a successful program.

There are various methods that can be used to collect customer feedback data. The customer feedback process typically involves formal data collection via a survey that asks standardized questions about the customers' experiences with services or products. A web-based survey approach used across a variety of survey types that is incorporated into a CRM system

helps companies easily and quickly understand different customer constituencies in a cost-effective manner.

Loyalty leaders understand customer requirements. Customer feedback tools, such as surveys and complaints, include questions that tap into factors that are important to customers. Establishing a list of these customer requirements leads to a better feedback tool that measures essential elements of the customer relationships.

Loyalty leaders also measure various components of customer loyalty (such as advocacy, purchasing and retention) that are designed for the company's specific needs. Rather than relying on one single measure of loyalty, such as likelihood to recommend, loyalty leaders think critically about the type of loyalty or loyalties they want to improve. Using various measures, loyalty leaders collect reliable results that help them grow their businesses through new and existing customers.

Reporting for duty

The quality of a customer feedback program does not stop at the collection of the customer feedback. Loyalty leaders know how to best summarize and present customer feedback so the company can make effective business decisions.

As a general rule, reporting customer feedback results needs to be guided by the overarching strategy of the company and the survey objectives of improving customer loyalty. Improving customer loyalty requires specific business responses that are designed to have an impact on customer experience. The analyses and reporting of the results need to assist executives and frontline employees with making correct business decisions that improve customer experience.

Analyzing, summarizing and disseminating customer feedback results are essential activities that provide insight into customer feedback data. Loyalty leaders apply two general loyalty management approaches:

1. **The micro (individual) approach** addresses special causes of customer loyalty and focuses on changing individual customer concerns with customer-specific improvements that are short-term solutions to improving customer loyalty.
2. **The macro (organizational) approach** addresses common causes of loyalty and focuses on improving systemic issues with organizationwide improvements that are long-term solutions to improving customer loyalty (see Table 2).

Loyalty management approaches / TABLE 2

Micro approach	Macro approach
Addresses special causes of disloyalty.	Addresses common causes of disloyalty.
Focuses on changing individual issues.	Focuses on improving systematic issues.
Makes customer-specific improvements.	Makes organizationwide improvements.
Finds short-term solutions.	Finds long-term solutions.

Do your research

Customer-focused research using customer feedback data can provide additional insight into the needs of the customer base and increases the overall value of the customer feedback program.

Applied research helps companies gain superior customer insight through in-depth, customer-centric research. This research extends well beyond the information that is gained from typical reporting tools that summarize customer feedback with basic descriptive statistics. Loyalty leaders link operational metrics to customer feedback data and other constituents' attitudinal data to customer feedback data. Loyalty leaders use the results of these studies to learn how to better integrate customer feedback into daily processes.

Loyalty leaders develop comprehensive research programs to help unlock the potential of their customer feedback data. They can maximize the value of their customer feedback programs by conducting in-depth satisfaction and loyalty research, ultimately gaining superior customer insight that is necessary to accelerate business growth. Through research, loyalty leaders transform their companies into customer-centric businesses.

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BOB E. HAYES is president of Business Over Broadway, a consulting firm based in Seattle. He earned a Ph.D. in industrial and organizational psychology from Bowling Green State University in Ohio. Hayes is the author of Beyond the Ultimate Question *(ASQ Quality Press, 2009) and* Measuring Customer Satisfaction and Loyalty *(ASQ Quality Press, 2008). He is a member of ASQ.*

Stay Ahead of the Game

Solid design, communication help halt recalls, lawsuits

BY RANDALL GOODDEN

WHETHER IT'S THE automotive industry or another cross-section of the business landscape, the problem of product recalls is getting worse instead of better, with manufacturers pulling back tens of thousands of their products—in some cases, millions.

One of the biggest causes of recalls is design defects that result in accidents, injury or even death. When that happens, the manufacturer must recall its product, opening the door to product-liability and class-action lawsuits. And if it doesn't recall the product, the same information will eventually surface through the legal discovery process, and the company could subject itself to large punitive damage awards.

It is a no-win situation, so the objective must be to make the product right the first time. Every company says it makes every effort to accomplish this, but sometimes those words aren't accompanied by action. The growing number of recalls speaks for itself. If manufacturers were successful in their efforts, the trend would reverse, and everyone would master the process so product recalls would become a thing of the past.

But executive management fails to understand the need to do things differently. Until the CEO recognizes this and takes the time to get everyone trained and on the same page, manufacturers will continue just as they have and will only learn a lesson when an incident surfaces.

Pay attention

Even with the best efforts in place, there is the potential of a defective condition surfacing in the field, whether it's because of an underestimation in the risk-evaluation process, a defective component part, a manufacturing defect or the failure to take into account foreseeable misuse of the product.

As these surprises begin to surface—hopefully before any catastrophic event happens—the question will be whether the company is paying adequate attention to the early warning signs. Typically, these early reports begin to filter in through the customer service, account management, sales, distribution, tech support or warranty returns departments. The question will be whether this information found its way to someone who can actually do something about it.

In the Toyota situation, Akio Toyoda said his company "failed to connect the dots" when it received information about product failures from North America and Europe. That information didn't find its way to corporate headquarters in Japan and the right individual—if there even was a right individual.[1]

One of the first requirements for manufacturers should be to identify the right individual and be sure everyone knows who he or she is. Then, all of the customer contacts need to learn how to separate everyday potential product problems and failures from ones that could lead to serious safety or liability implications. This requires training and procedures.

Current certified quality programs, Six Sigma training or any other programs to maintain or improve efficiency will not change the growing number of product recalls and product-liability lawsuits, nor will the practice of design engineers performing failure mode and effects analysis on their own designs. It didn't work for Toyota, GM, Ford, Firestone, Mattel and countless other product manufacturers. It takes specific training in the area of product safety, recall and product-liability prevention.

The current situation in the automotive industry is a wake-up call for all manufacturers. As is usually the case, it takes a major disaster for everyone to finally pay attention to what needs to be done. The question now is whether other organizations will pay attention to what led to this crash on the highway of production and profits or just drive past the scene.

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RANDALL GOODDEN is president of Randall Goodden International, a training and consulting firm based in Eagle, WI. He is the author of Lawsuit! Reducing the Risk of Product Liability for Manufacturers, Product Liability Prevention—A Strategic Guide *and* Preventing and Handling Product Liability. *Goodden is an ASQ fellow and is the chairman of the Product Safety and Liability Prevention Division.*

What's Your Responsibility?

An obligation to protect those outside your walls

BY RON ATKINSON

IN MY FIRST business management class, the instructor outlined every organization's management responsibilities, starting with providing stakeholders a return on investment. At that point, that was the only responsibility with which I was familiar. But during the course of my education, I learned many more, such as ensuring the organization's viability to preserve jobs and conformance to legal requirements. This was my first introduction to organizational social responsibility (SR).

Among the tenets of SR is responsibility to customers—more specifically, the promise that the product will function as advertised during its expected life in a manner that ensures a reasonable level of safety and security to the users.

Society feels strongly about this responsibility and has enacted laws regulating some products or industries to ensure the safety and security of consumers. These laws are viewed as minimum requirements by more socially responsible organizations, whose products are designed and manufactured so there is almost no chance they will injure a consumer.

These companies train management in the benefits of good quality and communicate that culture throughout the rest of the organization. When a quality-based culture is embedded in an organization, it's more likely its products will be safe and its customers satisfied.

But that culture must be present throughout the product life cycle. The design stage may include the use of quality tools such as design for Six Sigma or failure mode and effects analysis. Then, the product and processes are tested extensively so potential consumer problems are detected and eliminated before production. The rest of the steps in the process are controlled to maximize the product's benefit to society, particularly the safety aspect. This includes educating the consumer in the correct and safe operation of the product.

An organization that uses these levels of care in its processes is socially responsible. The difficulty arises when the organization expands its scope. The more complex it becomes, the more difficult it is to ensure the product will be safe and will meet customer needs.

A decrease in safety and satisfaction can happen for a number of reasons, including (but not limited to) process changes that are not immediately detected or documented, human error, design problems, premature failure of the product or a product component, and unanticipated use of the product by consumers. Negligence by the organization increases the probability of these negative events occurring, but they can happen even in an organization practicing due care and acting in a socially responsible manner.

When a **quality-based culture** is embedded in an organization, it's more likely its **products will be safe.**

Information on potential problems comes from a number of internal and external sources. Internal sources include laboratory and field tests, as well as quality checks. External data come from field use, warranty and customer complaints (either directly or through government agencies). Regardless of the source, the company must investigate to determine if further action is needed. That may mean a warning to the customer about certain applications of the product or a recall of the product for modification or replacement.

A socially responsible organization will act promptly in all of these situations and do everything it can to ensure customer satisfaction and the safety and security of everyone affected by its products.

RON ATKINSON is an ASQ past president with more than 35 years of experience in the auto industry, a majority of which was spent in quality-related activities. Atkinson is a Six Sigma Black Belt and holds certifications as a quality engineer, auditor, manager and quality improvement associate. He is also a member of the China Association for Quality board of directors and is retired from GM.

Risky Business

How to identify potential problems before they happen

BY FRANK MURDOCK

RISK IDENTIFICATION, MITIGATION and containment are absolutely necessary, but they're not sufficient for a business to be successful. You still need to provide innovative products and services that meet or exceed your customers' needs and expectations.

As a CEO or business owner, you must not only be mindful of potential risks, such as product liability, but you also need to be assured you have put in place an integrated business system that identifies all of the potential risks and prioritizes those risks based on the likelihood of occurrence, detectability and impact. Those familiar with failure mode and effects analysis (FMEA) will recognize these three parameters. The ideal situation involves being able to gather data for each parameter so prioritization is data driven rather than an exercise in engineering judgment.

Categorizing risk

When identifying risks, I prefer the three categories Perry Daneshgari uses:[1]

1. **Business risk** includes not getting the expected return on your investment.
2. **Technical risk** involves whether a particular part or subsystem fails in the field.
3. **Integration risk** is similar to what Toyota is experiencing with its acceleration problem in the field. In that instance, the problem could be the way the throttle-accelerator subsystem interacts with the physical interior protective system of floor mats, which are greatly influenced by customer choice.

Companies are usually good at identifying business and technical risks but not very good at identifying integration risks.

A risk-identification system needs to be at work throughout the business—from initial design to in-field support. It needs to be integrated so there is excellent communication up and down the value stream. That means it also needs to include the suppliers—not a trivial task; it takes years to build an integrated system of people, process and technology so the information gathered is useful and actionable.

The more you know

There are two primary sources to be used for risk identification in each of the three risk categories:

1. **History** is what has gone wrong in the past. This depends on a systematic approach to gathering useful information about field failures, starting with engineering test data from prototypes and accelerated testing to failure. The greatest risk is the occurrences that appear to be outliers. Too often, organizations will ignore these early warning indicators instead of aggressively trying to understand what they indicate.
2. **Knowledge of how the product or process works** is the physics and chemistry, engineering knowledge and logic that tells us what could go wrong. This depends on understanding the science that goes into product design and development.

FMEA can be applied throughout the value stream to help identify and prioritize risks, and drive actions to prevent the risk, find ways to make it easier to detect and reduce the impact if a failure occurs. When applied rigorously, it is an important learning tool. When applied superficially, it can provide a false sense of security.

For example, some organizations go through FMEA as an exercise in response to an original equipment manufacturer requirement, in which case the blanks are filled in and the risk priority number calculated, but the depth of commitment required to have an impact on the design or production process is lacking.

Part of the response to the potential for failures is a strong voice of the customer system for communicating customer issues, complaints and warranty claims to:

- Those who can quickly correct and contain the issue, thereby satisfying the individual customer.
- Those responsible for production, who can halt and correct the issue so more problems do not occur.
- Those responsible for design, so future products don't replicate the problem.

This is the equivalent of the *andon* cord in the assembly plant. In this setup, anyone on the line is expected to pull the cord if they spot a problem so it can be corrected immediately.

Check your warranty

Another issue for manufacturers is warranty systems, which are used primarily to finance repair or replacement rather than facilitating the diagnosis and subsequent prevention of customer issues. To that end, they are effective when it comes to containing errors in the short run, but they're also responsible for misinformation regarding the nature of the field failure.

An effective way to combat this problem is to develop engineering SWAT teams and require the failed product to be quarantined in the field so the SWAT team can perform an on-site diagnosis and not rely on second and third-hand descriptions. The availability of real-time onboard diagnostics, such as black boxes, as well as digital photography and video has greatly facilitated the ability to gather data regarding field failures.

We have many tools and methods for preventing the problems experienced by Toyota and for responding aggressively to failures in the field. But the organization must have the will to recognize any failure as an opportunity to help a customer, to catch the problem early and to learn how to prevent it from occurring in the first place. That begins with leadership instilling a culture that insists on serving customers, and it never ends.

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Born Again

Auto industry's challenges bring quality to the forefront

BY DON SMITH

FOR YEARS, TOYOTA has been viewed as a shining example of the success that accompanies a strong quality system, as well as the techniques that are lumped together under the label of lean or lean process. Considering Toyota's growing list of product recalls, you can't help but wonder what impact the current situation will have on the future of quality and lean process.

The question is: Will this crisis diminish the perceived value of quality and lean process, or will it bring to light their importance, resulting in a rebirth of quality? To put the question of diminishment or rebirth into perspective, let's compare it to a recent sporting event.

At two crucial junctures of Super Bowl 44, Indianapolis Colts quarterback Peyton Manning tried to connect with one of his receivers via a forward pass. Both passes were on target, and both receivers were in the correct position to catch the ball. Unfortunately, they failed to make either catch because, at the very last instant before the ball arrived, their attention was diverted. They took their eyes off the ball and dropped the passes.

As with any other process, successful implementation of all aspects of quality in general—and lean process in particular—requires the existence of proven methods, a plan for executing the methods and proper execution of the plan. All of these things must be done without taking your eye off the ball. It appears that somewhere along the line, Toyota may have done exactly that and paid the price.

Just as Peyton Manning won't stop using the forward pass because his receivers dropped one or two in a crucial situation, quality professionals will not stop using quality methods and techniques. They will study and analyze how methods and techniques were used in the case of Toyota's failures to determine whether the methods and techniques were flawed or simply weren't executed properly. When the causes are determined, changes will be made to reduce the likelihood of recurrence.

I believe the current publicity focused on quality issues will have a reenergizing effect and will lead to a resurgence of quality, with improved methods and techniques. QP

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Power to the People

Survey says talent management and internal service are **more important than ever**

In 50 Words Or Less

- People equity, a framework to measure and manage human capital, plays an important part in business performance.
- A recent survey explored whether that relationship was strained by the recent economic downturn.
- Results showed that companies that kept the focus on their employees outperformed those that didn't.

by Jerry H. Seibert and
William A. Schiemann

THE RECESSION HAS affected companies on every level. Many have been changed in fundamental ways, and some have not survived. The economic environment is so profoundly different from the beginning of this millennium, it begs the question of whether organizations' primary relationships have changed, including those with customers and their employees. It even calls into question the relevance of factors such as commitment to quality and internal service.

In past research conducted with QP, Metrus Group, a research and consulting firm specializing in strategic measurement and performance excellence, has documented a strong relationship between internal customer service, people equity (see sidebar, "What is people equity?" p. 26) and business performance, including financial outcomes, quality and customer satisfaction.[1,2]

But does this strong relationship continue to hold during times of economic dislocation, when corporate survival may be on the line?

This is the central question we addressed in a recent survey. We also explored the impact of various anti-recession strategies companies adopt involving the people-equity factors of alignment, capabilities and engagement (ACE). Finally, we examined the effect of those strategies on internal customer service and identified techniques that have been effective at closing internal service gaps.

About the survey

ASQ members, customers and a sample provided by Metrus Group were surveyed in October 2009. A total of 2,147 people responded. Almost half (48%) of the participants were managers or executives representing companies from a wide range of industries. A summary of the most frequently represented industries and a breakdown by organizational size is provided in Table 1.

We asked participating companies:

- How organizational performance changed during the past two years.
- What tactics the company used in response to the recession.
- The level of workforce alignment, capabilities and engagement, as well as the focus on business results and quality.
- Internal customer service levels for key functions.
- Techniques used to close internal service gaps.

We also asked how the companies were currently performing in the areas of financial results, productivity, customer satisfaction and quality relative to their industry.

WHAT IS PEOPLE EQUITY?

It is a framework to measure and manage human capital. People equity consists of three core elements:

- **Alignment** is the extent to which employees are connected to the business strategy. It includes employees' alignment with the strategy, customers and the brand, as well as clarity and connection of individual, departmental and organization goals.
- **Capabilities** refer to the extent to which the organization effectively deploys talent, information and resources to meet customer requirements and execute the strategy.
- **Engagement** goes beyond employee satisfaction and includes commitment, advocacy on behalf of the organization and discretionary effort. *—J.H., W.S.*

Executive summary / TABLE 1

Most frequently represented industries	Number of respondents
Manufacturing and industrial products	583
Professional services	247
Pharmaceutical, biotech and medical devices	148
Aerospace	105
High tech	92
Healthcare services	90
Government	60
Transportation and automotive	54
Defense	50
Others	718
Total	**2,147**

Number of employees	Number of respondents
100 or fewer	377
101-500	375
501-5,000	437
More than 5,000	385
Not reported	573
Total	**2,147**

Our first goal was to test whether the strong positive relationships previously observed between people equity (as measured by ACE) and business performance, people equity and internal customer service, and internal customer service and business performance held in a downturn.

In our previous research, we found that companies with more engaged employees outperformed those with lower engagement levels.[3] This is in keeping with other studies on the subject. But we also found that engagement alone is not enough.[4] Even if employees feel highly connected and committed to the organization, optimal performance is not achieved unless there is also alignment with company strategy and values, as well as sufficient capabilities to meet customer requirements.

The current survey results demonstrate that even in challenging economic times, high levels of people equity are associated with better performance, as illustrated in Figure 1. Organizations in the top quartile of

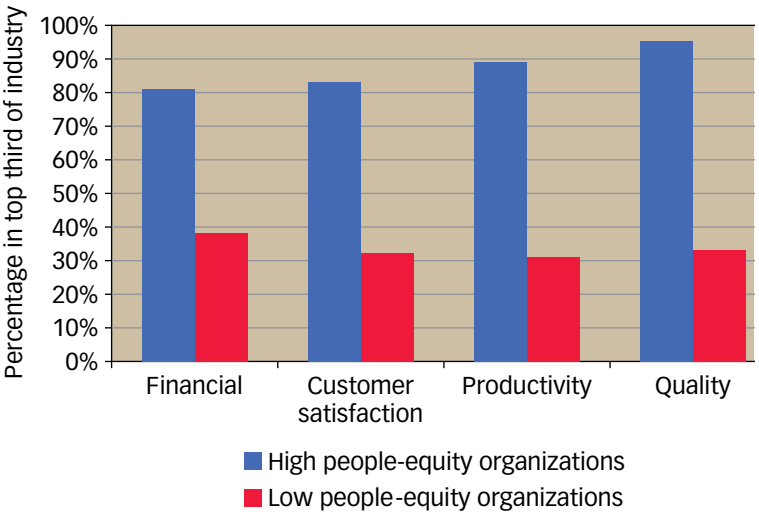
people equity are much more likely to be industry leaders (defined as being in the top third of the industry) on key metrics, such as financial outcomes, customer satisfaction, productivity and quality. While most companies with high people-equity are industry leaders, only about a third of companies with low people equity achieve that status.

In a 2006 study, we reported that internal customer service levels were also strongly influenced by ACE.[5] At that time, we found an average difference of almost 40 percentage points between internal customer service levels in high versus low people-equity companies. As dramatic as that difference was, it appears that during this stressful economic period, the differences are even more extreme. In Figure 2, we compare the internal customer service ratings of various departments for high and low people-equity businesses. The average difference in 2009 is a significant 56 percentage points.

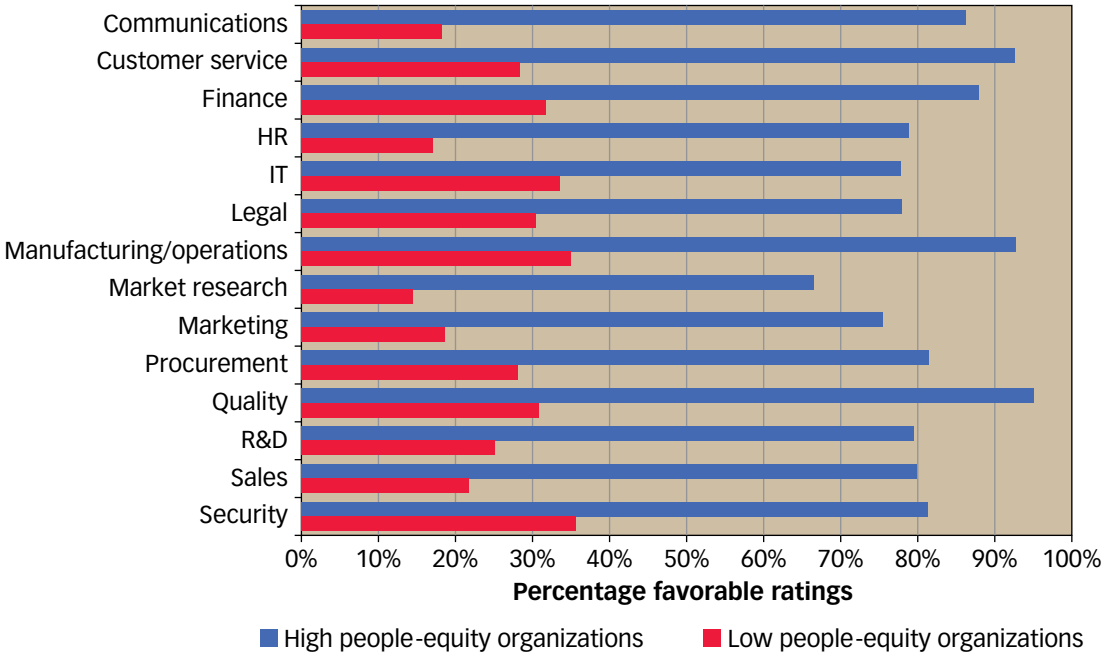
The third relationship we wanted to test was the pattern of better business performance among companies with outstanding levels of internal service. Because people equity showed a strong correlation to business performance and is an extremely strong predictor of internal customer service levels (see Figure 2), it seems a given that internal customer service and business performance are also linked.

Indeed, that was the case: Top quartile internal customer service companies are about twice as likely

People equity/business performance relationship / FIGURE 1



Internal service levels—high vs. low people-equity organizations / FIGURE 2



as low internal customer service companies to be industry leaders on the key metrics of financial results, productivity, customer satisfaction and quality.

With strong support for the robustness of the relationship between people equity and business performance, we examined the effect of the recession on people equity. Or, to be more precise, we examined the effect of tactical responses to the recession on people equity.

Recession-fighting actions' affect on people equity / FIGURE 3

Action	Alignment	Capabilities	Engagement
Laid off staff	↓	↓	↓
Mandatory budget cuts	↓	↓	↓
Hiring freeze	↓	↓	↓
Reduced pay	×	×	↓
Frozen pay (no increases)	×	×	↓
Reduced benefits	×	×	↓
Mandatory furlough	×	×	×
Identified process changes to reduce costs	↑	↑	↑
Reduced services to customers	↓	↓	↓
Reduced services internally, between departments	↓	↓	↓

× No impact ↑↓ Moderate impact ↑↓ Strong impact

Smaller vs. smarter

Belt tightening is the recession tactic of choice for most companies. Smaller is better, the current mantra goes, which leads to reductions in staff, budgets and services. An alternative to cutting back is to invest more in improving and streamlining processes. We wondered if choosing this approach—getting smarter, not just smaller—made a difference in ACE levels within companies. To put it another way, is there a people equity benefit from using the tools of process improvement and cost reduction as part of a recession survival strategy?

Common wisdom says the steps companies typically take to manage an economic downturn have an across-the-board negative impact on ACE levels. But we found there is a difference between the various recession tactics companies use and the impact of those actions on people equity factors. Figure 3 summarizes the results of regression models examining the impact of 10 different tactics on each people equity factor, including the following:

1. Reducing resources: Tactics such as layoffs, budget cuts and hiring freezes uniformly had a negative impact on ACE levels. These actions, which include the most severe responses to the recession, can leave employees feeling like they need to carry a heavier load with no additional recognition. With fewer resources, capabilities decline. The perceived inequity of these tactics weakens engagement.

Cutting back also can lead to a value disconnect between employees and their company, thereby undermining alignment. Employees find it difficult to be in sync with the strategic direction of the company when those around them are losing their jobs.

2. Compensation cuts: In an interesting contrast, the effects of compensation-oriented tactics were very different. Pay cuts, pay freezes and benefit reductions had a negative impact on employee engagement, which should come as no surprise. But compensation cuts did not have a significant impact on alignment or capabilities. It is possible these actions, while not welcomed, are more likely to be viewed as rational and acceptable—sharing the pain through lower profits for the company and lower rewards for staff. Thus, alignment may be maintained, and with resources preserved in the organization, capabilities remain largely intact.

We examined one other tactic for reducing labor costs: mandatory furloughs, which are typically used to cut pay by reducing total work hours. Like the other techniques, use of furloughs had no impact on alignment and capabilities. But they also had no impact on engagement. Perhaps that is because, unlike the other actions, a furlough may be viewed as somewhat more equitable—you don't get paid, but you're also not required to work during the furlough.

3. Service suffers: The greatest negative impact did not come from eliminating resources or reducing compensation. Surprisingly, the most powerful negative

effects occurred when companies chose to reduce service levels to customers and when they made changes that reduced services internally between departments.

Reducing services to customers had a strong negative impact on alignment and engagement. It would seem employees see a disconnect between oft-repeated strategies and mission statements that emphasize customer service, and actions that may damage customer relationships, if not harm the customers themselves.

It's no shock that aspects of engagement, such as advocacy and discretionary effort, might also decline in that situation. A lesser effect was observed for capabilities, which may mean employees realize the capabilities for good service remain in place; they are just being underused.

When companies reduced services between departments, there was a strong impact on all three people-equity factors. Logically, changes that imperil a department's ability to service other internal groups would lead to lower perceptions of capabilities. After all, points of failure within the organization can reasonably be expected to ultimately lead to failures with customers. Employees may feel less certain they are on the same strategic page as senior leadership, thus lessening alignment.

The strong impact on engagement is a little more puzzling. Perhaps it is a reaction to being placed in a situation where you're prevented from doing the best work possible, resulting in a certain degree of cognitive dissonance. Or perhaps it flows from frustration with a lack of support from other parts of the organization.

Each of the previously mentioned tactics for managing through an economic downturn can be considered reductive, if not destructive, in their fundamental nature. Leaders may choose to think of them as pruning now for future growth, but that does not change the fact that pruning has serious repercussions for employees and the customers they serve.

One tactic had a positive impact on people equity: identifying process changes to reduce costs. Companies that used this tactic reported a strong positive impact on alignment and engagement, and a moderate positive impact on capabilities. This tactic likely maintains consistency with prerecession goals. Therefore, looking within the organization to collaboratively make improvements and reduce costs actually increases alignment.

For employees, it represents the company choosing surgery over amputation. Not surprisingly, this path can actually lead to higher levels of engagement. Employees are highly attuned to organizational behavior that values people and recognizes their ability to help a company prevail in challenging times. There is a lesson here for every organization facing a difficult future.

The recession-service connection

In a study of internal customer service conducted in 2007, we reported that average service levels improved compared to a similar study in 1993.[6] In a recession, however, we expected lower levels of internal customer service. Surely, the effects of cutting back on people equity outlined in Figure 3 hold equally true for internal customer service.

In fact, the 10 recession-fighting tactics had similar effects on internal service. Service reductions between departments had the greatest negative impact, as you may expect. Cost-oriented process improvement had a moderate positive effect, while other tactics had modest negative effects. Yet, on average, internal customer service levels have continued to improve, even through the recession. The typical department had a seven percentage point increase in favorable ratings compared to the 2007 results.

But this unexpected finding is somewhat misleading. Companies that are doing well despite the recession—their performance on key metrics has improved during the last two years—account for all of the increase in internal customer service ratings. In companies where financial performance, productivity, customer satisfaction or quality have deteriorated over the last two years, internal customer service scores are down by approximately 15 percentage points. There is a gap of as much as 25% between the firms that are struggling and those that are successfully navigating the recession.

Closing the gaps

The finding that, for many companies, internal customer service (as well as business performance) is trending downward means there will be an increasing number of internal service gaps. The needs and requirements of internal customers are diverging from the capabilities of internal service providers, but there are a range of techniques that can be used for addressing such gaps. The final part of this study asked respondents which techniques they have used and how effective each has been.

Table 2 reveals that among 12 well-known techniques, most are used for closing internal service gaps by about one-third of companies. Two techniques stand out as more widely applied: plan-do-check-act and process management were used by at least half of the companies. They were also more likely to be effective compared to other techniques.

Customer value mapping, while one of the less frequently used techniques, was also among the most effective. Some—such as balanced scorecard, work out and theory of constraints—were rated as effective by less than half of those who applied them.

This data may help guide companies that are beginning to experience problems related to internal service gaps. An awareness of which techniques have been effective in other companies could accelerate service improvement efforts and help companies avoid wasting effort on approaches that are less likely to succeed.

The criticality of people

Our survey results demonstrate the importance of workforce alignment, capabilities and engagement on organizational performance and business results, independent of the vagaries of economic fluctuation. The relationship between people-equity factors and business outcomes remains strong, as does the connection to internal service levels.

These relationships take on more importance when you consider the impact of various tactics used in response to an economic downturn. Staff, budget and salary reductions all have detrimental effects, although not always in the same way. The riskiest strategies involve reducing service levels to customers or making changes that reduce internal service levels. Those tactics had the greatest negative impact on ACE levels.

Companies that take this route risk double jeopardy: Lower ACE scores lead to lower internal and external customer service, both of which are drivers of business results. Companies will be better served by focusing on process improvement and closing internal service gaps. The only recession tactic that had a positive impact on ACE was a strategy of process improvement, with a focus on reducing costs.

Internal service includes many processes amenable to this approach, and our data highlight several techniques that have been reported as effective at a wide range of companies. To maintain the highest levels of performance, leaders must manage more than the bottom line; there must be a focus on the organization's people equity and a commitment to internal customer service. QP

Techniques for closing internal service gaps / TABLE 2

Technique	Percentage using	Percentage rating effective or very effective
Plan-do-check-act	50%	67%
Process management	57%	66%
Customer value mapping	32%	62%
Lean/lean office	36%	60%
Lean Six Sigma	34%	58%
Benchmarking	40%	58%
Six Sigma	33%	57%
Process value analysis	27%	56%
Business process reengineering	30%	54%
Balanced scorecard	28%	49%
Work out	29%	48%
Theory of constraints	22%	44%

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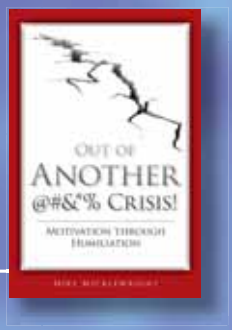

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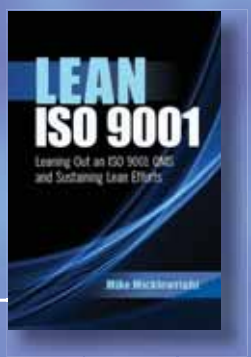

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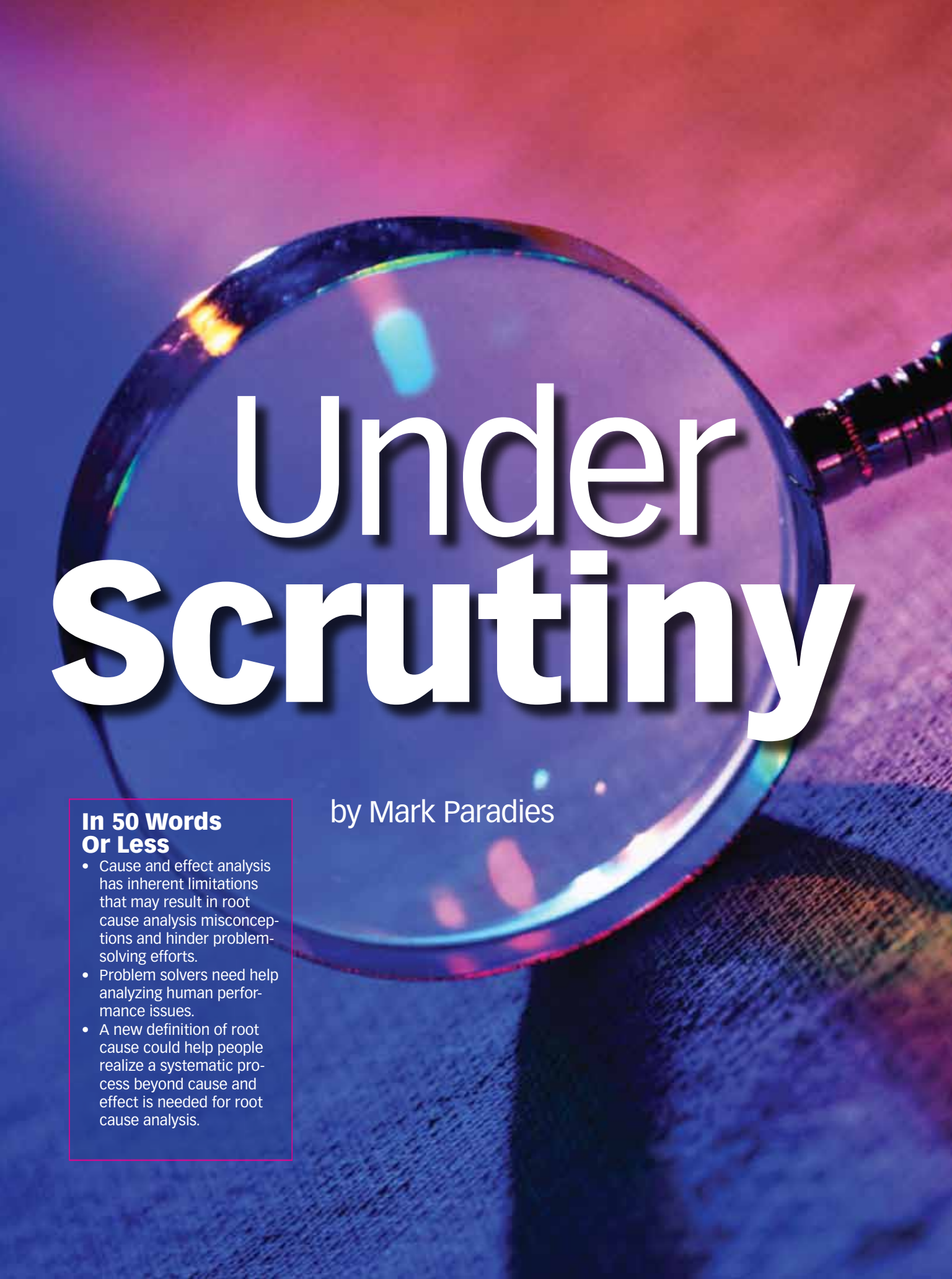

Under Scrutiny

by Mark Paradies

In 50 Words Or Less

- Cause and effect analysis has inherent limitations that may result in root cause analysis misconceptions and hinder problem-solving efforts.
- Problem solvers need help analyzing human performance issues.
- A new definition of root cause could help people realize a systematic process beyond cause and effect is needed for root cause analysis.

New approach to root cause analysis can help **clear up misconceptions**

FOR MANY YEARS, quality improvement practitioners have been taught to find root causes of problems by using a set of tools based on the theory of cause and effect. These tools include the five whys and fishbone diagrams. Many users of these techniques, however, find that some problems, especially those caused by human error, keep happening.

Because of the failure of these techniques to stop problems, some problem solvers might start wondering:

- Am I using the tools correctly?
- Is there a misconception in using cause and effect to find the root causes of problems that produces unacceptable results?
- Is there another technique to help me go beyond basic cause and effect analysis and get better results when investigating quality issues?

If you use cause and effect to find root causes, you might want to rethink your beliefs on this concept and look at what some consider to be misconceptions in applying commonly taught root cause analysis techniques.

"Only tool" misconception

Many quality professionals believe cause and effect (the infinite chain-of-causation philosophical model[1]) is the only (or perhaps preferred) method to find root causes, maybe because cause and effect is taught in most Six Sigma courses.

Many quality professionals don't realize, however, that cause and effect analysis has major shortcomings that could lead them astray. Perhaps their confidence in cause and effect is based on the fact that cause and effect has been around for so long. After all, Socrates first demonstrated the concept to the Western world prior to 399 B.C. through his Socratic method.

Similar to many philosophical concepts, it may surprise you that cause and effect is not a rule or law. It's a model—with benefits and limitations debated by philosophers since Socrates. For example, David Hume, author of *An Enquiry Concerning Human Understanding*, questions the very basis for our human understanding of cause and effect: "When we … consider the operation of causes, we are never able, in a single instance, to discover any power or necessary connection; any quality, which binds the effect to the cause, and renders the one an infallible consequence of the other."[2]

Rehashing philosophical arguments of a bygone era is not my purpose. Rather, as an engineer, I prefer to search for practical answers to everyday problems faced by people trying to improve performance, and to focus on the practical limitations of cause and effect.

Confirmation bias

Philosophical arguments may not convince current users of cause and effect to look beyond their current tools. An understanding of the scientific limitations of the approach, however, may convince people to explore other concepts.

For example, one practical limitation for people applying cause and effect is confirmation bias, a problem-solving heuristic that simplifies the analysis of contradictory information collected on a complex problem.

Researchers who have examined confirmation bias say people tend to jump to conclusions before all the data are gathered and analyzed. From the point that people see or hypothesize a familiar pattern (answer), they tend to look for information to confirm their conclusions (the bias).

People may subconsciously disregard evidence that counters their conclusion. This concept was first explored to explain the biases observed in scientific research. Extensive research shows this is a common human error made by all types of problem solvers, not just experienced scientific researchers or inexperienced problem solvers.[3-5]

Why are cause and effect analysis and the five whys susceptible to the trap of confirmation bias? Because the unguided, deductive reasoning inherent in cause and effect analysis requires problem solvers to use their understanding of the problem to develop a chain of causation. Problem solvers tend to collect evidence about problems they understand. Therefore, the evidence they search for confirms their existing bias. They disregard, or perhaps don't even see, evidence that doesn't fit their mental model (that is, a model based on their experience).

Can't go beyond current knowledge

Another misconception related to the reasoning behind the confirmation bias problem is that problem solvers using cause and effect seldom go beyond their current knowledge. This problem was demonstrated in a QP article, "Flip the Switch," which included an example of the Jefferson Monument dirtied by birds.[6] Park service rangers asked "why" five times (or more) to form this chain of causation:

- Why does the memorial deteriorate faster? Because it gets washed more frequently.
- Why is it washed more frequently? Because it receives more bird droppings.
- Why are there more bird droppings? Because more birds are attracted to the monument.
- Why are more birds attracted to the monument? Because there are more fat spiders in and around the monument.
- Why are there more spiders in and around the monument? Because there are more tiny insects flying in and around the monument during evening hours.
- Why are there more insects? Because the monument's illumination attracts more insects.

But this causal chain assumes the rangers know washing the monument is the causal chain to investigate. The rangers seem to come up with the idea that reducing the washing frequency could occur if the lights were turned on one hour later (thus, attracting less bugs).

You might ask, "Where did they get this idea?"

The first answer is already jumping to conclusions. You could assume that someone involved with solving this problem had the idea that bugs, birds and washing

A **common misconception** is that anyone can use cause and effect to **analyze any problem.**

caused this problem. The problem solver then built a causal chain to validate the answer.

Could other ideas be developed if the rangers had started looking at the sequence of events of the monument's deterioration? Could they discover other important factors? For example:

- Selection of materials for the monument.
- Selection and installation of lighting. Was it always lit?
- Selection or purchasing of cleaning materials.
- Application of cleaners and cleaning methods.
- Changes in bird habitats and feeding or roosting patterns.

This isn't an exhaustive list, but it presents a few possibilities to demonstrate what could be missed without fully understanding the sequence of events before drawing conclusions. Missing potential alternatives can waste efforts when fixing phantom problems or pushing problems from one area to another.

But how can you argue with success? The rangers' solution of turning on the lighting one hour later in the evening reduced monument deterioration by 90%. But remember that correlation does not prove causation.

Do we know the lighting change was the only change? Did the measurement of the problem cause the monument cleaners to be more careful and do less damage? Did a weather change (dry or cold spell, or global warming) contribute to a temporary shift in insect breeding and density? Are measurements of deterioration accurate? Did the change in lighting simply shift the bird-dropping problem to another monument where the bugs and birds now congregate?

This example shows it can sometimes be difficult for people to analyze problems beyond their current knowledge because they try to make the problem fit inside their understanding of the issue. Therefore, when using cause and effect, you must know the cause of an effect, and you must have knowledge of all possible causes to be able to reach an accurate conclusion.

The human factor

This may be OK in a narrow field being analyzed by one of the world's leading experts. But most quality problems are not caused by wildlife interacting with monuments. Most quality problems aren't within a narrow area of expertise. Most people on the factory floor aren't the world's leading experts in human performance, equipment reliability, or bug and bird habits.

Human performance issues (human errors) cause most quality problems. But most problem solvers have no formal training in human engineering or ergonomics (the science of human error and human performance).

In nonscientific polls of those who attended my root cause courses, few (less than 4%) said they had training in human factors, but almost everyone said investigations they perform look into causes related to mistakes made by people (operators, mechanics, engineers, doctors, nurses and managers, for example).

How can someone without training in the science of human error use a misguided process (cause and effect) to find the root causes of human performance problems when they don't know what causes human error? W. Edwards Deming said: "Lack of knowledge … that is the problem. You should not ask questions without knowledge. If you do not know how to ask the right question, you discover nothing."[7]

One common misconception is that anyone can use cause and effect to analyze any problem. Because of the limitation of cause and effect, however, you can only use it to analyze problems that are already understood.

Single-cause misconception

Another common misconception in analyses performed by people trained in cause and effect is the error of identifying a single cause. This was demonstrated in the two cause-and-effect examples presented in "Flip the Switch."[8]

Although neither example is a typical quality related problem, they were presented as successful examples of the technique and provide interesting insight into the limitations of cause and effect.

Both examples focused on a single chain of causation. This is common when people apply the five whys method. They ask why five times around a single cause and then correct the cause at the root of their five whys chain.

Why is this single causal-chain focus a problem? Major accidents or quality issues are seldom the result of a single causal chain. Trevor Kletz, an expert in accidents in the chemical industry and author of many books on process safety, wrote in *Lessons From Disaster*: "Every accident has many causes. Bill Doyle, one of the pioneers of loss prevention, used to say that for every complex problem there was at least one simple, plausible, wrong solution."[9]

Just like accidents, major quality problems are usually the result of a sequence of events containing multiple causal factors. Each causal factor has one or more root causes that, when corrected, will improve performance and eliminate future quality problems.

The single causal chain misconception leads to missed opportunities to improve performance by eliminating multiple root causes that may not be present in the causal chain picked by the five whys problem solver.

Some may argue the five whys technique isn't intended to be used to solve complex issues, but only simple ones. For this concept to work, a problem solver must know when a problem has a single causal chain (simple problem) and when a problem is more complex (multiple causal chains).

Unfortunately, in reviewing thousands of problem analyses, many simple problems (for example, injuries, human errors, equipment failures and management missteps) are either:

- Part of a much more complex sequence of events.
- Seen as a simple problem because they are not thoroughly investigated. After further analysis, the problems turn out to be more complex.

Thus, the five whys examples presented in "Flip the Switch" demonstrate the misconception that major problems (cholera epidemics and monument deterioration) may be caused by a single root cause, even though the article states before the examples that "There could be multiple root causes."[10]

More misconceptions

More misconceptions or problems are not the only practical limitations inherent in the cause and effect approach to root cause analysis. Other practical limitations include:

- Improper use of deductive reasoning.[11]
- Lack of practical training.[12]
- Difficulty in trending results.
- Tunnel vision.[13]
- Fuzzy haze (when the brain automatically fills in missing information when it perceives something, sometimes leading to misperceptions).[14-15]
- Results not repeatable (varied based on the analysts).[16]

Redefine and change your approach

A common definition of root cause that springs from the cause-and-effect tradition of root cause analysis is that a root cause is "an initiating cause of a causal chain which leads to an outcome or effect of interest."[17] This definition, the theory of cause and effect and the practice of "ask why five times" all lead to the problems outlined earlier.

With so many people trained in this method, is there hope? What can you do to move beyond cause and effect? Perhaps it's time to challenge some common beliefs, accept a new definition for root cause and adopt a new, systematic method for root cause analysis.

New definition: Let's begin with a completely new definition of root cause not based on the cause and effect philosophy: A root cause is the absence of a best practice and the failure to apply knowledge that would have prevented the problem.[18]

Once you accept that root cause analysis is the search for the missing best practices and knowledge that will prevent a problem, it is easier to see how a root cause analysis system should help guide a problem solver to the missing knowledge. Root cause analysis can be a structured, repeatable process that helps the problem solvers go beyond their current knowledge and find the real, fixable causes of the human errors and equipment failures that lead to most quality issues.

New method: For a root cause analysis process to help problem solvers go beyond their current knowledge, it must be much more robust than simply asking why five times (or more) or looking for an infinite chain of causation. It must:

1. Use evidence of the failure (problem) to completely understand what happened before trying to decide why it happened.
2. Identify multiple opportunities to stop the problem (multiple causal factors).
3. Have built-in expert systems that can be used intuitively by problem solvers to find the root causes of each of the causal factors.

4. Help problem solvers look beyond the immediate causes to find correctable systemic issues (generic causes).
5. Help problem solvers find effective actions to prevent the problem's recurrence when all the root and generic causes have been identified.

Anything less than the thorough understanding of the causes and corrective actions based on an advanced analysis of the problem's root causes is simply a misconception. To avoid being accused of bias, there are alternative root cause analysis techniques that can be used to find a system that avoids the drawbacks mentioned, and meets their needs and the criteria my research and experience has shown as necessary to produce reliable root cause analysis results.

Getting beyond the pitfalls common with cause and effect analysis is critical for those interested in systematic elimination of quality issues. QP

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Brewed Awakening

Beer maker uses **statistical methods** to improve how its products are distributed

In 50 Words Or Less

- A U.S. brewery wanted to evaluate the way its beer was being distributed.
- The brewery took data from audits of some of its distributors and used statistical techniques to rank their performances.
- The study also uncovered how the brewery could get fresh products to consumers more efficiently.

by Tony Gojanovic and Ernie Jimenez

MANUFACTURERS OFTEN RELY on an established network of distributors to move finished goods to retailers and consumers. A typical U.S. manufacturer of beer products, for example, may depend on a network of more than 500 distributors to deliver its line of malt-based beverages to more than 700,000 retail accounts.

How can such a complex system with time-sensitive product be strengthened? Are there hiccups in the process that could delay steps or cause bottlenecks? How well are the distributors in the system managing the quality of the product from the manufacturing plant to the retailer? How can the system become more efficient?

To answer these questions, a manufacturer can use statistics to analyze its system, evaluate its distributors and make smarter business decisions. MillerCoors does just that, collecting information on seven key quality measures from more than 500 distributors, combining the data and subsequently transforming, integrating and analyzing it with a simple statistical idea to form a basic distributor-performance ranking.

Three tiers

U.S. breweries rely on a three-tier distribution system to deliver product to retail outlets, such as supermarkets and convenience stores and on-premise accounts, such as bars and restaurants. The three tiers are the manufacturer, wholesaler (distributor) and retailer.

The breweries' use of a three-tier distribution system in the United States is actually a legal requirement tied to the repeal of prohibition in 1933, which resulted in the creation of a power-balancing, intermediary layer between brewers and retailers. One of the primary advantages of a three-tier system is that the intermediary layer (distributor) provides direct contact to local markets and can develop locally intensive business strategies. In other words, the distributors who know the local and regional markets are in a better position to help make smart business decisions with the breweries.

To maximize this advantage, a distribution network must be as efficient and cost effective as possible to deliver to the market a fresh product that is damage-free and at the right place at the right time.

Grading distributors

To understand distributor performance related to overall effectiveness, MillerCoors defined seven attributes of proper distribution and collected data from 500 of its distributors. Table 1 shows definitions of the seven attributes, along with weightings (or the importance) of each one. Management determined the weightings by looking at the desirable quality of each attribute based on business considerations.

A field quality specialist (FQS) audits distributors within an assigned region of the country and collects data on the attributes for the 500 distributors in Table 1. FQS audits are twofold: inspection of a distributors' facilities and auditing retail accounts.

Data collection categories / TABLE 1

Index (k)	Attribute	Definition	Weighting
1	Out-of-code product	Product that is expired.	20%
2	Process audit score	Audit of process areas at a distributor.	25%
3	Product damage	Damaged product in the field.	15%
4	In-house audits	Internal audit results.	10%
5	Out of rotation	Incorrect staging of product.	10%
6	Quality assurance certification	Quality certifications.	15%
7	Consumer complaints	Consumer complaints attributed to the distributor indexed by volume.	5%

ZEROING IN ON Z-SCORES

The z-score, or standard score, is a common statistical method for transforming a set of numbers in a data set into common or standard units. Specifically, it's the creation of a reference distribution with a mean of zero and standard deviation of one. The formula is defined by:

z = standard score = (data value – mean) / standard deviation.

The standard score is positive when the data value is above the mean, and the score is negative when the data value is below the mean. How far a data value is from the mean is expressed in standard deviation units, which can be interpreted on a normal curve.

For example, if a distributor has a score for a particular attribute that is 1.5 standard units above the mean, it implies that score is approximately at the seven percentile level. The standard score is optimal when the underlying data are normally distributed or not too small. In many cases, however, the score provides a close approximation in which the underlying data are not perfectly normal. In some cases, a stabilizing transformation for symmetry is first applied to the original data set to achieve a better approximation. *—T.G. and E.J.*

For example, an FQS visits a distributor in Steamboat Springs, CO, first inspecting the distributor's facility and processes against a checklist of items, such as cooler temperatures, equipment condition, storage practices and the existence of a quality system. Next, armed with a random list of retail accounts serviced by the distributor, the FQS visits various retail establishments the distributor covers to assess the already-delivered product for damages and whether it is out of rotation (incorrect staging of product) or out of code (expired).

The FQS uses a handheld device to scan the universal product code on each package to identify the product type and amount. Retail accounts are either on-premise (bars, restaurants and taverns) or off-premise (supermarkets, convenience stores and liquor stores). When audits of all retail accounts are complete, data are summarized and uploaded from the handheld device to provide statistics of the results for the distributor at the exit interview. Data are also uploaded into a master database.

From a statistical perspective, this distributor audit-

ing can be characterized as stratified random sampling with proportional allocation of samples based on the distributor's market share. In addition to providing a more representative sample and better logistical control of sampling, stratified random sampling enhances statistical precision when data are aggregated by market area served by the distributor (see the sidebar "Stratified Random Sampling," p. 42, for more details about this technique).

This enhanced precision is a consequence of smaller and typically homogenous market regions, which are able to provide realistic estimates of variability, especially when compared to another market region or stratum that is markedly different.

The market area within the respective distributorships of Durango, CO, and Brooklyn, NY, are relatively homogenous. The between-strata differences, however, may be vast. If combined under simple random sampling, the differences may provide an unrealistic variance estimate for the two distributorships lumped together.

Because the samples from each stratum are independently chosen, however, variance estimates from all the independent strata, or market areas, can be combined to determine a representative estimate of the systemwide variance. Moreover, stratification ensures nothing is missed in a market, and the proportional allocation of samples allows markets to be accurately assessed based on their size.

Selecting the samples

Randomization of retail accounts is achieved through a specially designed program based on the GPS location of the distributor and serviced retail accounts. Based on previous studies, at least 20% of the retailers audited must be on-premise accounts and 80% off-premise accounts. Depending on the size of the distributor, each distributor audit requires 15, 20 or 25 random retailers to be audited.

The sampling strategy ultimately addresses a specific distributor's performance related to out-of-code product, damaged product and out-of-rotation product at the retail level. All in

BEFORE TODAY'S sophisticated and complex system of hundreds of MillerCoors beer distributors, Adolph Coors Co. used 40 wooden billboard-style boxcars, like this one, to ship product in oak casks and bottles from the Golden Brewery in Golden, CO, to a handful of western states.

Example of distributor data by attribute collected / TABLE 2

		Out of Code	Process audit score	Product damage	In-house audits	Out of rotation	Certified	Consumer complaints
Weight		0.2	0.25	0.15	0.1	0.1	0.15	0.05
Distributor	1	1.95%	87.5%	1.19%	62.5%	0%	17.6%	0
	2	1.58%	100%	0.28%	75%	1.52%	17.7%	22.4
	3	0.74%	75%	0.43%	87.5%	1.04%	8.7%	0
	4	0.68%	87.5%	0.19%	87.5%	2.76%	3%	0
	5	0.33%	100%	0.1%	62.5%	1.99%	37.1%	44.8
	6	1.05%	100%	0.61%	100%	0.83%	46.4%	75.6
	7	0%	87.5%	1.28%	62.5%	0.9%	45.1%	21.7
	8	0.99%	100%	0%	100%	0.62%	21.2%	21.2
	9	0.22%	87.5%	0.6%	75%	2.45%	49.7%	41.5
	10	0.05%	75%	0%	75%	0.79%	3.9%	28.8
	11	0.22%	100%	0.07%	87.5%	0.54%	3%	49.4
	12	0.53%	87.5%	0.68%	87.5%	4.55%	25.4%	41
	13	0.34%	87.5%	0.41%	75%	8.4%	33.8%	36
	14	0.38%	87.5%	0.25%	87.5%	1.07%	40.9%	22
	15	0.07%	87.5%	0.87%	87.5%	1.65%	41.6%	76.3
Average		0.61%	90%	0.46%	80.83%	1.94%	26.34%	32.05
Std Dev		0.57%	8.45%	0.41%	12.38%	2.11%	16.9%	23.93

Std Dev = standard deviation

all, more than 6,000 of the brewery's national retail accounts are audited through stratified random sampling (a bit less than 1% of the total retail accounts available) during a sampling year. That's about 300,000 cases of beer being observed at the retail accounts. Randomization ensures the validity of the sampled results.

Data analysis and final rankings

Data collected by the FQSs during the year are used to develop a performance ranking of distributors. The data are combed extensively to ensure data quality, and some distributors are removed from the study for various reasons. For example, some distributors might be sold during the course of the year or are no longer viable business entities.

The final count for the ranking one year was 497 distributors. Table 2 (p. 41) is a truncated representative data example or slice of 15 distributors, along with the average and standard deviation for each column. Weighting factors are shown beneath each column heading.

STRATIFIED RANDOM SAMPLING

Random sampling is the cornerstone of modern statistical inference. A simple random sample is defined as being able to choose members from a study population so each member has the same chance of being chosen.

Random sampling allows minimization of bias and valid statistical inference through the use of known sampling distributions.

In stratified random sampling, the study population is partitioned into subpopulations, or strata, which are then randomly sampled. The principle of stratification allows better estimates of population variances, especially if within-stratum differences are small and between-stratum differences are large.

Stratification allows you to say something about the entire population by combining information from various independently sampled subpopulations. Stratification also ensures each of the subpopulations will have a prescribed number of samples.

For example, if a city is trying to determine reading effectiveness by using achievement scores from various school districts, a simple random sample may not characterize the various school districts by potentially underrepresenting some districts and, by chance alone, missing others.

A stratified random sample may use educational districts as strata with a random sample taken within each of the stratums (districts) to ensure the entire city is properly represented. Additional strata could be based on grade level or family income. The size of the district also would be included in the proportional drawing of samples and the final analysis as a weighting factor. *—T.G. and E.J.*

The final rankings are based on developing a scaling for each quality attribute. Scaled scores of all the variables by each distributor are performed according to the following formula, which is known in statistics as a z-score transformation (see the sidebar, "Zeroing in on Z-scores," p. 40, for more details),

$$Z_{ik} = \frac{X_{ik} - \overline{X}_k}{S_k}$$

in which the index, k, ranges over the seven quality attributes, and i represents a data point for a specific distributor. The statistics $\overline{X}_k$ and S_k represent the average and standard deviation for a particular attribute for the 497 distributors.

The scaling formula represents a "lower is better" approach for the variables. It was decided early in the development of the ranking system that a lower overall z-score would indicate better performance; similar to the scoring system in golf.

The final rankings are determined by multiplying each distributor's z-score by the weighting factor, adding all seven attributes across each distributor and looking for the lowest value. In some cases, data first needs to be transformed to induce symmetry.

Each distributor is ranked according to the entire system performance, similar to grading on a curve in school that looks at individual students' performance in relation to overall class performance. The drawback of this method, however, is that an individual distributor may appear outstanding even if it's mediocre because others in the group are operating at a much lower level.

Fortunately, this drawback is tempered with knowledge of the subject matter or, in this case, business knowledge of minimum levels of distributor performance. Regardless, this method still targets exceptional and poor performers relative to the entire system.

Table 3 shows the standardized scores for the 15-distributor sample set in Table 2, along with the final cumulative score. The rankings are obtained starting with the lowest sum.

As you might expect, a histogram of all the final 497 distributor scores produces a fairly symmetric, Gaussian distribution, illustrated in Figure 1.

Myths associated with the size of the distributor, in terms of volume and quality, are also dispelled. Old-school thinking of volume (productivity) versus quality performance is prevalent. Figure 2 (p. 44) shows dis-

tributor scores plotted against the natural log of volume in units of product distributed.

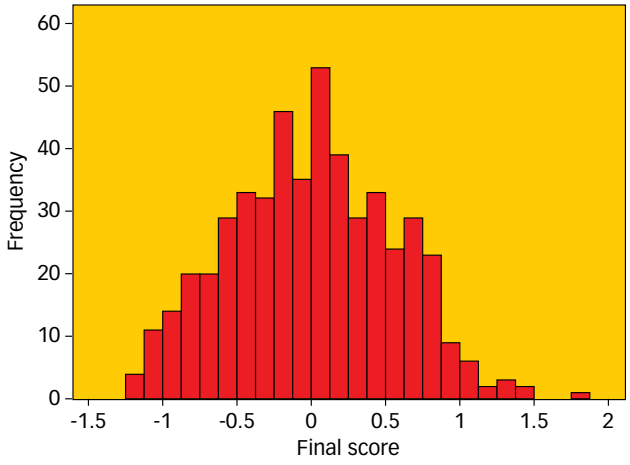
From the scatter plot, you would be hard pressed to say that productivity and quality are related measures. Figure 2 implies that quality performance is not dictated by the size of the distributorship. Opportunities to improve performance from a quality perspective are found in some large markets, which turned out to be no better than small "mom and pop" operations.

Key findings

Ranking distributors on sound study attributes is a great help in understanding the quality of the brewery's distribution system, and it has jumpstarted several initiatives. For example, in addition to identifying and using well-defined performance measures, the rankings uncovered the fact there was excessive handling of the product.

By tracing the product through the distribution system using a process flow diagram, it was discovered a package could be handled as many as 18 different times from the time it leaves the manufacturer to the time it arrives in consumers' hands. This excessive handling is not consistent with the goal of a world-class distribution system to get product into consumers' hands in the most efficient and effective manner.

Distribution of summed and weighted z-scores / FIGURE 1



Granted, sales goals are always critical and must be met. But productivity and quality are important, too, and knowing where to streamline operations and focus on areas to prevent damaging the product (excessive handling) is important insight to have when making decisions.

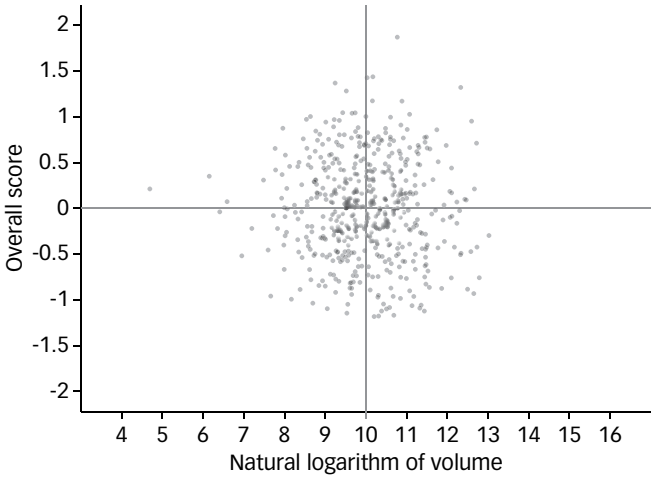
The most important aspect of the study and the greatest insight gained, however, was seeing the power of simple, well-proven statistical techniques. Huge

Common scaling for all attributes for the example data set / TABLE 3

		Out of code	Process audit score	Product damage	In-house audits	Out of rotation	Certified	Consumer complaints	Final score	Rank
Weight		0.2	0.25	0.15	0.1	0.1	0.15	0.05		
Distributor	1	2.35	0.3	1.79	1.48	-0.92	0.52	-1.34	0.88	15
	2	1.69	-1.18	-0.45	0.47	-0.2	0.51	-0.41	0.06	8
	3	0.22	1.77	-0.07	-0.54	-0.43	1.04	-1.34	0.47	14
	4	0.13	0.3	-0.68	-0.54	0.39	1.38	-1.34	0.12	10
	5	-0.48	-1.18	-0.89	1.48	0.02	-0.64	0.53	-0.44	3
	6	0.78	-1.18	0.36	-1.55	-0.53	-1.19	1.82	-0.38	4
	7	-1.06	0.3	2.01	1.48	-0.49	-1.11	-0.43	0.07	9
	8	0.67	-1.18	-1.14	-1.55	-0.63	0.3	-0.45	-0.53	1
	9	-0.67	0.3	0.33	0.47	0.24	-1.38	0.39	-0.13	6
	10	-0.98	1.77	-1.14	0.47	-0.55	1.33	-0.13	0.26	13
	11	-0.67	-1.18	-0.96	-0.54	-0.66	1.38	0.73	-0.45	2
	12	-0.14	0.3	0.53	-0.54	1.24	0.06	0.37	0.22	11
	13	-0.48	0.3	-0.13	0.47	3.06	-0.44	0.16	0.25	12
	14	-0.4	0.3	-0.53	-0.54	-0.41	-0.86	-0.42	-0.33	5
	15	-0.95	0.3	0.99	-0.54	-0.14	-0.9	1.85	-0.08	7
Average		0	0	0	0	0	0	0		
Std Dev		1	1	1	1	1	1	1		

Std Dev = standard deviation

Overall distributor score by distributor volume / FIGURE 2



stakes are involved in a company's policies regarding continuous improvement in terms of where to spend money and resources, not only to gain higher quality, but also to grow market share or sales.

A multiview approach is required, and a poorly designed study can have disastrous consequences by introducing unwanted biases, missing critical study areas or answering the wrong questions.

The use of stratified random sampling and the ability to combine contrasting data in a simple-to-understand manner—within a distributor market area and between market areas—into a compelling story was of paramount value, not only for the business, but also in selling the use of good science. QP

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Seamless Transactions

Finance company uses **service quality tools** to **drive excellence**

by Nicole Adrian, contributing editor

CUSTOMER SERVICE IS certainly important to any business in any industry. But when a company's purpose is to process millions of financial transactions on behalf of its customers who depend on the company's speed, accuracy and professionalism, it's especially important to pay close attention to treating customers right.

Pershing LLC, a BNY Mellon company, is a global provider of clearing and financial business solutions. With headquarters in Jersey City, NJ, the company has more than 5,000 employees.

In 50 Words Or Less

- After discovering poor ratings related to the company's service-level performance, a team from Pershing LLC tackled customer service issues.
- Using quality tools and methods, the team developed two critical service-level management tools.
- For its work, the team earned a bronze award at ASQ's International Team Excellence Competition.

Although customers were satisfied with Pershing's products and services, they were dissatisfied with the company's service support. This information caused prospective customers to choose another firm for its business. Upon discovering this and learning that only slightly more than half of its customers indicated they would recommend services to other companies, Pershing decided to tackle its customer service shortcomings head on.

During a two-year period, a team of Pershing associates used quality tools and methods to find opportunities for improvement and final solutions to problems. In the end, the team developed two critical service-level management tools—a quality scorecard and a service-level dashboard—which customers and Pershing management use to drive service excellence and efficiency, and to compete in the ever-changing financial marketplace.

For its work, the team tied for a bronze award at the International Team Excellence Competition during the 2009 ASQ World Conference on Quality and Improvement. Although the project was led by the quality management office (QMO), numerous Pershing employees participated in the project throughout its life. Representing the team at the competition were Tim Keough, Julie Kousen, Michael Tornello and Jim Halloran, all Pershing vice presidents, and Evan LaHuta, Pershing's QMO director at the time.

Six steps forward

For background on customer service, the project improvement team focused on data found in numerous outlets: customer feedback, operational reporting, internal feedback, organizational goals, contract requirements and regulatory requirements. This data indicated Pershing's service-level performance was about 95%, and an independent, third-party survey revealed only 60% of customers were likely to recommend Pershing. This all culminated in a lost business opportunity: a lack of attention to customer service led one multi-million dollar company to choose a competitor instead.

"We had some lost business opportunities that really brought to light the issue and brought to our attention the need to push this through," Kousen said.

Realizing the service numbers needed to change for the better, the team turned to Pershing's six-step project selection process (gather, analyze, present, validate, decide and measure) to distill inputs into viable project goals.

From the resulting drivers and goals, four goals that would establish a starting point for true quality metrics and continuous improvement were identified for the project:

1. Determine defined and measurable service-level targets.
2. Give operational-efficiency customers increased transparency.
3. Provide a framework for continuous improvement.
4. Systematically measure critical customer interactions.

From here, the team saw clear opportunities and gaps to address, including expanding revenue and market share—both of which are key to Pershing's commitment to its shareholders.

The team knew the results of whatever project it chose could have positive tangible and intangible outcomes, including minimized resources, faster turnaround times, improved margins and expanded management tools.

To assess the degree of potential project impact on each goal or performance measure, the team used management consensus and brainstorming. The areas with the highest degrees of impact included faster turnaround time, expanded management tools and increased customer loyalty.

Getting on board

Before working on project selection, the team determined who the stakeholders were and how they should be involved to ensure their input was considered as goals were developed and projects assigned.

The team used a suppliers, inputs, process, outputs and customers diagram to identify all internal and external stakeholders. By using this tool to analyze the high-level process flow, the team kept focus on all suppliers and customers. From a large group of high-level stakeholders, the team picked four stakeholder groups within the organization:

1. Operations.
2. Account management.
3. Technology.
4. QMO.

To assess how the project would potentially affect stakeholders, the team looked at optimistic and pessimistic impact for each group. The team also focused on the operations managers, as they would be

PERSHING EMPLOYEES (from left) Evan LaHuta, Jim Halloran, Julie Kousen, Tim Keough and Michael Tornello represented their team at the 2009 International Team Excellence Competition.

most impacted by any project.

Stakeholders were identified as senior executives and large-business unit leaders. To ensure they were represented on the project and to provide subject matter expertise, the stakeholders assigned representatives from their business units to the project team.

The stakeholders' involvement in the final solution selection process varied by expertise and their roles within the organization. Three types of involvement were identified: organizer, contributor and approver.

The team made sure stakeholders had the proper buy-in by holding approval presentations with other internal committees. Additionally, the team presented the project to the executive committee and business review, which is made up of managing directors from across the firm.

It was vital for the team to incorporate stakeholders from all facets of the organization.

"I think the project speaks to creating an infrastructure plus a culture," Halloran said. "To have the culture embraced by the firm, you really need to have representatives from across the firm. Everybody was going to be impacted by [the project] one way or the other."

Opportunities for improvement

After determining the service issues and project goals, the team—with the help of focus groups, which often included customers who helped identify issues and confirm the team was moving in the right direction—brainstormed improvement opportunities for each performance measure. In total, 20 opportunities were listed on a data-collection form. The team met with focus groups a second time to assess each of the improvement opportunities.

Each group rated its overall satisfaction with the performance of each potential improvement opportunity and how important it was for the business needs. Ratings, based on a five-point scale, were recorded on the data-collection form. Using the five-point scale, the focus group results were plotted on a scatter plot chart

to identify the improvement opportunities that would yield the biggest return. Out of 20, five improvement opportunities were eventually identified.

Again using Pershing's six-step approach, the research results for improvement opportunities were analyzed to narrow the options. A decision matrix was used to determine the final improvement opportunity. The team members who didn't know how to complete a decision matrix were trained to do so. From there, each team member completed a decision matrix independently, and then the team met to review the results and, through consensus, provided final ratings for each opportunity.

From all this work, plus more discussion and backing from stakeholders, two opportunities with nearly equal ratings were chosen: real-time service-level monitoring (SLM) and reporting.

Selecting solutions

The team used numerous tools, including competitive benchmarking, to develop a potential solution to the two opportunities, which led to productive brainstorming and focus group discussions (see Figure 1). Focus groups were expanded to include customers and industry experts, along with Pershing associates.

Identifying key pieces of qualitative and quantitative data—such as the current competition's limited capabilities and the confirmation that superior service quality is the No. 1 driver for financial solution institutions—led to a high-level list of nine potential solutions. All of the solutions were examined for the opportunity to either develop in-house, purchase from a vendor or a combination of both.

For SLM reporting, the potential solutions were:

- Manually created reports.
- Online ad-hoc data.
- An auto-generated report quality scorecard.
- SLM reporting dashboard.

For real-time monitoring, the potential solutions were:

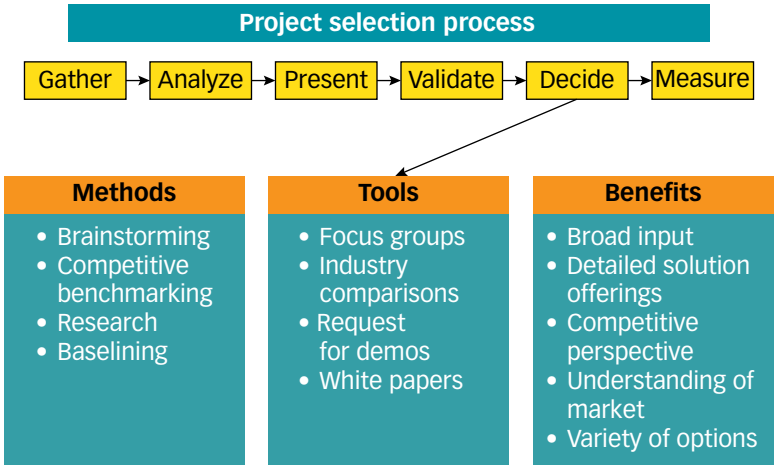
- Alerts.
- Online real-time dashboard.
- Near real-time dashboard.
- Online ad-hoc data.
- Monitoring board.

The criteria used earlier for determining final improvement opportunities were also applied in selecting the final solution. The core criteria were then expanded to include solution-specific criteria, such as cost and usability. The team also used a request for proposal and a proof of concept to compare vendors and determine costs.

The project team analyzed the data by again using a decision matrix, which rated each of the nine solutions against the selected criteria. The auto-generated scorecard was determined as the best solution.

After review, stakeholders raised concerns about customers having better access to Pershing's performance data than themselves. To address these concerns, the project team made the decision to include

Methods and tools used to develop potential solutions / FIGURE 1



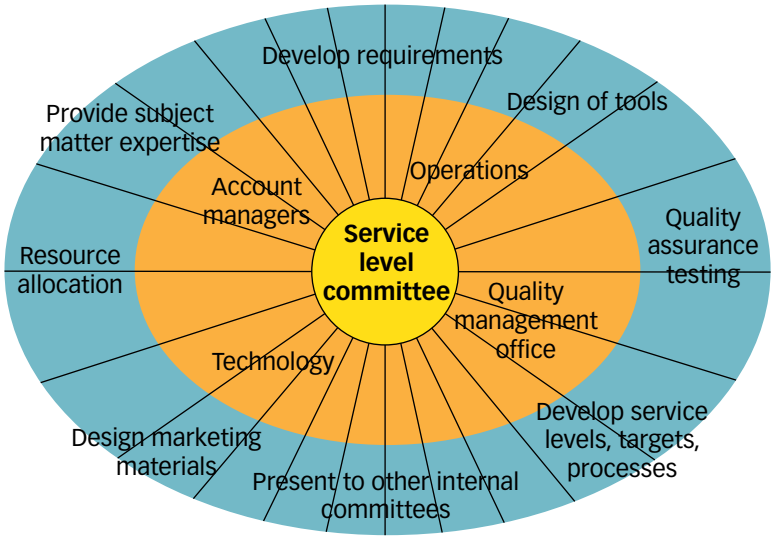
the second-highest weighted solution, a real-time transaction dashboard, in the final selection. The dashboard would allow insight into Pershing's performance for managers prior to reporting this information to customers.

For the final solution, the team decided to pair two of the potential solutions:

- **Quality scorecard:** An auto-generated, online report published monthly for all customers. The report reflects Pershing's performance in meeting established target service levels from the operational processing cycle times to the individual customer level.
- **Service-level dashboard:** Offers real-time performance monitoring for Pershing's operations group. Operations managers can now take action before items to be processed miss related target service levels, and they can also identify performance trends.

The project team evaluated the final solution against the project goals and the expected outcome of each goal. The stakeholders presented, reviewed and validated this evaluation.

Types of internal and external stakeholder involvement in implementation / FIGURE 2



Putting into practice

In implementing the final solution, the team followed an eight-step plan, including designing and developing the reporting engine and interfaces, executing user-acceptance testing and performing a continuous improvement analysis once implemented.

All internal stakeholders were updated on the implementation process through e-mail status updates. Each stakeholder group had specific responsibilities—for example, the operations group assigned service levels and performed testing, and external customers assisted through user acceptance testing (see Figure 2).

Many changes were made that allowed the team to ingrain a metrics-based culture at Pershing. The biggest shift came from the operations teams. Previous to the new project being implemented, the teams could have taken an indeterminate amount of time to complete requests. After the project, however, 495 target service levels were assigned, and the operations teams changed their workflows to meet them.

Additionally, managers now used real-time dashboards and included the data in their written supervisory procedures. To ensure the results were sustained, numerous reports were created to monitor performance. More than 10 Six Sigma improvement projects have been completed based on this data.

The new measurement system was validated through beta testing. First, operations teams participated in an internal rollout to review how transactions were being measured and to begin updating their workflows. Then, the team conducted beta testing with customers to get their feedback on the quality scorecard design and contents. The constant monitoring through the real-time dashboard and monthly scorecard analysis has helped the team sustain the results.

After implementing the project solution, numerous tangible and intangible benefits were realized. By developing a measurements-based culture—with a dashboard, scorecard and Quality Cup (an interdepartmental competition)—and by continually striving to improve performance using Six Sigma, the team succeeded in meeting organizational goals.

Intangible benefits realized were:

- **Increased customer satisfaction:** Pershing received positive feedback from customers, who

said they were satisfied with faster problem resolution.

- **New business win:** Quality scorecards and service excellence are now part of marketing materials, and customer service is no longer seen as a gap by prospective customers.
- **Increased customer loyalty:** Personalized reporting for the top 20 customers has strengthened the company-customer partnership.
- **Improved quality culture:** Managers now manage through metrics, the Quality Cup puts focus on service excellence, and additional quality metrics are being captured.

Additionally, five tangible benefits were realized:

- The team not only met its goals, but also far exceeded past management expectations.
- By the end of December 2008, the team measured 495 processes and almost 1 million transactions during that month.
- Service-level performance was measured and improved (see Figure 3). For six months, targets were met 95% of the time. From there, the team tightened 10% of the service levels, and in 2008 the team raised the goal to 97%.
- A baseline for continuous improvement was established.
- The team went from having 75% of its service levels processed the same or next day to having more than 98% of its service levels processed the same day or the next day.

The team realized other notable results:

- Improved efficiency by reducing Pershing and customer rework from 6.5% to 5.3%.
- In March 2009, the team met 98.6% of service-level targets.
- Error rates dropped from 4.5% to 2%.
- Survey results showed the "likelihood to recommend" score jump from 60% to 78%.

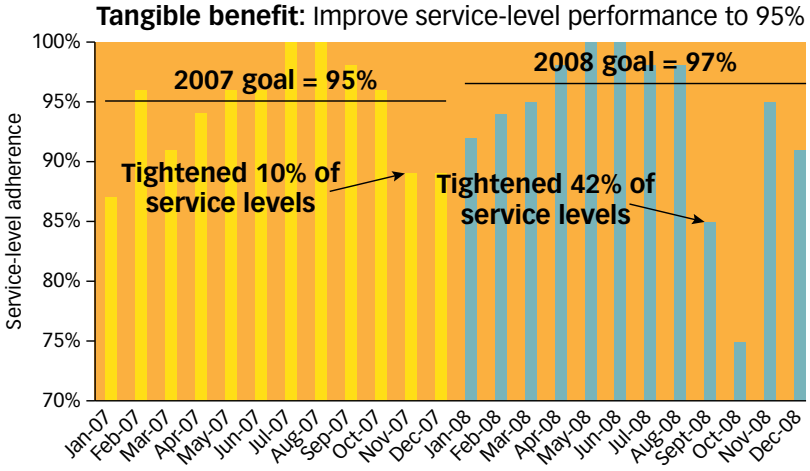
From the time the project solution was implemented, the team made sure to continue to touch base with the stakeholders and customers. Internal service-owner council meetings are held each month for operations managers to discuss any reporting or process issues. The team also hosts a quarterly quality forum so customers can discuss the scorecard and receive updates on future improvements.

"Customers found [the scorecards] to be very interesting because we had shown them things we had never shared with them before," Kousen said. "We had true and real data they could see. What they could do was validate how they perceived performance and service compared to the actual reports. They were very interested in that."

When it was all said and done, the team found Six Sigma to be an important project tool. Six Sigma provided some project structure, especially in terms of the scope and stakeholder identification, Halloran said. Six Sigma was also used for process improvement.

"Once we had data as a baseline, Six Sigma really helped us get to the next level," Tornello said. "Those tools really helped us focus on how to make those improvements."

Tangible and intangible results realized / FIGURE 3



Applying customer feedback

Changes have already been made to some elements of the project solution, mostly based on customer feedback. The quality scorecard was just the first step in Pershing's customer service improvements.

"Customers saw [the scorecard] and asked for more," Kousen said. "We've added more data to the quality scorecard. As customers have become comfortable, they have been asking for more data. We have provided them with that so they can implement quality improvements in their own offices."

Additionally, Pershing started sending out a standard transaction survey for all customers, Keough said. After customers call, they receive a survey in which they indicate the improvements they have seen in service delivery and customer service.

Perhaps one of the most important changes that has come from project implementation, however, has been the positive shift in creating a quality and continuous improvement culture at Pershing. Associates are beginning to anticipate and embrace new processes, new targets and new programs related to improving customer experience and increasing customer satisfaction, Kousen said.

Moving forward, Pershing associates will continue to keep the company as customer-centric as it has always been but will continue to set the service-level bar higher and higher.

"We continue to be customer-centric, but now we're being smart about it," Keough said. "We're capturing data, focusing on results and taking a much more systemic approach to meeting customers' needs." QP

SEE THE FULL PRESENTATION

This article is based on Pershing LLC's presentation at the 2009 International Team Excellence Competition. The full presentation can be viewed at http://wcqi.asq.org/2009/team-competition/presentations/pershing-llc_2009-bronze-winner.pdf.

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Lesson Learned

Use Toyota's recent troubles as an educational opportunity

LAST FALL, when I remarked to university educators that a particular decision-making tool was widely used at Toyota, their response was respectful interest. When I did the same in February, a similar group laughed derisively at the comment, as though I were being ironic.

For that audience, Toyota's reputation for quality had become a joke, a tragic reversal for a company accustomed to admiration and emulation.

Last year, Toyota was the world's eighth most valuable brand—down from sixth a year earlier—and worth $31 billion.[1] The company was named among the 100 most ethical firms, and books—most famously,

The Toyota Way[2]—spread the gospel of its quality systems from manufacturing to other industries, including healthcare.

Not so fast

The decline in market share, recent recalls and Toyota's CEO's public admission of a downward spiral led the *Economist*[3] to cite another book that may help diagnose Toyota: *How the Mighty Fall*.[4] As additional massive recalls were announced, negative press has turned melodramatic.

At the same time, the company has tried to recover, employing crisis management aligned with its espoused values: apologizing, telling the truth, avoiding finger pointing and taking direct action by stopping production to focus on making things right for customers.

Whatever the lasting damage to Toyota's brand, competitive position or ability to recover, the company's troubles have a special significance to quality professionals. Toyota's situation is different from other manufacturers that had safety problems and conducted recalls—Mattel or Bridgestone/Firestone, for example. No other organization, whatever its success in winning brand recognition or quality awards, has captured quality professionals' imaginations like Toyota.

In some respects, the company represents the culmination of the United States' decades-long adaptation of Japanese tools and techniques for improvement: Toyota offers a compendium of "how to." Its approaches have been successfully applied in a broad range of organizations. Now as the role model's reputation is damaged, there is significant risk to the credibility of those who have held it up for admiration.

Room for growth

In the Toyota story, there are warnings and opportunities for quality professionals. While many practitioners have applied the company's lessons intelligently—with systems perspectives and full awareness of the perils of knowledge transfer—others have not. They have reverted to selling tools and techniques by invoking the Toyota brand.

It's not a bad concept for marketing, but over time, it can be perceived as a fad: a set of practices that overpromise. Clients may have wondered, "Why didn't we become Toyota?" Now, of course, they may be grateful they didn't.

We should be warned that Toyota's brand is not quality's brand. When a brand suffers major blows—including media frenzy, government investigations and allegations of long-standing inattention to risks—successful marketing can become an albatross. The lesson applies to consultants and other quality professionals who need to make a case for improvement initiatives: Quality is a profession with a body of knowledge (BoK). It is not dependent on any single model, brand or training.

While our most persuasive arguments are often embodied in stories, narratives are perilous. Check out textbooks or trade journals from a decade ago for glowing case studies of quality transformation. How many fulfilled their promise? How many imperiled the credibility of the principles and practices they were intended to illustrate?

Peter Drucker wrote, "Failures, unlike successes, cannot be rejected and rarely go unnoticed. But they are seldom seen as symptoms of opportunity."[5] He understood failures as opportunities for positive, disciplined innovation. Innovators create value by applying what is already known in new ways.

Let that be a lesson

How might quality professionals use Toyota to spark innovation? First, focus on the full range of quality's BoK. Do we have perspectives that allow us not only

to capitalize on Toyota's success, but also to explain to a cynical public the dynamics of its failures? Do we have an enterprise perspective? Can we tell the rest of the story?

To what degree have we limited ourselves to functionary, and now defensive, roles by focusing on tools and techniques? Is our reaction, "But the tools work?" Can we offer a big-picture response based on quality's role in global economics and organizational life cycles? What is our level of understanding of strategic risk, especially in the supply chain? Do we grasp the implications of risk within a stakeholder approach to quality, involving ethics and social responsibility (SR)? Do we bring to the table an integrated view of the profound knowledge W. Edwards Deming advocated? How we answer these questions may be an indication of our willingness to innovate and to reinvigorate the profession.

Individually and collectively, we have the opportunity to define the quality profession by articulating how its BoK not only applies to improving efficiency, but also has the power to explain enterprise risk and strategies for improvement. This may require revisiting our BoK to ensure it integrates what we have learned about risk, stakeholder management and auditing for corporate SR. We may need to ask whether our education, training and certifications incorporate that knowledge.

We should use Toyota as our test. Can we analyze and explain its failures—and, we hope, its recovery—as convincingly as we did its success? QP

NOTE AND REFERENCES

1. For more information on brand valuation, visit Interbrand at www.interbrand.com. For a list of the world's most ethical companies of 2009, visit Ethisphere at www.ethisphere.com/wme2009.
2. Jeffrey Liker, *The Toyota Way*, McGraw-Hill, 2003.
3. *The Economist*, "Toyota Slips Up," Dec. 10, 2009.
4. Jim Collins, *How The Mighty Fall*, Harper Collins, 2009.

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For more quality-related articles on recent automotive recalls, read "TPS Troubles" on p. 8, Keeping Current on p. 12, and what five experts have to say on the situation and the lessons that come from it on p. 16.

BY ROBERT L. MASON
AND JOHN C. YOUNG

Detection Decisions

Select the right statistical methods to examine data, find outliers

A POTENTIAL OUTLIER is an observation located a considerable distance from the main data swarm. The inclusion of such outlying observations in a data analysis can produce erroneous estimates of means, variances and the correlations between variables.

In general, this distortion increases with the distance the point is located from the main data swarm. With a single variable, an outlier will be separate from and stand out on either end of the data set. This is usually readily apparent in data plots.

For example, consider a set of 81 observations of bottom sulfur readings from a chemical reactor. Figure 1 is a frequency histogram of these readings. Notice that the last two intervals—composed of the two largest observations—are somewhat removed from the cluster of the remaining intervals containing the other 79 observations. The inclusion of these two large observations in the data set will inflate the sample variance and increase the size of the sample mean. A Shewhart control procedure would designate these two observations as potential outliers.

Outliers in an industrial process become more and more difficult to detect with an increase in the dimensionality of the data. Although an outlier may not stick out on the end of the data distribution for multiple variables, they will stick out somewhere.

For example, consider a set of bivariate data in which the outlying observation does stick out. Figure 2 is a scatterplot of the waist size and chest size of a random sample of 147 college students. Notice there are only 80 visible points in the plot because there are multiple observations at some points.

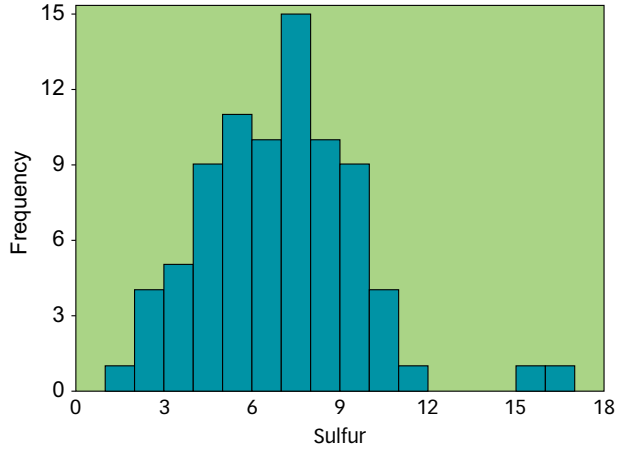
The two circled observations in Figure 2 are potential outliers. The first observation (27, 28) is marginally different from the others, but the second observation (47, 43) is definitely different from the others. Why does this latter observation stick out? Because it is the only observation in the data set in which the chest size of the college student is smaller than the waist size. It is interesting to note that a statistical control procedure using the T^2 statistic to locate outliers designates the second observation as an outlier but does not designate the first observation as an outlier.

Different ways to go

The search for determining the observations that stick out in a multidimensional data set has led to the development of many different statistical procedures for outlier detection.

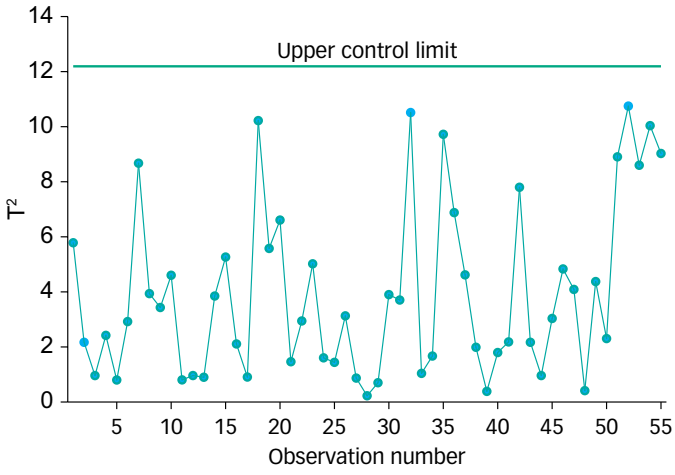
One example is the procedure based on examining the data set in a subspace of the principal component space.[1] Principal components are linear combinations of the original variables that are orthogonal to one another and are derived using either the correlation or covariance matrix of the data.

Frequency histogram of bottom sulfur readings / FIGURE 1

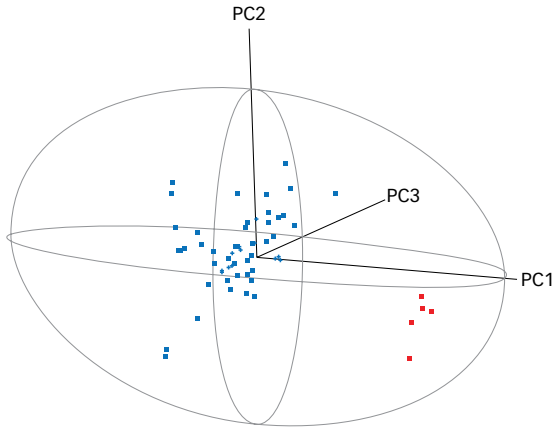


Scatterplot of waist size and chest size of college students / FIGURE 2

T^2 chart for preliminary data / FIGURE 3



Plot of preliminary data using first three principal components (PC) / FIGURE 4



The first few principal components of such data are sensitive to changes in variation and covariation of the variables, while the last few principal components are sensitive to strong collinearities in the data. Reducing the dimensionality of the data by using only the first two or three principal components often allows an analyst to visibly locate outliers in principal component plots, which contributes to variation problems.

Another popular outlier detection procedure is based on using a control chart of the T^2 statistic and designating points with T^2 values outside the control limits as outliers.[2] When the sample data contain clusters of outliers, however, this statistic is subject to masking and swamping problems. Clustering outlier observations on the fringe of a data swarm is the main cause of problems called swamping and masking.

Swamping occurs when the cluster pulls the data swarm toward it. In doing so, non-outlying observations on the fringe, opposite the cluster, will appear farther from the data swarm and be designated as potential outliers. Masking occurs when the cluster of outliers pulls the data swamp toward it and inflates the estimates of the mean and covariance parameters in the directions of the cluster so individual observations within the cluster do not show up as outliers.

Some of the more recent procedures for detecting multivariate outliers include those based on the use of robust estimators. Such outlier detection schemes are not subject to the masking and swamping problems that can plague methods based on common estimators.

And outliers do not have the same ill effects on the robust estimators as they do on the common estimators. Robust estimates of the variances, means and correlations of the related variables, however, may be far removed from the true values of these statistics. In addition, many of these procedures are limited from practical use because they can be computationally intense.

Better detection schemes

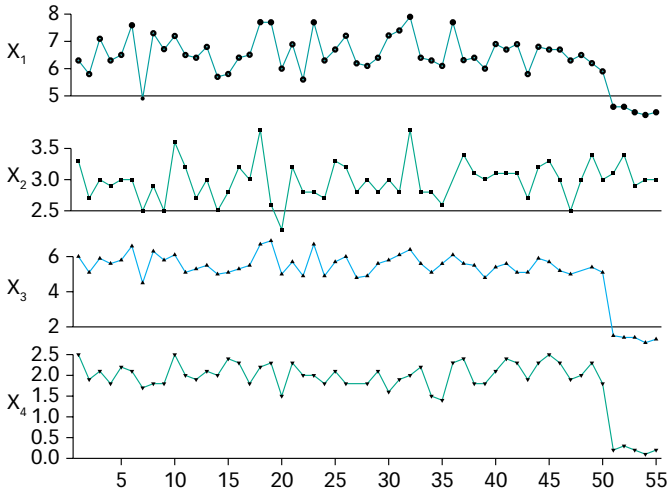
A preliminary step that would improve these outlier detection schemes is to follow the procedure recommended when creating a multivariate statistical control procedure for an industrial process.[3]

In a preliminary data analysis (that is, a phase I analysis) of such a procedure, a set of data is obtained under good operational conditions as judged by the process engineer. The data set then is subjected to a detailed data analysis from numerous perspectives. Charts, graphs and plots are used to locate unusual patterns and clusters in the data set. When these occur, irregularities are investigated for cause. This type of detailed data analysis will remove many of the outliers and data abnormalities that could be difficult for classical statistical procedures to detect.

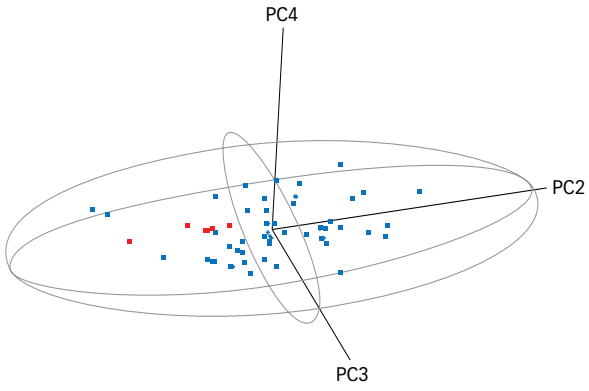
To illustrate this approach, consider a preliminary data set consisting of 55 observations on four variables. Suppose no detailed data analysis has been performed to search for data abnormalities. With $\alpha = 0.01$, we use the T^2 statistic based on the common estimates of the mean vector and covariance matrix to scan for potential outliers. Figure 3 shows the T^2 control chart.

Because none of the T^2 values signal in the chart in Figure 3, you might conclude that no outliers are present in the data. If we had plotted the data using the first three principal components of the correlation matrix and scanned the

Time-sequence plot for variables of preliminary data / FIGURE 5



Plot of preliminary data using last three principal components (PC) / FIGURE 6



resulting plot, however, a completely different conclusion would result. The first three principal components explain more than 98% of the total variation present in this data set. A principal component plot for these three components is shown in Figure 4 (p. 59). The data swarm is enclosed in a 99% ellipsoid that corresponds to $\alpha = 0.01$ and is equivalent to the T^2 chart in Figure 3 (p. 59).

Although no observation is outside the T^2 ellipsoid in Figure 4, two different data clusters are clearly evident in the plot. The larger cluster (the blue points) consists of the first 50 observations plotted in the T^2 chart in Figure 3. The smaller cluster (the red points) contains the last five observations located on the T^2 chart. The outlying observations in the smaller cluster were added to an original data set of 50 observations (with no outliers) to illustrate how a cluster of outliers can mask the performance of the T^2 statistic. A detailed data analysis based on use of the principal component plot in Figure 4 would have helped the analyst quickly spot this cluster of potential outliers.

These five observations would also have been detected as potential outliers if a time-sequence plot of each of the four variables had been examined. These plots are shown in Figure 5. Notice the last five observations for variables x_1, x_3 and x_4 all have much lower values than the rest of the observations on each variable. These three variables are the ones that dominate the first three principal components. In contrast, the last five observations on variable x_2 do not show any such change from the rest of the observations. This variable loads the heaviest on the fourth principal component, which has little influence on the results.

If you examine a plot of the data of the last three principal components, there is no evidence of the separation of the small cluster of outliers. This is shown in Figure 6. Notice the 50 observations (the blue points) in the large cluster now overlap with the five observations (the red points) in the small cluster.

Recall that plots of the first few principal components are most sensitive to changes in the variation and covariation among the variables. The data separation seen in the principal component plot in Figure 4 is caused by the influence of the five outliers associated with variables x_1, x_3 and x_4 on the overall variation based on the first principal component. As shown in Figure 6, these outliers do not have such an effect on the overall variation based on the last three principal components. QP

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2. Robert L. Mason and John C. Young, "Another Data Mining Tool," *Quality Progress*, February 2003, pp. 76-79.
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ROBERT L. MASON is an institute analyst at Southwest Research Institute in San Antonio, TX. He has a doctorate in statistics from Southern Methodist University in Dallas and is a fellow of ASQ and the American Statistical Association.

JOHN C. YOUNG is a retired professor of statistics from McNeese State University in Lake Charles, LA. He received a doctorate in statistics from Southern Methodist University.

BY WILLIAM O. NEWCOMB

Oh, the Places You'll Go

ASQ certifications open doors to new opportunities

IN 1988, after I had been working in the quality control department of a major alkaline battery producer for 10 years, I had the opportunity to move to the quality assurance department.

In my new department, the manager handed me a booklet from the American Society for Quality Control—that's what ASQ was called in those days—and told me I was going to become a member. I remember thinking, "Why not? The company is paying for it and who knows? I might learn something."

The first of many

Becoming a member turned out to be the single most important step in my career, especially because joining ASQ allowed me to pursue certifications.

In the subsequent year, one of my company's main objectives was to have its employees become certified. After a lot of studying, praying and losing some hair, I passed the certified mechanical inspector exam, which is now known as the certified quality inspector exam.

I became a believer in certification.

After passing the exam, my work and certification schedule got interesting. I began preparing for the certified quality technician (CQT) exam, which ended up taking a few years to complete.

During that time, because I was the company's only ASQ-certified employee, I was assigned to plan, furnish, set up and carry out procedures, and supervise a calibration lab and system that contained more than 3,000 pieces of measuring equipment based on ISO 9001. I completed the project with assistance and information from ASQ and members of the local ASQ section.

The next year, an ISO-approved auditor inspected the facility—and we passed. Afterward, the company learned that it was because of the calibration program and help from ASQ and its certification programs that the facility succeeded on the first try.

Lending a hand

Currently, I work for a company that builds nuclear power plants. Although I have stopped my personal certification activities, I now help other ASQ members obtain certification and encourage them to become their local section's certification and recertification chairs. It is especially important, in light of the current economy, to be prepared and up to date on training and new ways of doing things; certification can help with this.

Be a **mentor to those** seeking certification. **Help and encourage** others.

On the road

During the next few years, I passed the CQT and certified quality improvement associate exams. It was not easy, but it felt good to pass them.

My quality education didn't stop there. In 2000, I was chosen as ASQ's Inspection Division's International Inspector of the Year. This was humbling, and I appreciated it because the award came from my peers.

Also in 2000, I retired from the battery business. I took my certifications and hit the road as a consultant, teacher and contract worker. In the places I visited, I was able to see how items were made and meet a variety of people.

After traveling as a consultant, I went to work for a Japanese-owned company. It was a great experience—I had first-hand training and hands-on experience in processes such as 5S and lean. I traveled around Japan and returned to Europe, seeing places and meeting people I would not have seen or met if that manager had not handed me the ASQ booklet more than 20 years earlier.

If you already have all the certifications you want, be a mentor to those seeking certification. Help and encourage others, and leave a little of yourself behind so others can benefit from your knowledge.

I challenge those who are in management positions to encourage those who report to you to become ASQ members and make it an objective for them to become certified. There is no better way to improve employees, quality departments and companies. It will become a value-added continuous improvement process. QP

WILLIAM O. NEWCOMB is a quality engineer and specialist at Westinghouse Electric Co. in Rock Hill, SC. He earned his bachelor's degree in business management at Limestone College in Gaffney, SC. Newcomb is a senior member of ASQ and a certified quality improvement associate, mechanical inspector and quality technician.

BY JOHN E. "JACK" WEST

Prevent Defense

Take action to refocus your quality management system

ISO 9001 has become a well-established baseline for quality management worldwide. Its requirements constitute the absolute basics of an acceptable quality management system (QMS). But, in these times of sparse resources, it is often impractical to devote equal attention to every part of the system. At the same time, many practitioners struggle with the clause on preventive action.

Now is an ideal time for organizations to revisit the preventive action concept using innovative thinking. Effective preventive action requires focus and attention, both of which can be addressed via a method that starts with prioritization and ends with improvement actions.

Considering failure

The process starts with two actions for each QMS process, followed by two actions for prioritizing high-risk processes. But, if you haven't already, you should identify the QMS processes.

Ask how each process can fail and what the consequences of those failures are. One way to do this is to use the concepts of process failure mode and effects analysis (PFMEA), which gives us a method for managing the risks associated with potential process failures.

PFMEA is a technique for studying the causes and effects of failures before they occur. In addition to analysis of the potential failure modes and their effects, it is very common to analyze the criticality of each potential failure mode. This requires the following actions:

- For each potential failure, list the possible failure modes.
- For each failure mode, develop a description of the potential effects.
- For each potential failure, estimate (on a scale of 1 to 10, with 10 being the worst) the severity, probability (or frequency) of occurrence and detectability (ability to detect the potential cause and prevent the failure).
- Multiply the rankings to create a risk priority number that can be used to prioritize preventive actions.

Be careful not to make this a bigger project than it needs to be. Remember, all you want to do is determine the high-risk processes. This involves understanding process inputs, outputs, internal process measures (if any), process monitoring methods and expected process outputs. With the possible exception of measurement, all QMS processes should have each of these elements. If some elements are missing or insufficient, they should be noted. If any are missing for high-risk processes, fast action may be needed to rectify the situation.

Priority issues

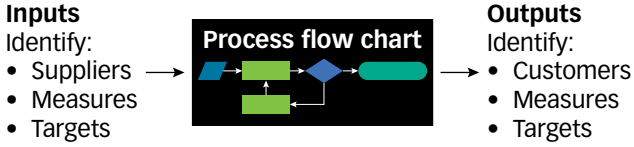
What processes typically emerge from prioritization? They can be very different from one organization to the next, but regardless, the processes can be categorized using ISO 9001 clauses. The following clauses are used most often:

- Clause 4.1, general requirements—outsourcing.
- Clause 5.1, management commitment.
- Clause 5.4.1, quality objectives.
- Clause 5.6, management review.
- Clause 6.1, provision of resources.
- Clause 6.2.2, competence, training and awareness.
- Clause 7.3, design and development.
- Clause 7.5.1, control of production and service provision.
- Clause 7.5.2, validation of processes for production and service provision.
- Clause 8.2, monitoring and measurement (particularly 8.2.1, customer satisfaction; and 8.2.3, monitoring and measurement of processes).
- Clause 8.4, analysis of data.
- Clause 8.5, improvement.

After prioritization is complete, there are two more concepts to help assess the high-risk processes. They involve understanding how the process is operated, measured and controlled. You should be able to demonstrate that all high-risk processes operate continually in a state of control. It might be helpful to answer the following questions for each high-priority item:

- Have criteria and control methods been determined for control of the QMS processes?
- Is information available to support the operation and monitoring of the processes?

Process map—flow chart and measures / FIGURE 1



The best changes are those that **foolproof the process** and make occurrence of the possible failure **all but impossible.**

- Are processes measured, monitored and analyzed, with appropriate actions taken to achieve planned results and continual improvement?
- Is the QMS established, documented, implemented, maintained and continually improved?
- Have provisions been made to ensure control of outsourced QMS processes?[1]

If the processes have not been previously mapped, doing so can prove useful at this stage (see Figure 1).[2]

More on measurement

This brings us to measurement, which is a part of the mapping process but is important enough to discuss in greater detail.

For many processes, particularly those that are capital-intensive, it may be critical to understand which process parameters are the causes of process performance. This concept is important when solving the basic problems that cause processes to miss targets. It is also important when developing new or reengineered processes because it helps establish which process parameters should be monitored or measured over time to ensure the process continues to meet requirements.

The concept is simple, but its power is often ignored. The idea is that most process output measures cannot be directly changed. Rather, they are response variables—that is, they respond to changes in other variables within the process.

These other variables can be changed and are called independent variables. To get better results out of the process, you must determine which of the many independent variables in the process affect process performance and learn to optimize them.

It is critical to remember that the process output results (response variables) are difficult to change unless you identify and change the independent variables. The best changes are likely to be those that foolproof the process and make occurrence of the possible failure all but impossible.

For example, you can't make candy sweeter unless you determine what makes it sweet and change the amount of the ingredients that make it sweet. Likewise, it is not practical to improve a management review process by writing memos; you need to get the attention of the responsible top managers with real data.

For critical activities that must be completed correctly by employees to achieve a desired result, the controlling independent variables may be the effectiveness of training and amount of practice.

You may be wondering how to determine which of the many variables of your process are the ones that, when changed, will ensure the process will not fail. One way to determine that is to ask those working in the process. It is also useful to have the workgroup or process team develop a cause and effect diagram (also called an Ishikawa or fishbone diagram) to identify the likely candidates.

Some processes contain activities or steps that involve a great deal of uncertainty. For example, the process for managing a maintenance process will necessarily have a step in which the availability of a critical repair part is determined. No matter how well you have selected which parts should be hand, it is reasonable for the maintenance process team to consider including in the process a provision for the situation in which a critical part is not available. In other words, think through a plan B for key foreseeable uncertainties in the process.

Again, don't make the mapping, measurement and improvement activities a bigger project than needed. All you want to do is determine the process activities you will need to change or foolproof to reduce risk. Go about it at your own pace. The key to making progress is to start, even if you need to start small. QP

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2. Charles A. Cianfrani and John E. "Jack" West, *Cracking the Case of ISO 9001:2008 for Service*, ASQ Quality Press, 2009, pp. 139-147.

GO WEST

John E. "Jack" West is one of many quality professionals who have contributed to Standards Outlook over the years. To see more of his work, as well as that of his fellow contributors, visit www.qualityprogress.com.

JOHN E. "JACK" WEST is a management consultant and business advisor. He served on the board of examiners for the Malcolm Baldrige National Quality Award from 1990 to 1993. West is past chair of the U.S. Technical Advisory Group to ISO/TC 176 and lead delegate to the committee responsible for the ISO 9000 family of quality management standards. He is an ASQ fellow and co-author of several ASQ Quality Press books.

QP TOOLBOX

Wireless recorder

The Eagle power quality (PQ) wireless recorders from Power Monitors are digital recorders that monitor real-time PQ data and download it remotely. They measure 5-3/8" x 2-3/8" x 1-13/16" and weigh less than 1 lb. each.

The Eagle all-weather recorder remotely downloads data to selected Palm PDAs or Bluetooth-equipped laptops. The Eagle recorder can access PQ data being recorded behind a locked security fence in a transformer buried underground, or from restricted areas where distribution voltages pose a safety hazard to crews.

The Eagle features 4MB of memory that can be downloaded for a detailed analysis when needed. You can also download the data to your PC using a standard USB connection.

- Call: 800-296-4120.
- Visit: www.powermonitors.com.

Digital junction box ▼

Rice Lake Weighing Systems' iQUBE2 digital junction box manages multiple-cell scale systems. The iQUBE2 identifies noise and tests for linearity, zero reference and monitor drift. It also features load-cell emulation and has the ability to update up to 500 times per minute.

As the diagnostic tool identifies a loadcell failure, iQUBE2 calculates an accurate weight based on comparisons to functioning cells. Users can continue weighing until a repair is made.

- Call: 800-472-6703.
- Visit: www.ricelake.com/iqube2.

Digital light meter ▶

The digital light meter 61-686 from Ideal measures incandescent, fluorescent, metal halide, high-pressure sodium and halogen lamp output. Users can place its remote sensor in the area to be measured and when they press the "on" button, the light level will appear on the LCD display. Values can be saved on the LCD by pressing the "data hold" button or the "max hold" button.

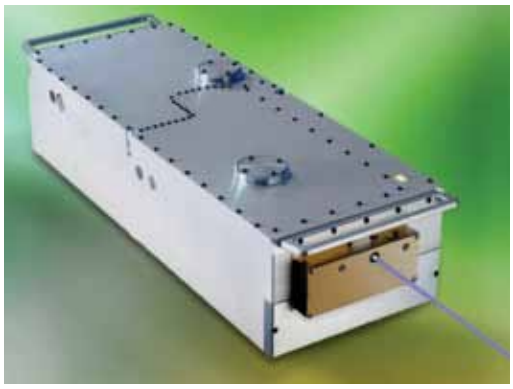
Hard-to-reach areas are measured by the meter's remote sensor with 1.5-meter cable. When finished, the compact meter slips into a pocket or the provided tool tote. The meter is shipped with a standard 9V battery.

- Call: 877-201-9005.
- Visit: www.idealindustries.com.

Laser wire-marking machine ▶

Laselec has released two UV laser wire-marking machines that meet the requirements of the aerospace, rail, rally and Formula One racing-car industries. Laselec has also developed equipment for the cable and wire industry, including the MT 200 inspection station.

The compact MT 200 marks cable samples using a UV laser, and then produces an analysis report. The machine enables users to check the markability of the cable and carry out periodic controls during produc-



Industrial laser ◂

Spectra-Physics has announced the Pulseo series of Q-switched, diode-pumped, solid-state industrial lasers. The rugged Pulseo 355-10 provides 10 W of 355 nm output at 90 kHz with a short pulse width of <23 ns.

Key applications for the Pulseo 355-10 are crystalline silicon photovoltaic solar-cell manufacturing processes, such as wafer scribing and dicing, drilling and marking.

The high-power industrial laser is also ideal for microelectronics applications, such as hole drilling, flex-circuit cutting, flat-panel manufacturing, LED-substrate scribing, silicon-wafer dicing or scribing and low K dielectric scribing.

The Pulseo 355-10 has a short pulse width and high peak power. These characteristics, combined with higher repetition rates, reduce undesired thermal effects, resulting in higher throughput with less damage to the parts.

- Call: 408-980-5546.
- Visit: www.newport.com/pulseo.

Digital load cell conditioner ▲

The OM-232-D digital load cell conditioner from Load Cell Central is ideal for force measurement applications in which the data must be recorded or viewed on a computer screen. Data can be saved and opened in MS Excel for charting and graphing. The force transducer, pressure sensor or extensometer can be calibrated using the provided software.

The unit can store calibration data for up to three sensors. At the rate of up to 60 readings per second, it provides peak and valley readings. It features a direct-to-PC RS232 output or a USB option that uses an adapter.

The 16-bit analog output tracks the load-cell signals, can be used to drive chart recorders or remote displays and can be transmitted to a central control room.

- Call: 800-562-3235.
- Visit: www.800loadcel.com.

tion. The machine complements the company's Ulys Modena and MRO 200 series of wire markers. The Ulys Modena is suitable for high production volumes and comes in four models. For smaller production runs, Laselec offers the MRO 200 series.

Direct marking with a UV laser offers the advantage of reducing the weight of the cabling. In turn, this results in reduced weight for the appliances that are equipped with the cables. Rising energy costs have also made weight an extremely important factor for manufacturers and users.

- E-mail: infousa@laselec.com.
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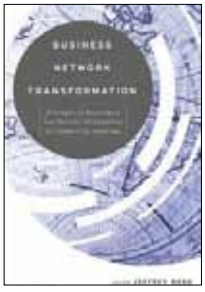
QP REVIEWS

Business Network Transformation

Jeffrey Word (ed.), Josey-Bass, 2009, 304 pp., $40 (book).



This book represents the work of 15 authors who focused on different aspects of the connected enterprise of suppliers, customers and other partners to deliver high value at high speed to customers worldwide. Word acts as editor, summarizing the best information in each of the chapters.

The book is based on Word's experiences with SAP and the company's 80,000 clients. Chapters one and two outline the global view of business network transformation (BNT), including the definition of the two types of networks: collaborative and coordinating. The book then moves into six chapters that discuss functional performance before closing with three chapters on critical resources and a roadmap for success.

BNT operates on three basic concepts: globalization, networks that help with the outsourcing process and networks that amplify differentiating core competencies, thus helping the company gain competitive advantage. The authors say the speed of business in 2009 required visibility through robust IT capabilities in small and large companies. They also say relationships are a new form of capital to be leveraged.

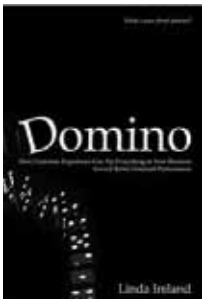
I found chapter seven on operational excellence to be an enlightening IT perspective on strategy, deployment and sustaining momentum, with some complex charts and examples. The discussion of trust in chapter nine by Jeffrey Dyer is excellent, and the last chapter lays out the roadmap to transform your business network.

This book is for top-level executives who can set corporate strategy in a networked world and drive organizations toward squeezing competitive advantage from all relationships.

Bill Baker
Speed to Excellence
Santa Fe, NM

Domino: How Customer Experience Can Tip Everything in Your Business Toward Better Financial Performance

Linda Ireland, Aveus, 2009, 228 pp., $24.95 (book).



In this book, Ireland shares her ideas and provides real-life examples of how customer experience can create a performance reward for any business. Her focus is on providing practical approaches to building and maintaining customer relationships, concerns certainly not new in the world of business and management literature.

Ireland manages to cut through the usual consultant psychobabble with her methodical, pragmatic approach to this important issue, helping readers extract and apply these concepts in any business, especially companies in the service sector.

The chapters take readers through the key steps of understanding a business's current state of customer experience. The book concentrates on businesses exceeding their customers' expectations.

Ireland's information is cogently organized and nicely broken into bite-size bits that exemplify for readers how the ideas are presented in the author's hands-on training sessions.

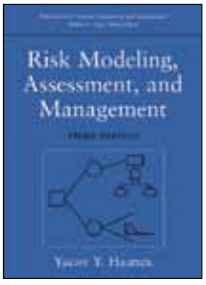
The solid material presented in this book will help any business create the ideal customer experience. The numerous tools and exercises further enhance the material, but, of course, these demand disciplined implementation by the reader.

I highly recommend this book for business leaders seeking a sustainable financial strategy in an increasingly fast-changing world.

Dale Farris
Groves, TX

Risk Modeling, Assessment, and Management

Yacov Y. Haimes, Wiley, 2009, 1,010 pp., $140 (third edition, book).



This encyclopedic book published in Wiley's Systems Engineering and Management series is up to date, comprehensive and well organized. This third edition (the book was first published in 1998) consists of chapters covering the fundamentals, advanced material, case studies and 12 appendixes.

The book is about incorporating risk analysis in the decision-making process for management and regulatory bodies. It covers an impressive range of applications,

such as healthcare, the environment, water resources, transportation, supervisory control and data acquisition, cyber security and electric power risk management. The case studies include the 2003 Northeast blackout, Hurricane Katrina, 9/11, the Lahar flow threat and an application of extreme events statistics to Six Sigma.

One particular feature of the book is its approach to rare events with extreme impact and conditional expected values of risk. Specifically, chapter 11 covers a partitioned multiobjective risk method with extreme events. The chapter discusses analytic methods and numerical solutions based on simulation and regression models.

The book positions risk analysis in the broader context of systems engineering and, as such, places it in a central role. The text represents more than 30 years of research and consulting experience and is a valuable resource for quality engineers, risk managers and system architects in almost all fields of application.

Ron S. Kenett
KPA
Raanana, Israel

ISO 9001:2008 Explained

Charles A. Cianfrani, Joseph J. Tsiakals and John E. "Jack" West, ASQ Quality Press, 2009, 320 pp., $105 list, $63 member (third edition, book).

A major revision to the ISO 9000 international standard series on quality management systems was issued in 2000 to update the standards and to make the documents more user friendly. The purpose of the recently released version of ISO 9001:2008 is to clarify, not to change, the requirements. This book focuses on the meaning of the requirements in ISO 9001:2008 and discusses the requirements as they relate to each product category.

New in this third edition of a well-known classic in the field are recommendations for implementation. Each clause now has a section on tips for implementation that sometimes go beyond the requirements. There are also new chapters on implementation, auditing and use of the system. The book contains the text of ISO 9001:2008 as contained in the U.S. adaptation.

Written by authors with a combined 100 years of experience in quality management system deployments, this book does a great job of addressing the interpretation of the standard and important implementation issues.

The book is strongly recommended for all organizations seeking a general understanding of the contents of ISO 9001:2008 or those with a desire to ensure their ISO 9001:2000 quality management system meets the new requirements.

Bengt Klefsjö
Luleå University of Technology
Sweden

RECENT RELEASES

Making Government Great Again

John Baranzelli, ASQ Quality Press, 2010, 208 pp., $75 list, $45 member (book).

Critical Factors Simplified

Marvin T. Howell, CRC Press, 2010, 156 pp., $39.95 (book).

The Power of Business Process Improvement

Susan Page, Amacom, 2010, 338 pp., $32.95 (book).

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❍ Associate
❍ Auditor
❍ CEO
❍ Chemist
❍ Clinician
❍ Consultant
❍ Contractor
❍ Controller/ Comptroller
❍ Coordinator
❍ Director
❍ Engineer
❍ Facilitator
❍ Foreman
❍ General Manager
❍ Inspector
❍ Instructor
❍ Machinist
❍ Manager
❍ Mechanic
❍ Nurse
❍ Owner
❍ Physician
❍ President
❍ Principal
❍ Professor
❍ Programmer
❍ Retired
❍ Scientist
❍ Six Sigma Black Belt
❍ Six Sigma Green Belt
❍ Specialist
❍ Statistician
❍ Student
❍ Superintendent
❍ Teacher
❍ Technician
❍ Unemployed
❍ Other

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Mailing Lists

❍ Occasionally ASQ shares its mailing list with carefully selected quality-related organizations to provide you with information on products and services. Please check this circle if you **do not** wish to receive these mailings.

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Member Name | Member Number

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Customize Your Membership Experience

1 Member Type:
❍ Full $129 ❍ Associate $74 ❍ Forum- or Division-only $31

$_____

2 The one geographic Section included with Full membership will be determined by your primary address.*

Sections (geographic or the e-Section) may be added to any member type for an additional $20.00 each. Visit www.asq.org for a listing of available Sections.

Sections ☐☐☐☐ , ☐☐☐☐ , ☐☐☐☐ $_____

* Contact ASQ to change your assigned Section.

3 Forum or Division Selection

As part of your Full membership you receive membership in one topic- or industry-specific Forum or Division. For Forum- or Division-only membership and Full membership use the list below to indicate the Forum or Division number and name.

(#) Name $ included

Additional Forums and Divisions may be added to all levels of membership. Please indicate in the list below the additional Forums or Divisions you would like and total the number you have selected.

❍ Audit (19)
❍ Automotive (3)
❍ Aviation, Space and Defense (2)
❍ Biomedical (10)
❍ Chemical and Process Industries (4)
❍ Customer-Supplier (15)
❍ Design and Construction (20)
❍ Education (21)
❍ Electronics and Communications (5)
❍ Energy and Environmental (11)
❍ Food, Drug, and Cosmetic (7)
❍ Government (22)
❍ Healthcare (18)
❍ Human Development and Leadership (13)
❍ Inspection (9)
❍ Lean Enterprise (23)
❍ Measurement Quality (17)
❍ Product Safety and Liability Prevention (25)
❍ Quality Management (1)
❍ Reliability (8)
❍ Service Quality (16)
❍ Six Sigma (26)
❍ Software (14)
❍ Statistics (12)
❍ Team & Workplace Excellence (27)

Additional Forum and Division selections:

Full or Associate member _____ (total) x $10 = $_____

Forum- or Division-only member _____ (total) x $31 = $_____

4 Publications

Quality Progress	Domestic	Canadian	International	Price/Cost
Full Member	included	included**	included**	
Associate Member	$58.00	$95.00	$95.00	❍ $_____
Forum- or Division-only Member	$79.00	$116.00	$116.00	❍ $_____
Electronic Only	$58.00	$58.00	$58.00	❍ $_____
Air Service Fee	n/a	$30.00	$35.00	❍ $_____
Six Sigma Forum Magazine	$47.00	$68.00#	$74.00	❍ $_____
Journal of Quality Technology	$32.00	$54.00#	$51.00	❍ $_____
Software Quality Professional	$47.00	$68.00#	$74.00	❍ $_____
Quality Management Journal	$53.00	$84.00#	$78.00	❍ $_____
Quality Engineering	$34.75	$51.25#	$51.25	❍ $_____
Technometrics	$30.00	$30.00#	$30.00	❍ $_____
The Journal for Quality and Participation	$47.00	$68.00#	$74.00	❍ $_____

**If you do not choose the airmail option, delivery can take approximately 8-12 weeks.
#GST included

Total of all magazines and journals $ _____

TOTAL OF ALL ITEMS (1-4): **$** _____

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or by calling ASQ Customer Care at
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In becoming an ASQ member, you have the duty to follow the ASQ Code of Ethics and Society governing documents.

QP CALENDAR

To receive information or to register for ASQ Education Courses, contact Learning Offerings, ASQ, 600 N. Plankinton Ave., Milwaukee, WI 53203; call 800-248-1946 or 414-272-8575; fax 414-272-1734; or visit www.asq.org/learninginstitute.

MAY

3 ASQ Education Course. **Corrective Action—Virtual Course**.

3-7 ASQ Education. **Black Belt/Quality Engineering Statistics.** Oakland, CA.

3-7 ASQ Education. **Certified Quality Engineer Exam Preparation.** Oakland, CA.

3-7 ASQ Education. **Introduction to Quality Engineering.** Oakland, CA.

5 ASQ Education Course. **Consultant's Boot Camp—Virtual Course**.

5-6 **Demonstrating Reliability With Accelerated Testing.** Irvine, CA. Call Hobbs Engineering at 303-465-5899 or visit www.hobbsengr.com.

5-6 **Product Safety, Recall and Product Liability Prevention.** St. Louis. Visit Randall Goodden International at www.randallgoodden.com or e-mail info@randallgoodden.com.

6-7 ASQ Education. **Lean for Service.** Oakland, CA.

11-14 **9th Annual Lean Six Sigma and Process Improvement in Healthcare Summit.** New Orleans. Call the Worldwide Conventions and Business Forums at 800-959-6549 or visit www.wcbf.com/quality/5104.

12 ASQ Education Course. **Lean Six Sigma Black Belt for Healthcare: Blended Format—Virtual Course**.

12-14 **HACCP II: Developing Your HACCP Plans.** Guelph, Ontario. Call the Guelph Technology Food Center at 519-821-1246 or visit www.gftc.ca.

17-19 **12th Annual NPSF Patient Safety Congress.** Orlando, FL. Visit the National Patient Safety Foundation at www.npsf.org.

18-20 **Montreal Manufacturing Technology Show.** Montreal, Quebec. Visit the Society of Manufacturing Engineers at www.sme.org.

20-21 ASQ Education. **Certified Quality Auditor Refresher Training.** St. Louis.

24-25 **Managing Supplier Performance: Measurement, Certification and Quality Improvement.** Atlanta. Visit the American Management Association at www.amaseminars.org or call 800-262-9699.

24-26 ASQ Conference. **World Conference on Quality and Improvement.** St. Louis.

26 **Nuclear Energy Standards Coordination Collaborative.** Gaithersburg, MD. Visit the American National Standards Institute at www.ansi.org.

28 ASQ Education Course. **Lean Six Sigma Green Belt for Service: Blended Format—Virtual Course**.

JUNE

7 **ISO/TS 16949 Requirements—Full Standard Review.** Webinar. Visit Eagle Food Registrations at www.eaglefoodregistrations.com.

7-10 **U Connect 2010 to Build a Visible, Secure and Sustainable Value Chain.** San Antonio. Visit Voluntary Interindustry Commerce Solutions at www.uconnectevent.org.

8-9 **Food Chain Summit.** Scottsdale, AZ. Call the Supply Chain Council at 202-962-0440 or e-mail info@supply-chain.org.

14-17 ASQ Education. **Guide to Process Improvement and Change.** Brookfield, WI.

14-18 **Executive Program in Strategic Sales Management.** Chicago. Call the University of Chicago Booth School of Business at 312-464-8732 or e-mail exec.ed@chicagobooth.edu.

16 **9th Annual Connecticut Quality Symposium.** New Britain, CT. Visit the Connecticut Center for Advanced Technology at www.ccat.us/cqc.

30 **Strategy and Quality: A Deming Perspective.** London. Visit the Chartered Quality Institute at http://thecqi.org.

SAVE THE DATE

If you'd like your event included in QP Calendar, submit information at least three months in advance to vfunk@asq.org. Non-ASQ organizations may list one event per issue.

What's the Plan?

Automakers' method helps healthcare group create hybrid strategy

LAUNCHING INTO a project without a plan is a blueprint for disaster. So, when ER-One of Livonia, MI, needed to transition the management of newly acquired hospital emergency departments (ED) to its organization, it turned to advanced implementation quality planning (AIQP).

AIQP rose out of the organization's efforts to combine traditional quality planning with the concepts used in advanced product quality planning, a method employed by the Big Three automakers to define and manage projects.

The AIQP model consists of five planning phases that provide a common path for and synchronization of the transition team's planning activities, while maintaining a rigorous focus on the client through each successive phase of implementation. This approach ensures all critical-to-quality areas are identified, analyzed and—if needed—improved prior to going live.

Here is how ER-One used AIQP (for a sample model, see Online Figure 1 at www.qualityprogress.com):

1. Analysis: This phase included a site visit to the hospital to conduct a gap analysis, which used in-person interviews of key hospital personnel to examine the existing ED management processes, as well as those of the interdependent areas.

The transition team compared the responses to the established requirements for managing an ED to identify gaps that needed to be closed prior to implementation. The team drafted a project plan, and provider recruiting (physicians, physician assistants and nurse practitioners) for the new site began.

2. Pre-start: In this phase, quality improvement methods and tools were used to close the gaps identified in phase one. This included identifying provider orientation and training needs, such as training on the use of hospital-specific technology. The transition team initiated the provider credentialing and scheduling processes, and began developing internal and external communication plans.

> "This approach ensures **all critical-to-quality areas** are identified, analyzed and—if needed—improved **prior to going live.**"

3. Implementation: This is the stage at which the project is most likely to lose momentum, falter and sacrifice any benefits gained in the previous phases. For ER-One, this phase included the development of ED management processes, results reporting, dashboards and quality assurance programs.

The process required constant interaction between ER-One and the hospital administration to ensure processes, measures, goals and strategic plans directly linked to the hospital strategies and objectives. Sticking to the quality planning model is most essential in this phase.

4. Going live: ED management was ready to go live, including the operational handoff from the existing management group to ER-One. The team conducted training and created an ED operations manual to ensure successful orientation of the providers to the site. The team implemented the processes developed in phase three and initiated ongoing process management, which included assigning responsibility (ownership) for each operational process.

5. Ongoing operations: At this point, ER-One was responsible for ED management on an ongoing basis. This included managing the quality assurance programs, monitoring clinical and process results, and implementing quality improvement as needed to ensure the gains are sustained.

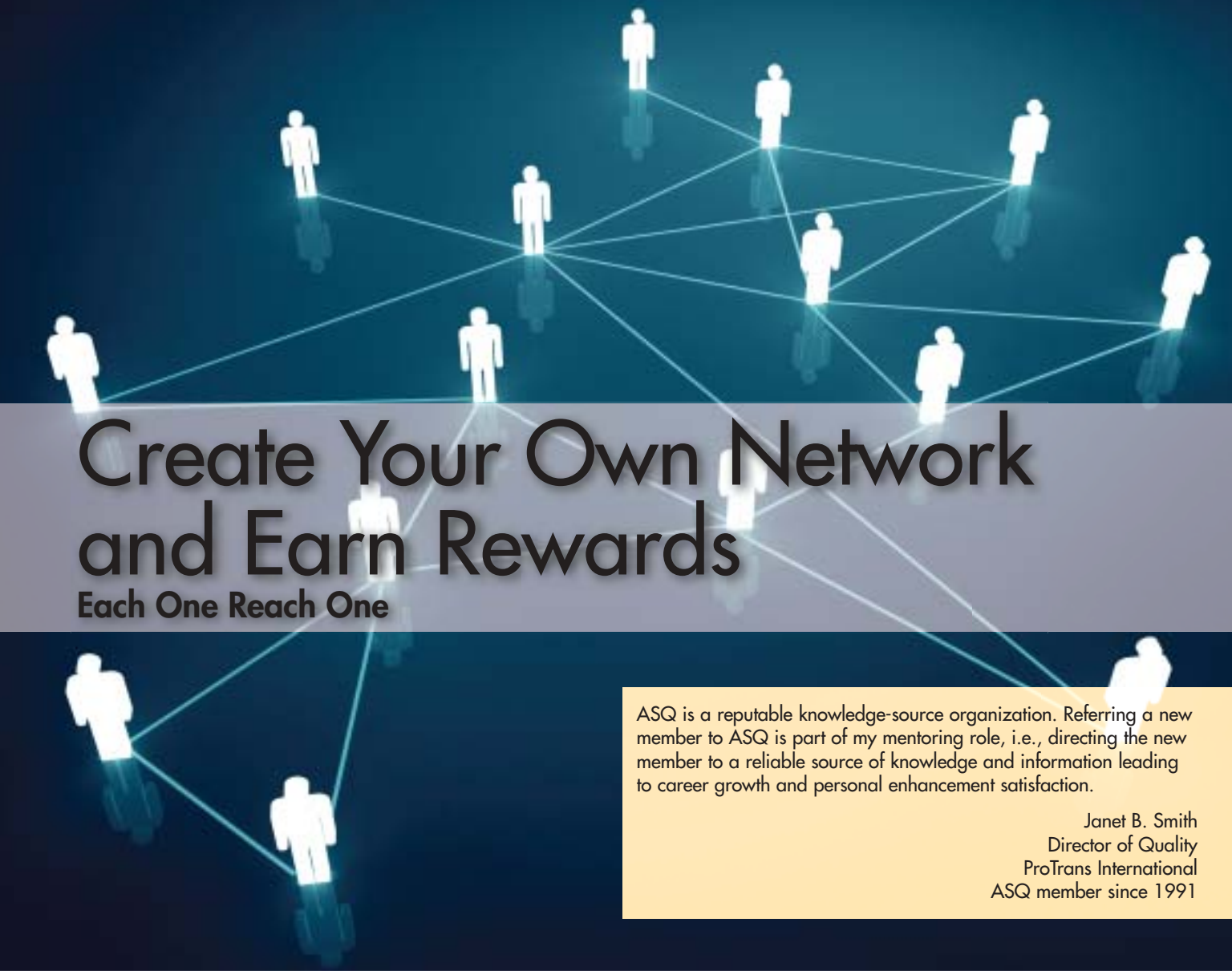
In addition to the five phases of the model, many quality tools were used, including implementation gap analysis, project plan, communication plans, process flow diagrams, job aids, failure mode and effects analysis, metrics, strategic plans, on-site orientation manuals, a quality assurance plan and dashboard reporting.

In the past three years, ER-One used AIQP to transition the management of ED clinical and administrative operations in four hospitals, three of which represented the company's first opportunities to venture outside Michigan. All of the new acquisitions experienced improved patient satisfaction, increased patient volume and positive core-indicator compliance. QP

MORE GOOD IDEAS

If you have a new quality method or tool—or an adapted version of one that already exists—share it with your fellow QP readers. Visit www.qualityprogress.com and check out our author guidelines to see how you can contribute.

CECELIA MCCAIN is director of corporate quality at ER-One in Livonia, MI. She attended Davenport University in Warren, MI. McCain is a senior member of ASQ and is an ASQ-certified quality auditor and Six Sigma Black Belt.



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Each One Reach One

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Janet B. Smith
Director of Quality
ProTrans International
ASQ member since 1991

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LEARN MORE AT www.asq.org/eoro.

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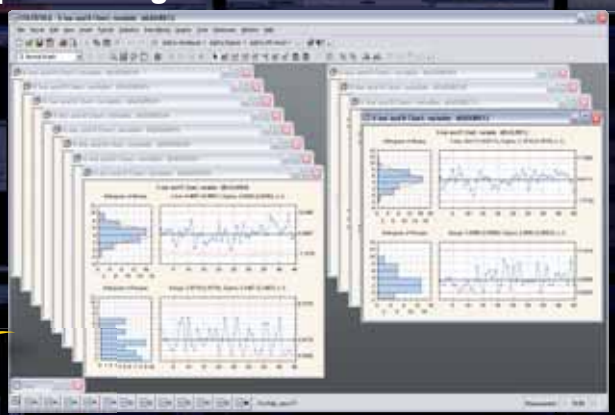

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