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UPFRONT



Get the Scoop What auditors can learn from journalists

AS A JOURNALIST, it was a treat to discover that this month's cover story—which follows the auditing theme—is based on secrets and tips gleaned from journalists that auditors can use to facilitate the most effective, insightful audits possible.

Asking questions that get to the heart of the story is a skill that can be honed with practice, and this article provides a unique perspective to help auditors better communicate with audit subjects in non-threatening and productive ways.

Having employed the majority of these approaches at one time or another, I know these tactics will help you drill down to the dirty details. Instead of getting yes or no answers, you'll elicit meaningful, illuminating responses about the topics that matter most. See "Ask, and Ye Shall Receive," p. 18.

The other auditing-focused article, "Think Again," p. 26, is about the importance of mind over matter when it comes to meeting some of auditing's toughest challenges. It includes important tips for taking the us-vs.-them mentality out of the equation by establishing common ground and altering long-held mind-sets about the audit process. Implement these tips, and you'll get more from your audits.

This year marks the 25th anniversary of the birth of National Quality Month. Passed as a joint resolution by Congress and proclaimed by President Ronald Reagan in 1984, National Quality Month focuses on the strategic importance of quality and continuous improvement. It also serves to strengthen the commitment to quality and performance excellence by organizations across the United States. In honor of the occasion, many organizations have created special events and recognition programs throughout October designed to convey the strategic benefits of quality in every industry.

Do you have a story about what you or your organization is doing to celebrate National Quality Month (or any other of the respective quality months and days recognized around the world)? If so, send me your stories; photos are a bonus.

In the 25 years since the resolution was passed, much has changed. The world, as it has been said, has been rendered flat, and quality—as well as ASQ's efforts surrounding it—have spread far beyond U.S. borders. ASQ offices in India, China and Mexico are now up and running, and training, certification and information have made their way to every corner of the globe.

The flatter, it seems, the better, as the sharing and dissemination of the benefits of quality no longer know boundaries. It's interesting, in light of this milestone, to consider what quality might look like in another 25 years. How much will change? **QP**

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INBOX

Do more with LSS

After reading the article on the study of lean Six Sigma (LSS) deployment in healthcare ("Get Your Checkup," August 2009, pp. 44-51), I was not totally surprised to discover the number of healthcare organizations with little or no deployment was high.

The first obvious prob-

lem—and one that also exists outside the healthcare industry—is leadership commitment, followed by supervisor support. All too often, managers attend workshops on LSS, and then experiment with projects that on occasion can produce great results but, for the most part, achieve marginal results.

Consequently, the people at various levels in the organization lose interest, and the culture does not change. If the LSS projects are not focused on the process constraints, then you can expect marginal results.

I work in the aerospace maintenance and overhaul industry, with business needs to dramatically increase throughput and quality. Our mission and processes are relatively similar to healthcare in that we bring the patients (helicopters) back to health in the fastest, most cost-efficient system we can develop.

Our previous team started with isolated lean and Six Sigma events with little employee involvement and actually made things worse. More recently, our new team integrated LSS solutions within the framework of the theory of constraints, included



critical chain project management and focused on implementing employee-generated solutions.

Results include cutting our cycle times nearly in half, increasing yield quality by more than 12% and improving throughput by 44%. Workforce morale has improved, and we won the 2009 Shingo Bronze

Medallion. Healthcare organizations would benefit from a similar approach.

Alex Fedotowsky LSS Master Black Belt Army Fleet Support Fort Rucker, AL

Sold out

Perhaps I have fully transformed into a grumpy old man, but I grow increasingly concerned by the amount of time and energy I see ASQ spending on the generation of articles and studies that tell us how to sell quality to upper management.

Has the quality profession become that marginalized? Do other professionals such as IT people, engineers and project managers—need to devote most of their waking hours to convincing someone they add value?

If we need to spend our time avoiding being shoved aside, then perhaps we have failed miserably as a profession to innovate and add true value to our organizations.

> Paul Ipolito Quality engineer SPX Process Equipment Rochester, NY

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EXPERTANSWE

Be aware

Q: I'm looking for some advice on how to create quality awareness in my organiza-tion. All other department heads, including the general manager, do not seem to understand quality. For example, the production manager and the general manager will blame only the quality inspectors for not being able to detect a defect during in-process inspection.

I cannot deny that the quality inspector has responsibility, but the production operators also share responsibility to make sure that only quality material is sent to quality inspection. When any problems happen, the only thing on their minds is to blame quality control. We are supposed to share responsibility and perform as a team. Name withheld

A: Having worked at a company with a similar quality culture, I can empathize with the frustration you are feeling. In your situation, many people would choose to leave such a company, so kudos to you for wanting to stay and make a positive change.

Your company's management doesn't seem to understand that inspection is not the way to manage product quality. Also, it seems as though management does not want to spend the time or effort to implement an effective quality assurance program.

ASQ has many resources on its website to address the issue, including an area titled "Making the Case for Quality."¹ There, you can find an online community of members who may be able to provide you with some assistance and support, as well as case studies and a white paper on the topic. Other resources on the website can be found by searching for "quality and the bottom line."



Your management may not be aware of how poor quality affects the bottom line. Work with your accounting department to determine how much value is added to the product at each stage in the process from beginning to end.

Examine and calculate the rework and scrap costs. Look through your inspection records and determine the point in the process at which each defect was introduced (root cause analysis). From there, you can calculate how much money is being spent using the inspection department to find defects rather than eliminating them at the source. Hopefully, this number will be significant enough to get management's attention.

Take a look at the types of customer complaints you are receiving. Look for recurring complaints and the types of defects associated with them. Again, work with accounting to determine the costs for replacing and repairing products returned from customers.

Talk with your sales department. Has the company lost any business due to product

quality issues? Has the company made concessions or offered lower pricing to smooth over quality problems with customers?

Who are your major customers? Do they have a quality culture? Would someone at one of those companies be willing to talk with your management about their experiences in managing quality assurance? Would your management be willing to listen? If not, then you have a very serious issue.

The road ahead is not an easy one. But, if you are willing to do the work and make a convincing case to management, it will likely have a positive effect on the company and on your career.

> Ken Cogan President Navis Pack & Ship MD-1106 Annapolis Junction, MD

REFERENCE

1. ASQ, "Making the Case for Quality," www.asq.org/ economic-case.

FOR MORE INFORMATION

 Sherman, Peter J. and James G. Vono, "All Ears," *Quality Progress*, July 2009, pp. 16-23.
 Wood, Douglas C., "Blurred Vision," *Quality Progress*, July 2008, pp. 28-33.

Testing, testing ...

Q: Which is the best test to use when comparing two sets of data (for example, two sample preparations for the same lot, or supplier results vs. company lab results): Mann-Whitney, Mood's median, paired t-test or two-sample t-test?

> Fabiola Albacarys Quality engineer Pfizer Inc. Arecibo, Puerto Rico

A: Of the four tests you mention, the paired t-test is the most powerful. It can detect small differences between samples even if

RS

Management **may not be aware** of how poor quality **affects the bottom line**.

the sample sizes are small. There is a catch, though: The data need to be in logical or dependent pairs.

For example, suppose you want to test a diet pill. You recruit a handful of study participants, distribute the pills and weigh the participants at the beginning and the end of the study. In this case, the pair of data is each individual's starting and ending weight.

To analyze the results, you would subtract the starting weight from the ending weight for each participant. Some people call this a paired difference t-test, because you must calculate the difference between the pairs. If the distribution of differences is significantly different than zero, then the test result is significant. If the result is favorable, then you may want to perform another test and include a placebo in a double-blind study to make sure the weight loss is due to the drug rather than the motivation of the participants.

In *Statistics for Experimenters*, the authors describe a test comparing two different materials for the soles of boys' shoes.¹ Some boys are more active than others, and the study designers did not want the study results (wear rate of the shoe) to be dominated by the activity level of the boys. The solution was very simple and quite clever.

The study designer created pairs of shoes with material A on one foot and material B on the other foot. The pairs were randomly assigned to the boys so some of them had material A on the left foot, and some boys had material A on the right foot. At the end of the study, they compared the wear rates using a paired t-test.

There is a lot of variability between boys. There is a lot less variability within each boy, because pairs of feet move together. This example illustrates why the paired t-test is so powerful. It focuses on the variability within pairs and effectively eliminates the variability between pairs or samples.

Let's get back to your question. Suppose you want to compare your lab data with your supplier's data. If you want to use the paired t-test, you could label and measure several samples, and then send them to the supplier. The supplier would measure the same samples, keeping track of which measurement goes with which sample. Analyze the data with a paired t-test for a powerful, efficient comparison of the measurement systems.

If the test is destructive, consider whether you can make a large homogenous sample and randomly split the samples (half for you and half for the supplier). This will usually work for things such as chemical assays and bulk materials if the sample is thoroughly mixed before it is split. There is one restriction on the paired t-test: The differences must be normally distributed.

If you can't get homogeneous samples or repeat measurements on a single sample, then you should consider a two-sample t-test. This test is used to compare the population means of the two samples, but it has restrictions: Both sampled populations must be approximately normally distributed with equal variances, and the samples must be collected independently of each other. It is not as sensitive as the paired t-test, but you may have existing data that you could analyze immediately without the delay or expense of conducting a round-robin test.

If your data are not normally distributed, then you could try the Mann-Whitney twosample rank test. The Mann-Whitney test compares medians and does not require a normal distribution, but it does require the two populations to have a similar shape and approximately equal variances.

The Kruskal-Wallis test is more general than the Mann-Whitney test because it does not require equal variances. It's also similar to the Mood's median test, in that both require the two populations to have the same shape. Mood's median test is generally less powerful than the other tests I mentioned, but one advantage is that it is more robust against outliers.

> Andy Barnett Consultant, Master Black Belt Houston

REFERENCE

 George E.P. Box, William G. Hunter and J. Stuart Hunter, Statistics for Experimenters, John Wiley and Sons, 1978.

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HEALTHCARE

Planning for a Pandemic Quality tools and techniques key to designing an effective response, health group advises

Ramping up for another H1N1 flu outbreak this fall, a national health organization is encouraging health agencies to use quality improvement methods and tools to review current policies and procedures and to better prepare for public health emergencies.

The Public Health Foundation (PHF), a nonprofit organization based in Washington, D.C., helps local and state health agencies improve performance, and is promoting the use of quality techniques—such as the five whys technique, rapid-cycle plan-do-checkact and force field analysis—for public health agencies to analyze and improve pandemic flu plans.

"The human and business impacts of H1N1 in the coming months in local jurisdictions are uncertain," according to a report prepared by the PHF. "We may face a situation that is no worse than the typical fall/ winter flu season. We could also experience a more serious situation, with increased levels of severity of illness.

"In either event, the systemic application

of quality improvement strategies will result in a better prepared public health community."

Much of the report was based on a panel discussion held during ASQ's World Conference on Quality and Improvement in May in Minneapolis. There, Ron Bialek, PHF's executive director; Kim McCoy, a principal planning specialist at the Minnesota Department of Health; and William Riley, associate division head of health policy and management at the University of Minnesota School of Public Health, offered suggestions on how quality methods and tools could strengthen state and local flu plans.

The report provides brief examples of quality tools used to review public health agency plans and to prepare for large-scale responses to health emergencies.

For instance, the five whys technique can determine a root cause for a school district that was not reporting any H1N1 cases last year. Building a flow chart can



help improve the value stream in an emergency operations center or streamline how medications are distributed.

"The easy part in preparing for the fall flu season is recognizing that lessons learned from the H1N1 outbreak need to be applied," the report says. "The more difficult part is developing an effective process to understand the reasons, or root causes, contributing to [public agencies'] successes and challenges. Using quality improvement methods and tools ... will lead to better prepared communities and more successful responses to the fall 2009 flu season."

To view the full report, visit www.phf.org.

REPORT: GRADUATES WITH ENGINEERING, STATISTICS DEGREES HAVE EASIER TIME FINDING EMPLOYMENT

College students who major in engineering or statistics have a better chance of landing a job upon graduation than graduates with other degrees, according to a recent report.

Using data and analysis taken from the Bureau of Labor Statistics and the Milken Institute, an independent economic think tank, *SmartMoney* magazine recently ranked the top five college majors that are closely linked to growing industries.

For example, by 2020, U.S. manufacturers will need as many

as 10 million new skilled workers, including mechanical and software engineers, the Milken Institute reported earlier this year. Statistics experts are always sought after by companies in virtually any sector, such as the pharmaceutical and insurance industries, and by investors on Wall Street, the report said.

Along with engineering and statistics, the other majors rounding out the top five were environmental studies, finance and life sciences.

CAREERS

HEALTHCARE

NEW CENTER TO TACKLE PATIENT SAFETY BREAKDOWNS

In an effort to use new and different methods to uncover causes of and to put a stop to dangerous and often deadly breakdowns in patient care, the Joint Commission—a nonprofit organization that accredits and certifies more than 16,000 healthcare organizations and programs in the United States—has launched the Center for Transforming Healthcare.

The center will team up with top hospitals and health systems across the United States to tackle problems that plague the country's healthcare system.

For its first initiative, the center focused on hand-washing failures, which contribute to infections that kill close to 100,000 Americans each year and cost U.S. hospitals \$4 billion to \$29 billion annually to fight. Hospital-acquired infections are one of the top 10 causes of death in the United States.

The center teamed with eight hospitals and health systems nationwide for the project, which it tackled by digging deep to find out where the breakdowns took place so targeted solutions could be created for now and the future. By consistently using the center's measurement methods and process improvement tools—such as lean, Six Sigma and change management—the hospitals found, on average, caregivers washed their hands less than 50% of the time.



The center hopes these efforts will yield new methods to systemically measure the magnitude of the problems, pinpoint the causes and find lasting solutions, said Mark R. Chassin, M.D., president of the Joint Commission.

From there, the Joint Commission will spread the use of these tools and inventions to tens of thousands of hospitals and health systems it accredits.

"The center aims to solve the most difficult and pressing quality and safety problems that plague American healthcare," Chassin said.

Visit www.centerfortransforminghealthcare.org for more information about the center and to learn about its next project. —Nicole Adrian, contributing editor





ASQ HOSTS FORUM ON QUALITY HEALTHCARE FOR HOUSE CAUCUS

ASQ convened a healthcare quality forum last month for members of the House of Representatives' 21st Century Healthcare Caucus. A panel of speakers discussed healthcare IT and the importance of proper preparation to ensure

successful implementation of such technologies.

Those who appeared before the caucus included: Joseph A. Fortuna, chairelect of the ASQ Healthcare Division; Paloma Hernandez, president and CEO of Urban Health Plan, Bronx, NY; Robert Burney, director of quality improvement with the medical department at the U.S. Department of State in Washington, D.C.: Christopher J. DeFlitch, chief medical information officer at Penn State Hershey Medical Center in Hershey, PA; and Doug Sears, director of performance improvement/



Congressman Patrick Kennedy (D-RI) at last month's healthcare quality forum.

knowledge transfer at Bon Secours St. Francis Health System in Greenville, SC.

The caucus is composed of 47 members of the House of Representatives who convene to discuss healthcare policy issues. Congressmen Patrick Kennedy (D-RI) and Tim Murphy (R-PA) are co-chairs of the caucus.

Updates from the proceedings can be found this month in ASQ's Advocacy Room at www.asq.org/advocacy/index.html.

Capitol Q is a regular Keeping Current feature that highlights ASQ's advocacy efforts with government leaders.

KEEPINGCURRENT

SHORTRUNS

THE LATEST DRAFT of the social responsibility standard is available for review and comment. The Draft International Standard of ISO 26000: *Guidance on Social Responsibility*, was released last month, and it can be found at the Standards Central corner of ASQ's website at www.asq.org/ knowledge-center/standards/index.html. Public comment is due Dec. 14.

WORLD QUALITY DAY will be celebrated Nov. 12 to promote awareness of quality around the world and reinforce quality, innovation and sustainability as the foundations of an organization. The Chartered Quality Institute is organizaing the event. For more information, visit www.thecqi.org/ community/world-quality-day.

THE QUALITY PERFORMANCE of cellular phone calls has improved during the last six months, according to a recent J.D. Power and Associates survey. Wireless carriers have reduced the number of connectivity issues, such as dropped calls, to four problems per 100 (PP100) from five PP100 six months ago. Failed initial connections have declined to three PP100 from four PP100 during the same period. Wireless customers also reported fewer audio problems For example, calls with static decreased from three PP100 six months ago to just two PP100. More information from the survey can be found at www.jdpower.com/corporate/ news/releases/pressrelease.aspx?ID=2009155. ACSI

CUSTOMER SATISFACTION SCORES TICK UPWARD

Customer satisfaction continued to climb last quarter, with strong showings for Ford and General Motors (GM), according to a recent report released by the University of Michigan's American Customer Satisfaction Index (ACSI).

During the second quarter, overall customer satisfaction climbed 0.1% to 76.1 on ACSI's 100-point scale. Customer satisfaction with durable products improved by 1.1% compared with a year ago.

Despite a severe drop in sales, customer satisfaction with automobiles was better than a year ago. The survey shows that customers said automakers are providing more value for the money, higher quality and better service.

Domestic automakers scored an 84 on the ACSI, as Ford (+ 5%), Chrysler (+ 4%) and GM (+ 2%) all scored higher than last year. ACSI for Japanese car manufacturers did not change much since. Only Honda showed a modest gain (+ 2%) over last year's score.

ASQ is a founding sponsor of ACSI. To view the full report, visit www.theacsi.org.

According to a separate report, customers seem happier with their auto insurance companies this year, driven primarily by low premiums, according to a recent J.D. Power and Associates survey.

In fact, customer satisfaction with auto insurers reached a five-year high this year, averaging 801 on a 1,000-point scale—up by 14 points from 2008.

Rates are beginning to increase during this recessionary period, however, and J.D. Power and Associates predicts customer satisfaction will take a hit in the next few years.

More details from the survey can be found at www.jdpower.com/ corporate/news/releases/pressrelease.aspx?ID=2009151.

Mr. Pareto Head BY MIKE CROSSEN



ASQ Inauguración de Oficina **ASQ opens Mexico City office**

Grand opening ceremonies were held last month to mark the opening of ASQ's Mexico City office. ASQ also organized a one-day quality and education conference in tandem with the celebration.

"We believe a commitment to quality, business excellence and social responsibility has become a universal principle and that the world is coming together to advance these concepts," said Robert Chalker, ASQ Global managing director. "ASQ hopes to provide the forum where this can occur."

ASQ is growing rapidly in Mexico. There are more than 600 members across the country, including five local sections and five student branches. ASQ offers many training and certification opportunities in the country, and ASQ holds a conference in Juarez every year.

Visit www.asg.org/global/countries/mexico.html for more details about ASQ activities in Mexico.



QUICK POLL RESULTS

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

Here are the numbers from the most recent Quick Poll:

"Is Six Sigma on the way out?"

- No 55.3% • Yes 27.7%
- Can't predict

17%

Visit www.qualityprogress.com for the most recent poll question posted:

"Organizationally, what is the reaction when an impending audit is announced?"

Defensive

Resigned

• Fearful

Open and confident

AS SEEN IN QUALITY NEWS TODAY

Monday through Friday, QP editors post the latest local, national and global news related to quality in Quality News Today at www.qualityprogress. com. Check out some of the most recent headlines posted, and be sure to visit regularly to keep yourself updated on happenings that affect the quality world.

- "Chrysler Workers Return to Major Production Changes."
- "Clunkers Success Limited by Program Flaws."
- "Biden to Announce Almost \$1.2B for Medical Records."

ASQNEWS

JOINT CONFERENCE ASQ's Statistics Division and the Quality Management Division are sponsoring the Institute for Continuous Quality Improvement conference, to be held in conjunction with ASQ's World Conference on Quality and Improvement in 2010 in St. Louis. Visit www.asqstatdiv.org/aqc.htm for details.

LATEST ENTERPRISE MEMBER The U.S. Defense Department's Defense Contract Management Agency has joined ASQ as an enterprise member. To find out more, visit www.asq.org/enterprise.

MEETING OF SR MINDS ASQ is hosting a meeting next month in Milwaukee for members of its Socially Responsible Organization (SRO) movement. The event will be held Nov. 15-17 and is billed as an international think tank on social responsbility. For more information about the event and the SRO, visit http://thesro.org.

QUALITY FOR LIFE A new website has been unveiled that features inspiring stories from ASQ members about how quality has made an impact on their personal lives. The "Quality for Life" website (www.asq.org/qualityforlife) was created to share stories and recognize quality professionals who use guality tools and techniques at work, home or through volunteer efforts to make a positive impact on the lives of others.

NEW STUDENT BRANCHES Four new student branches have been approved by ASQ's Board of Directors: Ferris State Grand Rapids, sponsored by the Grand Rapids Section 1001; University of Central Oklahoma, sponsored by the Oklahoma City Section 1408; the University of Central Missouri, sponsored by the Kansas City Section 1301; and the Universidad de Celaya, sponsored by the Mexico City Section 1403.

EDUCATOR HONORED Jens Jorn Dahlgaard, an ASQ member, has been selected as one of the top 100 educators in the world this year by the International Biographical Centre in Cambridge, England. Dahlgaard also received ASQ's Lancaster Medal in 2004.

KEEPINGCURRENT

THE NUMBER OF ORGANIZATIONS from Asia and the Pacific Rim honored recently by the Asia Pacific Quality Organization (APQO) with its World-Class Winners of the International Asia Pacific Quality Awards. They are:

- Vietnam Electric Cable Corp., Ho Chi Minh City, Vietnam.
- Orel Manufacturing, Sri Lanka.
- Hindalco Industries Ltd., Uttar Pradesh, India.
- Shanghai Investment Consulting Corp., Shanghai, China.
- Colegio Compoverde, Colinas De Santa Barbara, Mexico.
- Hydroelectric Power Plant, San Joaquin Queretaro, Mexico.
 The awards were presented at the 15th APQO/International Conference
 in Mexico City.

WORDTOTHEWISE

To educate newcomers and perhaps refresh practitioners and professionals, QP will feature a quality term each month.

De·light·er (di līt´ər)

A feature of a product or service that a customer does not expect to receive but that gives pleasure to the customer when received. Also called an "exciter."

Source: "Quality Glossary," *Quality Progress*, June 2007, www.asq.org/quality-progress/2007/06/quality-tools/ quality-glossary.html.

WEBWATCH

This month's Web Watch focuses on standards and auditing. For more quality-related websites, visit www.qualityprogress. com.

www.theiia.org

The Institute of Internal Auditors (IIA) is a professional association that provides free resources on its website. Visitors can find IIA newsletters, articles, links, a discussion board and downloads, such as the IIA's public sector audit guide.

www.internalauditor.com

This free site is divided into four areas: quality management systems internal auditing, environmental management systems internal auditing, financial internal auditing and risk analysis. Each area provides articles, tips, book recommendations, links and conference and job listings.

www.niso.org

The National Information Standards Organi-

zation (NISO) develops standards for libraries, bibliographic and information services, and publishers. The site also includes drafts of standards in development by NISO, a calendar of events, links to other standards organizations and information on NISO membership.

www.ams.usda.gov/standards/ stanfrfv.htm

This site, run by the Agricultural Marketing Service of the U.S. Department of Agriculture (USDA), provides PDFs of USDA fruit and vegetable quality standards. More than 100 standards cover fresh-market fruits and vegetables, fruits and vegetables for processing, and nuts and specialty crops.

www.powerstandards.com/ tutor.htm

This page, part of the Power Standards Laboratory website, provides extensive information on Institute of Electrical and Electronics Engineers (IEEE) electric power standards. Resources include tutorials, drafts of standards and detailed minutes from IEEE meetings. Downloads on the Power Standards laboratory homepage include technical papers, software and manuals.

www.standardsinfo.net

The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) have created the ISO/IEC Information Centre. This website provides information about standardization, standards and related matters, as well as access to reference publications on standards development, distribution and use.

www.whosregistered.com

QSU Publishing Co. has set up this search engine of ISO 9000, ISO 14001 and QS-9000 certificate holders. Companies can register their information online, and potential customers can search companies at no cost to see which ones are registered.

www.qaaudits.com

Concise information on recent standard changes, including those relating to AS9000/ AS9100, ISO 9000:2000 and TL 9000, is offered on this commercial site. There are several links to standards-related quality sites.

FOUND AN INTERESTING QUALITY SITE?

If you come across a noncommercial site that could be useful to other quality professionals, e-mail it to medmund@asg.org.

ASQ

EDUCATION CONFERENCE SET FOR LATER THIS MONTH

The 17th annual National Quality Education Conference (NQEC) will be held Oct. 25-27 in Jacksonville, FL.

The conference follows the theme of "Leading, Learning and Teaching for Tomorrow's World."

Activities and events will include educational and informational sessions on topics supporting the national education agenda for high standards, data-driven decisions, increased graduation rates, improved teacher and principal quality, and a reduced achievement gap.

Keynote speakers scheduled for NQEC include:

- Joseph and Judith Pauley, authors of *Communication: The Key to Effective Leadership*.
- Dan Lukich, superintendent of Community Consolidated School District 15

in Palatine, IL, a 2003 Baldrige recipient.

- David Langford, author of Orchestrating Learning With Quality and Tool Time for Education.
- Rich DeLorenzo, co-founder of the Re-Inventing Schools Coalition, an education reform organization.

For more information about the event, visit http://nqec.asq.org/index.html.

DATEINQUALITYHISTORY

QP looks back on an event or person that made a difference in the history of quality.

Oct. 15, 1926

Genrikh Saulovich Altshuller, a Russian engineer and scientist who created the *teoriya resheniya izobreatatelskikh zadatch* (TRIZ), was born on this date. TRIZ is a method for developing innovative ideas in problem solving.

In 1946, Altshuller began developing a body of principles and knowledge that lays out a process for solving difficult problems. Altshuller, who was employed at the patent department of the Russian navy, analyzed thousands of patents and inventive solutions from different fields of engineering. He discovered that often the same problem had been solved in different technical fields using a core set of fundamental inventive principles.

The TRIZ approach was further extended and used by engineers and inventors in the former Soviet Union before it was introduced in other parts of the world. In the early 1990s, it caught the interest of many major U.S. companies, which offered workshops on the TRIZ methodology.

SOURCE

Provost, Lloyd P., and Gerald J. Langley, "The Importance of Concepts in Creativity and Improvement," *Quality Progress*, March 1998, pp. 31-38.

Who's Who 📊

NAME: V. Siva Kumar.

RESIDENCE: Hyderabad, India.

EDUCATION: Master's degree in organic chemistry from Annamalai University in India.

INTRODUCTION TO QUALITY: In 1997, Kumar worked as a senior chemist in the quality assurance department at Orchid Chemical and Pharmaceutical Co. There, he initiated and imple-



mented quality systems and good manufacturing practices (GMP) regulations in manufacturing and quality control areas.

CURRENT JOB: Since 2007, Kumar has been senior manager—auditing and testing services in United States Pharmacopeia (USP). He conducts on-site GMP audits, managing the testing of samples and reviewing drug master file/chemical manufacturing and control documentation to support USP product certification offerings in the pharmaceutical industry.

ASQ ACTIVITIES: He is a senior member of ASQ and became a certified quality auditor last year.

OTHER ACTIVITIES: He is a trained International Conference on Harmonization Q7 auditor by the European Compliance Academy. He is also an on-site GMP trainer and has spoken at several conferences in India and China.

QUALITY QUOTE: Quality is never an accident—it is always the result of intelligent efforts.

Auditors can **take a page** from journalists to get the **answers they need**

Ask, and Ye Shall Receive

In 50 Words Or Less

- While technically proficient, some auditors struggle with the more human side of the auditing process.
- Auditors can apply journalistic techniques to help overcome the difficulties encountered during interviews.
- These techniques can help auditors get the answers they need without making the interviewee feel uncomfortable.

by Natalia Scriabina, Romayne Smith Fullerton, Joel Brinkley and Kim Kierans

Part of what makes a good auditor is knowing where to find answers. That's as true when it comes to professional growth and development as it is when conducting a thorough audit. It's important, then, to keep an open mind when dealing with a career obstacle many auditors face, because the solution may be as close as the nearest newspaper.

Most quality management systems auditors bring an extensive technical background to their jobs, but the human side of the auditing process can sometimes be a challenge.¹ This can be overcome by adopting a few of the skills journalists use to fill newspapers, magazines and websites every day.

Journalists are experts in managing conversational flow and encouraging people to open up and provide vital information. Some of their techniques can serve auditors well as they navigate the sometimes frustrating quagmire of audit and assessment interviews.

"The interview is more than a simple process of asking questions. It's a relationship, however brief, between two people."²

A personal interview is different from any other form of information gathering. The relationship starts the moment that you, the auditor or assessor, enter the room.

There is never a second chance to make a good first impression: Did you enter with an expression of interest or suspicion? How confident did you appear? Did you introduce yourself or wait to be introduced? Did you take on the role of host or guest? Did you display enthusiasm? Your answers form the baseline of the interview relationship, and they determine the quality of the information you will obtain.

Let's begin by outlining five underlying principles and techniques journalists use to conduct productive interviews:

1. Establish two-way trust: Work from the assumption the interviewee wants to share information and wants to make a valuable contribution to your audit or assessment results. Be professional, open and non-judgmental; try to establish that you share a common goal. While your subject may have his or her own agenda, set aside your concerns about that for the moment and try to put the person at ease. People need to feel confident you value what they offer and believe what they say—and that they can trust you.

2. Create a comfort zone: An interview should be relaxed and conversational.² Social psychologists suggest we feel more comfortable around people who appear similar to us, with whom we feel familiar, who appear to like us and whose personalities are inherently attractive.⁴ If we try to conform to these ideas, there can be a real improvement in the quality of the interview.

Phrased a different way, people communicate more easily with those they perceive as being like them, so your goal is to almost blend your appearance with your interviewee's. Choose a neutral color of clothing and similar style of dress to what's worn in the interviewee's office, and avoid drawing attention to yourself.

By nature, people are unlikely to be open to com-

plete strangers, so share a bit about who you are from the outset. Self-disclosure is key. Robert S. Boynton, a journalist and director of New York University's magazine journalism program, offered this advice: "How do you get people to talk who have good reasons to be resentful? I tell them about myself, and listen carefully when they talk to me. In combination, those things will usually get people to open up."⁵

Be prepared. Before you meet your interviewees, try to learn about their work and achievements. If you have the opportunity to meet them in their surroundings, look carefully around their offices and note photos, plaques or other memorabilia.

3. Pay attention: Ken Metzler, in his book *Creative Interviewing*, suggests that people who make eye contact while speaking are judged to be friendly, self-confident, mature and sincere, while non-lookers are judged as cold, pessimistic, defensive, evasive and immature.⁶ Journalist Sally Adams frames it this way: "How much you look at your interviewee matters vitally—look, please do not stare. Whether you realize or not, it affects how much they will tell you."⁷

In some instances, people look away when they are being evasive, but sometimes your subject may break the visual connection because he or she is thinking in a more introspective manner. To reestablish eye contact, lean forward as you ask your next question, arrange your face in a quizzical manner or make a hand gesture to draw the person's attention back to you.

4. Paraphrase: During the interview, you might include an interviewee's words and phrases in your questions. By paraphrasing, you indicate to your subject that you are listening and following. This technique creates empathy, suggests you are free of preconceptions and clarifies information for others who might be involved in the interview, such as representatives of partners, customers or suppliers. When you paraphrase, you speak the other person's language, and it helps to convey shared meaning clearly.

5. Downplay yourself: The purpose of an interview is to gather information, not to talk about yourself. The best interviewers "concentrate on their interviewees so much that they almost become invisible," Adams suggests. "One sign of a good interviewer is that he [or she] is forgotten." Adams also recommends mirroring body language to establish rapport. "If they sit back relaxed, you sit back relaxed. If they lean forward, you lean forward ... It needs to be subtly done."

These five tips can be used in concert and should overlap in the areas of underlying attitude, behavioral baseline and conversational style, as shown in Figure 1.

"A good interviewer is someone who listens for a living."?

How you structure the interview—what kinds of questions you ask and the order in which you ask them—is incredibly important. Journalists generally begin with the easier and more factually based queries to make the subject feel somewhat at ease. They ask a series of open-ended questions—usually these will begin with words such as how, what and why.

Regardless of the type of question, avoid the use of any words that imply a value judgment. So instead of asking, "How good/bad was the experience?" rephrase and ask, "How was the experience?" Always save the toughest questions for the end of the interview; if you have laid a solid foundation with your interviewee, he or she will be more cooperative, and you will have a better chance of gaining the information you need.

The International Organization for Standardization and the International Accreditation Forum suggest that the key elements of a value-added audit include identifying problems, spotting opportunities for improvements and identifying possible areas of risk.¹⁰ None of this information will be readily available to you, and you must remind yourself that most interviewees will have reservations when talking about such material.

Once you have outlined for yourself the order in which you plan to pose your queries, you can consider the following five types of questions, which may help remove barriers and encourage your subject to speak more openly about problems and risks:

1. Split questions: With this method, the uncomfortable question is divided into separate, disconnected questions. The uncomfortable questions should be avoided because they break the flow of the interview. Because the goal is to gather information, use the split question to garner material while maintaining trust.

Consider the following scenario: You ask the uncomfortable question, "This technology was changed. Were you trained in the new one?" The interviewee answers "No," and for the rest of the interview, the interviewee is nervous, thinking about the potentially negative consequences of this reply. Instead, split the question:

- 1. When was the technology changed? (neutral and open-ended)
- 2. How did the change happen? (neutral and openended)
- 3. Are there any records of the changeover? (neutral, closed question that requires a follow-up question)
- 4. Is there any relevant record of training? (neutral, closed question that requires a follow-up question)

Now you can obtain the required information and avoid irritating the interviewee.

2. Balanced questions: With the balanced question method, the uncomfortable question is prefaced with a positive comment. This emphasizes that there are plenty of good results to counterbalance minor issues. Balanced questions soften difficult ones when it is impossible to split the question into several parts. They change the auditor's outlook from an investigative to a contemplative one.

Working from the assumption that everything has at least two sides, start with the positive and then move to the problem area. For example, "This is a thoroughly developed plan. How was it reviewed?"

3. Stupid questions: In the news business, there is no such thing as a stupid question. As journalist Gail Sedorkin says, this is because these questions "can work very well, particularly in getting the interviewee to explain something in simpler terms and to reveal more information."¹¹



Stupid questions start with a preface such as, "I can't understand this," or "Can you clarify this?" Questions that follow the preface should be very short and simple, such as, "Why was it selected?" or "How was it used?"

4. Protected questions: With the protected question method, build questions on the circumstances of a situation.

For example, instead of asking, "Why did you miss the deadlines that were established by stakeholders?" frame the question as, "How were deadlines determined?" Or, instead of asking, "Why do you use incomplete requirements?" try, "How do customers provide you with requirements?"

Reframing the questions creates a nonthreatening environment in which the interviewee can give information about problems, challenges and concerns. This information helps reveal process breakdowns and missing links within the scope of the audit or assessment.

5. Loyal questions: The loyal questions method builds on questions such as, "How do you cope with this?" Using this approach, you can change a potentially threatening question into a benign one:

- Threatening: "Why don't you keep evidence of ...?"
- Nonthreatening: "One of the toughest jobs is to keep all of this evidence. Tell me more."
- Threatening: "Why is your review log half empty?"
- Nonthreatening: "Is it a manageable task to maintain so many review comments?"

Five types of questions / FIGURE 2

Exploring the topic:

- Make the question simple (stupid question)
- Split and disconnect the question

(split question)

Identifying nonconformity:

- Ask about circumstances around the situation (protected question)
- Preface with praise (balanced question)

Exploring nonconformity:

• Take interviewee's perspective

(loyal guestion)

This style of question asks you to consider the situation from the interviewee's perspective. Attentive listening, as well as your sincere desire to understand his or her position, is generously rewarded, and the interviewee will start to see you as a partner instead of an examiner.

Figure 2 outlines when and how these five types of questions can be used.

"It's income, not privacy, that often makes a source evasive."¹²

People avoid answering questions for a variety of reasons. Perhaps they are nervous, they misunderstand the questions or don't know the answer, or they could be trying to avoid revealing something unpleasant. Along with being a keen listener, a good interviewer must also consider the subject's speaking tone and body language.

When someone looks away, moves around, coughs or changes voice pitch, it can mean an interviewee is evading your question. Here are five types of evasive replies and some tactics auditors and assessors can use to get the information they seek:

1. Bridging replies: Interviewees are often tempted to speak about what interests them rather than providing the specific requested information. Subconsciously, they create a bridge between the question and topics about which they want to talk.

In this scenario, the interviewee gives short answers, such as "yes," "certainly" and "probably" before moving on to some larger topic he or she wants to discuss. After giving a bridged reply, your subject may feel the question is fully covered.

To counter this situation, note that the question wasn't properly answered. Ask a loop-and-circle question, neatly returning to points you want to have answered.¹³ Questions of this type can be started with one of the following phrases:

- "That's great information, but first I would like to clear up ..."
- "Impressive, but what I really want to know is ..."

2. Misunderstood replies: The interviewee finds something unclear in your question and asks for an explanation. For example, "How does this question per-

The best interviews do not just happen. They are the result of **careful preparation.**

tain to what we are discussing? Can you elaborate?" or, "What do you mean by inspection?"

In extreme scenarios, the interviewee wants to clarify more things, and the roles between an auditor or assessor and an interviewee reverse. But it's very important to stay away from explanations when you receive a misunderstood reply. If you start explaining, you lose valuable time and control over the interview.

Instead of an explanation, ask another question using different words, or structure the sentence or level of detail in a different way. Start your next question with, "I am sorry for not being clear. What I wanted to ask was ..."

3. "As I said before" replies: In some cases, people believe your question has already been answered. Replies of this kind usually combine a phrase such as, "As I said," and add very brief information. For example, "We review it monthly in the manner I described before."

The fact that the answer was or wasn't given previously doesn't matter. What matters is you don't have the answer. Stay calm and don't move to the next question until you are satisfied with the answer to this one.

Acknowledge the given reply and then split your original question into a set of smaller ones. The small questions can be especially helpful if they are requests for facts and data. For example, "Right. Can you show me the review records?" or, "Agreed. Who were the participants of the review?"

4. Yes-and-no replies: In this scenario, the interviewee gives answers such as "yes," "no," "occasionally," "in some cases" or references a procedure. For some people, this pattern is just a natural way of talking, but the concern is that the interviewee's attention may not be fully on the interview.

Try to use open-ended questions (beginning with what, how and why) to which a person can't reply with a single word. In some instances, you might try using the power of silence, but be careful with this tactic. Use it judiciously.

While silence can make people uncomfortable, and they will speak to fill it, it can seem like a hostile act on the part of the interviewer. To use this technique effectively, look at the person and smile. If this isn't successful, ask for an example or say you do not really understand. That way, the onus is on your subject to speak.

5. Waffled replies: In this scenario, interviewees answer the question by providing too much information, usually because they are nervous. As a signal to the interviewee, raise a finger and your head just enough that it will impede the flow of conversation. Try reverting to bridging and say, "That's very interesting, but what I want to know is ..." Or, after an interruption, ask easy yes-and-no questions.

"Ultimately, by looking for chances to practice doing interviews in nonthreatening settings, accepting small failures as part of the learning curve and building up your skills to observe, record and participate in conversations, you will be able to approach interview settings with less anxiety."¹⁴

While the jobs of a journalist and an auditor are not identical, both are trying to procure valuable information from sometimes reticent sources. The craft of journalism is more than 300 years old, and there is much auditors can learn from those who have perfected the art of interviewing.

The best interviews do not just happen. They are the result of careful and conscientious preparation by the interviewer. Auditors must spend a great deal of time learning about the organization, the employees and the processes involved before asking the first question. Once the background material is collected, spend time organizing your questions into a coherent outline that follows some or all of the earlier suggestions.

Make time to consider which questions you will use to open the discussion, which ones will flesh out the details and which ones will extract material from an evasive subject. During the interview, listen actively

AUDITING

to seek clarity and detail in a neutral, nonthreatening manner.

The best way to improve your interview skills is to practice—the more opportunities you have to ask questions, the better you will become at procuring the information you seek. **QP**

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NATALIA SCRIABINA is managing director of the Quality Professionals' Resource Center in Waterloo, Ontario. She earned a master's degree in engineering sciences from the National Technical University of Ukraine. Scriabina is an ASQ member and author of Quality Management Basics (Interregional Academy of Personnel Management, 2000).



ROMAYNE SMITH FULLERTON, Ph.D., is an associate journalism professor at the University of Western Ontario in London, Ontario. She is also director of communications at the Quality Professionals' Resource Center.



JOEL BRINKLEY is a journalism professor at Stanford University in California following a 23-year career at the New York Times. He earned a bachelor's degree in journalism from the University of North Carolina at Chapel Hill. Brinkley has authored several books, including U.S. vs. Microsoft (McGraw Hill. 2001).



KIM KIERANS is a professor and the director of the school of journalism at the University of King's College in Halifax, Nova Scotia. She earned a master's degree in Atlantic Canada studies from St. Mary's University in Halifax.



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Think I have been seen as a second se

In 50 Words Or Less

- Because of people's mind-sets, many audits are rendered ineffective before they begin.
- The organization and the auditor must work together to overcome the misconceptions and us-vs.-them mentality.
- By doing so, an audit can be what it's supposed to be—a tool to help ensure success.

Change your view of audits to improve their effectiveness

by Sonny Sahi

THERE IS A SUBTLE dance organizations choreograph and perform in the weeks prior to a scheduled third-party audit. Besides ensuring the organization puts its best foot forward, many of the machinations are intended to ensure failure is avoided.

But, if we stop and contemplate why we think of audit results as pass or fail, we may become more aware of how our mentality affects the way we behave during an audit and how that mind-set influences others. Part of preparing for the third-party auditor is blitzing the organization with mini-audits. These unscheduled walkthroughs of office and manufacturing areas with eyes peeled are intended to identify anything out of the ordinary, such as untagged nonconforming material, unlabeled or past-due inspection and measuring equipment, general housekeeping, obsolete or uncontrolled documents, and outdated communication boards with performance data. engage in firefighting prior to the third-party audit, and then feel as though failure has been avoided or at least put further in the distance? How does that mentality affect our behaviors and actions, as well as those of others?

Getting off-message

The first things to examine are the messages being conveyed through the blitzes:

The message that **audit findings are failures** is **not easy to change.**

As soon as a discrepancy is observed, it is brought to the attention of someone with the appropriate level of authority in the area targeted for correction. Then, additional blitzes are performed with a heightened sense of urgency and mission, focusing on the observed problem.

Naturally, all identified discrepancies are fixed right away, there is a sense things just got a little bit better, and we become a little less vulnerable to the auditor's sword ... er, pen.

You may throw your head back with laughter and a bit of know-it-all smugness as you point out that, in the aforementioned scenario, things did not just get better. You're right.

The obvious problem is that the system did not get better. The discrepancies observed were symptomatic of deficiencies in the systems' processes that continue to lurk beneath the veneer of calm assuredness that all is well. This only promises the problems will return unless causes are identified and effectively resolved with robust corrective actions.

In addition, personnel are coached to say as little as possible during an audit, so as not to inadvertently volunteer information that could be used against them. "Provide yes-and-no answers, and only elaborate if asked to," we're told. This makes the audit an us-vs.them proposition.

Some advice is very pertinent: Speak only about that which you know. Don't speculate. Speak only about that over which you have responsibility and authority. But what is this mentality that compels us to

- Inspection and verification activities effectively ensure conformity.
- Correcting the deficiency observed fixes the problem, taking us out of danger.
- Focusing on satisfying an auditor and passing the audit is as important—if not more important—than focusing on the customer and the processes that ensure customer satisfaction.
- Nonconformances are failures, and failure is to be avoided at all costs, lest there be consequences.
- Discrepancies are the failure of people, not the system.

It's also important to examine the behavioral outcomes of the mentality that typically accompanies audits:

- We become defensive because we feel we have something to hide or a consequence to avoid.
- We do not collaborate with the external auditors to discover deficiencies that could give rise to robust corrective actions that benefit all stakeholders (employees, the organization and customers).
- We unnecessarily push back and challenge auditors because we can't admit—in the words of someone I know—"our baby is ugly."
- We have on-the-spot meetings (though discreetly out of the auditor's earshot) to formulate answers that keep us out of trouble.
- We rush to fix discrepancies.

As you read both lists, look inward at your organization, and you'll be able to identify other messages conveyed and behaviors reinforced that don't normally exist outside of an auditing situation.

Making the grade

There is a tendency to negotiate with the auditor to change the grade of a finding, because a major or minor finding is an admission of failure. Thus, if a finding can be graded as an opportunity or scope for improvement, the message received is that all is well. We passed because all we received were some nuggets of wisdom that don't merit obligatory action. As a result, the awareness that comes from analyzing the findings and acting on them to resolve any issues is not considered a priority, and the benefits that could have been accrued from corrective actions never materialize.

In some organizations, it is not hard to see why failure is associated with an audit outcome. Individual, process and organizational performance measures often include minimization of nonconformance. Is this really a measure of success or failure? Are fewer nonconformances always in the interest of the organization or its customers? Is ignorance regarding failures in our systems and their processes a cause for success?

Understanding the benefit audits bring when they're done right relegates audits to just another business process, whether internal or external, that hums along with other parts of the business machinery and provides a measure of assurance of organizational success.

System effectiveness is evident every day, week and month as performance data are gathered, analyzed and disseminated. An aware and empowered organization should be able to clearly distinguish between the minor infractions and their quick fixes, and the big picture conveyed by the trend of the performance measures most important to business success.

Embracing failure

The message that audit findings are failures is one that is not easy to change. Yet it is one of the most important changes management must embrace as a priority.

Because the lesson we are trying to undo is one of management's doing, it is up to management to transform the organization's environment so audits are seen as a positive learning activity not to be feared, but welcomed. The change in mentality—to focus on the truth and on the improvement, not to "win" the audit—will ultimately result in changes to organizational behavior toward audits.

Management must have a better understanding of how audits can benefit the organization and, ultimately, its customers. It's up to the leaders to do a better job of communicating and reinforcing the purpose and rationale of audits to the rest of the organization. At the first hint of dissention in the ranks, the purpose of audits must be reinforced again and again to ensure the negative mentality regarding audits perishes.

The effectiveness of an audit is not measured by the number of nonconformances. Reduced nonconformances are not an indicator of success. This is part of the message management must get out. Is it better to live in ignorance of process and system deficiencies, or would you rather discover deficiencies and fix them permanently?

Redefining nonconformance

Nonconformances are typically viewed as the result of an individual performing an activity contrary to requirements. Management puts people on the spot to explain why such a discrepancy could have occurred and why someone didn't identify it before the thirdparty auditors came on site.

Instead of asking how the process or system failed, the investigation by management is rarely pursued beyond the first question: Why did (insert name here) let this happen? Once management makes its query, the next stage of the investigation is left to the underlings. By that time, the blueprint for how to perceive the issue is already established by the question raised by management—that it's somebody's fault.

For obvious reasons, pointing the finger at people makes them defensive and trains them that such situations are to be avoided. Because of the personal trauma associated with nonconformances as exhibited by management's questions, people don't associate the nonconformance's impact on the process or system—and, ultimately, the customer. Why should they? After all, management doesn't. But, by focusing on the issue and its impact on the system, success is more likely.

A collaborative effort

If audits are merely inspection activities, they can be a waste of resources that are perceived as just another check-up. Nobody wants to participate in nonvalueadded activities; they are a waste of employees' time and the organization's resources. This mentality arises from negative perceptions of audit activities and their results.

A **collaborative approach** to audits is a **win-win situation** and prevents the us-vs.-them mind-set.

Why do all audit records look more like after-thefact exercises? Why do audit-planning activities tend to look at program records, such as a production parts approval process, after the launch of a new program or after the first job, when production parts are being shipped?

If an audit is integrated into the program planning and implementation phases of advanced product quality planning, it can be a tremendous tool for identifying improvements in the process, as well as the product. The challenge is ensuring the program's timing is not adversely impacted.

Here again, our mentality impacts our behavior by considering audits wasteful because the proverbial horse has left the barn: The program is completed, so why are the records being audited now?

Audits should be smoothly integrated into the program at appropriate stages, and planning and implementation should be evaluated continuously while considering the status and importance of the activities. Auditing a process as it is being performed is much more ideal than only auditing its output, with no regard for the activities in the process that produced the output.

Seeing audits as part of—rather than apart from the process can be an important change in the mentality that impacts behavior during audits. This collaborative, participative approach to audits is a win-win situation and prevents the us-vs.-them mind-set and its subsequent behavioral outcomes.

No fear

Driving fear out of the auditing process is a task for top management, as well as auditors. Prior to the audit, management needs to emphasize the purpose and benefits of the audit and raise expectations to focus on improvement outcomes. Once the audit begins, that must continue, with the auditor joining management. That can go a long way to ensuring a collaborative and beneficial result.

By adjusting the manner in which audits are conducted and reported, auditors can help manage expectations. Knowledgeable, flexible, aware auditors with good interpersonal and communication skills can convey a feeling of being part of the improvement rather than apart from it without violating ethical or professional codes of conduct. By focusing on the process, its outcomes and factual information instead of the individual, an auditor can help assure the organization this is not a witch hunt.

Auditors can also reinforce the message that nonconformances are nothing more than opportunities to be seized upon as improvement projects for the benefit of all stakeholders, while still emphasizing the importance of timely and meaningful responses.

Management, in partnership with the employees, must commit to the audit process as a tool for continual improvement of the system and its processes for the benefit of the organization and its customers. Doing so ensures the audit will be looked upon as just another business process—not to be feared, but rather considered to be all in a day's work. **QP**



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WHAT DO YOU THINK?

Let us know what your organization does—or doesn't do—to make the auditing process as effective as possible. Share your thoughts using the comment tool on this article's page at www.qualityprogress.com.

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Score One For Improvement

In 50 Words Or Less

- Intel's IT organization developed a simple scorecard to measure the progress of projects and monitor process compliance.
- The scorecard included proof points and could address multiple product life cycles.
- Keeping the scorecard simple helped everyone understand that process compliance is an issue an entire organization needs to own.

Intel built its own basic scorecard to measure process compliance

by Terry Leip

FIVE YEARS AGO, Intel's IT organization decided to improve internal customer satisfaction and the efficiency of IT projects with a Capability Maturity Model Integration (CMMI)-based process improvement activity to develop standard processes for project management.

As a part of that effort, quality assurance audits were introduced to help measure and understand the progress in process compliance and to drive process improvement. In 2007, the number of projects using standard processes increased from 25 to more than 150. Audit resources, however, stayed constant, and management still wanted some level of compliance measurement for each project.

The quality assurance audit team needed a way to provide more continuous feedback about process compliance without expanding the time and effort involved in conducting audits. The decision was made to provide a scorecard for project managers (PM) to report compliance. This decision was backed by randomly auditing projects to verify compliance and understand the accuracy of selfscoring.

While there wasn't a clear vision for the solution, management and other stakeholders identified a few high-level requirements, shown in Table 1. Adding to the challenge, the first version of the scorecard needed to be ready for limited deployment in a few weeks, so any solution needed to be constructed quickly.

Approach

Given the requirements and short timeframe, our team decided to use the criteria defined in our existing audit checklists as the basis for the scorecard. In addition, we decided to keep the methods as simple as possible because we knew we would likely need to explain every aspect of the scorecards to our stakeholders at deployment. We broke down the work into four main tasks:

- 1. Aligning the process requirements between life cycles.
- 2. Defining weighting methods.
- 3. Defining scoring methods.
- 4. Creating the scorecard.

1. Aligning process requirements

We had five distinct product development life cycles in our organization, each with its own audit checklist, shown in Table 2. These separate audit checklists made it difficult to meet the requirement for providing a standard score regardless of life cycle, so we moved the list of deliverables for all life cycles into a single MS Excel worksheet.

Product development life cycles / TABLE 2

Life cycle name	Description
1. Cascading Waterfall	Traditional sequential development life cycle.
2. eXtreme Programming	Agile life cycle using short iterations.
3. Spiral	Risk reduction life cycle.
4. SAP	Life cycle using existing SAP functionality.
5. Non-software generic	Life cycle for any stagnant software, installing routers or creating white papers.

SAP = systems applications and products

Scorecard requirements / TABLE 1

Requirements	Explanation
1. Simplicity	Very simple to understand and use.
2. Low effort	Only a few minutes for an experienced project manager to self-score.
3. Life cycle independent score	Provide a standard score regardless of the project's life cycle.
4. Consistent criteria	Projects and auditors must work from the same basic criteria.
5. Score consistency	Self scores and audit scores must be able to be compared on an "apples to apples" basis.
6. Weighted scores	The relative importance of each deliverable needs to be reflected in the overall score.

We aligned deliverables and activities common among the life cycles by focusing on the intent of the deliverable or activity (even if they had different names or minor content differences). Each of these groups of common items was assigned a title, which we called a proof point. For each proof point, a set of criteria was documented addressing the absolute minimum required to demonstrate a proof point had been completed.

Timing for completion of the proof point (in other words, when it was due) was added in the form of the product life cycle (PLC) phase. For example, the requirements peer review proof point must be completed before the requirements baseline proof point.

Table 3 shows a partial example of the alignment of the process requirements for "code peer review" and "construction baseline" proof points for the Cascading Waterfall and eXtreme Programming product life cycles. In some cases, no analogous process requirement existed for a life cycle, so criteria for these were simply marked as N/A.

2. Defining weighting methods

Because some proof points were considered more or less important than others, we needed a method to ensure they would have a corresponding impact on the overall score. Assigning a weight to each proof point was an easy solution, but determining the correct weight was a challenge.
Alignment of process requirements

DY IITE CYCIE / TABLE 3	3
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Proof point	PLC finish phase	Waterfall	eXtreme Programming
Code peer review	Development	 Records of peer reviews. Review issues and resolutions documented. Completed before test baseline. Performed for at least 25% of total modules. 	 Records of pair programming evidence or peer reviews (either): Review issues and resolutions documented. Task assignment records or scrum minutes reflect the use of pair programming. Completed prior to iteration baseline. Performed for 100% of code modules.
Construction baseline	Development	 Baseline occurs after unit testing is completed. Baseline label exists for code baseline 	N/A
		3. Baseline contents:Code (snapshot).	

PLC = product life cycle

Lacking any organizational data that could tell us the relative importance to project success of one proof point vs. another, we relied on a small team of experienced PMs and auditors who discussed how to select the weights. Agreement on this topic was dramatically aided by two key concepts:

- 1. Limit the number of weights: Too much freedom in weighting made decisions difficult, and fewer weighting choices simplified consensus. We settled on four possible weights (see Table 4), which also made the concept easier to explain to scorecard users.
- 2. Weight categories of similar items first: Group proof points of similar types together (reviews and baselines) and weight the entire category, then identify weighting for any exceptions to those categories. Again, this reduced the number of decisions and drove consistency across similar proof points.

3. Defining scoring methods

Developing the scoring method was another challenging aspect of the scorecard because we needed a simple approach, yet one that could still provide a useful level of detail about compliance. Stakeholder suggestions ranged from a "done/not done" approach to a complex, multidimensional scoring method that separately scored timing, sufficiency, completeness and correctness.

While the done/not done approach had strong sup-

port from management, proof points that were late or incomplete were considered the same as those not done at all. This could limit our insight into the actual level of compliance. The more complex approaches provided a finer level of detail, but those approaches required too much time and effort to learn and use.

Seeking a balance, we settled on a four-level score, shown in Table 5 (p. 36). While simple, the scoring criteria offered more detail than just done/not done.

A blank entry in the score identifies a proof point that isn't yet due in the life cycle or for which a deviation exists. These blank proof points are not included in the score calculation, so the project isn't negatively impacted by being early in the life cycle and only having a few proof points scored.

The clause "completed more than one life cycle phase late" was added to the zero scoring (meaning an item was not completed) criteria after we discovered project teams were completing the

Weight categories / TABLE 4

	Weight	Proof-point category
ing	0.25	Work product approvals, traceability.
eas orta	0.50	Work product reviews, baselining.
inci mp	0.75	Metrics, change management.
	1	Requirements, plans, schedule.

required work for some proof points extremely late. Teams were attempting to improve their scores retroactively by going back and completing missed deliverables long after any value would have been added to the projects. In one instance, a team baselined its requirements after project closure (and prior to a quality assurance audit), hoping that it could improve its score for that item.

The frequency for updating the scorecard twice a month was established by IT management. At those times, the PM must evaluate the status of any items completed on the project, and then update the scorecard accordingly. Because projects of average duration generally complete about one to two proof points in a two-week period, this provided a reasonably current score without being overly burdensome.

4. Creating the scorecard

Each project needed visibility to proof points and criteria that pertained to its life cycle, so we created separate per-life-cycle scorecards in the same workbook on separate worksheets.

To reduce data duplication and ensure consistency, we used a MS Excel formula to reference the proof point name, criteria and PLC finish phase from the single side-by-side list of criteria, which was stored in a hidden worksheet in the same workbook.

This formula recognizes the difference between a common criteria (criteria that is the same for multiple life cycles) and unique criteria (criteria that is specif-

Audit report fields added to scorecard / TABLE 6

Field	Description
Audit notes	Notes created by the auditor during the course of the audit.
Noncompliance details	Description of the noncompliance.
Root cause of noncompliance	Results of root cause analysis of noncompliance.
Root cause category	Drop-down list of standard root cause categories.
Corrective/preventative actions	Description of any corrective or preventative actions relating to the noncompliance.
Owner/due date	Owner of any corrective or preventative actions and required date of closure.
Status	Status of any corrective or preventative actions (for example, open, closed or late).

Scoring criteria / TABLE 5

Proof-point scoring criteria	Score
Performed correctly, completely and on time.	1
Performed incorrectly, incompletely or late.	0.5
Not performed or completed more than one life cycle phase late.	0
Too early in the life cycle to score or not applicable to this project (not included in score calculations).	Blank

ic to a single life cycle). It also recognizes that using this information and criteria applicable to more than one scorecard needs to exist in only one place. This prevents duplication of criteria and greatly simplifies maintenance and verification activities.

Columns were added for PMs and auditors to score each proof point, as well as a column to explain the reason for discrepancy, allowing PMs to document the reason for any 0 or 0.5 scores or any deviations that existed for a proof point.

Auditing

Prior to the introduction of the scorecard, audit notes were entered into an audit checklist, and a report was created in a separate document based on those notes. The PM was provided the report at the audit debrief meeting and stored it with the project collateral.

Using separate documents resulted in wasted time copying, pasting and reformating information from the audit checklist into the audit report. Because the information was divided between two documents, it was also time consuming to collect the data when producing the monthly audit summary reports.

With the audit score now accessible in the scorecard, it seemed only logical the audit report fields (Table 6) should be located there, too. Table 7 shows an example of how some of those fields now appear in the scorecard. This approach did have the drawback of making the scorecard physically larger; however, many agreed that having only one document saved much time and effort.

Deployment

The scorecard was deployed as part of a larger set of process improvements, so communication and support

Partial example of scorecard's audit portion / TABLE 7

Proof point	Criteria	Corrective/preventative actions	Owner/due date	Status
Code peer review	 Records of peer reviews. Review issues and resolutions documented. Completed prior to test baseline. Performed for at least 25% of total modules. 	 Complete code peer reviews for remaining modules. Submit change request to identify code peer review requirements in CM training course. 	1. JM 11-9-07 2. TL 11-11-07	Closed

were addressed as a part of those changes. We have an existing deployment and support system (newsletter, process coaches, process training, website and various communities of practice) that provides details on the scorecard and its workings.

Because we knew management would be reviewing the scores, we suspected there would be anxiety around this topic. We arranged a series of questionand-answer sessions for individuals to call with specific questions about the scorecards. Callers typically had questions about unusual situations, and the majority indicated they understood how to interpret and use the scorecard.

Overall, the deployment went surprisingly smoothly, and we attributed this to the relative simplicity of scoring and providing scorecards customized to the terminology of each specific life cycle.

High scores for scorecard

From the standpoint of simply meeting requirements, the scorecard was deemed successful (see Table 8). The real measure of success has been its widespread use throughout the IT organization and the resulting changes in behaviors. For instance:

- The score produced by the scorecard is now a required metric for every IT project that lasts more than eight weeks and is monitored by multiple levels of the organization's management.
- Scores have steadily improved since the scorecard was implemented, and they are now above 90% in all nine IT divisions.
- In an informal survey of PMs, 90% said they felt the scorecard made audits less stressful.
- Audit effort was reduced by 15% from the previous quarter, largely due to eliminating the copying and reformatting of audit data.

In late 2007, the Excel version of the scorecard was automated and added to the IT PM dashboard online status tool. This allows PMs to score projects more easily, and overall scores are automatically rolled into IT metrics reports. The online version also ensures PMs make updates twice per month as required.

Auditing was decentralized in 2007, and ownership of compliance was moved to each of the divisions. Only two organizations have continued auditing to

Requirements vs. results for the scorecard / TABLE 8

Requirements		Results
1. Simplicity	Very simple to understand and use.	The majority of project managers (PM) informally surveyed felt the tool was easy to use and understand.
2. Low effort	Only a few minutes for an experienced PM to self-score.	Informal survey of PMs indicated that biweekly scoring took less than five minutes.
3. Life cycle independent score	Provide a standard score regardless of life cycle used by the project.	Design of scorecard aligned common deliverables among scorecards.
4. Consistent criteria	Both projects and auditors must work from the same basic criteria.	Projects and auditors now use the same scorecard and criteria.
5. Score consistency	Self scores and audit scores must be able to be compared on an "apples to apples" basis.	Auditor and self scores are calculated using the same formula and weighting.
6. Weighted scores	The relative importance of each deliverable needs to be reflected in the overall score.	Each proof point is weighted.

Keeping the scorecard simple **helped everyone understand** that process compliance is an issue **an entire organization needs to own**.

confirm the accuracy of the scorecards. Their scores remain high. Those organizations that discontinued auditing have kept their scores above 90%. There is doubt, however, on the accuracy of the data because there is no longer independent confirmation.

While still in discussions, there are calls from some corners of the organization to resume some method of independently verifying the scorecards to improve accuracy issues.

While we understood at the outset that our scorecard would not be an extremely sophisticated tool, we also knew a simple tool used correctly would be superior to something more complex used incorrectly or not at all. The widespread acceptance of this tool by all levels of the organization allowed us to move process compliance from being an audit-driven issue to one the entire organization owns. **QP**

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In 50 Words Or Less

- Studying the timing and motion of machines on a production line can help you better understand the manufacturing process, prevent unnecessary downtime and uncover ways to become more efficient.
- Machine order of operation analysis allows you to dissect how machines interact with product and aids in simplifying the manufacturing process.

New technique can make manufacturing lines more efficient

by Robert Cartia

Noving Right Along

ART IS KNOWLEDGE kept in the

artist's mind. Science is knowledge that is documented. The goal of any lean organization is to transfer art to science: tacit knowledge to explicit knowledge.

Applying lean to aid in the process of control is vital. One method to achieve this transformation is to extract knowledge from the employees (the artists). Another way is to conduct time and motion studies. These methods can be used to standardize and simplify every aspect of the process. Remember, you can't measure what you can't control, and you can't improve or control what you don't understand. A gap exists in literature with respect to the promotion of machine order of operation for simplification purposes. There are several methods available to study human and machine motion that includes time and motion studies, machine motion studies and opportunity analysis. But none specifically address machine order of operations for simplification purposes.

New form of machine simplification

Frederick Taylor and Frank Gilbreth were early contributors to motion study who focused on worker motion. Very little time and energy, however, were focused on machine order of operation.

Henry Ford applied Taylor's management theory of motion study to his manufacturing strategies on assembly lines. Shigeo Shingo, influenced by Taylor and Gilbreth, focused on worker motion and machine motion. Shingo's approach to machine motion was from a machine cycle efficiency perspective.

A budding concept called machine order of operation analysis—a process of visually identifying machine order of operation to better understand machine sequential motion—was developed in 1996. In addition to identifying machine order of operation, the analysis can be enhanced to include time analysis—documenting the time it takes for each motion to occur, identifying the motion in which the machine contacts the product it is producing and identifying the motion manually controlled by operators. See Figure 1 for an example of this analysis.

This approach promotes the simplification of machines, which is beneficial to those who troubleshoot machine downtime. Applying this analysis is ideal when the machine manufacturer's order of operation is unavailable or not easily attainable. If the machine is controlled by programmable logic control (PLC), in most cases the supplier, who used the machine's order of operation to design the programmable logic, will not attach order of operation verbiage to the ladder logic.

Machine order of operation is required to create machine logic tree and fault tree diagrams. Logic tree diagrams are decision path-based tools used to map a complex sequence of conditions. Fault tree diagrams are event-based tools that can be used in probabilistic risk (failure) assessment. Machine order of operation analysis does not serve the same purpose as fault tree and logic tree diagrams.

Toyota Production System

Machine order of operation drew inspiration from one of the most well-known quality-based organizations the world has ever seen: Toyota.

Toyota is one of the world's most storied companies, drawing the attention of journalists, researchers and executives seeking to benchmark its famous production system. The Toyota Production System (TPS) is a system of nested experiments through which operations are constantly improved.¹ TPS aims to deliver quantitative improvements in a rigorous, systematic manner.

TPS emphasis should not be on the mere tools or techniques, but more on the rigor and discipline of applying the scientific method for thinking and then achieving the related goals of quality, cost, delivery and profit improvements in the respective operations.²

The underlying tactical knowledge of TPS can be captured in four basic rules:

- **1. Activity:** addresses standardization and human values.
- 2. Flow paths: encourages simple, prespecified, fixed flow path.
- **3. Customer-supplier connections:** outlines relationships between every customer and supplier.
- **4. Continuous improvement:** follows the plan-docheck-act cycle.

These rules guide the design, operation and improvement of every activity, connection and pathway for every product and service.³ These rules share common themes: Expectations of how something will work should be articulated in advance; and gaps between the expected and the actual performance should be recognized immediately.⁴

TPS's first rule—activity—states: Specify each activity's work-element content, sequence, timing, location and outcome.⁵ This is achieved by designing and executing each activity so it is structured and selfdiagnostic (for example, time and motion study, standardized work, visual management and value stream mapping).

Scientific thinking mechanism

Shingo, a consultant to Toyota for 25 years, used the scientific thinking mechanism to focus on manufacturing activity and teach motion analysis and time study analysis during his well-known P course (production course) training sessions at Toyota. Everything he

Machine order of operation analysis example / FIGURE 1

	New / Rev	/	Page 1	of 1	Date 00/00/00	•	Machine number: 001				
Organiz	ation: XYZ	Dept.	Leader			Machine name: Welder					
Prod. Li	ne: A	ABC	RAC	Machine order of operation analysis		Macl	Machine cycle time: 56 sec.				
Order	•					Time ana	lysis	Product	Co	ntrol	No. of
#	Comp	onent		Motio	า	Motio	n	contact	Auto	Manual	operators
1	Cradle tran	sverse cyl.	Cradle ind	exes to C s	ide (with shield)	4		Х	Х		0
2	(4) cente	ering cyl.	S	Shield is cer	ntered	2		Х	Х		0
3	OH tra	ansfer	Frame lowere	ed into crac	lle on top of shield	3		Х	Х		0
4	(4) clam	ping cyl.	Shi	eld/frame o	clamped	3		Х	Х		0
5	(4) Z-pos	gun cyl.	Z-position	guns exter	id, weld, retract	3			Х		0
6	(1)A/(1)D p	os. gun cyl.	A/D-position §	guns extend	d, weld, retract pt.1	2			Х		0
7	(1)A/(1)D p	os. gun cyl.	A/D-position §	guns extend	d, weld, retract pt.2	2			Х		0
8	(1)A/(1)D pos. gun cyl.		A/D-position guns extend, weld, retract pt.3		2			Х		0	
9	(1)A/(1)D p	os. gun cyl.	A/D-position guns extend, weld, retract pt.4		2			Х		0	
10	(4) clam	ping cyl.	Shield/frame clamps released		3			Х		0	
11	OH tra	ansfer	Shield/frame assembly raised out of cradle		4		Х	Х		0	
12	Cradle tran	sverse cyl.	Cradle ind	dexes to B	side (no shield)	4			Х		0
13	Manual	switch	Shield C/V	placed int	o manual mode	1				Х	1
14	Hun	nan	(1) sta	ck of (8) shi	elds loaded	5		Х		Х	1
15	Auto s	witch	Shield C/	V placed ir	ito auto mode	1				X	1
16	C/V trans	verse cyl.	Shield	C/V indexe	es to B side	5		Х	Х		0
17	Welder OI	H transfer	Shie	eld removed	d upward	3		X	Х		0
18	Welder OI	H transfer	Shie	eld indexes	to D side	4		Х	Х		0
19	Welder OI	H transfer	Shiel	d lowered i	nto cradle	3		Х	Х		0
19						56		10	16	3	3
cyl. = cy pt. = po pos. = p OH = ov	vlinder int osition verhead										

taught in the P course had a distinct bent toward applying the principles in a scientific manner. He taught the basics of motion analysis in which every machine was analyzed and even the value-added part of the machine cycle was challenged. For example, Shingo might ask:

- Why did it take so long to clamp the part?
- Why was the part idle for two seconds?
- Can the cutting cycle speed be increased?
- Why did the operator have to wait two seconds at the end of the cycle?
- Why was this type of tool used?
- Why did it take three seconds to unclamp? Everything was studied to see if it could be elimi-

nated, combined, rearranged or even simplified for the sake of the operator and efficiency.⁶

Connection to TPS

Shingo taught simplification through scientific methods during his P courses. The machine order of operation analysis is a logical method to simplify a manufacturing process by identifying a machine's high-level order of operation. Shingo taught the importance of conducting motion analysis with respect to identifying wasted machine motion. The machine order of operation analysis can be used as a means of reducing machine delay losses. Machine order of operation analysis also can be considered a useful tool and an extension of Shingo's belief in simplification for the sake of the operator. The machine order of operation analysis, a machine's highlevel order of operation displayed at the machine, is a form of visual management provided for the benefit of the process employees.

Concept benefits

Manufacturing equipment typically uses PLC, a standard in a modern manufacturing environment. With PLC, a process technician or process engineer can refer to ladder logic to isolate a general problem, such as a clamping cylinder not clamping. If the problem is more in-depth or the PLC logic is more complex, such as level 2 programming with three layers (threedimensional logic), the advantage of using PLC dissipates.

Even experienced process technicians and process engineers can be challenged. It is important to note that PLC programs assume the user understands the flow of ladder logic. In lean production and when working with little inventory, stopping the production line to troubleshoot a machine to determine delay root cause creates a crisis in which time is of the essence.

With PLC in mind, the immediate benefits obtained through the use of the machine order of operation analysis are:

- 1. Increasing the process operational availability, a factor used in the calculation of overall equipment effectiveness, thus decreasing operating costs.
- 2. Troubleshooting problems to root cause. This highlevel method can be used alone in some cases or in conjunction with PLC (low-level), if applicable.
- Easily understanding the machine motion product contact points that have the potential to cause quality issues.
- 4. Tracking machine component life cycles by determining how many specific machine component motion occurrences take place per operating cycle. This data can be used to create a preventive maintenance schedule.
- 5. Enhancing process visual management. The printed machine order of operation analysis can be displayed at the machine.
- 6. Identifying efficiency opportunities through familiarization with the motions of the machine.
- 7. Training technicians on machine motions.

Applying the concept

The machine order of operation analysis concept can be applied to manually or PLC-controlled machines. The largest benefit of this concept is achieved with manually controlled machines, such as those found in older manufacturing facilities in the steel industry.

With regard to PLC-controlled machines, the machine order of operation analysis is categorized as high-level because it provides a general sequencing of what motions should occur in the machine's operating cycle. In addition to the high-level machine order of operation analysis, the machine's designated PLC ladder logic can be used when more complicated troubleshooting warrants it.

It is common knowledge in the manufacturing industry that most organizations supplying PLC programs do not provide machine order of operation information. In many instances, even the machine manufacturers do not provide that information.

As a process technician, I first applied this order of operation analysis to a machine that welded a metal shield to a metal frame. The machine was PLC controlled with a cycle time of about 56 seconds. The machine manufacturer's order of operation was not available, and the PLC ladder logic did not contain the order of operation verbiage. I applied the concept analysis out of necessity because I was not familiar with the machine and had received PLC training only weeks prior.

Being responsible for the operational availability of the machine and learning how to minimize machine delays was very critical to the process and to my success as a process technician. Developing analysis began with the following steps:

- 1. Observing each motion the machine made.
- 2. Documenting high-level view order of operation beginning from the home position point of the machine.
- 3. Documenting each component that initiated each motion.
- 4. Documenting each component cycle time.
- 5. Documenting machine to shield and frame contact points.
- 6. Documenting manual controls.
- 7. Documenting the number of occurrences in which machine operators were responsible for manual intervention.

Once the machine order of operation analysis was complete, I had a tool to determine machine delay root cause. In the example in Figure 1, if the welder stopped

PLC programs assume the user understands the flow of ladder logic.

operating and displayed a PLC error code indicating cradle travel overtime, I would look at the machine and determine the exact position of the cradle when it stopped. For this example, it stopped mid-cycle of the cradle indexing to the C side.

At this point, I would determine from viewing the machine order of operation analysis that order 1 cradle indexes to C side (with shield)—was initiated, however, the machine stopped prior to order 2—shield is centered. Now I would know the machine delay occurred in the order 1 motion cycle time.

I would continue investigating by viewing the cradle transverse cylinder as listed on the analysis sheet. From investigating the cradle transverse cylinder, I would determine the cylinder stopped short of its travel because the proximity sensor located under the cylinder was loosened due to machine vibration. Thus, the PLC ladder logic was not reading a desired condition, resulting in a cradle travel overtime condition.

If I was a process technician familiar with the machine with the PLC ladder logic, I could simply enter the error code number into the PLC hand controller and scroll back in the ladder logic rung until I found the proximity sensor in a "not made" state.

Consider another example: If the downstream internal customer of the welder notified me of a quality defect affecting the shield, I would refer to the machine order of operation analysis and view the product contact column.

For this example, the quality defect affecting the shield was an indentation located on the bottom B side of the shield. From this point, I would determine from the machine order of operation analysis that orders 1 through 4 and 19 are machine motions in which the machine is contacting the shield in the specific location of the reported quality defect.

I would continue my investigation by observing each of the five motions to determine the source of the quality defect. Through the investigation, I would identify the root cause of the quality defect as a raised recessed bolt that secures the B-side shield cradle rest pad. The bolt most likely was not tightened during scheduled maintenance, or it simply became loosened due to machine vibration. The raised bolt was not creating the indentation mark until order 4—shield/frame clamped. The downward pressure of the clamps was forcing the bottom of the shield on the B side to mold around the raised bolt and created the quality defect.

Immediate results

The machine order of operation analysis concept is a logical method of identifying—from a high-level view—a machine's order of operation for simplification purposes. The primary benefit derived from the analysis is reducing time to troubleshoot machine delays to root cause. This analysis has proven to be beneficial for those responsible for a machine they are not familiar with or those who are not efficient in their use of the PLC ladder logic.

The machine order of operation analysis is a visual management tool to be used during machine delay troubleshooting. Application of the machine order of operation analysis within any manufacturing process will require no capital investment but some short-term financial investment in labor to conduct the analysis. But machine order of operation analysis is likely to pay immediate dividends through an increase in operational availability. **QP**

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In 50 Words Or Less

- There are many moving parts and details to consider when implementing and maintaining a new quality management system.
- Strong communication and organization skills are essential to leading such efforts.
- Following this impementation plan will get you started on the right foot.

11 steps to get your quality management system **off and running**

by Jill Cooper

Starting Jac

SO, YOU'VE VOLUNTEERED (or, as one of my coworkers says, you've been "volun-told") to lead your company through the implementation of ISO 9001. Now what do you do?

Your new position may be called a quality Champion, quality systems manager or continuous improvement coordinator. As the quality Champion, you must understand ISO 9001 requirements and translate them into the language of your business. You must clearly and passionately communicate the value of adopting these processes in your organization. You will be the project manager for the implementation and maintenance of the new management system. A background in quality management is a plus, but not a necessity. ISO 9001 is not just about controlling the quality of your products and services; it's also a list of activities the top management team must implement to operate the business in a systematic way that helps guarantee it meets customer expectations.

If you organize and communicate well, collaborate effectively with management on long-term projects, and are enthusiastic about helping your company develop a formal continuous improvement program, you can implement the standard and become a successful quality Champion. Remembering these 11 steps will help you ease your organization through the implementation and avoid rocky stretches and unexpected setbacks.

Who knows? Perhaps your organization will want more and ask you to lead the implemention of additional standards, such as ISO 14001 (environmental), OHSAS 18001 (safety) or others that apply to your business.

After your first successful implementation, look for the elements common among the standards to simplify ensuing implementations. For now, because the implementation scope may include several standards, I will refer to it as a management system (but it is often referred to as a quality management system).

Learn the subject

Depending on your experience with ISO 9001, you will want to prepare your own training program. Below are some suggested actions.

- Read the standard(s) five times—front to back.
- Join ASQ and attend a quality conference.
- Take an online ISO 9001 class.
- Complete lead auditor training.
- · Take ASQ's certified quality auditor exam.
- · Read magazine articles on quality management in QP.
- Find an author you like and read his or her books. Try www.asq.org or www.patonpress.com for leads.
- If you work in a large organization, there may be other quality Champions you could contact. Ask them to meet with you to share some do's and don'ts about implementing a management system.
- Take a class in program management if you aren't a natural organizer.

2: Prepare a budget

Determine when upper management pulls together next year's budget. Ask now. Management may begin preparing for the following year early this year. Submit your request and begin begging. Some potential requests (with ballpark estimates) may include:

- \$75,000 for quality management software to manage documents, nonconforming material reports, corrective and preventive actions, the audit program, management review meetings or calibration. Don't try to do this manually—you will drown in paperwork. Talk to the IT department and remember to add money for new hardware as needed.
- \$15,000 per year for three years to hire a quality consultant.
- \$3,000 for training classes and materials for yourself.
- \$1,500 per year for online safety and environmental training for all employees.

Write a mission statement

It is important that you begin your management system implementation by writing a mission statement. The statement will force the management team to define the most important aspects in your business. For example, list the most important aspects of your organization's:

- **Products.** Perhaps your business prides itself in providing unique products, delivering on time, offering the lowest prices or producing the best quality product.
- Service. Maybe your business guarantees experienced or quick service.
- **Employees.** Perhaps your business promotes flexible work hours, training and advancement, a safe work environment or a no-layoff policy.
- **Neighbors.** Your company may commit to supporting community programs or protecting the environment.

Spell out whatever defines your company's uniqueness and the commitments made by upper management. Even if you are implementing more than one standard, you may need only one statement. For example, the quality statement, environmental mission statement and safety vision statement can be rolled into one.

H: Write a management system manual

This is a booklet describing how you organize your business. To begin, just copy the standard(s). For example, where the standard says, "6.4—The organization shall determine and manage the work environment needed to achieve conformity to product requirements," rewrite your manual to say "6.4—(Company name) has determined and manages the work environ-

Don't change your title to quality Champion. If or when it's time for layoffs, this job title **looks like pure overhead**.

ment needed to achieve conformity to product requirements. Refer to maintenance of infrastructure and environment procedure for more information."

If you have an electronic copy of the standard(s), even better. When you sign up for an online training, sometimes a copy of the standard will be supplied.

If your company is using more than one standard, you may decide to combine them into one. Often, there is a lot of redundancy among standards. You don't have to produce a quality manual, a safety manual and an environmental manual. One management system manual may suffice.

5: Define your programs

List the activities required by the standard(s) or your newly prepared management system.

Break them up into groups—these are your programs (also called processes). Give each program a name, such as "management responsibility," "infrastructure and work environment" or "product realization."

Don't worry about who does what at your organization right now or how the job activities are organized. Forget about the names of the departments and the titles of the managers. If you align your new management system activities with the standard, it will be much easier to write procedures that meet the requirements. You may identify seven to 20 programs. As long as there is one program owner ultimately responsible for each program, fewer groups may be easier to manage.

5: Identify program owners

List the names of the general manager and his or her direct reports. Divide the programs among them.

- Don't give the majority of the programs to the quality department. This is not a quality control system—it is a management system. It belongs in the hands of top management, including the general manager.
- Don't assign yourself many programs. Consider keeping only the audit program. You will be very busy helping other program owners develop, document, train, implement, monitor and measure their programs.

- Do consider each manager's strengths and weaknesses when assigning programs. Don't give material integrity to the warehouse manager if he or she has a tendency to hide quality issues. Do give document control to the finance manager if he or she writes and organizes well. Remember, it doesn't matter what current job titles are.
- Do sit down with the general manager and get his or her approval before sharing the responsibilities with the rest of the management team.

Completing a process matrix similar to the one from *ISO 9001 in Plain English* is a good first step when designing your management system.¹ You also can use this process matrix to meet ISO 9001:2000 section 5.5 "define and communicate authorities and responsibilities," and section 8.2.3 "monitoring and measurement of process" requirements.

Define responsibilities

A program owner is responsible for:

- Program development, documentation, implementation, training and oversight.
- Developing programs within applicable law, regulations, standards or company requirements that effectively ensure the continuous supply of material, product or services that meet company specifications.
- Ensuring the planning of his or her program is consistent with the overall requirements and objectives of the company's management system through review of key plant metrics and the company's annual business plan.
- Including all other program owners, the quality Champion and the safety, environmental and security (SES) manager to develop and approve any program. The program will receive final approval at a management review meeting.
- Determining if any additional supporting instruction documents are necessary (with approval from quality Champion).
- Determining applicable statistical techniques and the extent of their use.

- Determining if equipment is needed to monitor the program and to ensure program capability. Ensuring the availability of any monitoring or measuring devices and ensuring the proper use of the equipment also falls under the program owner's purview.
- Reviewing, analyzing and evaluating program-monitoring data to determine where continual improvement for the effectiveness of the management system can be made.
- Determining appropriate corrective action if program performance does not meet company requirements.
- Including all other program owners, the quality Champion and the SES manager (as applicable) in discussions when a substantial change is made to the respective programs. The newly revised program will receive final approval at a management review meeting.

B: List procedures, then write them

A procedure documents a program and describes the roles and responsibilities between and among departmental groups, programs or people. Each program will probably need one or two written procedures to describe it.

Don't worry if your list isn't perfect. You can always add more procedures later. If you gave a newly hired manager a copy of your management system manual and each procedure, he or she would have a good idea how the company is organized and what he or she needs to know to manage the business.

The procedures will not provide detailed steps to carry out a specific activity. That information is covered in instructions and will be completed at a later date in your implementation schedule. Instructions are typically a set of specified tasks and activities to be completed by one person. Do not begin by writing work instructions. For now, focus on developing the procedures.

Brepare an implementation schedule

All the activities in steps one to eight are part of the planning process. Now, it's time to focus on:

- Listing every program.
- Listing each procedure needed per program.
- Listing the program owner.

• Negotiating due dates when a first draft of the procedure will be completed by the program owner (usually, four weeks is the right amount of time).

About once a month, meet face to face with each program owner and review the status of the implementation schedule. Remind the owners of their commitments, and provide example procedures for them based on research you've done on the internet, in magazines and from other quality Champions. If needed, write a procedure outline to get program owners started. Help them in any way you can.

Approve every procedure

As the quality Champion, you must review every procedure. Require that each program owner submit his or her draft to you. Verify that each procedure:

- Describes each activity required by your management system manual (or the standard[s]).
- Doesn't include a lot of "requirements" that aren't in the standard. Once you put it in writing in a procedure, it becomes an additional requirement.
- Is management-level material. Don't let it become detailed instruction. That information will be captured elsewhere.
- Describes a program's requirements for the entire company. In other words, there will be one calibration program for the entire plant, not one for the laboratory, a slightly different one for production equipment and yet another for the maintenance department. Program owners have a tendency to develop programs based only on what they are responsible for in their day-to-day activities. You will have to remind them that the program applies to the entire business.
- Doesn't repeat information already captured in another procedure. Put the activity in the one program with which it belongs (look at your program matrix). Again, don't worry about the job title of the procedure's author. It doesn't matter whether the author is typically responsible for an activity. A procedure is a description of the company's program, not the author's daily job.

Get the draft of the procedure about 80% complete. Remember, it does not need to be perfect or pretty. Don't worry about what extra sections are needed, such as scope, purpose, responsibility, approval authority or definitions. Let the program owner write the content however he or she chooses—in paragraph form, tables or flow charts. When you and the program owner are happy with the procedure, invite all the program owners to review the procedure and provide input. Don't take it personally when they pick apart the document you spent hours preparing. Try to include their input. Remind every program owner these procedures describe how the business is managed. Because they are all managers, they are all responsible for understanding and supporting each and every program.

Some managers will not understand why all the other managers are allowed to give input into their procedure and that the quality Champion has final approval. They may be used to running their department their way. You will have to explain the benefits of having companywide programs instead of individual departments:

- This management team approach will break down walls or silos.
- It will improve efficiency, promote communication and foster teamwork.
- It will develop a more cross-functional management team, because every manager will be familiar with and responsible for supporting every program.
- It will be easier to manage.
- Each manager may be losing some individual control, but he or she will be part of the management team that manages the entire business.

Begin management review meetings

Normally, program owners use management review meetings to present the effectiveness of their programs. Because you may not have any programs effectively implemented in the beginning, use these monthly meetings to review the status of your implementation plan.

Keep meeting minutes. These become the action plans for each program owner. You may need one to three years to develop, document, train, implement, audit and correct all your procedures.

More tips to remember

By now, you're on your way to implementing a successful, streamlined management system. Here are a few more reminders:

- If your boss and general manager don't understand the value of implementing a formal documented management system, don't volunteer to be the quality Champion.
- If you decide to become the quality Champion, don't

give up all of your current responsibilities. This will keep you in touch with the product or service side of your business and prevent you from becoming isolated. Besides, sitting at your desk all day writing procedures can drive you crazy.

- Some managers will understand the value of an organized documented management system. They may have experience. Get to know them and get them on your team. You need all the help you can get.
- Some managers will keep forgetting the definition of the words "responsible for." Keep reviewing with them what it means to be a program manager, as mentioned earlier.
- Some managers can't or won't write or read written documents, and you will have to prepare these documents yourself. It may be frustrating to do their work for them, especially if they make more money than you do. Just repeat to yourself a phrase I learned from our quality consultant: "Their success is your success."
- If the situation presents itself, ask for a promotion to the next level of your current job description. Don't change your title to quality Champion. If or when it's time for layoffs, this job title looks like pure overhead.

As the quality Champion, you will have to modify this management system implementation plan, depending on the size and structure of your organization. Some companies already have corporate quality departments and resources that can help you implement a system in your facility, and these departments may be responsible for some of the steps.

Oftentimes, however, the big boss will choose a willing employee and say "Our biggest customer expects us to be ISO certified. I'm not sure what that means, but I'm counting on you to make it happen."

In this situation, following this implementation plan will get you started off on the right foot. **QP**

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Digging the Holistic Approach Rethink business improvement to improve the bottom line

FEW WILL ARGUE we live in a dynamic world in which change is accelerating. What often goes unnoticed is that along with this rapid change, there is the opportunity and the need to improve. Improvement methods come and go, but the need to improve business performance and the bottom line never goes out of style.

The financial meltdown has created a great opportunity for quality professionals.^{1, 2} This is certainly a time when we all wish we had a cash cow—a source of continuing cash flow to help us through these lean times. Indeed, every organization has a cash cow in the form of continuous improvement.³

Sizeable bottom-line results with

minimal capital investment are possible. Companies focused on improvement regularly complete projects returning \$50,000 to upwards of \$500,000 or \$1 million per project per year. Annual returns of 2 to 4% of annual revenue—every year—are realistic. There are a lot of resources wasted (funds left on the table) by many organizations in which a rigorous focus on continuous improvement could have moved them to the bottom line.

The continuous improvement cash cow need never dry up, even though competitors change strategies, new products are introduced, and economic downturns occur. Innovation and growth are not perfect—they can create waste and inef-

AN EXAMPLE OF HOLISTIC

The need to improve an organization that manufactures a biopharmaceutical product provides a good example of holistic improvement at work.¹

The organization had developed a new blockbuster drug and was creating a manufacturing process to produce it. Soon, it became clear the manufacturing process was not going to meet market demand. An assessment of the entire organization was done, and it was determined that organization-development process improvement was needed. A holistic approach would address this broad range of issues.

Using lean techniques, batch release cycle times were reduced by 35 to 55%, depending on how the product sped up product release and reduced inventory and manufacturing costs.² Six Sigma techniques increased process understanding and increased yield by 20%.

Because the organization contained a large number of people who had developed the product in R&D, the manufacturing organization had an R&D mind-set, which needed to be evolved to a manufacturing mind-set. This was accomplished through leadership development workshops. Process operator training helped improve process reliability. In addition to improvement mentioned earlier, the holistic approach produced a 50% increase in capacity, enabling the process to meet market demand. —*R.S.*

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ficiencies that reduce returns. If left alone, processes and products deteriorate. They do not get better by themselves. Improvement opportunities continually appear and must be addressed for the long-term effectiveness of the organization.

A holistic approach is needed because **a single method does not work** for all problems.

Getting better all the time

Lean Six Sigma (LSS) has been effectively used for the last 15 to 20 years, and much has been learned during this period. Now is the time to focus energies on helping your organization use continuous improvement to meet the challenge of the financial meltdown by creating the cash cow. At the same time, you can use what you have learned to create and develop a more effective approach to improvement.

We see companies that are mature in their use of LSS and other methods move their focus from the method to improvement. Some have followed Toyota and use the term "production system" to refer to their approach to process management and improvement. Some use other business process improvement terminology.

"Holistic improvement" captures the essence of what is needed.^{4, 5} Holistic improvement is defined as: "An improvement system that can successfully create and sustain significant improvements of any type, in any culture for any business."

Discussion of the key words in this definition helps explain the breadth and depth of the approach.

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- To "create and sustain" improvement, some things are needed, including infrastructure: management systems and resources, a continuous improvement culture and leadership development.⁶
- "Significant improvements" refers to enhancing all measures of organizational performance—quality, cost, delivery, customer satisfaction and the bottom line.
- "Any type" refers to the type of improvement needed, such as any of the process performance measures noted earlier; speeding process flow; reducing variation; and the design, improvement, control and optimization of processes. A holistic improvement method is needed to address this broad array of issues.
- Improvement is needed in many places (in "any culture"), including any function in the business (functions can create cultures often described as silos) and any region or culture around the world.
- Organizations run many different types of businesses and processes. "Any business" refers to manufacturing, nonmanufacturing processes and service. Holistic improvement also works in nonprofit, healthcare and government organizations.

The characteristics of holistic improvement are illustrated in the sidebar, "Characteristics of Holistic Improvement" (p. 54) and summarized in the sidebar, "An Example of Holistic Improvement." These characteristics show a holistic approach is more than just a method for conducting improvement projects.

The type of culture, function, leadership, management systems and other key elements of the business must be considered. This leads us to see the two principal aspects of holistic improvement:

- 1. A focus on applying the approach to all aspects of the business in every part of the organization.
- 2. A method (such as LSS) to deploy, ex-

ecute and sustain process and organizational improvement.

These aspects of improvement must be addressed by the improvement system for it to adequately address all types of improvement needs of an organization and to be a truly holistic approach. those that deliver significant bottomline results.

• Failing to plan for sustaining the improvements at the beginning of the initiative.

The holistic approach described in this article can help eliminate these mistakes.



Learn from the past

George Santayana admonished us many years ago that, "Those who remain ignorant of the past are doomed to repeat it."⁷ Despite what has been learned in the past three decades regarding business improvement, these common mistakes continue to be made:

- Failing to design improvement approaches that require the active involvement of top management.
- Focusing on training rather than improvement.
- Failing to use top talent to conduct improvement initiatives.
- Failing to build the supporting infrastructure, including personnel skilled in improvement and management systems to guide improvement.
- Failing to work on the right projects—

Just as importantly, statisticians and quality professionals can play active roles in the process.

Things to watch for

As I attend conferences, read literature and work with clients, I hear a number of issues that continue to hinder improvement initiatives.

Project selection: This is perhaps the biggest issue, even for organizations with mature improvement processes.

One of the most significant root causes is there is too much focus on tactical improvements at the expense of strategic improvements. Both types of projects are needed. Strategic projects have greater value to the organization and are of more interest to senior management. Using value stream mapping and projects

3.4 PER MILLION

needed to address strategic business goals are good ways to help ensure the right mix of projects.⁸

Some organizations need to broaden their views regarding sources of improvement projects. The list of high-impact projects gets shorter if you keep looking in the same area.

Project reviews: Organizations continue to have problems sustaining improvements of individual projects and of improvement initiatives. The periodic management review of projects (weekly to monthly, depending on the level of management involved) and quarterly management reviews of the health of the improvement process are essential. A critical component of the quarterly strategic review is the assessment of the project hopper (the portfolio of projects the organization has on its to-do list).

If you want improvement to be effective on a regular and sustained basis, you must have management systems in place to guide and support improvement efforts. Successful improvement systems have management systems to support improvement. Critical elements include communication, reward and recognition, annual review and goal setting, project execution (identification to closure) and budgeting.

Management involvement: There are many demands on management's time. Managers are always looking for duties that can be delegated to others. The monthly and quarterly reviews are effective ways to keep management involved, particularly when these reviews are part of their normal management work.

Data quality: Getting quality data in the right amount with minimal effort continues to be a challenge. Effective and sustainable improvement requires the collection, analysis and use of data. There is no way around this. The availability of statistical software has enabled

CHARACTERISTICS OF HOLISTIC IMPROVEMENT

- Works in all areas of the business—all functions and all processes.
- Works in all cultures, providing a common language and tool set.
- Can address all measures of performance (quality, cost, delivery and customer satisfaction).
- Addresses all aspects of process management (process design/redesign, improvement and control).
- Addresses all types of improvement (streamlining, waste and cycle time reduction, quality improvement and process robustness).
- Includes management systems for improvement (plans, goals, budgets and management reviews).
- Focuses on developing an improvement culture (uses improvement as a leadership development tool). —*R.S.*

more companies to use data analytics as a competitive weapon,⁹ a trend that will no doubt continue.

We must recognize that data cost money, and it is important to make costeffective use of data. When the importance of the problem is clear, the role of data in the problem solution is well defined and the method of analysis is well thought-out, the cost benefit of the data will be much clearer. Support will become easier to obtain.

Never out of style

Improvement is a global imperative. To survive in today's marketplace, you must improve quality, cost and delivery, leading to customer satisfaction.

There are many types of opportunities for improvement. A holistic approach is needed because a single method does not work for all problems. We need to match the improvement method and tools to the project and use an approach that works in all aspects of the business, solving all types of improvement needs.

Process variation affects process flow, product quality and the ability to sustain process performance. Reducing variation must be part of the approach. The bottom line is that improvement can be a very profitable business, with enhanced process performance and customer satisfaction resulting in improved financial results. An improved bottom line never goes out of style. **QP**

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Make a Pit Stop

Use your company's downtime to make long-overdue improvements

WITH EACH passing day, it seems as though the U.S. economy gets a little worse. The stock market, unemployment rates and layoffs all paint a grim picture of the current state of the nation. While everyone is looking for an end to the economic crisis, those of us in the quality profession are looking for ways to make the case for quality and explore how we can help businesses through these difficult times.



Earlier this year, we were talking about the economic turbulence and discussing how lean can be used to help companies. The conversion then shifted to auto racing and how the pit stop can serve as an example for lean's single-minute exchange of dies method.

As NASCAR fans and typical engineers, we dove into a technical discussion of the pit stop. We realized the pit stop is a powerful metaphor for today's economic state. Our organizations' leaders should change the way they think during an economic crisis not only to survive, but also to come out ahead of the competition.

Coming to a stop

There are two reasons for pit stops in auto racing. The first is to fix something that has broken on the car. The second is to make improvements to the car to make it run faster and handle better.

During a race, there are only two times the pit crew is allowed to work on the car. The first is during a green flag, when the race is at full speed. This is not, however, the best time to bring the car into the pits

at speeds that are only 25% that of the other cars on the track.

The second time is during a caution, or yellow flag, in which the speed of the cars on the track is almost the same as those on pit road. Drivers are not allowed to pass and improve their positions, and the only way to lose positions on pit road is

coming to the pits while other cars stay on the track.

Why do NASCAR drivers like to pit under the yellow flag? This is the best time because all cars have slowed down. Using time and effort to improve operating capability during caution periods provides a definite competitive advantage. There is much less risk in taking a pit stop during a yellow flag than while everyone is running at peak speeds.

Under a yellow flag

We realized we are working in an economy under a yellow flag. The questions that

HAVE A STORY TO SHARE?

Our readers are interested in stories like yours. If you'd like your story to be considered for publication, e-mail editor@asq.org and share your journey.

stemmed from this were, "What do we intend to do as a company during this time of caution?" and, "Is this a good time for us to pull into the pits and get some fuel, replace tires and make improvements?" The answer to both questions was yes.

AND CHAD VINCENT

In fact, there is no better time than the present to use employees—not lay them off—by putting them to work to make improvements that have been put off because organizations have been running too fast to make progress.

Employees have more free time if processes are not running at full capacity. The competition has slowed down, and now is the time to make improvements. Will we treat these economic times as a yellow flag, or will we wait until the economy is back to moving at a high rate of speed?

If we make improvements now, we will be better off than the competition when we go back to green-flag speeds. **QP**

NOTE

Single-minute exchange of dies (SMED) is a series of techniques pioneered by Shigeo Shingo for changeovers of production machinery in less than 10 minutes. The longterm objective is always zero setup, in which changeovers are instantaneous and do not interfere in any way with continuous flow. Setup in a single minute is not required but is used as a reference.



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Changing Times

Adapting to a new market for quality, engineering professionals

IN CONSULTING and planning with notfor-profits—especially universities, which are unaccustomed to market turbulence— I often use the phrase "glacial change." The phrase implies change that is large but so gradual that human beings don't see it in their lifetimes.

But I've had to modify my language. Climatologists predict that by the middle of the 21st century, there will be no glaciers in Montana's Glacier National Park. What we've thought of as geological time has been abbreviated.

We've all heard this, and satellite images confirm what we've heard. Change guru John Kotter even produced a useful fable about it.¹ Now, we have the more immediate metaphor of "reset," echoing the title of Kurt Andersen's *Time* magazine cover story and book.² decades are suddenly made visible in massive changes, many of which are unlikely to be reversed in a new cycle.

As I recently tracked the fate of a large manufacturer negotiating concessions from its union, I was struck not only by the weakened condition of a great company, but also by how the firm made sense of its future. As it expressed hope of emerging stronger, it made clear its market would be forever different.

So, too, the market for quality and engineering professionals has changed. We've seen engineering unemployment double this year, and the long, slow downward drift in manufacturing has accelerated. How do we adapt?

Change vs. transition

Thirty years ago, William Bridges



In reset, we suddenly come to the painful realization the world is transformed. The gradual, accumulated economic, social and environmental shifts that take observed the important difference between change and transition.³ Change is situational, and transition is psychological, with three phases: an ending, a neutral zone and new beginnings. In ending, we lose something. The neutral zone is a sort of wilderness in which we let go of the past and either go dormant or we try new things. In new beginnings,

we engage a new reality—ourselves transformed—with a new sense of identity.

During the last decade, I've worked with quality professionals in transition.

HOW HAVE YOU ADAPTED?

Please share how you and your company have addressed new training needs by posting your remarks on the *Quality Progress* Discussion Board at www.qualityprogress.org, or e-mailing editor@asq.org.

Some have moved to new industries. Others have cultivated new instrumental and networking skills to find jobs in emerging industries. Now, mature workers are even taking advantage of internships.⁴

In reset, we suddenly come to the painful realization that **the world is transformed.**

A *New York Times* article notes that science and technology professionals are broadening their skills to include business and communications.⁵ I've noticed this gradual trend, as those with doctorates in engineering, law, biology and medicine have entered the management program in which I teach. At the same time, many are just entering or still wandering in the wilderness, reassessing what they bring to this reset world.

Organizations in recovery

To assist those in transition, I consulted with Jeff Dean, training specialist at Oshkosh Corp. The vehicle maker is different from many other manufacturers as it faces rapid growth challenges. Having obtained billion-dollar contracts from the federal government, the firm has needed to hire and rapidly train hundreds of new employees. Participating in both processes has given Dean important insight into job searching and what will be required of organizations in recovery.

More than 4,000 job-seekers turned out to apply for about 750 positions at Oshkosh. Dean interviewed candidates for two days.

"Lines began to form as early as 3 a.m.,"

he said. "Many people came with nothing more than hope and a resume. As the days progressed, I had to take a break and process the magnitude of what was happening in front me."

He was deeply moved by the hardships many faced, but he had to choose. "Everyone I interviewed wants to work," he said. "What separated the group was their ability to combine their cognitive, affective and psychomotor skills. I call it, 'head, heart, hand—do you know how, do you want to and do you have the ability to?"

Dean's formula is a good one. Detailed career plans aren't worth much if you can't define your skills in the few minutes you have.

Training day

Dean also needed to help redesign train-

ing for new employees, many of whom brought rich experience from other industries. His team began rapid improvement of training approaches and materials. By reviewing outcomes and efficiency, they were able to develop training programs that delivered the same or better results in less time. His experience models what we may expect as the economy recovers.

Many organizations are themselves in the wilderness, partly dormant, awaiting change. During their new beginnings, they will look at new realities. They will hire in new ways—often for projects rather than permanence—but they will screen carefully for a good skills fit. They will also look for those who understand urgency and know how to rapidly improve existing systems that have to be upgraded to compete in reset markets. Quality professionals should be first in line. **OP**

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Interval Training Answering the right question with the right interval

Scientists, engineers and researchers should also come to love intervals. Choosing the right type of interval provides a means of supplementing an estimated quantity with an appropriate calibration of the uncertainty associated with that value. It means not only that you have a single best guess, but you also can provide a range of sensible values likely to contain the true value and a precise interpretation of how "sensible" is defined.

STATISTICIANS LOVE INTERVALS.

The flip side of this, however, is that an interval is often provided that doesn't match the question it's supposed to answer, or insufficient details are provided about some aspect of the interval. In these cases, intervals can cause confusion and lead to erroneous conclusions.

Consider a recent example I encountered: A 95% interval (110.6, 131.3) was given to summarize the results from a single population's sample. Unfortunately, the raw data were not provided, and untangling the meaning of the interval was impossible.

A starting point

First, let's consider some of the ground rules of intervals and examine the common types of intervals constructed.

Intervals provide an estimated range for a population characteristic based on



an observed representative sample from that population. A representative sample means the sample shares the same characteristics as the population from which it was drawn. Most often, this is achieved by drawing a random sample from the population in which all items in the population have equal probability of being selected.

Scientists, engineers and researchers should also **come to love intervals.**

Different intervals exist for many different characteristics of the population: mean, variance and new observations. Consequently, for clarity, it is essential to identify the population characteristic for which the interval is intended.

Intervals have a level associated with them. For example, a 95% confidence interval for the population mean has a level of 95%. This means if you repeated the process of collecting a sample of data many times—each time building a confidence interval—then the true population mean, on average, would be contained in 95% of the intervals. This is reassuring in some ways; however, you are generally only looking at a single sample for any particular problem.

Consider three of the most common types of intervals you might construct, based on a representative sample from a homogeneous population in which the characteristic of interest takes on continuous values.

1. A confidence interval for the mean: In general, confidence intervals

can be constructed for a parameter or a function of parameters that characterize the population. The mean is a common choice for the center of the population.

- 2. A prediction interval for a new observation: This provides a range where you predict a new observation from the same population will fall.
- **3.** A tolerance interval for a specified proportion of the population: This interval gives a range you're confident will contain at least a certain proportion (usually chosen to be large) of the population distribution.

Each of these intervals answers a different question about the population, and the width of the interval is adjusted so the level of the interval (for instance, 95%) will be correct for the question of interest. The level is often referred to as the "coverage probability" because we anticipate the interval will cover the population characteristic of interest according to the interval's level.

Suppose you have 40 observations drawn at random from a large population, which is thought to be approximately normally distributed. You wish to construct the three types of intervals described above. Each of the intervals has the same basic form:

$$\label{eq:clevel,n} \begin{split} \overline{x} \pm c_{(\text{level, n})} \cdot s \\ \text{in which } n \text{ is the sample size, } \overline{x} = \sum x_i \, / \, n \\ \text{is the sample mean,} \end{split}$$

$$s = \sqrt{\frac{\sum x_i^2 - n\overline{x}^2}{n-1}}$$

is the sample standard error, and $c_{\rm (level,\,n)}$ is a constant that changes, depending on the type of interval you wish to construct, the specified level and available sample size.

For each of the intervals, \bar{x} is the best guess for the center of the population and gives you a good midpoint for the range. For this example, $\bar{x} = 121.2$ with s = 10.6 based on the 40 observations. A histogram of the raw data is shown in the top panel of Figure 1.

Variations of prediction and tolerance intervals / FIGURE 2



P.I. = prediction interval T.I. = tolerance interval Obs = observations

Confidence interval

For the confidence interval,

 $c_{(\text{level, n})} = t_{\text{level, }n-1} (1/\sqrt{n})$

in which $t_{level, n-1}$ is a value, the percentage of a *t*-distribution with *n*-1 degrees of freedom contained in $(-t_{level, n-1}, t_{level, n-1})$ is equal to the level selected. You use a *t*-distribution instead of a normal distribution for this calculation because there is some uncertainty in the estimate of the unknown population standard deviation from using the sample standard deviation. You must expand the interval to reflect this uncertainty. For this example, a 95% confidence interval for the mean of the population is:

 $121.2 \pm 2.022 (1/\sqrt{40}) 10.6 = [117.8, 124.6].$

This is shown as the first interval (labeled C.I. or confidence interval) below the histogram in Figure 1.

Prediction interval

A 95% prediction interval for a new observation uses a value for $c_{\rm (level,\,n)}$ of

$$t_{level, n-1} \sqrt{1+1/n}$$
.

Again, the *t*-distribution is used because there is uncertainty associated with the estimation of the population standard deviation. This interval must be wider than the confidence interval for the population mean. Why? In addition to estimating the center of the distribution, we must also allow for the natural variability of the new observation around that mean (hence the additional value of 1 under the square root). For our example, a 95% prediction interval for a new observation is:

 $121.2 \pm 2.022\sqrt{1+1/40}$ 10.6 = [99.5,142.9].

This is shown as the second interval (labeled P.I. or prediction interval) below the histogram in Figure 1.

Tolerance interval

For the tolerance interval, you must decide what proportion of the population distribution you wish to have contained in the interval. Suppose you are interested in a 95% tolerance interval that contains at least 80% of the population.

The $c_{(\text{level, n})}$ can be obtained from looking up $c_{(\text{level, p, n})}$ in *Statistical Intervals: A Guide for Practitioners*,¹ in which *p* is the

STATISTICS ROUNDTABLE

proportion of the population distribution to be included in the interval. For our example, a 95% tolerance interval for at least 80% of the population is:

 $121.2 \pm 1.602 \ 10.6 = [104.2, 138.2].$

This is shown as the third interval (labeled T.I. or tolerance interval) below the histogram in Figure 1.

A few notes about these intervals:

- All of the intervals are centered at the sample mean because it is our single best guess of where the population mean and new observations are located. The form of the intervals ensures the intervals will be symmetric in width around this point estimate.
- Estimating the population mean can be done quite precisely, and the estimate is quite robust to the assumption that the original data come from a normal distribution.
- 3. For the sample of 40 observations, one observation lies outside the 95% prediction interval for new observations. This is not unexpected because of the interpretation of a prediction interval: If we collected new observations, we would expect about 95% of them to fall within this interval. Therefore, it is not unexpected for the majority of our observed observations to fall inside the prediction interval.
- 4. There is often confusion about how to interpret tolerance intervals because of the two percentage values in its description. For our interval, you can say you are "95% confident that at least 80% of the population distribution will lie within this interval." Or, if you repeated the process of collecting a sample many times, you can say about 95% of the constructed intervals would have at least the correct coverage (for example, at least

80% of the population).

5. Prediction and tolerance intervals are more sensitive to the assumption of normality than confidence intervals for the mean because they are interested in the tails of the distribution, not just the center. Therefore, for these intervals, it is good to examine the distribution of the raw data to make sure the normal assumption is reasonable.

Figure 2 (p. 53) shows variations of prediction and tolerance intervals. The top three prediction intervals illustrate the effect of changing sample size on which the prediction interval is based. As the sample size increases, the width of the interval shrinks but at a diminishing rate. Here, we have assumed the mean and standard deviation estimates are unchanged with any new sample. Of course, that would not necessarily be the case in practice.

The second set of three intervals shows the impact of changing the level of the interval based on the original 40 observations. To be more confident the interval will include a new observation, we must add extra width. The third set of intervals shows tolerance intervals—where we are changing the proportion of the population to be covered by the interval. As you can see, to have a larger proportion included, the width of the interval needs to increase.

Making the right choice

Choosing the right interval is critical for having a meaningful result. Clearly communicating the purpose of the interval will allow those viewing the interval to understand it. Returning to the initial interval [110.6, 131.3] presented earlier, this was actually the sample mean plus or minus one standard deviation, which does not have any obvious interpretation or level

INTERVALS INQUIRY?

What challenges have you encountered when using intervals? Submit your dilemma at www.qualityprogress.com or send it to editor@asq.org. We can connect you to one of our subject matter experts to help you find a solution.

associated with it, despite the label that it had received.

There are many types of intervals that answer many other questions and many types of intervals for other different data types. For an excellent guide on available options for appropriately constructing and interpreting intervals, see *Statistical Intervals: A Guide for Practitioners.*² QP

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STANDARDS OUTLOOK BY JOHN E. "JACK" WEST

Remaining Relevant

How to ensure longevity for the world's most popular standard

ISO 9001 has become a well-established baseline for quality management worldwide. Some have even speculated that without it, globalization of world trade would not have been practical. This may be a stretch, but I believe ISO 9001 has been a major contributor to global commerce. The standard has become a common framework for conversation and agreement about supplier quality management requirements.

During the development of ISO 9001:2008, a key notion was to hold the line on new requirements. Little has changed in the fourth edition of ISO 9001, which was

issued late last year by the International Organization for Standardization. This should not surprise anyone. As work was being completed on the 2008 edition,

a number of major industries were in the midst of implementing ISO 9001. The time was not right for significant changes.

In some industries, however, the concepts embedded in ISO 9001:2008 have long been woven into the cultural fabric. In fact, I find that organizations large and small are using the requirements of ISO 9001 with little or no actual references to the standard itself. These days, I even hear ISO 9001-related questions from the mouths of angel investors and venture capital (VC) firm representatives at VC conferences where small companies pitch their businesses to get equity investment funding.

Stick to the basics

ISO 9001 has become the baseline-the expected minimum for effective management systems. Organizations across the globe have learned the basics of ISO 9001 and the ideas inherent in the standard, such as:

- · Objectives set with customers and improvement in mind.
- Using design controls including verification and validation.
- Operating all processes in a state of control.
- Control of supplier-furnished inputs and outsourced processes.
- Measurement, analysis and improvement of all aspects of the business.
- Internal auditing.

🖌 🖥 When the world has been

taught well, it is time for the

itself-to move on. Change is

teachers—and the standard

almost a necessity. 🔳

These notions are accepted, understood and implemented with or without the actual use of ISO 9001 or its related certification processes. A

great job has been done of teaching these ideas, and the concepts work well most of the time. The quality community can be proud of this accomplishment.

But, when the world has been taught well, it is time for the teachers-and the standard itself-to move on. Change is almost a necessity. Certainly, there will be new generations that need to be taught these basic ideas. But ISO 9001 is likely to remain relevant only if it is changed to include newer concepts that bring the latest value-adding features to users across the globe.

Without changes, ISO 9001 risks becoming irrelevant on the world stage. Of course, even without major changes, certification to the standard in its current iteration will continue for many years. But there is concern that ISO 9001's relevance as a driver of worldwide quality control and improvement is almost certain to wane over time.

After all, the requirements in the last major revision of ISO 9001, which was released in 2000, will have been static for 15 years if a new version with updated ideals and requirements were to be published in 2015.

Anv ideas?

So, what new ideas should be included in the next edition? First, remember that the baseline quality management document is not likely to include the latest ideas. But there are some fairly recent concepts that have proven useful and might be considered as part of a new baseline.

Many ideas have been discussed informally. They include:

- A greater focus on results—ISO 9001:2008 requires establishment of objectives, and its scope (clause 1.1) is results oriented, but little else is said on the subject.
- Strategic planning—Considerations of quality and the quality management system (QMS) in the organization's strategic planning would seem to be a natural enhancement.
- More focus on customers—It may be time to include more comprehensive coverage of customer-satisfaction measurements.
- Coverage of innovation—Sometimes, the QMS is viewed as an inhibitor of innovation, but it needs to become a framework for positive innovation. Perhaps the next revision should describe how innovation is facilitated by the QMS.

Without changes, ISO 9001's relevance as a driver of **worldwide quality control** and improvement is almost certain to **wane over time**.

 Greater emphasis on the systems approach—Migrating from a very strong focus on the process approach to something that adopts concepts of the systems approach to management would allow inclusion of systems thinking and other related concepts.

The cycle continues

The ISO technical committee (TC) responsible for ISO 9001 (ISO/TC 176) is in the very early stages of exploring what changes need to be made in the next version of the standard. Formal work has not yet begun, so predicting its outcome is risky, but I think the revision process will take a while.

Some expect a new version as early as 2013. Based on the history of the standard's development, however, I think it is likely to be closer to 2015. Consider the following timeline:

- 1980: ISO/TC 176 is established.
- 1987: First edition of ISO 9001 issued (seven-year development).
- 1990: Beginning of parallel development process for the 1994 and 2000 revisions.
- 1994: Minor revision issued (seven years after previous version).
- 2000: Major revision issued, with the introduction of the process approach (six years after previous version).
- 2008: Minor revision issued (eight years after previous version).
- 2013-2015: Possible window for next major revision.

The work to produce an effective management systems standard takes time. The first edition, ISO 9001:1987, took about seven years. When ISO 9001:2000 was released, it was technically six years after the previous revision, but in actuality it took about 10 years from concept to reality.

In both cases, there were years of preparation required to decide what new concepts to include and—in the case of ISO 9001:2000—how to describe the process approach.

If you consider there are more than 1 million users with myriad potential user needs, it's hard to see—given past development cycles—how the committee can develop a new version with new ideas and expanded requirements in less than seven years, even if the committee were free to develop it without other pressures from within ISO.

But there are other things that make the situation more difficult for the committee.

Standards align

The ISO Technical Management Board, the group that manages ISO's technical work, has directed that a new vision be implemented for all ISO-developed management system standards that contain requirements. This includes ISO standards for other disciplines, such as ISO 14001 for environmental management. The vision indicates that all ISO management system standards are to be aligned, and the current levels of compatibility among any existing management system standards are to be enhanced. This is supposed to be done by promoting the use of identical clause titles, sequence of clause titles, text and definitions. There will also be an effort to use as much identical text as feasible.

A joint technical coordinating committee is responsible for development of the common format (clause titles and sequence of clause titles), and it will likely drive the process of developing identical text in which requirements are the same. It is my opinion that this part of the revision process will detract from and diminish the work to develop and include new ideas in ISO 9001. As a result, there will be a significant number of issues to resolve.

So, what will be in the next version of ISO 9001? In a very real sense, it is up to you. A survey of users' needs is being developed. When it becomes available, provide your input. There is also always room to participate in the U.S. Technical Advisory Group to ISO/TC 176. For more information, visit ASQ Standards Central at www.asq.org/standards or e-mail standards@asq.org. **QP**



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 and is past chair of the U.S. Technical Advisory Group to ISO/TC 176 and lead delegate to the commit-

tee responsible for the ISO 9000 family of quality management standards. West is an ASQ fellow and co-author of several ASQ Quality Press books.

PAST AND FUTURE

Before chiming in about the next version of ISO 9001, see what QP authors had to say about the last revision, including "Small Change, Big Payoff" by John E. "Jack" West (April 2009) or "Energize Your QMS" by Lorri Hunt (October 2008).

QPTOOLBOX

Carbon dioxide sensor >

Sundae's K-33 CO2 sensor assists scientists and environmental and agricultural engineers who need to measure indoor and outdoor changes in carbon dioxide levels.

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Runout and concentricity inspection system ▼

Johnson Gage has introduced the Centrax runout and concentricity inspection system for verification of cylindrical runout or concentricity in manufacturing or inspection applications. The JCR-1 model incorporates precision datum rolls, an upper tension roll assembly and integral axial stop pins to ensure proper part staging and absolute gage accuracy.

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Inspection software >

Renishaw has introduced version 2.02 of its OMV Pro software that includes more advanced coordinate measuring machinestyle capabilities, with an extended range of geometric dimensioning and tolerancing functionality.

The OMV Pro 2.02 also has the ability to work with multiple alignments in a single program, an advantage in working with multi-axis machine tools.

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Linescan camera 🔻

Sensors Unlimited has announced that high-resolution, shortwave infrared (SWIR) area and linescan cameras are being used



to improve the manufacturing yield of photovoltaic (PV) cells. SWIR technology is suited to monitor the quality of solar thin films, as well as concentrated PV and crystalline cells, to maximize efficiency of the solar cell manufacturing process through final assembly of the completed modules.

The SWIR cameras, which operate between 0.9 to 1.7 microns, are ideal for inspecting silicon boules and wafers due to the material's transparency beyond 1.2 microns. They reveal voids in silicon boules, bricks and ingots before they are sliced into wafers to produce mono and multicrystalline solar cells.

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QPREVIEWS

Enterprise Excellence

Normand L. Frigon and Harry K. Hackson, John Wiley and Sons, Hoboken, NJ, 2009, 474 pp., \$95.00 (book).

This book is organized into 10 chapters, with key points summarized at the end of each. The first chapter is an introduction intended to break the ice on Frigon and Jackson's defini-

tion of enterprise excellence, and its value to the organization. Chapters 2, 3 and 4 focus on management and the deployment of enterprise excellence including change management. Chapters 5 to 10 are focused on improvement tools.

The book is a compendium highlighting Armament Research, Development and Engineering Center's Malcolm Baldrige national Quality Award in 2007. The book covers the organization's ambitious approach to outlining all the tools and techniques in lean enterprise and Six Sigma, including the details of using milestone charts and program evaluation and review technique charts.

One of the chapters focuses on all the statistical process control techniques to measure at the shop-floor level and can get heavy technically. But it does not address strategic measurement systems, such as the balanced scorecard or policy deployment techniques.

This book is a good primer for the manager who would like a reference to strategic application of enterprise excellence and how to turn a 1960-era organization on its ear and bring it up to speed in the 21st century. It gives a good description of most improvement tools and when to apply them and is very ambitious, although it barely touches on some of the most important key tools, such as benchmarking and value stream mapping. *Reviewed by Bill Baker Speed To Excellence*

Executive Focus: Your Life and Career

Grace L. Duffy and John W. Moran, ASQ Quality Press, 2009, 168 pp., \$30 list, \$18 member (book).

Duffy and Moran have blended their insights and expertise to create a compendium of do's and don'ts presented in an easy-to-comprehend format. Intended as a

Santa Fe. NM

stimulus for an executive's self-assessment and adjustment, this book covers a great deal of ground in a few pages. The writing is as down-to-earth as one can get.

There are 12 chapters, plus a summary. Each chapter begins with a short, succinct list of questions. If the reader answers "yes" to one or more questions, then the door is opened to visit the topics and actions suggested by the questions. You can skip around the book as individual needs and interests may suggest. There are planning tools and suggestions for the reader's self-adjustment.

This book is not a technical treatise on everything you need to know and do to attain and maintain a successful career as an executive. It provides the opportunity for individual improvement, usually in very simple ways. It would be safe to say that if you adopt, adapt and apply just one suggestion from the 168 pages, your time was well spent, your work became more fun, your stress level was reduced, and quite possibly the people you deal with found you more balanced in your interactions with them.

Let's look at just four situations the authors address:

- You are experiencing a conflict between your personal vision and that of your employer. A suggestion is to employ a personal SWOT analysis (strengths, weaknesses, opportunities and threats).
- You feel you don't have the best and most-current information with which to make decisions. The concepts of the balanced scorecard or report card of core business processes and functions is suggested.
- You are losing people or talent faster than you can recruit, train and assimilate replacements. Suggestions are made for addressing the talent management crisis, one of which is to be sure you include the HR function as an essential member of your executive team.
- You realize you may not comprehend the details of a problem, but you sense tension in the way people interact with one another. Suggestions are provided for confirming your feeling, understanding the signal you are receiving and developing an appropriate response or action.

Want to adjust one or more aspects of your executive focus? Follow the advice in this book. Keep it close to you until you have squeezed out the last helpful bit of learning possible to enhance your life and your career.

> Reviewed by Russ Westcott R.T. Westcott & Associates Old Saybrook, CT

Project Management that Works

Rick A. Morris and Brette McWhorter Sember, Amacon, 2008, 240 pp., \$24.95 (book).

This book helps readers navigate the politics of project management in the corporate world. Morris and Sember cover the basics of project management,

including program evaluation and review technique and work breakdown structure, but the book's main focus is on less-technical issues. They place emphasis on developing communication skills, teamwork and the importance of customers.

Throughout the book conversations, situations and scenarios are highlighted in actual stories of project managers' experiences with advice on the best way to deal with those situations. The authors place importance on understanding and provide an evaluation tool to determine your personality characteristics.

The book also considers critical issues such as turning around failing projects, myths about meetings, making positive change to your corporate culture and risk assessment tools. This book is a great complement to more technical books on this topic.

> Reviewed by Denis Leonard Business Excellence Consulting Bozeman, MT

The Basics of FMEA

Robin E. McDermott, Raymond J. Mikulak, and Michael R. Beauregard, Productivity Press, 2008, 90 pp., \$15 (second edition, book).

This book is a handy and useful resource, illustrating how the failure mode effects

analysis (FMEA) process with ready-to-use worksheet templates can be used to analyze processes and products for potential failures. It is a standardized process consistent with ISO/TX 16949:2002 and the Automotive Industry Action Group guidelines. For leaders committed to quality and engaged problem-solving teams, the book is clear on how to perform FMEAs

step by step. There are tips for a good FMEA, including the need to complete the FMEA form with lists of multiple effects and listing actions to be taken

to prevent the occurrence of a failure. Responsibilities for the actions need to be assigned and tracked, as good project management requires. Careful consideration for risks associated with quality, equipment, safety, materials, processes and costs must be done with due diligence to protect the customers from receiving noncompliant products.

This book will assist the problem-solving team in understanding the fundamentals of

FMEA. A cross-functional team is strongly recommended. The book offers severity, occurrence and detection scales to be used for various industries and processes (manufacturing and administrative). It is noted that team leaders need to balance the rigor of doing an FMEA so as not to overwhelm participants. Follow-through on actions is critical, and driving actions across the board in a systematic way is also important.

The authors demonstrate how the FMEA process can be a continuous learning process to mitigate the risks of future product and process development.

Reviewed by John J. Lanczycki, Jr. West Springfield, MA

RECENT RELEASES

The Basics of Performance Measurement

Jerry L. Harbour, CRC Press, 2009, 102 pp., \$14.95 (second edition, book). Process Driven Comprehensive

Auditing

Paul C. Palmes, ASQ Quality Press, 2009, 152 pp., \$24 member, \$40 list (second edition, book and CD-ROM).

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2-4 11th Annual Information Quality conference. London. Visit the Data Management and Information Quality's website at www.irmuk.co.uk/dm2009/cfp/iq.htm.

2-6 ASQ Education Course. **Certified Quality Engineer Exam Preparation**. Atlanta.

4-5 ASQ Education Course. Developing High-Performance Supplier and Partner Relationships—Virtual Course.

5 Good Governance for Supply Chain Operations (live webinar). Call Pilgrim Software at 813-915-1663 or visit www. pilgrimsoftware.com.

9 Medical Device Risk Management. Seattle. Visit Hobbs Engineering's website at www.hobbsengr.com or call 303-465-5988.

9-11 Service and Management Conference and Expo. Washington, DC. Visit www.thinkhdi.com.

9-13 ASQ Education Course. Certified Quality Engineer Exam Preparation. Toronto.

9-13 ASQ Education Course. ISO 9001:2008 Lead Auditor Training (RABQ-SA International). Toronto. 10-11 ASQ Conference. Internation Conference on Software Quality. Northbrook, IL. Visit the Software Division's website at www.asq.org/divisions-forums/ software/index.html.

10-12 AeroTech Congress and Expo. Seattle. Visit the Society of Automotive Engineers at www.sae.org.

11 Data Integration Architecture: What it Does, Where it's Going and Why You Should Care. Webinar. Visit the Data Warehousing Institute's website at www. tdwi.org or e-mail Phillip Russom at prussom@tdwi.org.

12 39th Annual Innovation Awards Competition and Gala. Detroit. Visit the Society of Plastics Engineers International's website at www.4spe.org.

12 world Quality Day. Visit the Chartered Quality Institute's website at www. thecqi.org.

14 Roadmap for Lean Six Sigma Transformation. Southfield, MN. Visit Systems for Better Quality's website at www.sybeq. com or e-mail info@sybeq.com.

15-18 Fabtech International and AWS Welding Show Featuring Metalform. Chicago. Visit the Society of Manufacturing Engineers' website at www.sme. org. 17-19 six sigma in Innovation Conference. Miami. Call Worldwide Conventions and Business Forums at 800-959-6549 or visit www.wcbf.com/quality/5100.

19-20 **9th Annual International Software Testing Conference**. Bangalore, India. Visit Quality Assurance International's website at www.qaiglobal.com or e-mail conferences@qaiglobal.com.

20 ASQ Education Course. Service Quality Measurement: Analyzing—Virtual Course.

DECEMBER

3-11 21st Symposium on Quality Function Deployment. Savannah, GA. Visit the Quality Function Deployment's website at www.qfdi.org.

8-9 **SCOR Framework.** New York. Call the Supply Chain Council at 202-962-0440 or e-mail info@supply-chain.org.

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Building a Consensus

New chart helps everyone get on the same page

CERTAIN WELL-KNOWN two-by-two matrices are used by quality professionals to facilitate decision making and prioritization—for example, the effort/impact matrix and the importance/urgency matrix.

A new but similar tool, the consensus chart, can drive improvement activities identified during the development or operation of a quality system process. It can be used for facilitating, obtaining buy-in and standardizing to achieve a more comprehensively documented and effective process. The chart is especially useful in an environment with the following characteristics:

• **Continuous improvement.** Inevitably, issues and opportunities arise and need to be prioritized and addressed.

- **Differences of opinion.** Sometimes, discord arises regarding the execution of a quality system process. It may be necessary to align personal preferences before progress can be made.
- **Desire to optimize documentation.** Documenting the quality system is a good thing, but there may be cases where spelling out every detail is not beneficial.
- Appreciation of the team approach.
- Complex processes that interact with other processes.

To construct a consensus chart, assemble a cross-functional team of those who own the process and those most affected by the process. Compile and describe each issue and the current situation



surrounding each issue. Ask two yes-or-no questions:

- 1. Do we want to standardize?
- 2. Is there consensus about best practices? The answers can be separated into four quadrants with the following titles:
- 1. Hold meetings to work out differences. Standardization is desired, but consensus has not yet been achieved.
- 2. Proceduralize, communicate, train. Standardization is desired, and there is already consensus. This is where process improvements are made.
- **3. Let there be variation.** Use when there is no need to standardize and also no consensus. No action is driven from this quadrant.
- **4. Everyone agrees anyway.** Use when there is no need to standardize, but there is consensus.

There are certain paths that issues may follow. For issues in quadrant 4, the issue may be moved to quadrant 3 or 2. The movement is based on whether it is beneficial to document the issue's resolution. Issues in quadrant 1 can be moved to quadrant 2 once consensus is achieved.

The consensus chart in Figure 1 was used to classify issues and improve a quality system process, with the issues generically redefined for confidentiality. In the final step of the improvement initiative, methods of standardization were decided on and included new or revised policies, procedures, forms, databases and training plans. As a result, the process was improved. **QP**



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quality manager, Six Sigma Black Belt and quality auditor.



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