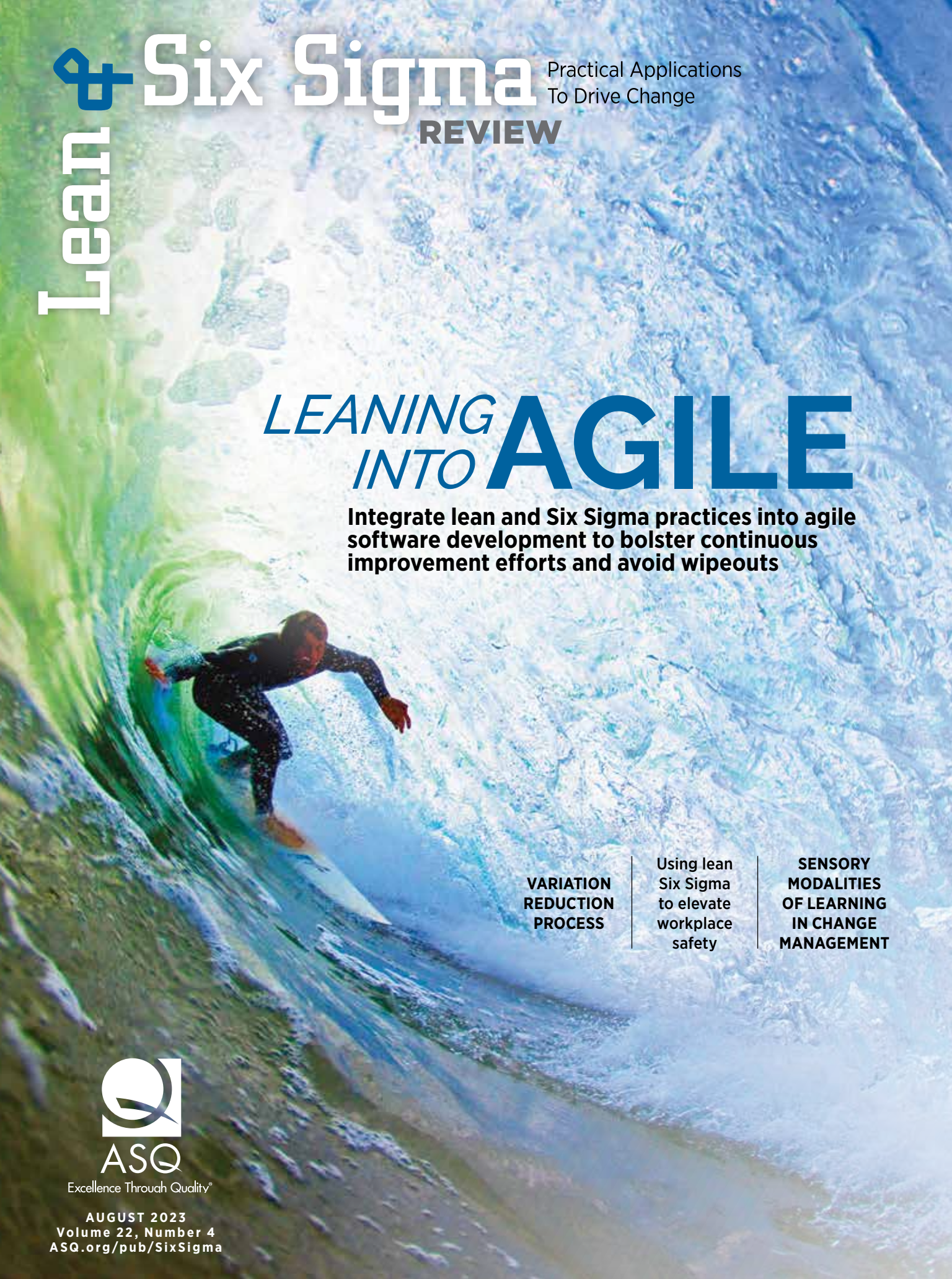
Lean & Six Sigma REVIEW
Practical Applications To Drive Change

LEANING INTO AGILE

Integrate lean and Six Sigma practices into agile software development to bolster continuous improvement efforts and avoid wipeouts



VARIATION REDUCTION PROCESS

Using lean Six Sigma to elevate workplace safety

SENSORY MODALITIES OF LEARNING IN CHANGE MANAGEMENT

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Lean & Six Sigma REVIEW

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CASE STUDIES

DEPARTMENTS

Amplifying NextGen Voices

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In case you're unfamiliar, for the past few years I've been leading an initiative on behalf of the ASQ Board of Directors focused on cultivating the learning and development of the next generation of quality professionals.

ASQ NextGens include students, early-career quality professionals and those of any age who are simply new to the quality world. As part of ASQ's effort to encourage participation in this group, I'm thrilled to share this special issue in which all the feature articles were authored by ASQ NextGens.

If you're an ASQ NextGen, please join our online community at my.asq.org/communities/home/377. Here, you can make connections with others who are new to quality, share resources and ask questions that will help you navigate the early years in your quality career.

To get more involved in ASQ NextGen initiatives and help build the future of the quality profession, or to recommend someone who may want to get involved, please email NextGen@asq.org. While we're always looking for NextGens to participate directly in this work, of course we welcome ASQ members of any age and experience level to get involved.

+ To sign up for our ASQ NextGen online community, visit **tinyurl.com/nextgen-community-signup**.

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The three feature articles in this issue address some interesting topics related to lean and Six Sigma—agile, safety and communication.

Our cover story, "Leaning Into Agile" (p. 10), demonstrates the value of using lean Six Sigma (LSS) approaches for improving project management of agile software development, particularly from the perspective of the product owner role. Examples explore how LSS and agile software development can be integrated to generate improvements, and lessons learned are discussed.

The article "Beneath the Surface" (p. 18) summarizes various lean tools—such as *gemba* walks, five whys and 6S—and describes how these tools can be applied to workplace safety. This topic is important and relevant to quality and safety professionals because creating a culture of workplace safety also can increase productivity, improve quality, reduce employee turnover and absenteeism, as well as boost employee morale.

Finally, given the challenge of effective communication, "Getting in the Mode" (p. 26) details the VARK framework, which consists of four categories of learning styles: visual (V), aural (A), read/write (R) and kinesthetic (K). The author describes how to use this framework to guide the creation of training materials and exercises, and procedure revisions to communicate changes clearly and effectively as part of your process improvement efforts.

I hope you enjoy this issue of *Lean & Six Sigma Review*. Please feel free to share your thoughts on these articles by emailing me at lssr.editor@gmail.com. &

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Lean & Six Sigma Review

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QuickWins

What You Need To Know Now

ARTIFICIAL INTELLIGENCE

Can ChatGPT Change Healthcare?

Recent chatter around ChatGPT has been mixed. Some contend that this artificial intelligence (AI) technology is the wave of the future, bringing with it efficiencies and advancements never seen before. Others warn this development is something that might go beyond what we're expecting and get out of hand.

For the healthcare field, ChatGPT could complement care options.

In a recent study, a research team from the University of California San Diego compared written responses from physicians and ChatGPT to real-world health questions and found that a panel of licensed healthcare professionals preferred ChatGPT's responses 79% of the time, rating ChatGPT's responses as higher quality and more empathetic (seven times as empathetic as the ones from humans). ChatGPT came out well ahead of the human doctors on usefulness, too.

The study's team suggests that physicians working together with such technologies may revolutionize medicine—that is, highly trained chatbots could work in tandem with physicians, nurses and physician assistants to deliver more empathetic and more complete answers to people who need care.

"A human clinician backed by the knowledge base and processing power of AI systems will only be better," said Jonathan Chen, a physician at the Stanford University School of Medicine who has studied AI systems. "It is entirely likely that patients will reach for imperfect medical advice from automated systems with 24/7 availability, rather than waiting months for an appointment with a human expert."

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DULY NOTED

"There's still a pretty big mess out there."

—Ryan Patel, senior fellow at Claremont Graduate University's Drucker School of Management in Claremont, CA, when commenting on how the U.S. supply chain continues to heal from pandemic shocks that sent shipping costs skyrocketing and squeezed supplies of everything. The labor market remains tight, fueling costs. Shortages of machine parts for automakers persist, and cement has been difficult to find for infrastructure projects.

Source: Lisa Baertlein, "U.S. Supply Chain Woes Shift and Persist in 2023," *Reuters News*, May 17, 2023, bit.ly/3Cx3zqb.

STATISTICS

A Rundown of New(er) Baseball Terms

Major League Baseball (MLB) season is in full swing, and so are the fantasy baseball leagues chock full of fans looking for an edge—any edge—to beat their competition.

For years now, sabermetrics has taken over much discussion surrounding baseball and how to measure the effectiveness of players and teams. Forget just using ERAs, RBIs, batting averages, strikeouts or slugging percentages. Those are your dad's baseball stats.

Here's a rundown of just a few new(er) stats that have become part of the standard vernacular being bandied about around baseball diamonds, according to MLB:

- **BABIP:** Batting average on balls in play measures a player's batting average exclusively on balls hit into the field of play, removing outcomes not affected by the opposing defense (namely, home runs and strikeouts).
- **WAR:** Wins above replacement measures a player's value in all facets of the game by deciphering how many more wins he's worth than a replacement-level player at his same position.
- **OPS+:** On-base percentage plus slugging percentage plus takes a player's on-base plus slugging percentage and normalizes the number across the entire league. It accounts for external factors like ballparks. It adjusts so a score of 100 is league average, and 150 is 50% better than the league average.
- **DRS:** Defensive runs saved quantifies a player's entire defensive performance by attempting to measure how many runs a defender saved. It considers errors, range, double-play ability and outfield arm.
- **LIPS:** Late inning pressure situations are defined as any at-bat in the seventh inning or later where the batter's team trails by three runs or fewer, is tied or is ahead by only one run.

+ Visit the glossary of advanced statistics—for offense, defense, pitchers and teams—at MLB's website at **www.mlb.com/glossary/advanced-stats**. Also check out the Society of Baseball Research's guide to sabermetrics at **sabr.org/sabermetrics** for more background.

ASQ

Innovations Summit Set

The ASQ Quality Innovations Summit, formerly known as the ASQ Quality 4.0 Summit, will take place Sept. 19-21 in Boston.

Preliminary plans include a conference theme titled "Innovations and Future Trends for Excellence." Focus areas will include specific topics around:

- **Leadership:** Evolve as a leader and gain skills to tackle change management successfully, integrate voice of the customer and create strategies as you champion a culture of excellence in your organization.
- **Operations:** Explore new trends in supply chain management, process automation and risk mitigation, for instance, to streamline process improvements and increase efficiency.
- **Information:** Develop a digital strategy and break through fragmented data silos after you've mastered the critical skills and programs of the Quality 4.0 era.

More details on the in-person event will be available in the coming weeks at **asq.org/events**.

There, you also will find information about other upcoming ASQ events including: the Women in Quality Symposium (Dec. 7, virtual), Lean and Six Sigma Conference (Feb. 18-21 in Phoenix) and next year's World Conference on Quality & Improvement (WCQI) (May 13-16 in San Diego). The call for WCQI proposals remains open through Aug. 21.

STATISTICS

Women in Statistics Event Slated

This year's Women in Statistics and Data Science Conference will be held Oct. 25-27 in Bellevue, WA.

Madhumita (Bonnie) Ghosh-Dastidar, head of the statistics group and a senior statistician at RAND Corp., will be a featured speaker at the event, sponsored by the American Statistical Association.

+ For more information on programming and registration, visit **bit.ly/3N9CuOw**.

Putting It All Together

Topic
Variation

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Taking a swing at the variation reduction process to score better outcomes

As the famous quote goes, "Golf is a good walk spoiled." As anyone who has attempted to hit a golf ball knows, it's maddeningly difficult to do it with any sort of consistency. Consider the capabilities of the best golfers in the world currently:

- The most accurate driver, Russell Henley, ends up on the fairway less than 72% of the time after a drive.
- On shots approaching the hole, the most accurate golfer is Ryan Armour, who still leaves the ball an average of 33 feet (10 meters) from the hole.
- The most accurate putter, Taylor Montgomery, averages about 1.7 putts per green. Montgomery only sinks his first putt on 48% of holes.

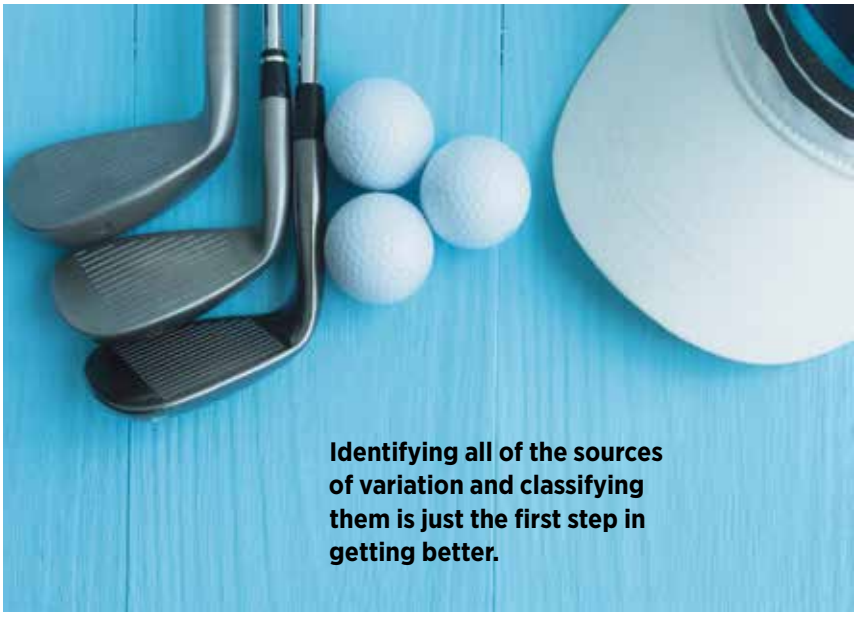
Obviously, professionals are playing on challenging courses typically. But still—the absolutely best performers in the world on each type of shot demonstrate statistics that are fairly unimpressive. Consistently hitting a golf ball where you want it to land is essentially impossible, and we are all just varying degrees of terrible at it.

Now, before anyone thinks I'm downplaying the level of skill professional golfers possess, rest assured that I would pay good money to perform at anything even approaching the level of the worst PGA Tour golfer. They are exceptionally *not bad* at consistently hitting the ball where they want it to go. How did they get there? Rigorous elimination of sources of variation in their swing and an understanding of how to compensate for noise factors.

3 types of variation sources

Rather than thinking of a professional golfer, consider clear amateurs who have just learned even the basics of swinging a golf club. They stand at the tee ready to hit the ball, and from the moment they plant their feet, they have introduced lots of sources of variation: how high the tee is, what type of golf ball and golf club they're using, where they're standing relative to the ball and whether to wear a hat.

They take the swing, which is perhaps the biggest factor in consistency and introduces many other sources of variation in the outcome. Finally, as the ball travels through the air (hopefully) the wind, humidity, grass conditions, presence of a small-but-intimidating pond and myriad other factors play a role in where the ball ultimately comes to rest.



Identifying all of the sources of variation and classifying them is just the first step in getting better.

Table 1 **VARIABLES IN GOLF**

Noise	Constant	Experimental
• Wind • Terrain • Grass conditions	• Wearing a hat • Type of club	• Type of golf ball • Tee height • Hand position

That new golfer is swimming in a sea of variation and probably feels a total lack of control. But every one of those sources can be categorized into one of three types:

1. Noise variables are those that exist, affect the outcome and cannot be reasonably controlled.
2. Constant variables are those that would affect the outcome but instead are not exhibiting variation themselves or are exhibiting it, but we have a good idea of what an optimal condition would be and can keep it there.
3. Experimental variables are controllable, exhibiting variation and affecting the outcome, but we're unsure what's the best condition to control them and we must use some form of experimentation to try to determine it.

For our golfer, an incomplete look at variables falling into each category type is shown in Table 1.

Identifying all the sources of variation and classifying them is just the first step in getting better, however. This information must be used to improve.

Reducing variation

In general, it may be obvious that the overarching goal is to compensate for noise variables and convert experimental variables to constants by identifying their optimal conditions. But order matters in this case, so the diagram in Figure 1 can help visualize in what sequence to do things.

The reason that sequence matters is actually a statistical one. In the second step, we will use a designed experiment. In such experiments, our ability to detect statistical significance and build an accurate model improves as our unexplained variation is reduced. By first forcing as many variables as possible to be constant before the experiment, we greatly improve our chances of success. Then, before trying to understand the impact of noise variables, we remove even more variation so those impacts are even clearer, and we can fine tune around them.

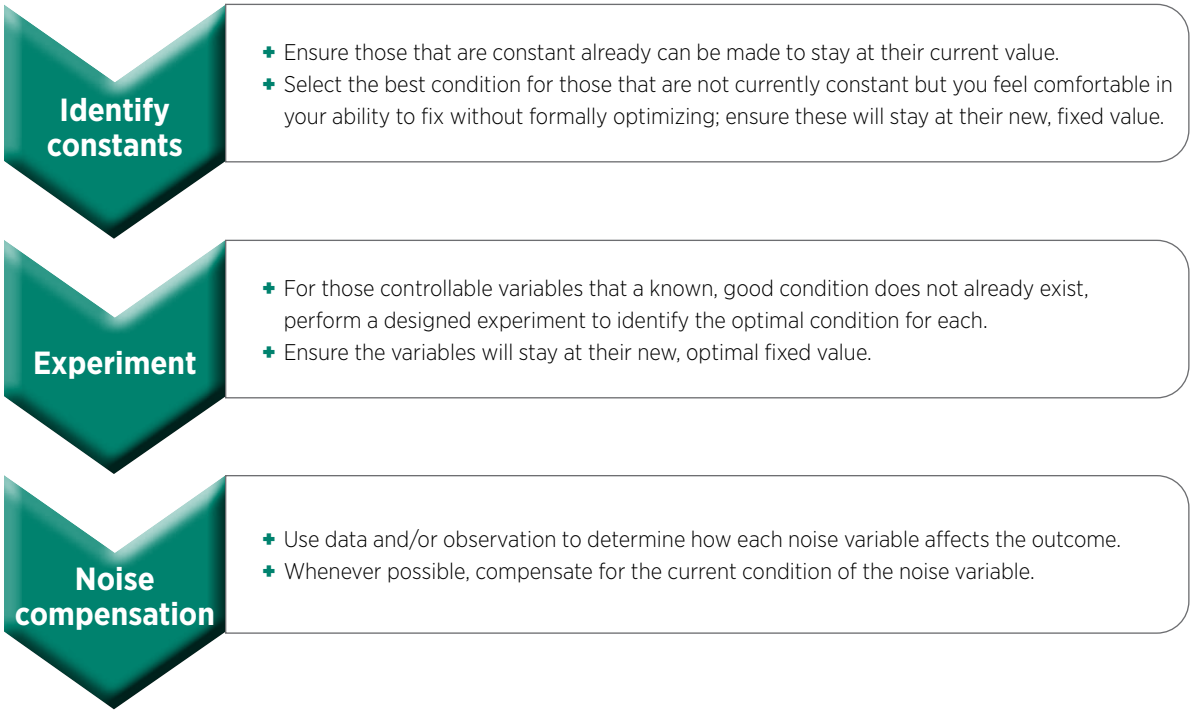
Consider our golfer. He or she first decides that he or she prefers golfing in a hat anyway because it helps with the sun. So, he or she opts to wear a hat every time—regardless of the weather. Golf clubs are expensive, so he or she opts to keep playing with his or her current set. He or she decides to try three different types of highly rated golf balls, two different hand positions recommended by instructors and two different tee positions in a designed experiment at the driving range one day. By doing the experiment at once on a relatively smooth range, many of the noise variables don't play much of a role—for example, the wind is probably fairly constant.

Finally, having selected an optimal hand position and ball and tee height, the golfer can practice to gain even more consistency. But while practicing, observation or data can be collected on how the wind, the slope of the ground and the grass conditions affect the outcome of the ball. While the golfer cannot control these, learning how much to adjust aim to compensate for a particular wind speed will take out further variation in the outcome of the ball.

Isn't this DMAIC?

Well, sort of! This variation reduction process can be thought of as a "light" version of what we might do in a full define, measure, analyze, improve and control (DMAIC) process. It wouldn't be wrong to use a DMAIC framework on this, but there are some definite shortcuts taken in this process that the rigor of a true Six Sigma project would not—or at least should not—normally take.

Figure 1 ORDER THE VARIABLES



Perhaps most importantly, no data analysis or rigor is put into determining what variables to make constant or at what condition they should be held constant. Such a determination is based on experience and is a judgment call, and while that often will get us in the ballpark (or on the green) of an optimum, it certainly isn't guaranteed. The process is highly focused on reducing variation quickly, but at the expense of truly optimizing the outcome.

But no claims are made that this process is the end of improvement. This can be a really effective first step in taking a process that is a sea of variation and simplifying it down to something that is much more consistent, even if not yet high performing. After that clarity is gained for a period of time, one or more DMAIC projects might be assigned to then better optimize those variables made constant early on.

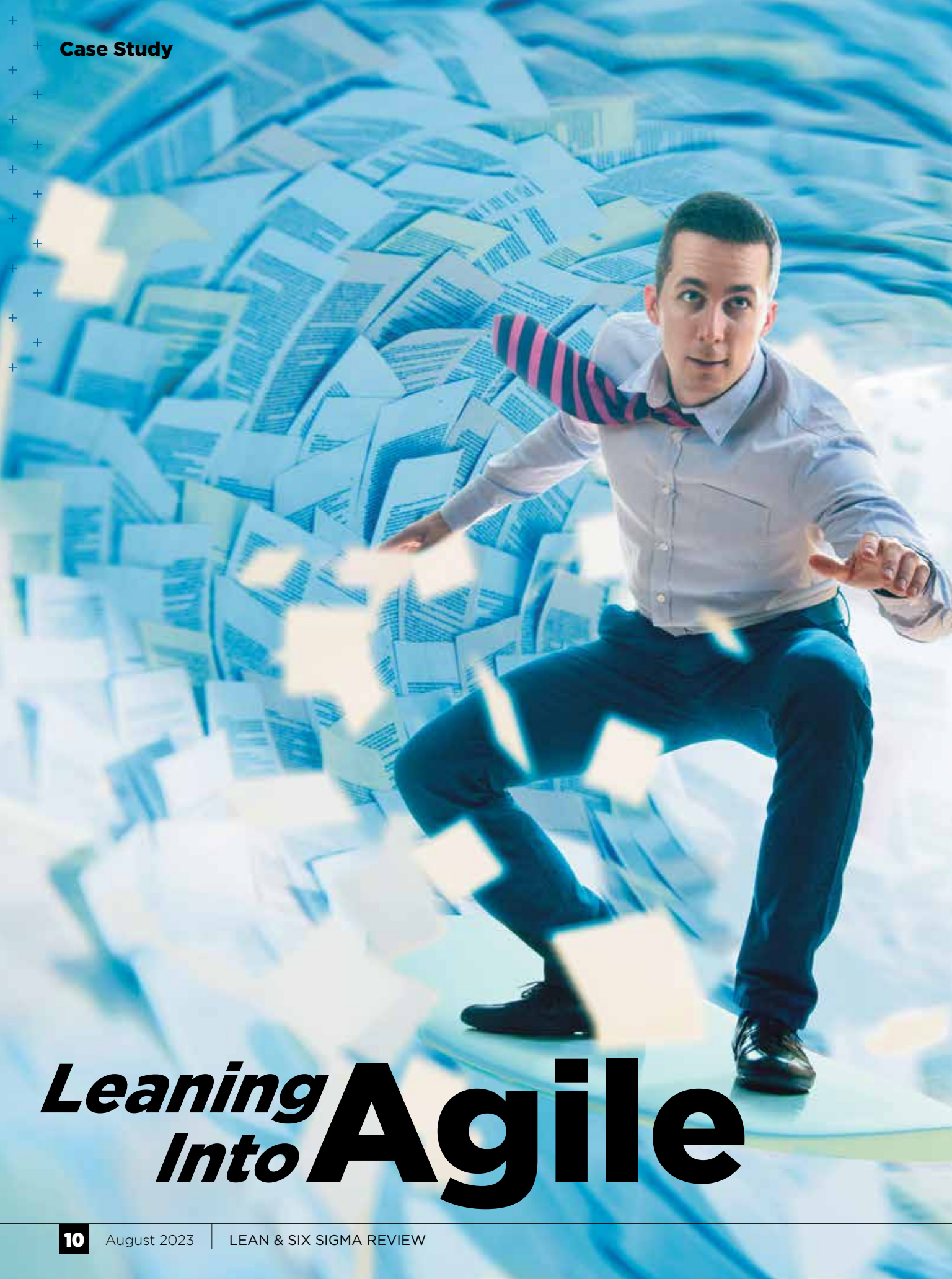
In golf terms, this might be the point in time at which different types of clubs are trialed or more golf lessons are taken to better understand where performance that is consistently mediocre now could be done consistently great. The instructor will be able to give much better guidance to someone with a repeatable swing than someone without.

Improve your score

It is often said, "Don't let perfect get in the way of better." The variation reduction process is a great way of doing so when first approaching a process that exhibits so much variation a team doesn't even know where to start. It usually won't solve all of your unplanned downtime, returned invoices, late shipments or product defects, and that's OK because we have more rigorous tools and methods to continue improving after getting the process stable and consistent.

After all, Henley misses 28% of fairways, Armour averages a school bus away from the hole and Montgomery misses his first putt 52% of the time. And they are the best golfers in the world! &

JOEL SMITH is director of rapid continuous improvement at Keurig Dr Pepper Inc. in Frisco, TX. He holds a master's degree in statistics from Virginia Tech in Blacksburg, VA. Smith is a senior member of ASQ and a former chair of the ASQ Statistics Division.



Leaning Into Agile

Integrate lean and Six Sigma practices into agile software development to bolster continuous improvement efforts and avoid wipeouts

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Lean and agile development

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Agile development has been a significant force in software development over the past two decades. It emerged in the early 2000s as a response to the limitations of traditional software development methods, which were often slow and inflexible, and failed to deliver value to customers. The Manifesto for Agile Software Development,[1] created in 2001, outlines the core principles of agile development, which include focusing on individuals and interactions, working software, customer collaboration and responding to change.[2]

Since then, various agile methods have been developed and evolved, taking key learnings from scrum, *kanban* (*heijunka* board—originating from lean and used by agile) and lean principles. These methods emphasize flexibility, collaboration and continuous improvement, and have been widely adopted by industries and organizations of all sizes. As technology and business environments continue to change, agile development principles and practices remain influential in delivering value to customers.

I have come to realize that my education and initial work experience in lean Six Sigma (LSS) has equipped me with valuable skills that have facilitated a smooth transition to a product owner (PO) role in software development. Over the past decade, my diverse roles have exposed me to LSS and agile methods. This article describes some examples of how I have integrated LSS in my role as a PO.

Overview of agile

Agile development is an iterative and incremental approach to software development. It emphasizes collaboration, flexibility and rapid response to changing requirements and circumstances throughout the development process.

Key components of agile development include:

- **Iterative development:** Is built on the idea of breaking down the project into smaller, more manageable pieces called sprints. Each sprint typically lasts two weeks and results in a working piece of software that can be tested and reviewed.
- **Continuous feedback:** Requires constant feedback from stakeholders, including end users, customers and other members of the development team. This feedback is used to guide the development process and ensure that the final product meets the customer's needs.
- **Collaboration:** Emphasizes teamwork and collaboration among all members of the development team including the product team, developers, testers, project managers and other stakeholders.
- **Flexibility:** Is designed to be flexible and adaptable to changing requirements and circumstances. This means that the development team can respond quickly to changes in the market, user needs or issues that may affect the project.
- **Continuous improvement:** Focuses on continuous improvement and learning. The development team is encouraged to reflect on its processes and identify areas for improvement to refine continually its approach to software development.

Similarities and differences

There are several similarities and differences between LSS and agile. Both methods:

- Focus on continuous improvement and eliminating waste.
- Are data-driven and rely on statistical analysis to measure and improve performance.
- Involve cross-functional teams working together to achieve common goals.
- Aim to deliver maximum customer defined value.

Key differences between the methods include:

- **Focus.** LSS is focused primarily on reducing waste and improving process efficiency, while agile is focused primarily on delivering customer value through iterative development and flexibility.
- **Approach.** While agile emphasizes flexibility and adaptability, lean aims to eliminate waste and improve efficiency. Agile follows the Manifesto for Agile Software Development and involves

continuous testing, learning and adaptation to deliver value to the customer quickly. In contrast, lean is a structured, step-by-step approach that follows the define, measure, analyze, improve and control method to identify and eliminate waste in the process. While both approaches share the principles of iterative improvement, they use different approaches to achieve them.

- **Tools.** LSS relies on statistical analysis tools such as control charts and regression analysis to measure and improve performance. Agile uses tools such as user stories, sprints and burndown charts to manage projects and prioritize tasks.
- **Application.** LSS is widely used in many industries to improve processes and reduce defects. Agile is used primarily in software development, but also can be applied to other projects that require flexibility and rapid adaptation.

The role of the PO

A PO is a critical role of an agile development team and is responsible for defining and prioritizing the product backlog. The PO's primary role is to ensure that the team delivers the right product to meet business objectives and customer needs.[3]

Some specific responsibilities of a PO may include:

- Creating and managing the product backlog, which is a prioritized list of tickets detailing features and requirements for the product.
- Defining user stories and acceptance criteria to guide development efforts.
- Collaborating with cross-functional stakeholders and team members to gather requirements and inputs, and aligning product vision and goals.
- Making trade-off decisions between competing priorities to ensure that the team is working on the most valuable features and delivering the right thing at the right time.
- Participating in sprint planning, daily standups and sprint reviews to collaborate and provide guidance and feedback to the development team.
- Accepting or rejecting completed work based on whether it meets the acceptance criteria and delivers value to the business and customers.

Agile emphasizes collaboration, flexibility and rapid response to changing requirements and circumstances throughout the development process.

LSS and PO intersection

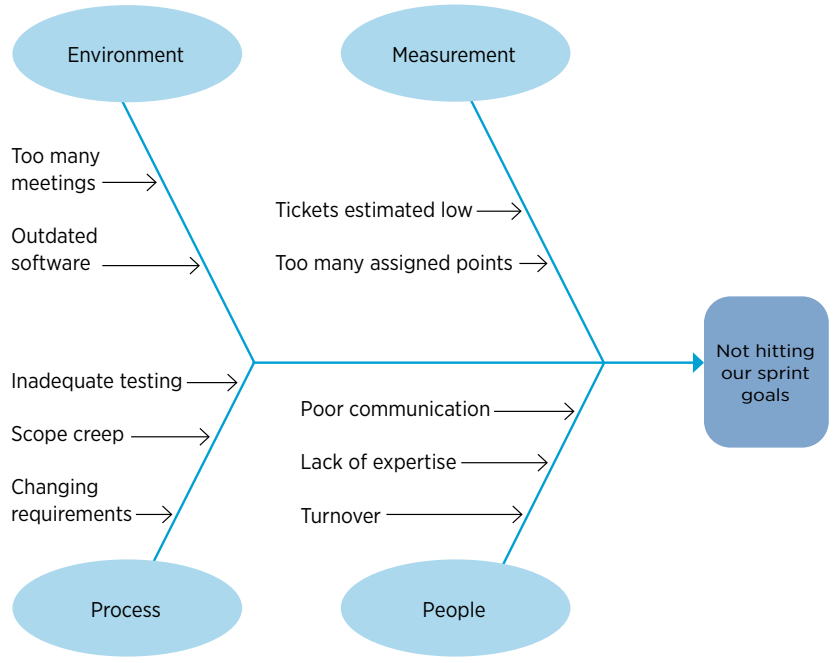
I started my career practicing lean and Six Sigma. I was responsible for leading process improvement project initiatives as a healthcare consultant. This involved identifying areas of inefficiency, analyzing processes to identify root causes of problems and leading teams to implement solutions that improve quality, reduce costs and increase efficiency, specifically in the healthcare industry. We began creating software for our projects to further support our clients, track progress and provide clients with tools to make educated decisions. Eventually I transitioned to a PO, using my process improvement, project management, communication, collaboration and change management skills to be successful.

Root cause analysis

Recently, I conducted a root cause analysis to assess my development team's disparity between story estimates and work delivered at the end of a two-week sprint. I wanted to identify the underlying causes of inefficiencies and develop strategies to eliminate them. These are the seven steps and outcomes of this work:

1. **Define the problem.** We defined the problem we were trying to solve as clearly as possible. When there is a discrepancy between our estimated level of effort and actual sprint completion rate, it makes forecasting and planning software releases challenging.
2. **Collect data.** We collected data on the problem. We interviewed each development team member to better understand the problem. We worked with the leads to identify potential issues in the processes and workload we had in place.
3. **Identify possible causes.** Based on the data we collected, we identify possible causes of the problem. We conducted a fishbone diagram[4] (Figure 1) to identify possible causes.
4. **Analyze the causes.** We analyzed each possible cause to determine whether it could be a root cause of the problem. The measurement factor was investigated first.
5. **Determine the root cause.** Based on our analysis, we determined the root cause of the problem. We found that junior developers did not participate in the estimation process, which skewed the estimates lower. We also did not account for the time needed to conduct code reviews to ensure quality standards and identify potential issues.

Figure 1 **FISHBONE DIAGRAM**



6. **Develop and implement a solution.** After we identified the root cause, we developed and implemented a solution to address the problem. We included all junior and senior developers in all estimation meetings to provide more well-rounded estimates. We also added code review time in our estimates to account for all steps in the development process.
7. **Monitor and evaluate.** We monitored the effectiveness of the solution we implemented and evaluated whether it resolved the problem. We found that our estimates were 30% more accurate overall. We now are observing that our quality assurance testing workload and queue are affecting our overall ticket estimates and have begun a five whys exercise to investigate the root cause.

Kaizen events

As a new employee within an organization, I met with stakeholders and discovered the following:

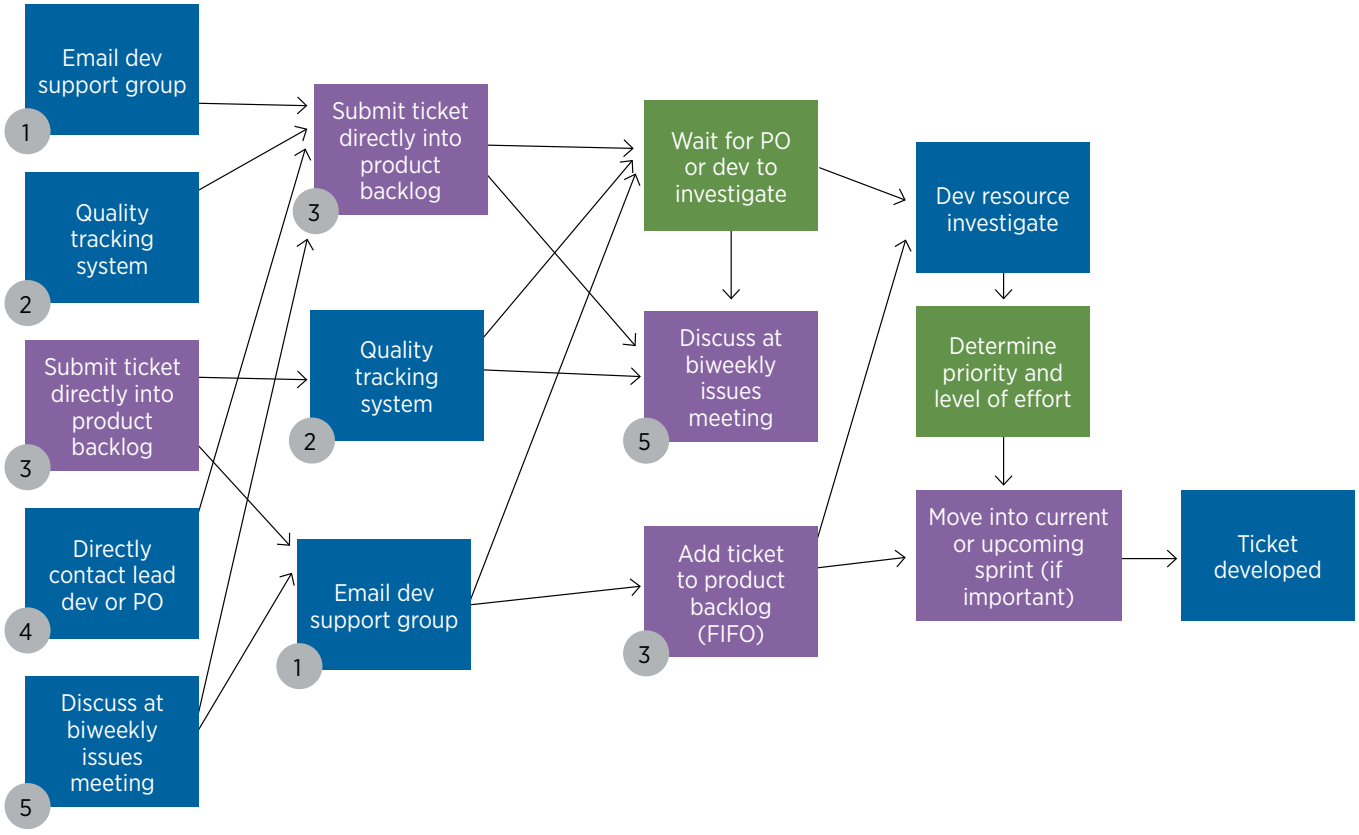
- There were various methods to first report an issue.
- Stakeholders were unaware of when the product team would review and investigate the reported issue.

- There wasn't a clear feedback mechanism for reporting findings and timing of when issues would actually be addressed.

All were ultimately affecting customer communication and satisfaction. The team decided to conduct a mini *kaizen* to consolidate efforts to understand all the processes, identify pain points in processes, and improve the team's productivity and confidence that the product backlog was prioritized consistently with the incoming items.

- **Define the scope.** We identified what was in and out of scope for the event. The scope was to identify the various methods of reporting issues for the first time, and how issues would potentially be addressed.
- **Assemble the team.** We assembled a cross-functional team that included members from different areas of the organization. Stakeholders included were the PO, lead developers, quality testers, clinical customer success members and the support team.

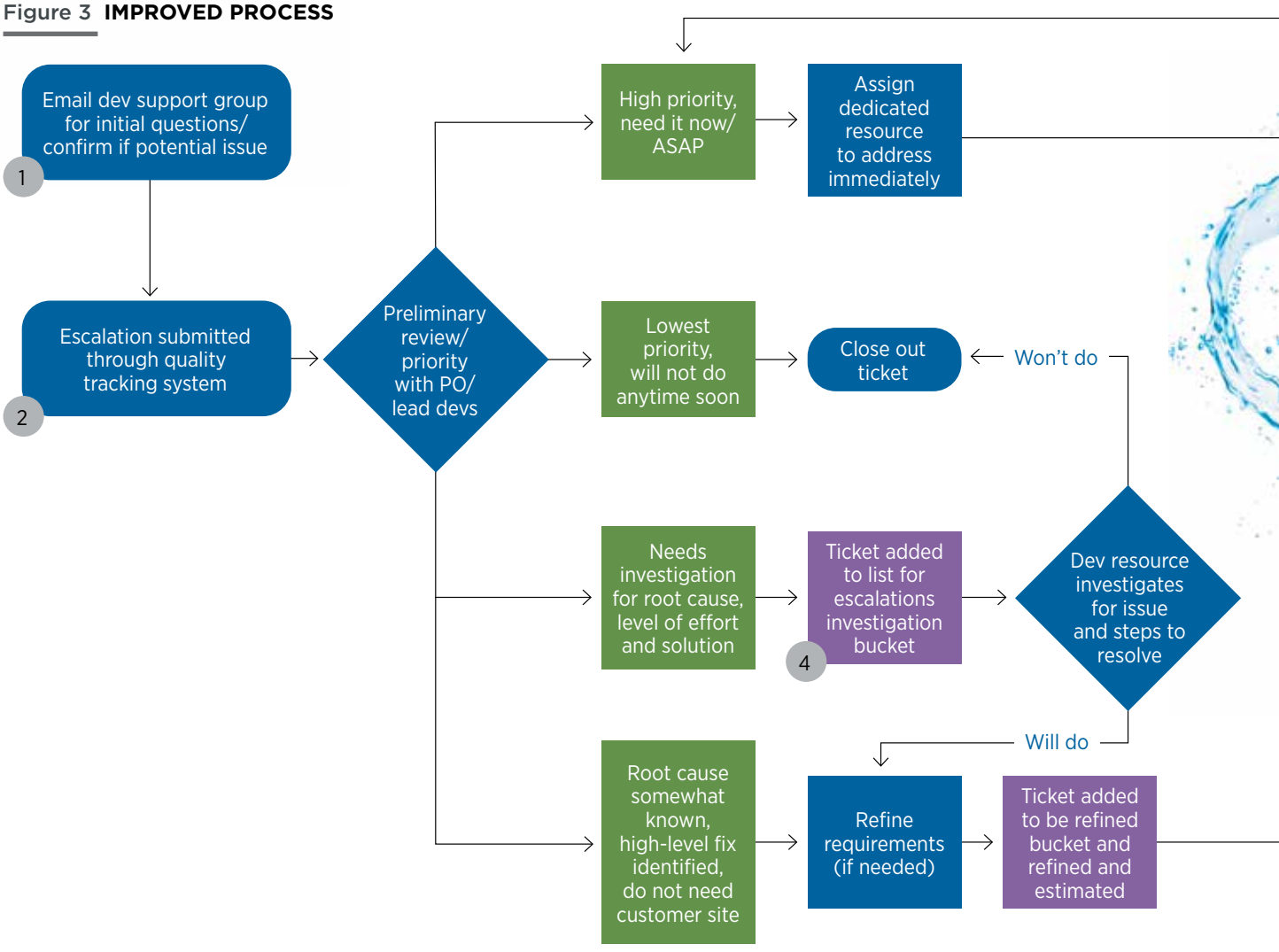
Figure 2 METHODS TO COMMUNICATE A CUSTOMER ISSUE



Dev = development FIFO = first in, first out PO = product owner

- **Map the current processes.** We identified and mapped out the current processes. Five different methods were identified for communicating a customer issue to product and development, shown in blocks one through five in Figure 2 (p. 15).
- **Identify bottlenecks.** We identified inefficiencies where work was getting stuck in the current processes. We found that an issue initially was reported through one of the five methods. This caused information to spread across various platforms (ticket tracking, emails, meeting minutes and personal documents, for example), which made it difficult to track and understand true item status and prioritization. This caused circular conversations to gather all relevant information. Some stakeholders also would submit another request via another method to ensure the product or development team received the ticket. This caused rework and duplication.
- **Analyze the root causes.** We analyzed the root causes of the inefficiencies we identified. The product and development team typically looked at issues in the order in which they were reported. This caused tickets with unknown priority to sit in the queue for longer than appropriate, which caused stakeholders to resubmit their issues.
- **Develop solutions.** Based on our analysis, we developed solutions to address the root causes of the inefficiencies. Figure 3 shows

Figure 3 **IMPROVED PROCESS**



Dev = development
PO = product owner

Lean and agile share the principles of iterative improvement and customer centricity.

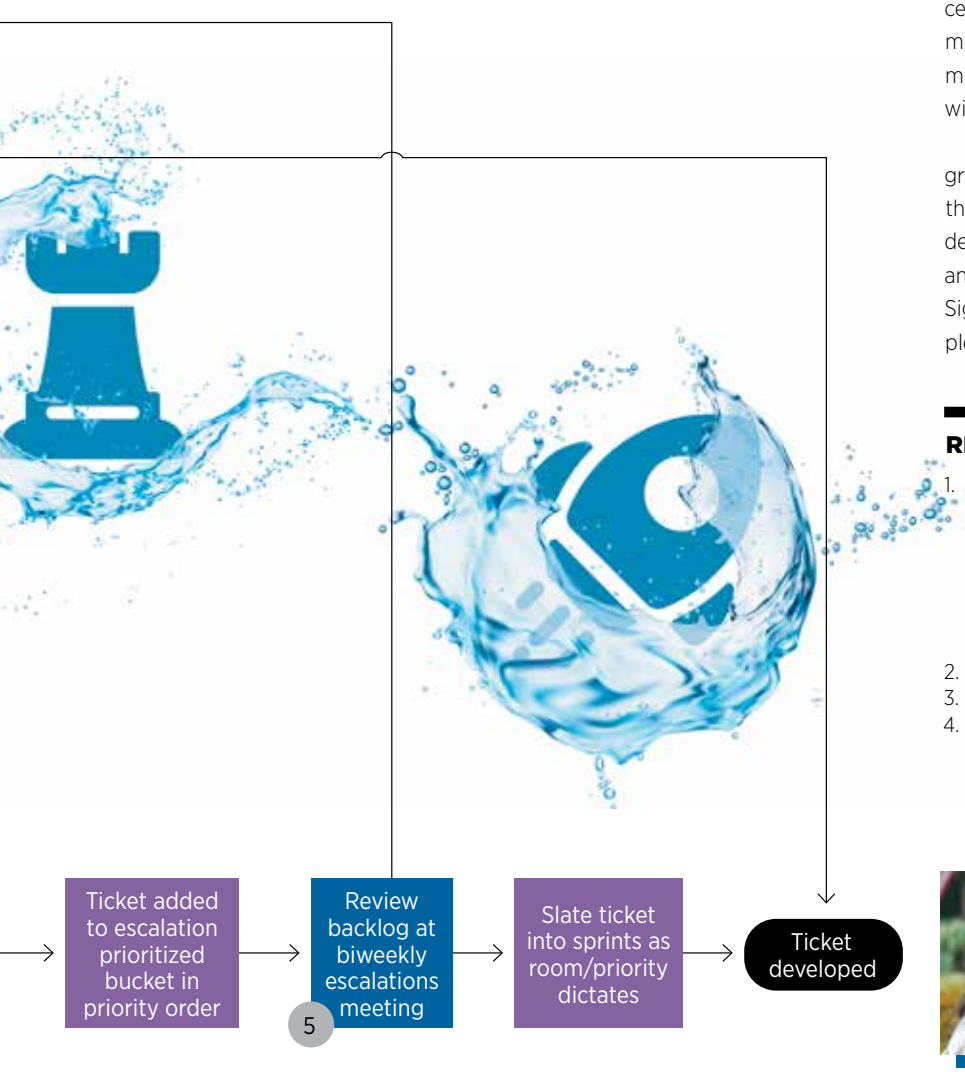
the improved process for an issue from documented to developed (or closed). We decided to continue methods one and two to reduce the number of ways to first report an issue. We kept the development support email group to field general questions, and directed the stakeholder to submit a ticket if questions could not be answered. Otherwise, the stakeholder would submit a ticket through the quality tracking system, which allowed for all tickets to be on one platform and visible to the whole group.

+ **Implement solutions.** We implemented the solutions we developed and monitored the results to ensure they were effective. The product and development team implemented a preliminary review meeting to assess the reported issue, understand requirements and determine initial priority (green boxes in Figure 3). During the weekly quality review meeting, status updates were given for each ticket as they moved through different buckets in the product backlog (purple boxes in Figure 3).
+ **Continuously improve.** We monitor the processes continuously and make ongoing improvements as needed. The quality tracking system and product backlog are on two different platforms, and it is recommended we move to the same platform to remove duplication of tickets.

A time and place

Though the tools and techniques to achieve goals can be different, lean and agile ultimately share the principles of iterative improvement and customer centricity. I have found that incorporating both methods has led to maximum continuous improvement, reduced waste and increased productivity within my teams.

I am confident that more can be done to integrate the two methods and potentially transform the applications to meet the advancements and developments of Quality 4.0. If you have more tips and examples on how to integrate lean and Six Sigma practices into agile software development, please reach out! &



updates as tickets move through the process

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Beneath The Surface

Lean Six Sigma can help organizations dig deep to pinpoint problems and elevate workplace safety

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Safety

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In 1970, the U.S. Congress established the Occupational Safety and Health Administration (OSHA) to "ensure safe and healthful working conditions for workers by setting and enforcing standards and by providing training, outreach, education and assistance."[1]

Despite OSHA guidelines and industry-specific regulations, 2.6 million cases of nonfatal workplace injuries and illnesses were recorded in 2020, with 1.2 million cases resulting in a median of 12 days away from work.[2]

Promoting a safe and healthful workplace does more than protect workers from injury and illness. Employers also benefit through increased productivity and product quality, improved employee morale, and reduced turnover and employee absence.[3]

It is management's function and responsibility to add value to an organization by creating a safer and more productive environment for its employees. Managers can optimize workplace safety in their organizations by applying lean Six Sigma (LSS) tools.

When implemented and sustained, LSS is a method that provides quality improvements, enhances organizational performance, creates efficiencies and improves financial performance.[4] At its heart, LSS strives to reduce waste in the value stream and eliminate defects by minimizing process variation.

Although LSS often is thought to be best applied in manufacturing settings, the tools learned from LSS can be applied to any circumstance, including workplace safety. If organizations optimize how they identify and problem solve hazards, they can promote a safe organization more effectively.

Creating a culture of safety

The way employees approach workplace safety starts with the organization's culture. Without a shared commitment to safety between upper management and employees, safety will not be taken seriously.

Creating a culture centered around safety is not easy. Cultural change can take years. Without proper guidance, organizations often lose momentum and regress to old ways. For a cultural transformation to be successful, at least 75% of management must accept the change.[5] Employees look to executives for the organization's direction. Without a substantial majority of upper management accepting the culture change, employees will receive mixed signals on the direction the organization is moving.

It is management's responsibility, after buy-in to the culture change, to communicate the organization's vision frequently to its stakeholders. Management can empower people to act on the organization's vision by removing systems that can undermine the safety coalition.

This process takes time, so it is essential to emphasize short-term wins. Instead of taking on the most extensive safety problem to be solved, look for quick, visible improvements to increase excitement and show progress toward the culture change.

The organization also must encourage suggestions and ideas from employees, who shouldn't fear they will be ridiculed for

Instead of taking on the most extensive safety problem to be solved, look for quick, visible improvements to increase excitement and show progress toward the culture change.

offering what others consider a bad idea. When employees don't feel comfortable sharing thoughts, executives can overlook key concepts from the people closest to processes that might benefit from a change. Creating an anonymous suggestion box can help minimize this fear and allow employees to share thoughts and concerns they would generally keep to themselves.

When the culture change begins to take hold, it is crucial that the organization continues to prioritize safety. Continuous improvement means continuous change. When executives become complacent with the status quo of their organization, they miss critical improvement opportunities. A great way to ensure safety stays at the forefront of the organization's culture is to form a team of employees in charge of safety.

Cross-functional teams

Tasking a safety committee with identifying improvement areas helps ensure that the burden of change does not fall all on one person. The members selected to be on the committee, however, are crucial to the direction and success of the culture change. In LSS, a cross-functional team is assigned to best deal with policies, practices and operations.[6]

The power of a cross-functional team is that it is comprised of individuals who represent different departments within the organization. Cross-functional teams usually consist of eight to 12 members who should be subject matter experts from their respective departments (see Figure 1).

Each department brings a different perspective to the problem-solving process because they all have different career experiences. For example, developmental chemists and salespersons will solve the same problem differently. To optimize its problem-solving ability, the safety committee must capture each approach.

Cross-functional teams also are valuable because they ensure that at least one person in each department will have safety improvement on his or her mind, making it easier for progress to be implemented in each department.

Figure 1 **EXAMPLE OF A SAFETY CROSS-FUNCTIONAL TEAM**

Gemba walks

After the safety committee is established, part of its role is to determine areas of improvement inside the organization. Traditionally, safety procedures for an organization are made from within the office of an upper manager without observing what is happening in the areas that most need the safety procedures.

Gemba walks are an LSS continuous improvement tool that requires the safety committee to go and observe the place where things happen. *Gemba* is a Japanese term meaning the actual location where value is created and work is done.[7] For safety, this involves two to three members of the safety committee visiting different departments in the organization to observe what is happening.

Gemba walks are short in duration and are nothing to fear. The committee members observe activities and ask high-lumen questions to spur dialogue and help discover potential safety hazards. During a *gemba* walk, participants should not try to devise solutions for the problems, but should write down what they see to bring back to the rest of the safety committee.

After information is collected and presented to the entire safety committee, solutions to these problems can be brainstormed. The results always should be shared with the department in which the *gemba* walk was conducted (see Figure 2).

When staff repeatedly perform tasks daily, they often become desensitized to the potential hazards surrounding them. Having members from other departments perform *gemba* walks helps to illuminate these hazards. The safety committee can extract more information than simple yes or no answers by engaging department staff with high-lumen questions.

Questions such as "What would that do for you?" and "Why is that important to you?" probe staff for answers that give the committee more insight into potential safety issues. These insights create a better opportunity for the safety committee to eliminate hazards in the organization.

Five whys

From the observations made during the *gemba* walk, the solutions generated must fix the root cause of the problem as opposed to addressing the symptoms. Quick fixes may appear convenient, but often solve only the surface issues while the underlying root cause is still in effect.[8]

If during a *gemba* walk, chipped glassware is observed in the lab as a potential cutting hazard, for example, replacing the broken glassware won't fix the problem if glassware continues to chip in the future. The five whys tool repeatedly asks "why" to get past symptoms and identify the root cause. By applying the tool, the safety committee can get to the root cause and eventually address why the glassware is being chipped in the first place (see Figure 3).

Figure 2 ***GEMBA* WALK GUIDELINES**

Source: Patrick Valentine, "Lean Six Sigma Continuous Improvement Tools" Uyemura International, 2022, https://bit.ly/3OKRK77.

The committee members observe activities and ask high-lumen questions to spur dialogue and help discover potential safety hazards.

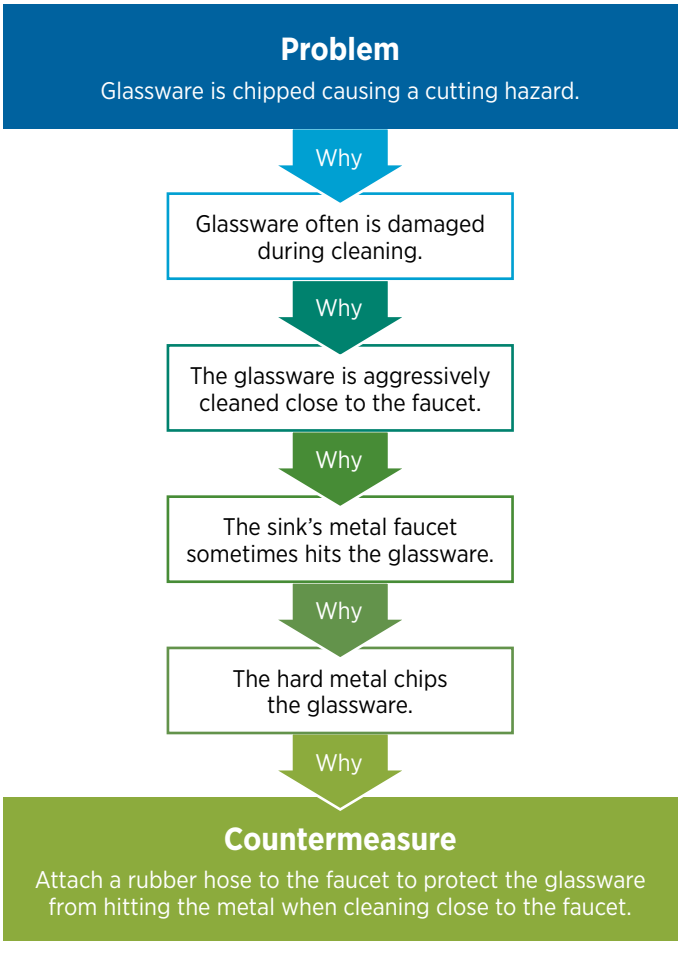
By using the five whys tool, the committee can develop a countermeasure to help stop the glassware from getting chipped in the first place. More than just replacing broken glassware, this solution helps prevent a cutting hazard from happening in the future. The five whys tool should be used in all scenarios to help discover the root causes to prevent the safety hazards at the source.

The 6S's

How can the organization's progress be measured with all the tools discussed so far? In *Better: A Surgeon's Notes on Performance,* Atul Gawande writes, "If you're trying to get better at anything, start counting."[9] Without metrics to measure against, organizations cannot see their growth and determine their struggles.

One LSS continuous improvement tool that can assist organizations with developing metrics is 6S. Those familiar with Japanese manufacturing might

Figure 3 **EXAMPLE OF FIVE WHYS**



recognize the 5S's—sort, straighten, shine, standardize and sustain—designed as a technique to enable just-in-time manufacturing.

In recent years, safety was added as the sixth S to emphasize that safety must be a top-most priority in every workplace. The 6S model aims to promote and sustain high productivity and safety throughout a workplace.[10]

6S creates an organized and simplified workplace that allows workers to distinguish between normal and abnormal conditions at a glance.[11] To ensure the 6S's are maintained, a simple audit is conducted in each department regularly. These audits should investigate five items for each of the 6S's and rate the current state of each item on a five-point Likert scale—ranging from one being "very bad" to five being "very good."

For safety, things such as training, safety improvement memos, safety guards, hazard control measures and chemical storage could be some items investigated. Because the audit assigns scores to each of the 6S's, the safety committee now can track the organization's safety initiative progress in each department from audit to audit. Management can track each item's progress to see what the departments do well and what they struggle with.

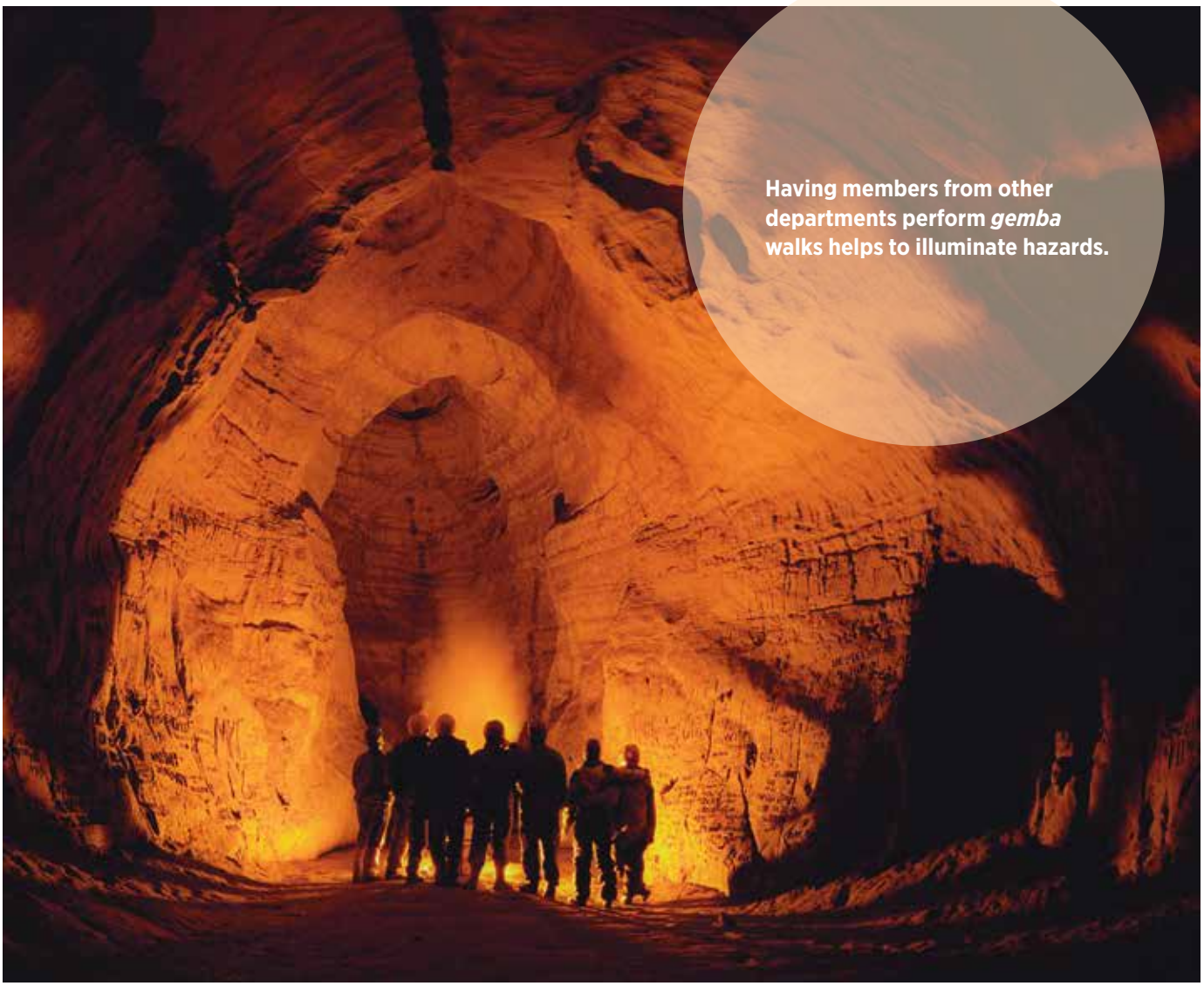
Results of these 6S audits should be posted for the entire organization to see so that progress is quantified, and a culture of safety is reinforced (see Figure 4).

Standardized and successful

Workplace safety must be taken seriously in all organizations to ensure the well-being of everyone. By applying LSS, organizations can optimize how they troubleshoot and eliminate safety hazards.

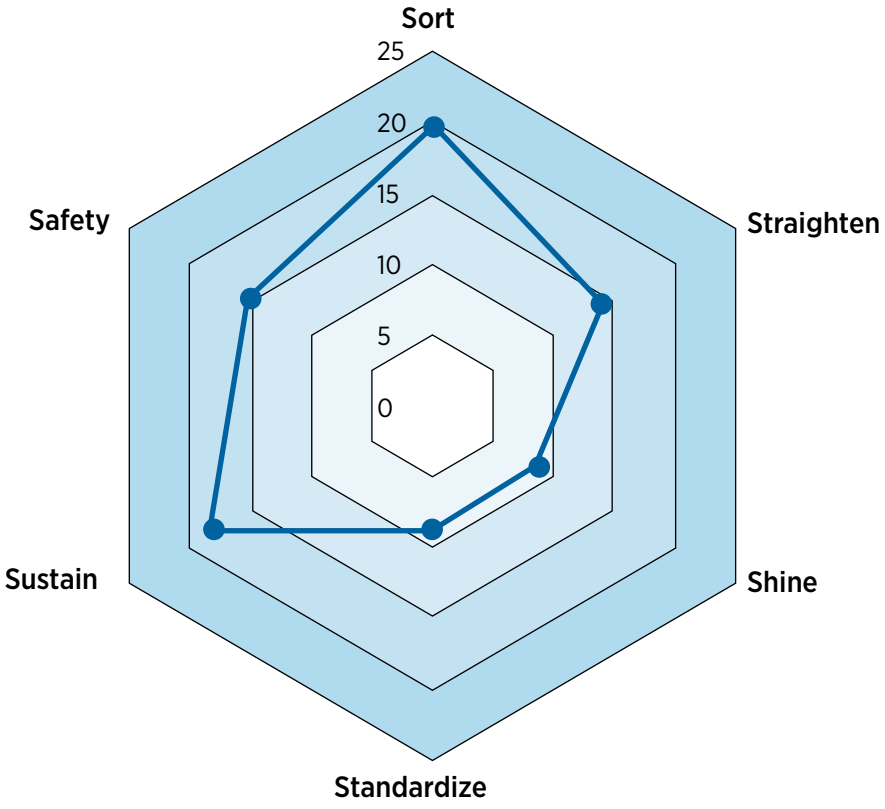
Creating a culture within an organization committed to workplace safety must have upper management and general staff buy-in. A safety committee composed of members representing different departments of the organization allows the organization to have other points of view for troubleshooting safety hazards.

By using *gemba* walks and asking high-lumen questions, committees can deduce what is happening in the organization. With those observations, and using tools such as five whys and 6S allows



Having members from other departments perform *gemba* walks helps to illuminate hazards.

Figure 4 EXAMPLE RADAR CHART FOR 6S AUDIT RESULTS



committees to dive beneath surface issues to pinpoint the root cause of safety hazards while measuring their progress.

These changes do not happen overnight. Organizations must stick with these techniques and portray the vision of safety to the entire organization consistently. Using continuous improvements for workplace safety within an organization provides a safer workplace for employees, increases productivity, quality and employee morale, and reduces employee turnover.

Tackling safety in the workplace does not need to be a daunting and mundane task. With LSS, safety improvements in an organization are standardized and successful. &

ACKNOWLEDGMENT

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Case Study

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Training

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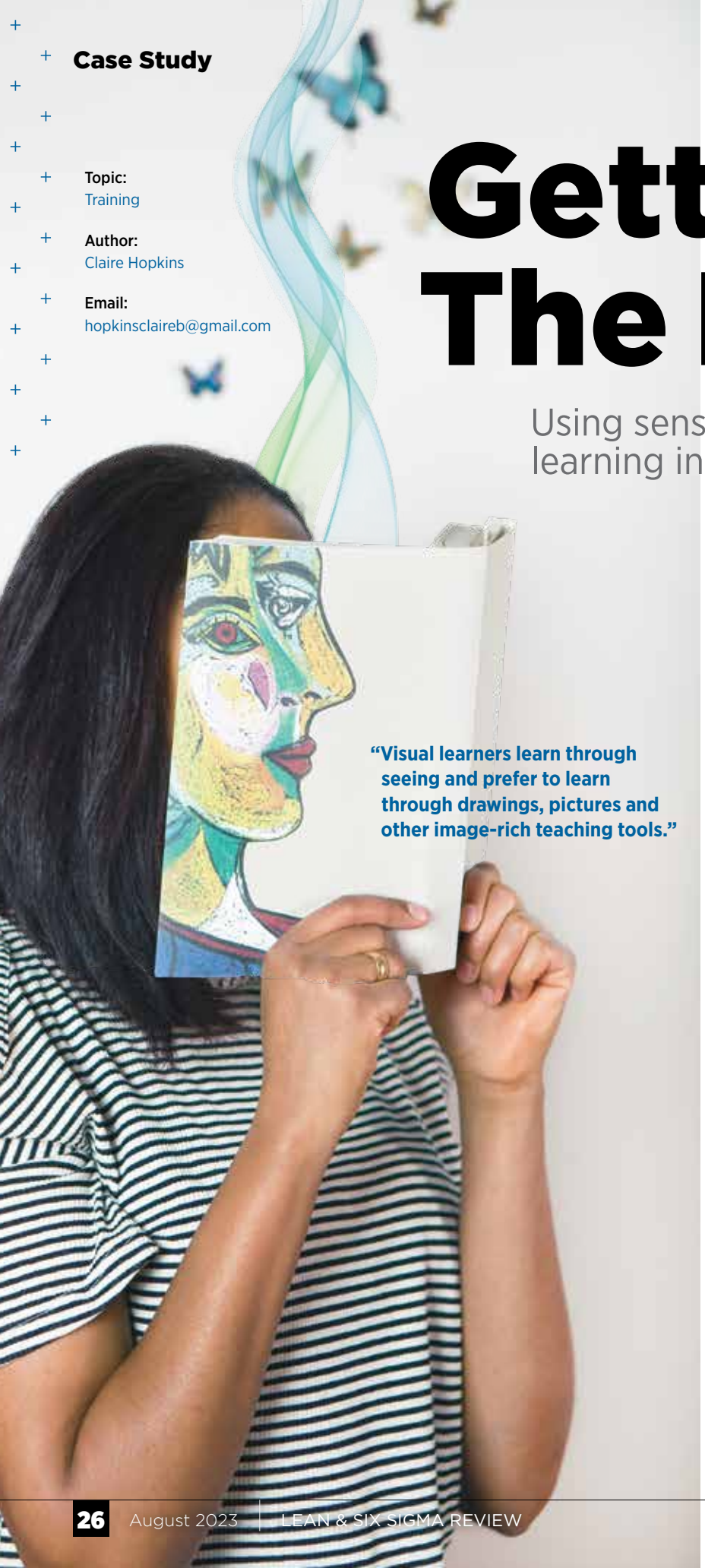
Getting in The Mode

Using sensory modalities of learning in change management



"Visual learners learn through seeing and prefer to learn through drawings, pictures and other image-rich teaching tools."

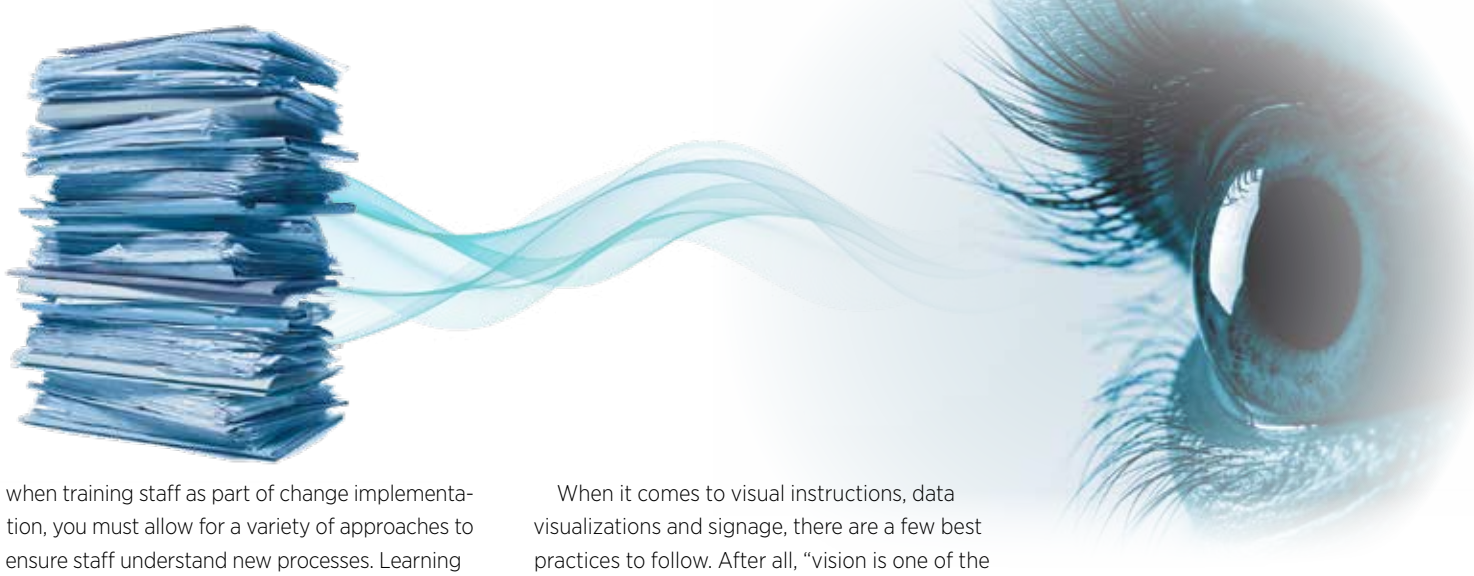
Change management is a core quality systems tool. Whether you are performing a corrective and preventive action (CAPA) or executing process improvements, you always are evaluating workflows and implementing changes. Whether you are using define, measure, analyze, improve and control in process improvement, making changes in the analyze stage of design for Six Sigma or using any other tool, there are myriad resources about changing workflows analytically to yield better outcomes.

In an ideal world, these changes would be implemented immediately and perfectly. Many of these changes, however, must be deployed technicians, inspectors, scientists and quality professionals, among others. We must, therefore, consider the human element of change and the many variables that come with it. This article focuses on the training aspects of change implementation.

There are many factors to consider when working with staff to implement a change. You might need to address resistance to the change, or leave space for them to process a change emotionally before getting on board.[1] As part of this, effective communication is an ever-present need and challenge. As quality professionals, we often are tasked with communicating the details of a change, sometimes in the form of training or procedure revisions. For staff to understand and execute these changes, it must understand the steps and reasoning behind them. When communicating changes to your teams, it is vital for those changes to be communicated as clearly and effectively as possible.

Using learning styles to support effective communication

Effective communication isn't one-size-fits-all. People excel using a variety of learning styles, have access needs and are subject to making errors. So,



when training staff as part of change implementation, you must allow for a variety of approaches to ensure staff understand new processes. Learning styles—which are "the preference or predisposition of an individual to perceive and process information in a particular way or combination of ways"[2]—should be considered not just in academic classrooms. Humans always are learning, and we should factor learning styles into workplace training as well.

There are diverse ways that learning styles have been categorized in cognitive psychology. Here, we will use the framework of sensory modalities of learning, which initially was established as the visual, aural and kinesthetic (VAK) framework. Visual, aural and kinesthetic are three major sensory modes of learning.[3]

Later, this tool was expanded by educator Neil Fleming into the VARK framework, further splitting the visual category of learning into visual and reading/writing. This establishes the four categories as visual, aural, read/write and kinesthetic.[4]

The VARK model has the advantage of being easy for individuals to understand, and it has clear links to various training materials. For example, visual learning directly relates to the use of graphics and images, while reading/writing applies to commonly used written training materials, such as standard operating procedures and work instructions. This framework is used here to offer new tools and perspectives that can be applied when planning and executing training.

Visual learners

Many people might describe themselves as visual learners. "Visual learners learn through seeing and prefer to learn through drawings, photos and other image-rich teaching tools."[5] When training co-workers on a new process, consider incorporating illustrations or images of the new process. For example, work instructions could include step-by-step images of a new packaging configuration rather than just written instructions. Make these available to technicians whenever they need them, not just during training, but either as part of your e-quality management system or an easily accessible job aid.

When it comes to visual instructions, data visualizations and signage, there are a few best practices to follow. After all, "vision is one of the most fundamental means of communication."[6] First, consider your use of color. An estimated 0.5% of females and 8% of males in the world have some sort of color vision deficiency, such as red-green color vision, which is the most common deficiency.[7] Though these individuals represent a small portion of the population, small changes to how you display instructions and data can make materials accessible to them, and it might even benefit everyone.

Ensure graphics that rely on color to communicate a message (such as a color-coded pie chart or graph) are in colors that maintain their contrast for individuals with color vision deficiency. There are an abundance of online resources that will help you generate and color-check your graphics for color contrast. Additionally, consider whether your document will be readable if copied in black and white. If it relies only on color to differentiate data in a graph, for example, it may be rendered unusable if copied.

Reading/writing learners

Also in the visual category are reading/writing learners, who learn best "through interaction with textual materials."[8] For these individuals, you might wish to provide thorough written instructions, perhaps alongside the photos intended to help visual learners.

Write in clear, succinct sentences and have multiple people proofread materials and check for clarity. Even better, have a non-subject matter expert review the materials and evaluate whether they contain jargon. For example, do you use quality terms that aren't widely known? Do you advocate for concepts of *muda* (the Japanese term for waste—a term used in quality methods to determine process changes to eliminate wastefulness) without explaining the meaning? Small things like this will make the materials more useful and accessible.

When distributing text instructions, also ensure they are always in a format accessible to screen readers. Screen readers "are software programs that allow blind or visually impaired users to read

In the visual category are reading/writing learners, who learn best "through interaction with textual materials."

Auditory learners "learn preferentially through hearing and are adept at listening to lectures and exploring material through discussions and might need to talk through ideas."

the text that is displayed on the computer screen with a speech synthesizer or braille display."[9]

Inaccessible formats can include text in the form of an image (such as a screenshot) or webpages that are not in semantic HTML—that is, not properly coded on the back end to make it easy for the screen reading software to parse. By doing this, you also ensure that the content is editable for future revisions and robust in the face of technology updates.

Auditory learners

Both previous examples involve the written/printed materials you might use to train employees. Auditory learners, however, "learn preferentially through hearing and are adept at listening to lectures and exploring material through discussions and might need to talk through ideas."[10]

These individuals can benefit from live, lecture-style training that talks through the procedures for a given change. If resources are limited or the scope of training needed makes in-person training a challenge, video content is a great option. Additionally, videos have the advantage of being easy to distribute, and they can be viewed anytime, without the need for instructor availability.

Kinesthetic learners

The final learning style to mention is kinesthetic learners, who "prefer learning experiences that emphasize doing, physical involvement and manipulation of objects."[11] This learning style often is given the least attention because it can be more challenging to incorporate depending on the training material.[12]

Kinesthetic learning could consist of performing the actual task being trained on, such as packaging products for shipping. It could include inviting trainees to sketch a new workflow on a whiteboard or arrange color-coded note cards to outline a process. Get creative in drafting ideas, and ask your colleagues and trainees what activities might work for them.

Bringing learning styles together

The main takeaway from this: Allow for a diversity of learning styles when preparing materials and conducting training. This will require more time and effort, but it will yield better long-term results if training on changes is more effective. Importantly, your colleagues deserve to have their learning styles accommodated so that they can best excel in their work.

Separate from learning styles, there are a few best practices for communication to use:

- **Purposefully and clearly make space for questions.** Your audience might need clarifications, or perhaps you didn't explain something clearly. Even the simple statement, "Does anyone have any questions?" is helpful, but consider instead, "What questions do you have?" This shows that you don't expect everyone to understand the content perfectly, and that questions are particularly welcome.
- **Bring positivity to training and changes.** You might be tempted to use phrases such as "This is going to be frustrating but…" or "I'm sorry to make you change this." Instead, frame the changes around the intended positive outcome. Explain why a particular change is being made, and while you should express that you understand making changes can be challenging, do not linger on the negatives. Empower trainees to be part of the solution rather than assume they'll be resistant to the change.
- **Don't expect training on a change to be 100% effective the first time.** Even if you use all the tools listed earlier, mistakes will happen. That's why we have effectiveness checks and process improvement to continuously evaluate and improve. But by offering information and training materials in multiple formats to accommodate different learning styles, you'll enable better communication and yield better long-term results.

Kinesthetic learners "prefer learning experiences that emphasize doing, physical involvement and manipulation of objects."

Putting new perspectives into practice

Consider a change implementation in a packaging process: You are updating the configuration of a package containing reagent vials to improve the user experience. The product is packaged by packaging technicians who are overseen by a manager, and each run has a single package inspected for accuracy. There is an existing work instruction document that guides technicians through packaging this product and the correct configuration of the components.

There are multiple points in the workflow that must be addressed in the context of this change implementation, such as updating the work instructions, securing updated packaging and labels, or distributing change notifications to customers. This example focuses on personnel training and the associated learning materials.

First, ensure that the packaging manager is aware of the upcoming change. They likely are the primary contact for the technicians, so they should be an active participant in the change implementation and training. The manager is a subject matter expert in the packaging workflows, so use them as a resource when writing training materials. When updating the work instructions, take the opportunity to add photos of the process, if they're not already included. Ensure any photos are well lit and in focus, and that there are no unnecessary items in the work area that will distract from the focal point of the photo. Ensure the written instructions are clear, and have multiple people proofread the instructions for clarity.

With those materials updated, you can now train staff on the workflow change. You may need to schedule multiple sessions to accommodate staff availability or shift changes. Have an agenda for the sessions, and ensure you have all written and demonstration materials ready in advance. Identify who should lead the training. Should it be a quality employee, or perhaps the training manager? Work collaboratively and bring a supportive attitude to the training sessions.

To accommodate kinesthetic learning, incorporate a hands-on demonstration of the new packaging configuration. If possible, use dummy vials (ones not filled with product) to make the demo as realistic as possible. For the reading/writing learners, provide copies of the updated work instructions. Visual learners will be supported by the hands-on demonstration, but you also can provide a slideshow of step-by-step photographs showing the process. Finally, talk through the process during the training to reinforce it for auditory learners.

This might seem like a lot of labor to implement a single change, but in situations in which errors might be costly or require product rework, it is worth the effort to get it right the first time. Your efforts will be supported by built-in inspection processes to identify any errors. If errors still are identified during product inspections even after taking all these steps, consider repeating the training. Use your CAPA tools to identify why the mistake might be happening (Are two of the components similar in color? Are the work instructions vague or confusing?) and correct as needed.

Training takeaways

There are endless ways you can use these tools in your daily work. Training not only takes place during change implementation, but change also can be one of the more challenging situations in which to train staff. By using these tools, you can streamline these processes, better support employees and yield better results. &

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Ask a Belt

You Have Questions,
We Have Experts.

READER QUESTION

How do I convince my organization's leaders to practice lean?

OUR RESPONSE

You've undoubtedly examined your situation and considered the possibilities before reaching out to ask this question, so you likely realize one of the fundamental business truths when dealing with an organization's executive leadership: Always appeal to the bottom line.

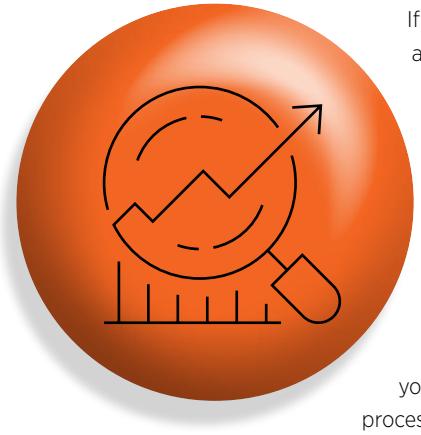
Executives deal with business health as a whole, which usually is expressed in terms of dollars (or euros or yen, for example). Executives won't want to approve a project or investment if it doesn't add value to the business by increasing profitability. This leads to the first step in building your case: Identify the problem. What specific problem does the organization face that gets in the way of adding value? Answering this question will help guide your approach.

Executives won't want to approve a project or investment if it doesn't add value to the business by increasing profitability.

Also remember that lean is not one size fits all. The overarching principles apply regardless of your end goal, but the specific tools you implement may depend on the problem you're trying to solve and the type of industry you're working in. Lean implementation on an assembly line looks different than in a financial institution or healthcare setting, for example. So, based on your understanding of the problem and the industry you're in, what specific approach would you recommend?

If possible, consider benchmarking. Is there another organization in a similar industry or facing the same kind of problems? What kind of solutions is it implementing? What kind of results is it experiencing? Has it achieved its goal yet? What are its future plans and how were they determined?

Finding an organization with similar issues that you can use as a case study could be invaluable to your case.



Finding an organization with similar issues that you can use as a case study could be invaluable to your case. It allows you to walk leadership through the entire process—from problem identification to project planning and implementation—and present results that demonstrate the project's success and the specific approach used.

If you can't readily identify an organization to use as a benchmark, you could gain some information through an internet search for other organizations' white papers. ASQ also may be a useful resource for finding case studies. You may find your professional network to be particularly useful, too. Who do you know who has worked on successful lean projects that would be willing to share their knowledge? Don't be afraid to check with your entire network, including those on myASQ. Someone out there may have exactly what you need.

Leadership may be open to the idea of lean but unsure of how to put it into practice. If leadership isn't completely sold on the idea based on your benchmarking results, complete a pilot project to show what's possible. In this case, choose the pilot project carefully; it should be limited in scope but enough to demonstrate a positive impact.

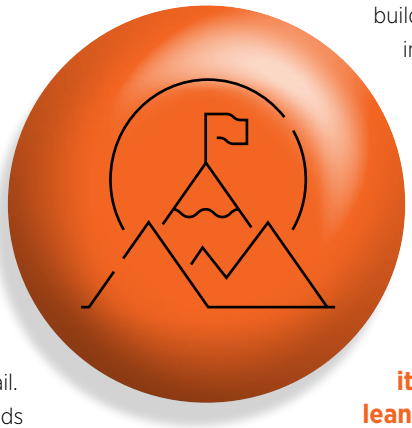
Also understand how your process links to upstream and downstream processes so you can anticipate and mitigate any negative impacts throughout the value chain. You don't want to

make an improvement in one place only to break something somewhere else. If that happens, you haven't actually made anything better—you've only moved the problem.

That brings us to the final point: The ultimate goal of this is to gain leadership's support to embark on a lean journey. Just by asking this question, it's clear that you understand how important this support is. If leadership isn't supportive of these efforts, they will fail.

It's imperative that leadership understands that lean is a continuous journey, which means efforts will be ongoing. Each improvement can be managed as a distinct project and celebrated when it crosses the finish line, but in and of itself, lean does not have an end date; it should become embedded in the organization's culture.

Leadership must be willing to implement and support the entire effort, including providing the resources necessary to achieve positive results. By building the business case for lean, including a demonstration of results through benchmarking, case studies and pilot projects, you're making the case for this ongoing support, which over time will provide value to the organization and its customers. Good luck! &



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THE BELTS **This response was written by STEPHANIE PARKER, quality manager, and GREG GREENLAND, continuous improvement manager, Boon Edam Americas, Lillington, NC.**

5whys

Getting to Know a Lean & Six Sigma Leader

Each issue, *Lean & Six Sigma Review* poses five questions to a lean and Six Sigma leader.

CLAIRE HOPKINS is a quality systems and documentation control specialist at New England Biolabs in Ipswich, MA. She received a bachelor's degree in English and plant biology from the University of Vermont in Burlington. A member of ASQ, Hopkins also is co-chair of the ASQ NextGen subcommittee, a member of the ASQ Technical Program committee and an ASQ-certified quality engineer.

1 Why lean Six Sigma (LSS) for you?

I am a quality professional in manufacturing, and I am always looking for ways to increase efficiency and accuracy in our workflows. I believe eliminating waste in all its forms and achieving quantifiable outcomes is the best way to track and pursue success. Additionally, LSS emphasizes collaboration. It always is my goal to get input and investment from all participants in a given process because the best experts on a process are those executing it.

2 Why is leadership support crucial?

As with so much of quality work, Six Sigma projects require buy-in at all levels of the organization, whether they are direct participants in the initiative or not. A quality culture will excel best if it is modeled and endorsed by leadership. This not only motivates employees to become invested in a process, but it also gives them permission to take time to work on process improvement. In a fast-paced work environment, it's easy for employees to focus on immediate outputs and getting product out the door. But leadership encouragement gives them permission to devote time to process improvement to achieve long-term results.

Leadership encouragement gives employees permission to devote time to process improvement to achieve long-term results.

3 Why is LSS better than other improvement methods?

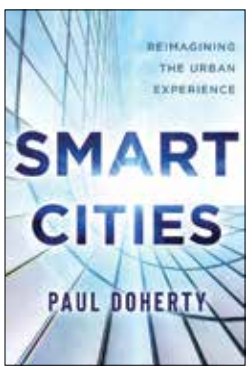
It's easy for folks to accuse quality of adding too much complexity or red tape to a process. However, Six Sigma embodies the true purpose of quality: efficient workflows free of unnecessary steps or waste.

4 Would you have done anything differently in your career and why?

I would have gotten involved in ASQ and professional societies earlier. My certifications have been excellent ways to build knowledge, and my involvement with committees and events has allowed me to network and find new opportunities. Attending events and contributing to publications (like writing this column) has furthered my learning and introduced me to new quality concepts.

5 Why do organizational LSS initiatives fail?

These initiatives can fail if the purpose and principles of LSS are not communicated properly to the entire organization. Without proper context, the steps and methods might seem unnecessary, or individuals might cut corners. It is important to educate all departments patiently and properly on the initiative's path to ensure they are invested in the project's success. As with all quality initiatives, we must cultivate a quality culture so all departments understand the long-term benefits of the initiatives. &



NEW FROM QUALITY PRESS

Smart Cities: Reimagining the Urban Experience

Paul Doherty

In a post-pandemic world, amid environmental crises and advances in technology, the dynamics of what the average city looks like have called for change, leaving governments and policymakers to reimagine urban planning and development. Readers will discover how metaverse was used to develop a virtual reality industrial park (VRIP) and implement ten guiding principles to create a smart city framework.

Item: H1584

RESHAPING TALENT IN THE WORKPLACE

We Culture

Luciana Paulise

Today's global, complex, and disruptive business environment demands organizations become more adaptive and agile. It's imperative that organizations upskill their personnel and set their culture intentionally. This book will help you create a culture to increase employee engagement, agility, quality, and innovation through the 12-skills CARE model for hybrid workplaces.

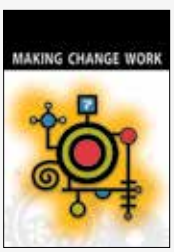
Item: H1591

Culture Is Everything

Jeff Veyera

This book offers practical and effective suggestions to help readers diagnose and improve their company's culture. It gives guidance on how to tailor a quality improvement approach to the culture in order to establish a productive workplace.

Item: H1568



Making Change Work

Brien Palmer

Making Change Work provides many tools to help your organization gain acceptance of changes successfully. This book addresses buy-in, acceptance, motivation, anticipation, fear, uncertainty, and other relationship dynamics that often cause change to fail in the workplace.

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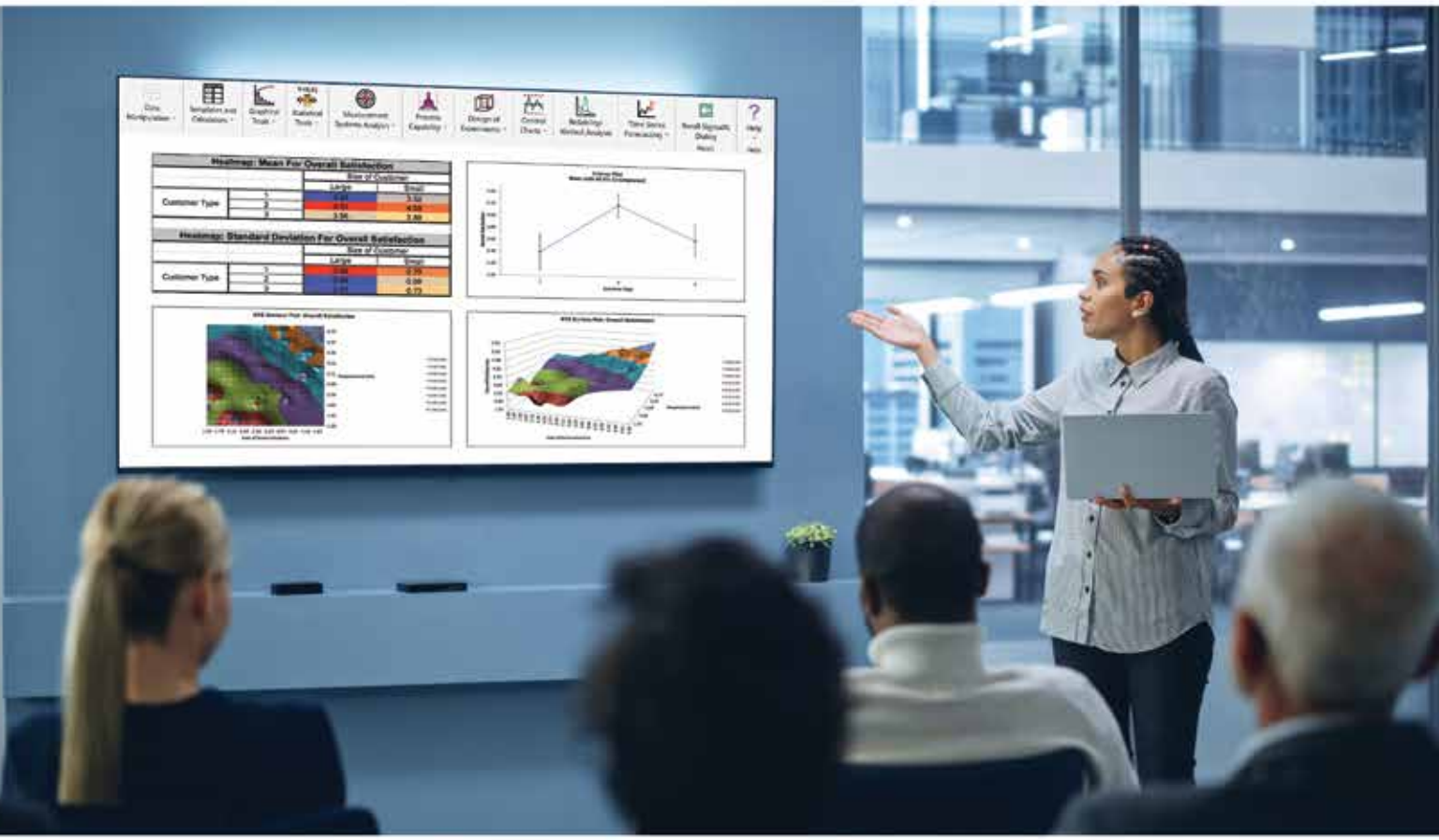

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