



# Continuous Improvement within an Environmental Testing Laboratory

Scott D. Siders | 2023 NEMC | Best Management Practices for Environmental Laboratories | August 1, 2023

# Presentation Overview



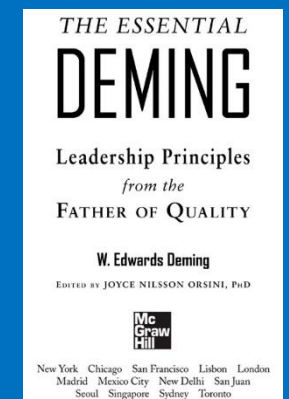
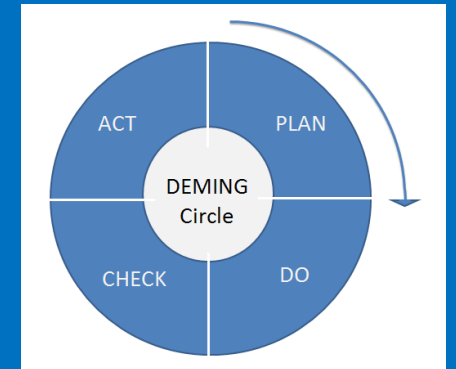
- What is Continuous Improvement (CI).
- How it helps the laboratory succeed.
- Drivers of Continuous Improvement.
- Obstacles to Continuous Improvement.
- Multiple Quality Management System elements can contribute to Continuous Improvement.
- Tools for Continuous Improvement.
- Best practices for Continuous Improvement.
- For further learning on Continuous Improvement.
- Conclusions and Recommendations

# You might ask, what is continuous improvement?

- First and foremost, the laboratory must have a quality culture, and adopt a mindset that CI is a necessity to achieve organizational long-term success and to survive in today's competitive environment.
- It is an ongoing effort and not a one-time event.
- CI improves processes and systems, products and services.
- It increases efficiency, quality and customer satisfaction.
- CI brings about change, reduces risks, helps solve problems and lower the cost of poor quality.
- To practice CI you use tools, techniques and data or metrics.

# What is Continuous Improvement, as envisioned by famous quality gurus.

- W. Edwards Deming: Deming believed that continuous improvement was essential for organizations to remain competitive and successful. He defined it as a cycle of Plan-Do-Check-Act (PDCA), where an organization sets goals, implements a plan to achieve those goals, checks the results, and then adjusts the plan as necessary to improve performance.
- Deming's philosophy of continuous improvement is based on a number of key principles, including:
- Focus on the customer: This means understanding the customer's needs and preferences and continually striving to improve products and services to better meet those needs.
- Emphasize quality: Deming believed that quality should be the top priority of any organization. Quality should not be an afterthought, but rather an integral part of the entire production process.
- Continuously improve: Continuous improvement is the key to long-term success, according to Deming. This means constantly seeking to identify areas for improvement and making incremental changes to products, services, and processes over time.
- Empower employees: This means giving employees the tools and training they need to do their jobs effectively and trusting them to make the right decisions.
- Use data and metrics: Deming was a strong advocate of using data and metrics to measure performance and identify areas for improvement. He believed that organizations should collect and analyze data on a regular basis to understand their processes and identify opportunities for improvement.



# What is Continuous Improvement , as envisioned by the quality gurus.

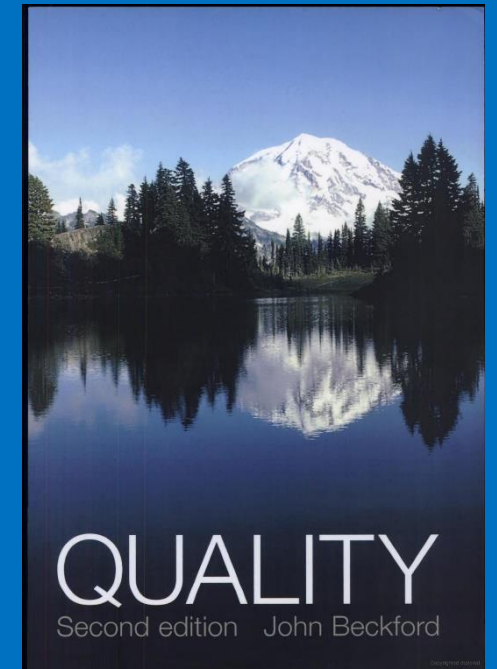
Joseph Juran: emphasized the importance of quality planning and quality control in achieving continuous improvement. He defined it as a process that involves analyzing data, identifying problems and opportunities for improvement, developing solutions, implementing those solutions, and then evaluating the results to ensure that the desired outcomes have been achieved.

**Box 9.3** *Joseph Juran's ten steps to continuous quality improvement*

---

Step 1	Create awareness of the need and opportunity for quality improvement
Step 2	Set goals for continuous improvement
Step 3	Build an organization to achieve goals by establishing a quality council, identifying problems, selecting a project, appointing teams and choosing facilitators
Step 4	Give everyone training
Step 5	Carry out projects to solve problems
Step 6	Report progress
Step 7	Show recognition
Step 8	Communicate results
Step 9	Keep a record of successes
Step 10	Incorporate annual improvements into the company's regular systems and processes and thereby maintain momentum

---

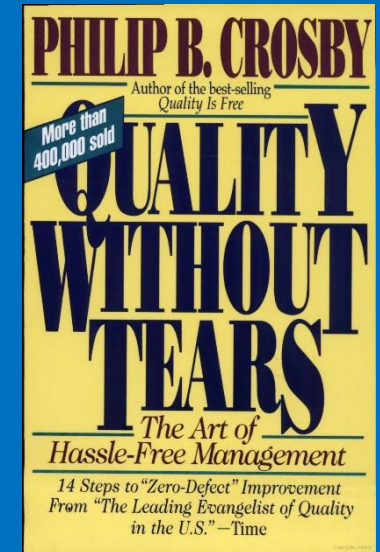


# What is Continuous Improvement, as envisioned by the quality gurus.

- Kaoru Ishikawa: Ishikawa focused on the importance of employee involvement and teamwork in continuous improvement efforts. He defined it as a process of "making small improvements every day" through the use of quality circles and other collaborative problem-solving techniques. He expanded the concepts of W. Edwards Deming into Japanese industry.
- According to Ishikawa, there are several key principles of continuous improvement:
- Quality control circles: Ishikawa believed that involving employees in the continuous improvement process was essential for success. He advocated for the use of quality control circles, which are small groups of employees who work together to identify and solve problems in the workplace.
- Customer focus: Ishikawa emphasized the importance of focusing on the needs and expectations of customers. He believed that continuous improvement efforts should be driven by a desire to improve customer satisfaction.
- Employee involvement: Ishikawa believed that employees should be empowered to identify and solve problems in the workplace. He emphasized the importance of providing training and support to employees to enable them to contribute to continuous improvement efforts.
- Statistical process control: Ishikawa believed that data and statistical analysis were essential for identifying areas for improvement and monitoring progress over time. He developed a number of statistical tools and techniques to support continuous improvement efforts.
- Overall, Ishikawa believed that continuous improvement was a never-ending process that required a commitment to excellence and a willingness to learn from mistakes. By involving employees, focusing on customers, and using data to drive decision-making, organizations can achieve continuous improvement and drive long-term success. Ishikawa, K., (Lu, D. J. trans.), 1985, What is Total Quality Control?, Prentice-Hall Inc., Englewood Cliffs, NJ.

# What is Continuous Improvement, as envisioned by the quality gurus.

- Philip Crosby: Crosby emphasized the importance of setting clear quality goals and using metrics to measure progress toward those goals. He defined continuous improvement as a process of "doing it right the first time" and eliminating defects and errors through a systematic approach to quality management.
- According to Crosby, continuous improvement involves four key principles:
- Prevention: The focus should be on preventing problems and defects from occurring in the first place rather than fixing them after the fact. This requires identifying potential sources of errors and taking steps to eliminate them.
- Measurement: Organizations should use data and metrics to measure their performance and identify areas for improvement. This requires setting clear goals and tracking progress over time.
- Corrective action: When problems do occur, organizations should take immediate corrective action to address the root cause of the issue and prevent it from happening again.
- Recognition: Organizations should recognize and reward employees who contribute to continuous improvement efforts. This helps to build a culture of continuous improvement and encourages employees to take ownership of their work.



# Why you first must have a Quality Culture (QC).

- A QC is important for the success of CI. What a QC brings to the table:
- Focus on Customer Satisfaction
- Establishes Boundaries and Norms for Quality
- Gets Everyone on the Same Page or Mindset Regarding Quality
- Promotes Employee Engagement
- Continuous Learning and Innovation
- Proactive Problem Solving
- Data-Driven Decision Making

A QC creates the environment and mindset that supports and sustains CI.



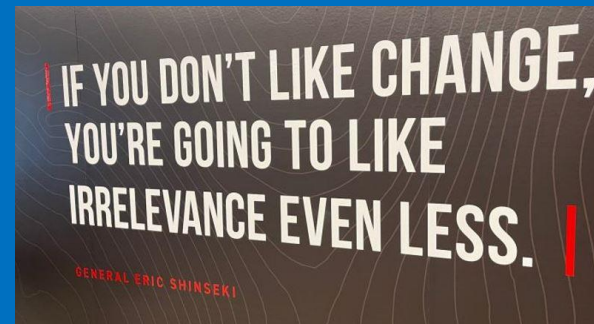
# How CI efforts can help a laboratory succeed.

- How it helps the bottom line:
- Reducing Error Rate and Cost of Poor Quality
- Reduce Downtime and Improve Productivity
- Improving product or service quality
- Improved Quality (Improvement via QMS elements) and Productivity
- Compliance with Regulatory Requirements
- Eliminate Inefficiencies/Waste via Optimization of Processes and Workflows
- Innovation
- Improved Employee Engagement, Job Satisfaction and Retainment
- Risk Reduction and Mitigation



# Key Driver of Continuous Improvement

- Competition
- External and Internal Pressures
  - “Our world continues to change regarding technology as well as environmental dangers (PFAS never heard of it when I started in the business) it is essential for businesses to adapt. Covid-19 created unexpected staffing challenges. All of these changes around us require us to change how we do things too. Survival of the fittest requires a successful lab to have focus on continuous improvement.” - Dorothy Love, QA Director, Eurofins Environmental Testing
- Financial Performance
- Sustainability
- Improvement is required by the ISO 17025 standard:
  - The QMS must include CI processes
  - Accredited labs must regularly review the processes, identify areas for improvement and take corrective actions to address any deficiencies
  - The CI process helps ensure that labs are meeting the needs of their customers and stakeholders
  - Helps labs stay up-to-date with advances in technology, best practices and improving efficiency, reduce costs and improve quality
  - Again, allows accredited labs to demonstrate they are continually improving their operation



# CI can help lab be responsive to Customers Needs.

- Improve Turnaround or On-Time-Delivery
- Better Communications (internal and external)
- Customer Services
- Adoption and Optimization of New Technologies and Test Methods (Adaptability)
- Digital Transformation
  - Digital transformation involves the integration of digital technology into all areas of a business, which can lead to significant improvements in efficiency, productivity, and customer experience (e.g., LIMS, QMS Software, Data Mapping, Paperless Lab, Data Mining, Data Review, AI).

# Obstacles to Continuous Improvement (will need to address)

- Lack of Resources, Funding and Personnel
- Lack of Training
- Lack of Collaboration and Communication
- Resistance to Change e.g., fear of unknown, loss of control, personal preferences, past experiences
- Lack of Understanding of Benefits of CI
- Limited Management Support and Lack of Commitment, (i.e., lack of leadership for CI)
- Prioritizing Day-To-Day Tasks
- Focus only on compliance with regulations and minimally meeting accreditation requirements (see next slide)

# Compliance-focused culture

- In some laboratories, the primary focus may be on meeting regulatory requirements and just passing the audits, rather than on continuous improvement efforts. While compliance is important, a sole focus on it can hinder progress towards continuous improvement.
- I call this, “just meet the minimal requirements for accreditation and nothing else.”
- At these labs the view is, “anything more is overkill.”
- They typically don’t see the benefits from or the real value QMS and CI adds to the organization and business success.

# Common Arguments That Sceptic of CI Make

- It's too time-consuming
- Not enough return on investment (ROI)
- It's too Expensive
- It's not Necessary
- It's not Feasible
- It's not Realistic

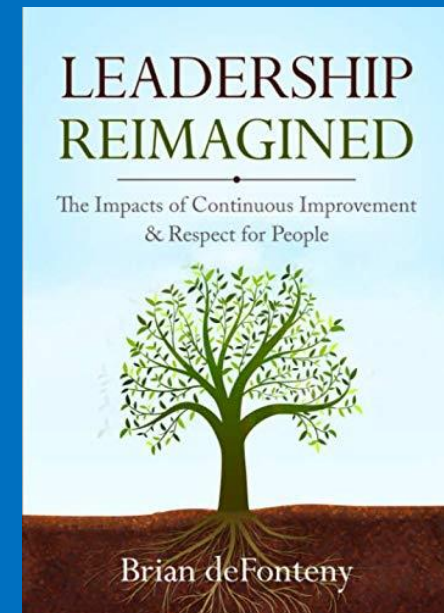
It is **important to note** that while these concerns may be valid to some extent, they do not necessarily outweigh the potential benefits of continuous improvement. It is important to carefully consider the specific needs and resources of a company when deciding how or when to implement a continuous improvement strategy or effort.

# Overcome These Challenges (the ball is in your court)

- First and foremost is, Management Support and Commitment
- Create a culture of collaboration, sharing of ideas and problems
- Training on implementation and maintenance of CI
- Communication by Management of the benefits of CI
- Involvement of Staff to increase buy-in and ownership of CI
- Prioritize time and budget for CI
- Educate Staff on how CI can improve lab's performance and profitability over time

# Management's Leadership Role to Promote CI

- Set Clear Goals and Expectations
- Foster Culture of CI
- Set-up a CI Program
- Ensure Regular Audits and an Effective and Efficient QMS
- Provide Resources and Training
- Foster Collaboration
- Measure Progress





# CI can Contribute to Beneficial Change



- “Continuous improvement basically means that we are willing to change. Change is not typically something people want, but we can get used to or at least more comfortable with changes as we experience them more. The biggest benefit I’ve seen in continuous improvement in a laboratory is that people become comfortable with changes so they are more willing to point out difficulties or things that could be done better and suggest ways to improve. When people see that management is supportive of improvements, it allows employees to question what and why they do what they do for a possibility of doing something better in a better way. This promotes the virtuous cycle we’d all like to see in an organization.” Debbie Bond, Chairperson, TNI’s Laboratory Quality Management Systems Committee

# When asked on LinkedIn



## How focused is your laboratory on continuous improvement (CI)?

CI essential to our efforts: 70%

Occasional CI projects: 10%

Rarely address CI: 10%

Don't have a CI program: 10%

## Which type of continuous improvement work does your organization generally give the highest priority to?

Leader selected projects: 45%

Projects with high \$ ROI: 40%

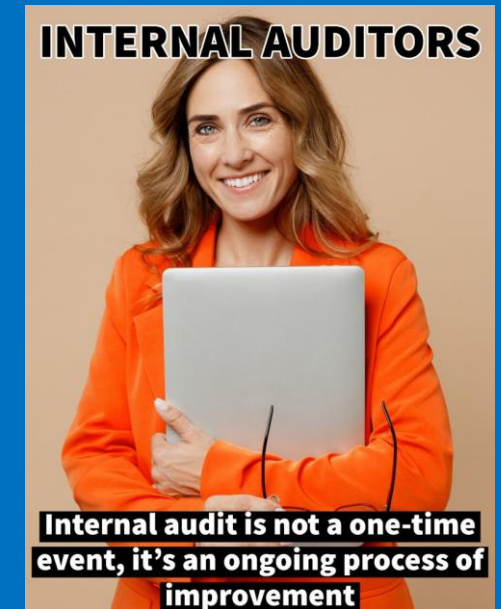
Employee driven ideas: 15%

# ISO 17025 and TNI's QMS Standards Driver and Integral to CI

- “Improvement (ISO/IEC 17025:2005, Clause 4.10) The laboratory shall continually improve the effectiveness of its management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and management review.”
- Internal Audits
- Data Review and Trend Analysis
- Corrective Action and Preventive Action
- Training
- Risk Analysis, and the
- Management Review

# Internal Audits as a Driver of CI

- Identify areas for improvement
- Evaluating effectiveness of controls
- Can identify best practices and need for corrective actions
- Providing feedback to management
- Promoting a culture of continuous improvement



# Data and Trend Analysis can drive CI and be used during CI

- Data-driven decision-making (can provide insights on historical data)
- Proactive problem solving (can identify emerging issues)
- Setting improvement goals (highlight areas where CI opportunities exist)
- Feedback Loop (trend analysis can provide data on CI efforts)
- Predictive Insights that can spot potential systemic problems

# Risk Management and CI

- Continuous improvement and risk management are interdependent and complementary processes. The relationship can be visualized as a loop where continuous improvement drives risk management and risk management drives continuous improvement.
- Continuous improvement identifies areas for improvement and opportunities to reduce risk.
- Risk management assesses and prioritizes risks and implements controls to mitigate them.
- The reduced risks from risk management enable further continuous improvement efforts.
- The improved processes from continuous improvement reduce new risks and create a cycle of continuous improvement and risk management.

# Management Review's role in CI

- A quality management system (QMS) is a set of policies, processes, and procedures that organizations use to ensure that their products and services meet customer requirements and regulatory requirements. The management review is an important part of a QMS because it provides a mechanism for management to assess the effectiveness of the system and identify opportunities for continuous improvement. Make use of CI tools during Management Review!
- The management review is typically conducted at regular intervals, such as annually or semi-annually, and involves a review of the organization's quality objectives, performance data, and any changes in the organization's internal and external environment. The purpose of the review is to determine whether the QMS is meeting the needs of the organization and its customers, and to identify any areas where improvements can be made.

# How Corrective Actions Contribute to CI and are part of the CI Cycle

- Problem Identification
- Root Cause Analysis
- Action Planning
- Implementation
- Monitoring and Evaluation
- Lessons Learned

Corrective actions are part of a continuous improvement cycle. By addressing problems systematically, organizations create a culture of ongoing improvement. The feedback loop of problem identification, analysis, action planning, implementation, and evaluation ensures that organizations are constantly learning, adapting, and evolving their practices to achieve higher levels of performance and quality.



# Effective and Proven **Tools** for CI

- Pareto Chart: A graphical tool used to identify the vital few causes that are responsible for the majority of the problems.
- Flowchart: A graphical representation of a process that helps to identify potential areas for improvement and to better understand the flow of work.
- Cause-and-Effect Diagram: A graphical tool used to identify the root cause of a problem by breaking it down into smaller and more manageable parts.
- Control Chart: A statistical tool used to monitor a process over time and to detect any changes or deviations from the normal performance. <https://asq.org/quality-resources/statistical-process-control>
- 5S: A workplace organization method that helps to improve efficiency and effectiveness by eliminating waste, improving workflow, and promoting a safer work environment. Toyota uses this. <https://asq.org/quality-resources/lean/five-s-tutorial>

# Effective and Proven **Tools** for CI

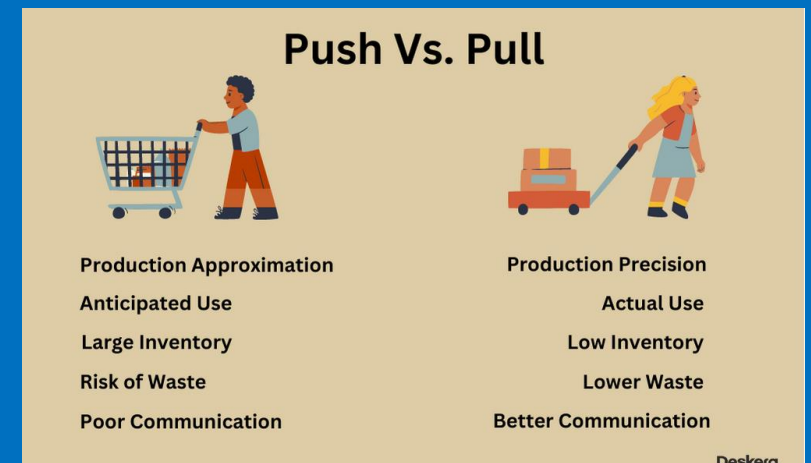
- Value Stream Mapping: A tool used to map out the entire process flow of a product or service from beginning to end, identifying areas for improvement and waste elimination. <https://asq.org/quality-resources/lean/value-stream-mapping>
- Lean Six Sigma: A methodology that combines the principles of Lean and Six Sigma to eliminate waste, improve quality, and reduce variability in processes.
- Root Cause Analysis: A systematic process of identifying the underlying cause(s) of a problem or defect, and developing a plan to prevent its recurrence.
- Total Quality Management (TQM): A management approach that seeks to continuously improve the quality of products and services by involving all employees in the process.

# Effective and Proven **Tools** for CI

- Kanban <https://www.exin.com/article/what-is-kanban-and-how-it-can-help-get-more-done-in-less-time/>
- Performance Metrics and KPIs (as mentioned earlier)
- Kaizen: This approach involves making small, incremental improvements on a continuous basis, with the goal of gradually improving overall performance. It emphasizes the involvement of all employees in the improvement process, as well as the use of tools such as root cause analysis and process mapping.  
<https://openai.com/chatgpt>
- The above tools are just a few examples of the many effective and proven tools that can be used during continuous improvement projects. The choice of tools will depend on the nature of the project, the goals of the organization, and the skills and expertise of the team. It is important that the laboratory provide training in the tools they feel are most beneficial to a given CI effort. This can be “just in time training” as needed for a CI effort.

# Best Practices for CI - Process Optimization (Lean is one way, there are others)

- Define Value From The Customer's perspective
- Map The Value Stream (what is your desire future state)
- Create the Flow by Streamlining Processes
- Establish Pull-Based Systems for Efficient Workflow
- Pursue Continuous Improvement Through Feedback, Use of Metrics and Data Analysis



# A Best Practice for Planning a CI Effort

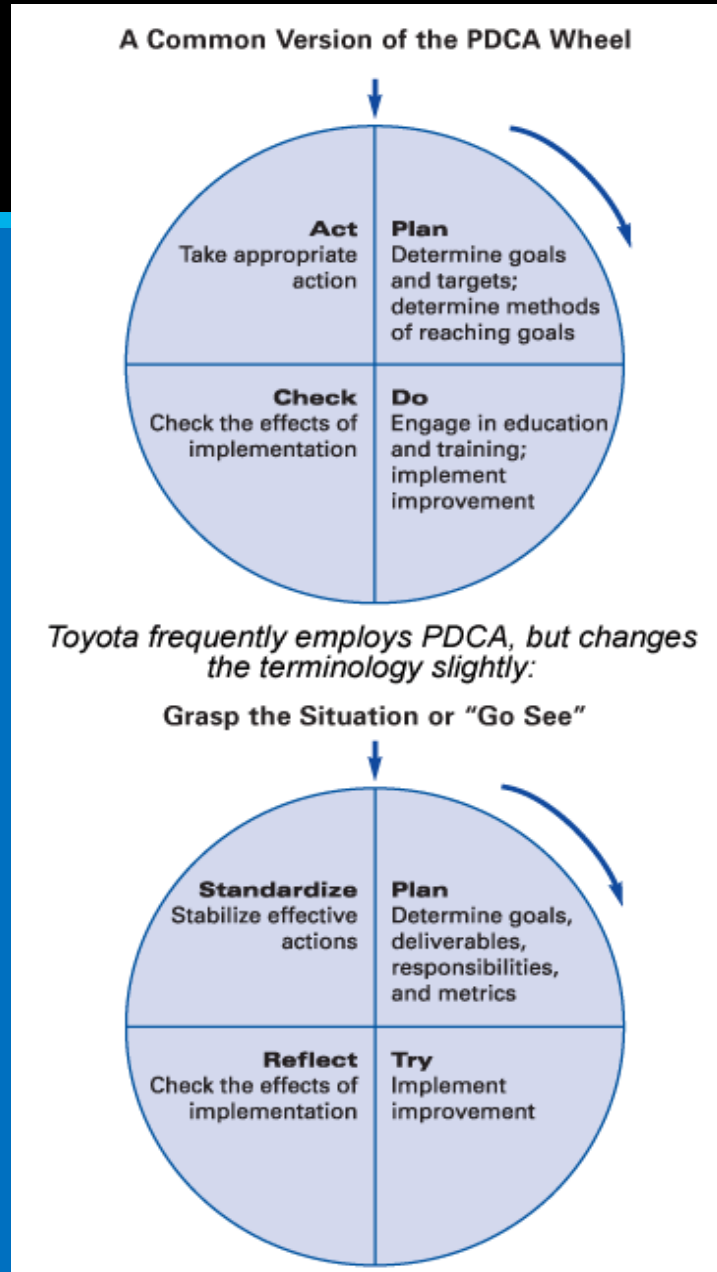
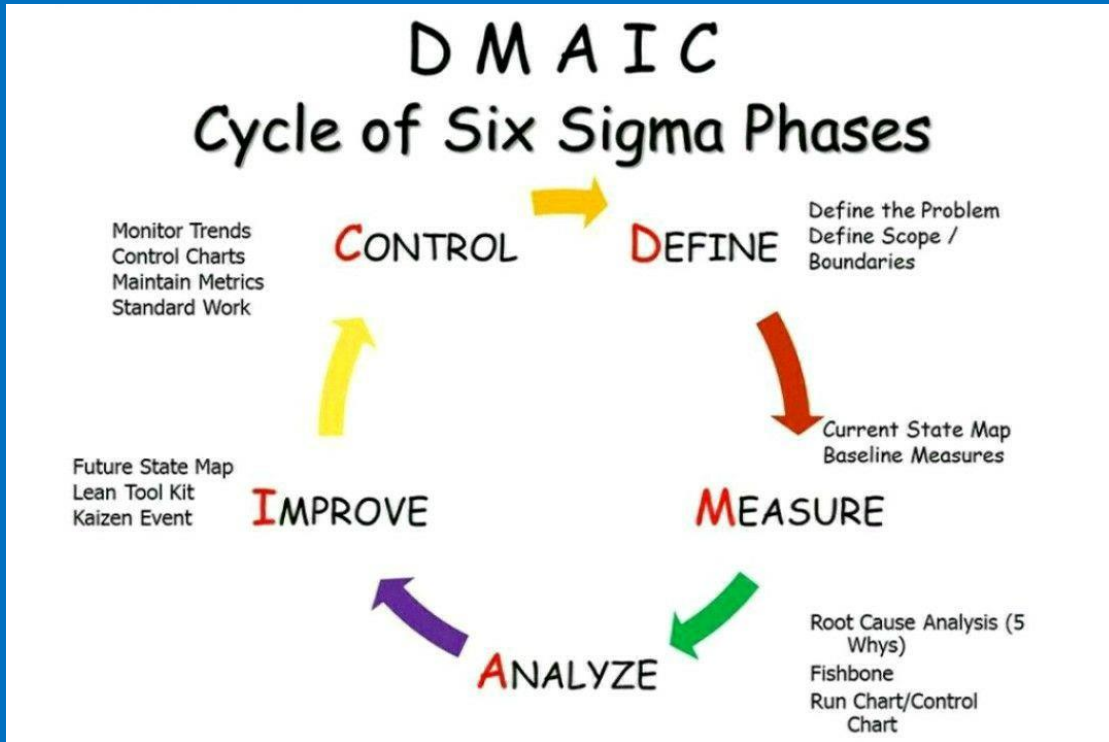
- Set specific, measurable, achievable, relevant, and time-bound (SMART) goals: This is a fundamental principle in any continuous improvement initiative. Goals should be clearly defined and aligned with the laboratory's mission and vision. They should be specific, measurable, achievable, relevant, and time-bound, ensuring that progress can be tracked and evaluated. <https://www.forbes.com/advisor/business/smart-goals/>



# Other Best Practices that go hand-in-hand with CI

- Keeping up-to-date on the latest developments in testing technology and methodology: Continuous improvement involves staying abreast of new developments in testing technology and methodology. Laboratories should ensure that they have the latest equipment, software, and analytical techniques to maintain their competence.
- Provide ongoing training and development for staff: Accredited environmental testing laboratories should provide their staff with regular training and development opportunities to ensure that they have the skills and knowledge to perform their duties competently. This can include attending workshops, seminars, and webinars, as well as on-the-job training. This is critical for developing skills for a successful CI program.
- Monitor and analyze laboratory performance metrics: Accredited environmental testing laboratories should track and analyze performance metrics regularly to evaluate their laboratory's effectiveness and efficiency. Metrics can include turnaround times, error rates, customer satisfaction, quality and profitability.

# Numerous CI Cycles or Models



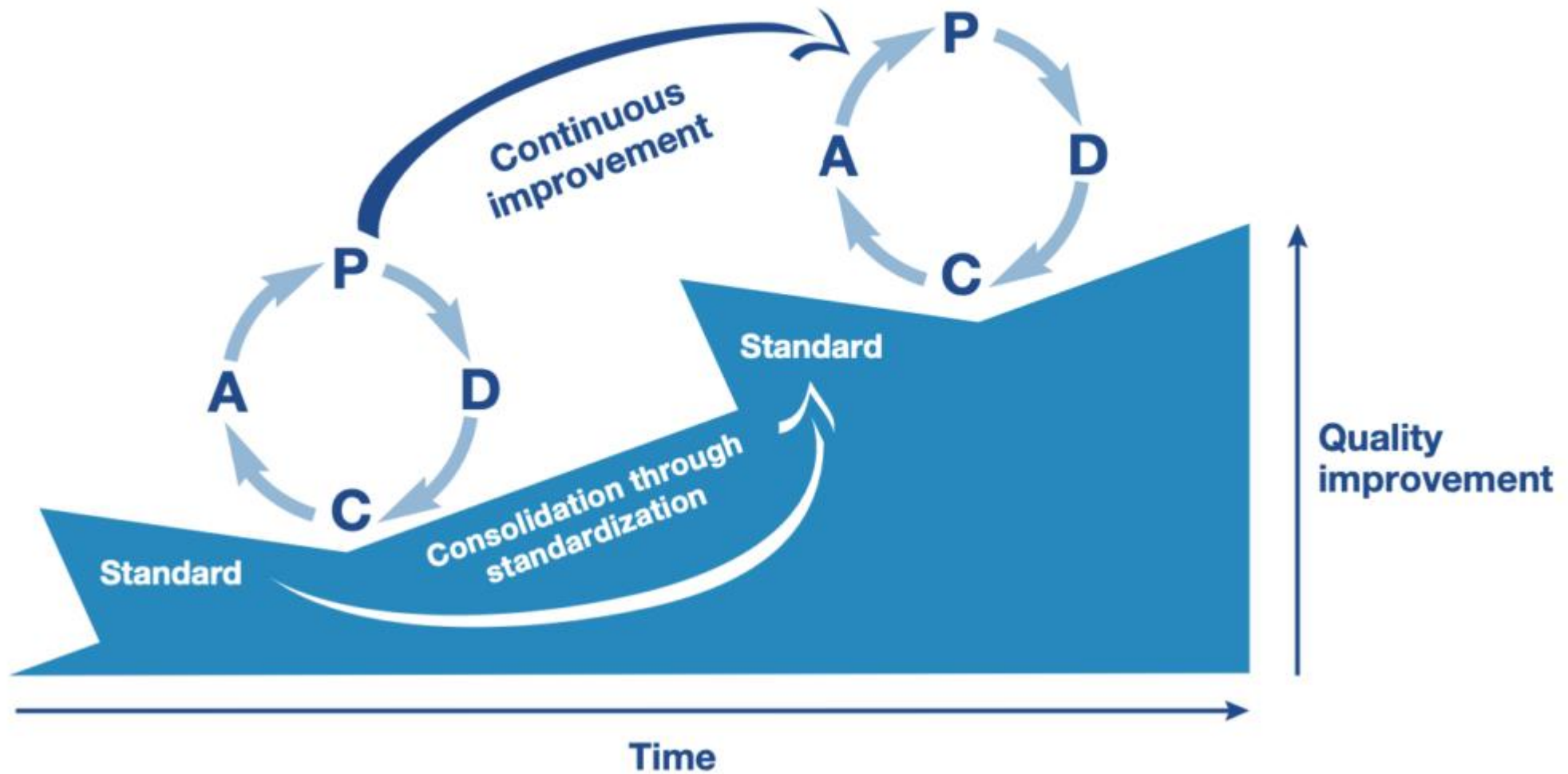


SOURCE: DIANN DANIEL FOR TECHTARGET; ART: FIREOFHEART/GETTY IMAGES

©2018 TECHTARGET. ALL RIGHTS RESERVED. 



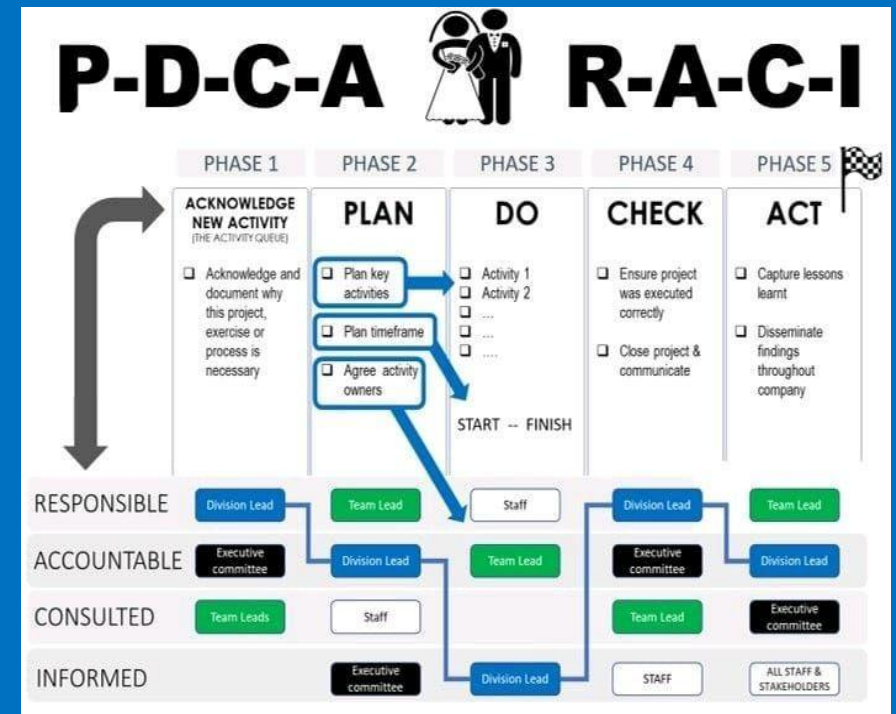
## Sustain and Share the Standard



# Possible Steps to Rollout a CI Process

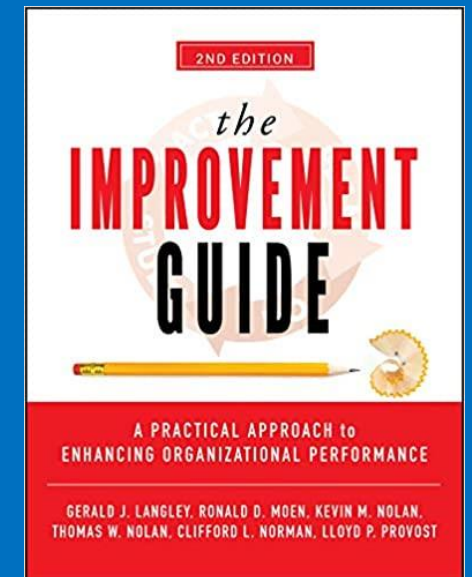
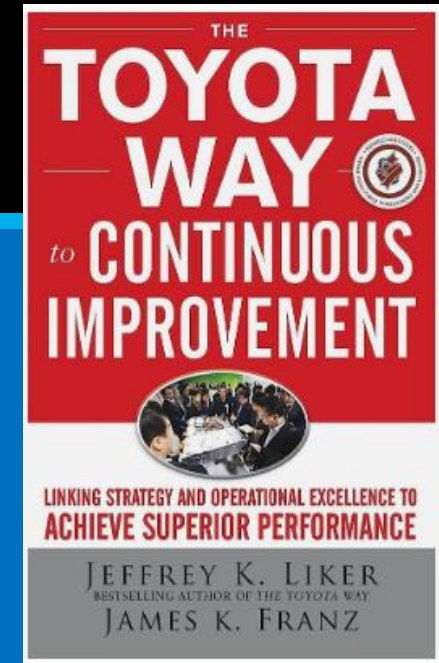


- As said, management establishes a CI Culture and provides support
- Make use of KPIs and performance metrics
- Establish one or more CI Teams
- Analyze Processes and Identify Areas for Improvement
- Select and plan for a Pilot Effort
- Implement Change and Monitor Results
- Celebrate Successes and Learn from Failures



# For Additional Information on CI

- "The Lean Startup" by Eric Ries
- "The Toyota Way" by Jeffrey K. Liker
- [Krüger, V.](#) (2001), "Main schools of TQM: "the big five"", *The TQM Magazine*, Vol. 13 No. 3, pp. 146-155.
- "The Improvement Guide: A Practical Approach to Enhancing Organizational Performance" by Gerald J. Langley, et al.
- <https://openai.com/chatgpt>
- "The Goal: A Process of Ongoing Improvement" by Eliyahu M. Goldratt and Jeff Cox
- "The Lean Six Sigma Pocket Toolbook: A Quick Reference Guide to Nearly 100 Tools for Improving Quality and Speed" by Michael L. George and David Rowlands
- "Gemba Kaizen: A Commonsense, Low-Cost Approach to Management" by Masaaki Imai
- "The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change" by Stephen R. Covey
- "The 5S Pocket Guide" by James Peterson and Roland Smith
- "Leading Continuous Change: Navigating Churn in the Real World" by Jeanie Daniel Duck
- "The PDCA Management Method: A Practical Guide to Continuous Improvement" by Masaaki Imai



# Conclusion and Recommendations

- The laboratory should be encouraged and in-fact driven to strive for continuous improvement to meet ever-evolving demands of environmental testing while ensuring accurate results, customer trust, sustainable practices and yes, profitability.
- If you are a laboratory that does not utilize or focus that much CI or never has, please give CI serious consideration. Again, do a pilot CI effort.

- Thank you for your attendance.



- P.S. - Retirement is great!

- Special shout-out to Jerry Parr for his many years of Leadership at TNI!

