From PDCA to PPPP

The four P's of process management lead to quality success.

by Praveen Gupta

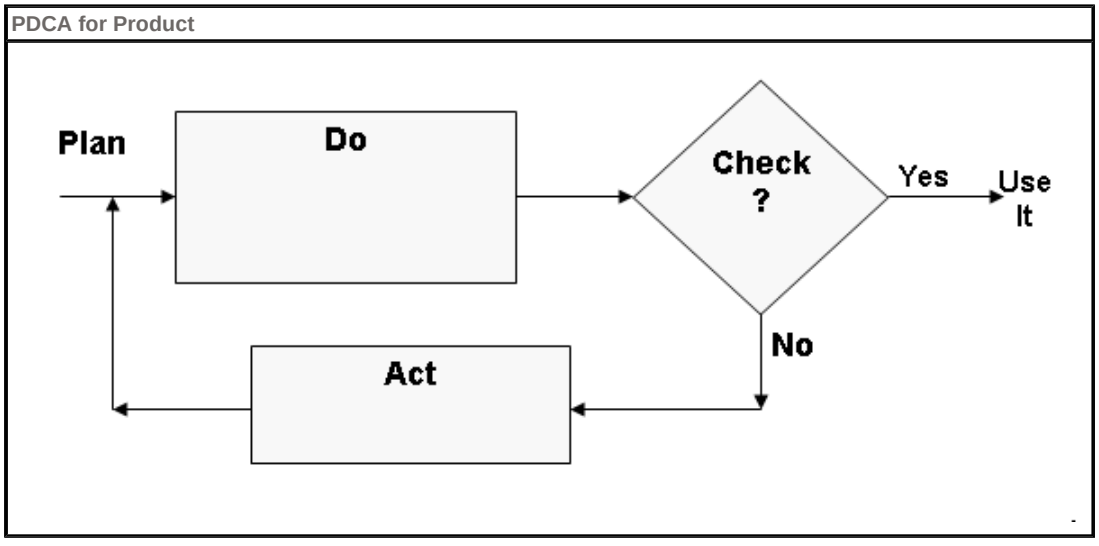
If you're considering opportunities for business improvement, dynamic growth and profitability, "plan," "do," "check" and "act" (PDCA) is a leading option. Walter A. Shewhart developed the PDCA cycle in the 1920s and W. Edwards Deming made it famous in the 1980s, even though he modified the PDCA cycle to PDSA (plan, do, study and act).

Today, PDCA has become a fundamental tenet of quality management. All the emphasis on process thinking is based on the PDCA cycle, be it ISO 9001, ISO/TS 16949, Six Sigma, TQM or SPC. PDCA is a closed-loop engineering application, or a feedback diagram for the quality process. In fact, if you consider the evolution of quality from in-line, on-line, off-line and quality management to the best-in-class, PDCA has held up pretty well.

Every step of the quality evolution leads to performance improvement. Increased quality leads to rising customer expectations, which in turn drives further product and process improvement. Faster and better communication, along with methodologies like Six Sigma, have evolved over time to further accelerate improvement.

During this evolution of quality, several experts have come up with their own unique twist on quality. Shewhart developed control charts, Joseph M. Juran emphasized execution or project management, Genichi Taguchi strived for performance on target and Deming targeted variability reduction. Directly or indirectly, all of these men have improved various elements of PDCA.

The PDCA cycle provides a feedback mechanism for continual quality improvement, which is similar to an engineering feedback model. The four elements of PDCA equate to the four states of a process. Deming modified the PDCA by replacing the "check" step with "study." The "study" step implies understanding the nature of variation in the process output. But the "act" step has led to different interpretations. For some people, "act" implies standardization, whereas for others, it means improvement. Currently, "act" is best known as the correction of the process through corrective action and prevention from recurrence through standardization.



Examining PDCA in the context of time

In the 1920s, "plan" implied defining a process, "do" referred to doing tasks as planned, "check" meant verifying acceptance, and "act" entailed containment, disposition and correction. Though prevention was intended, it rarely occurred. Quality management systems of the past, including TQM, have emphasized process thinking using PDCA to ensure shipment of acceptable product to the customer. The sampling plans were designed to determine quantities to check the product. In other words, the "check" step has

become synonymous with “inspection” in many businesses. An inspection phase was added to weed out unacceptable product.

In practice, “act” has become the weakest link. The input to ”act” comes from ”check,” which provides inadequate and insufficient feedback for action. The data available from “check” for analysis in most companies appears to be the attribute type. It’s like counting the number of OKs, although acting on this number has been difficult. Therefore, typical root cause analysis for the rare “not OKs” has been the operator. Most companies have a problem with poor root cause analysis and recurring problems leads them to question the current PDCA model. That’s why Deming promoted the PDCA cycle for problem-solving process by modifying PDCA to PDSA.

The PDCA model was most likely developed to manage the product disposition through process control, which led to the development of workmanship standards with upper specification limits (USL) and lower specification limits (LSL). The system of limits was actually developed to verify the product, but the concept was passed on to process and design personnel. This started the concept of limits, leading to an increase in variability. At this point, Deming tried to reduce excessive variability, while Taguchi tried to avoid it by focusing on targeting in the design phase. Deming focused on reducing variation using statistical tools. Taguchi promoted the concept of “robust” engineering.

With continually improving processes and products, performance levels have reached into the single digits in terms of percentage of defects and, sometimes, in parts per millions instead of large proportion defectives. To further improve, new methodologies like Six Sigma have been developed where all aspects of a business must be improved to achieve the process output to a level close to perfection for customer requirements. Recent analysis of machining process at a company led to standard operating procedures that required set up and verification against the target values instead of the limits. This shift from production to limits led to an improvement of approximately 70 percent, with minimal effort. To institutionalize such a mindset, the PDCA must change to accommodate higher customer expectations.

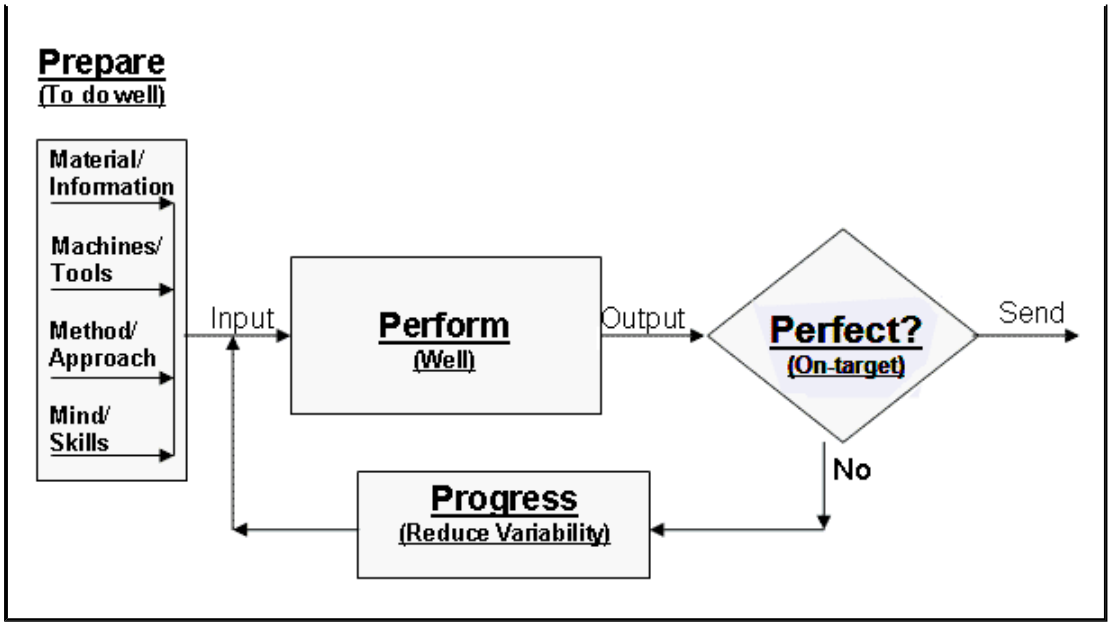
The 4-P cycle comprises “prepare,” “perform,” “perfect,” and “progress” phases. The 4-P cycle is based on the closed loop feedback diagram. It has incorporated the wisdom of quality management gurus such as Karaou Ishikawa, Juran, Taguchi and Deming. For example, according to Ishikawa, the most likely process inputs are grouped in material, method, machine and manpower (4 M’s) categories. These four M’s must be managed proactively instead of sought after the postmortem through root cause analysis.

Because product and process complexity and performance expectations have been increasing, verifying the output for acceptance isn’t sufficient. The inspection and sampling plans of the past are no longer as effective as they used to be. Companies must now look at the output against the target performance, trying to be as close to the goal as possible. The deviation from the target must be understood and continually reduced. According to the Taguchi’s philosophy, the goal is to produce closer to the target and continually reduce variability around it. Focus from inspection shifted to reduction of variability in the early 1980s. Therefore, the effectiveness of PDCA must have been in question since at least then.

The four P’s of process management

The “preparation” step represents assurance of good inputs to the process. The inputs consist of Ishikawa’s 4 M’s. The goal is to ensure that these 4 Ms are delivered as inputs to the process. The “perform” step implies that the process is well-defined, mistake-proofed and understood for consistent and effective execution. The “perfect” step ensures that the process is performing as planned and that the process output is on target. If the process output isn’t on target, the gap in the “perfect” step must be recognized. The “progress” step leads to improvement in the process and its outputs if variation around the target is reduced. By continually applying the 4-P cycle, companies can reengineer a process to achieve desired results by the customer through a better process instead of a better inspection of the product.

Four P’s of Process Management



Below is a comparison between the PDCA, PDSA and the 4 P's. The main difference lies in moving from product control to design control. Because design affects most of the cost factors, it makes sense to control design. Besides, it's easier to achieve a faster improvement by controlling design, than by controlling a process within limits.

Comparison of PDCA, PDSA and 4 P's			
Attribute	PDCA	PDSA	4 P's
Date of development	1920s	1980s	Present
Intended objective	Acceptable output and improvement	Continuous process improvement	Accelerate process improvement
Constraints	Specification limits	Excessive variability	Target
Expected outcome	Acceptable output through inspection	Reduced variability using statistical techniques	Robust output and improved process capability
Perceived source of problem	Operator	Process	Design
Perceived actions	Development of inspection plans	Application of statistical methods	Improvement through innovation
Typical performance	Quality control	Quality assurance	Quality engineering

The 4-P cycle is more suited in today's environment of process management when compared with the PDCA cycle. Below, you can see that the 4-P cycle is a culmination of four major principles highlighted by four quality gurus. Thus, it's important to question the effectiveness and the paradigm created by PDCA and consider the use of the 4-P cycle for process management and process thinking development.

Contributions to 4 P's	
4 P's Element	Quality Guru of Origin
Prepare (Manage inputs, the 4 M's)	Ishikawa
Perform (Ensure superior execution)	Juran
Perfect (On-Target)	Taguchi
Progress (Reduce variability)	Deming

About the author

Praveen Gupta is a corporate performance improvement consultant at Quality Technology Co.*. Praveen is the author of books entitled* Six Sigma Business Scorecard *and* The Six Sigma Performance Handbook*.*

Acknowledgement: The author would like to thank participants in his Six Sigma Black Belt class at Dentsply (Brian O'Reilly, Harold Papazian, Gary Cunkelman, Ken Peterson, Tom Barker and Scott Cheuvront) for great brainstorming sessions leading to the 4-P's model, and Prof. Rajesh Tyagi of DePaul University for his suggestions to improve the 4-P's model.
