

DEMING CYCLE WHITE PAPER

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ISO-9001 SUMMARY:¹

The International Standard promotes the adoption of a process approach when developing, implementing, and improving the effectiveness of a quality management system, to enhance the customer's satisfaction by meeting customer's requirement

NOTE: In addition, the methodology known as "Plan-Do-Check-Act" (PDCA) can be applied to all processes. PDCA can be briefly described as follows:

- **PLAN:** *Establish methods and methods necessary to deliver results in accordance with customer requirements and the organization policies".*
- **DO:** *Implement the process.*
- **CHECK:** *Monitor and measure the processes and product against policies, objectives, and requirements for the product and report the results.*
- **ACT:** *Take action to continuously improve process performance.*

SOFTWARE ENGINEERING CHALLENGE:

The easiest implementation of ISO9001 is in a Manufacturing company. In this case, virtually all of the PDCA steps are performed by employees of the company on company property. The proximity of the required activities to management facilitates the enforcement to the approved methods and processes.

The implementation of ISO9001 in a service-providing firm is considerably more difficult. In this case, most of the PDCA steps will be performed by company employees at the customer site. Good on-site supervision and the maintenance of an activity log will greatly facilitate the enforcement of the company's approved methods and processes.

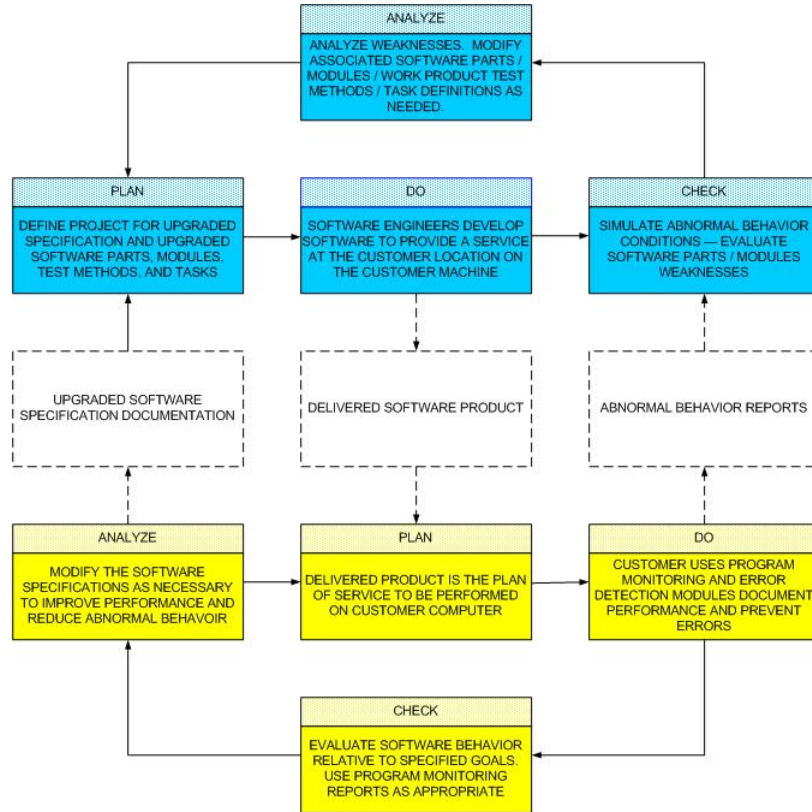
The product of the Software Engineer is a special document defining a complex process to be performed by a computer at the customer site. In this case, most of the PDCA steps will be performed at the customer site without the presence of company employees. The company that develops a software product provides a service to the customer at the customer site without human intervention.

Is this "process-defining document" the "P" Step of the PDCA Deming Cycle? If so, how does is Deming Cycle related to the ISO9001 Quality Program of the Software Engineering Organization? The following figure presents the associated pair of Deming Cycles and their inter-relation.

¹ ANSI/ISO/ASQ Q9001-2000

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PROVIDER
CUSTOMER

ERROR FREE SOFTWARE PRODUCTS ARE DEFINED BY DUAL COUPLED DEMING CYCLES

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DO-PLAN INTERFACE:

The Developed Software Product is that special “process planning document” prepared by the Software Development Organization to be performed at the customer's facility on a customer machine. In essence, the Provider, during the DO step, defines the Customer's PLAN. To this end, the Software Engineering team must develop the “process defining document” using standard methods and processes to the maximum degree possible.

The “What If We” programmable code generator (PCG) enables the provider to use enforceable standard methods and processes in the development of the “process defining document” during its “DO” Step. Specifically, the PCG redefines the programming effort as a formal two-step process:

- The development of a library of “software parts”.
- The use of this library in the development of product; i.e., the “process defining document”.

This two step operation gives management and the software engineering staff greater control over the quality of the “process defining document”.

CHECK-DO:

The interface between the customer's “DO” Deming step and the Provider's “CHECK” Deming step is the Abnormal Behavior reports produced by the program.

Unfortunately in the Software Engineering World, the large majority of the customer DO step is performed at the customer's site on the customer's machine during normal use of the product. This often causes the customer to become an unwilling member of the software test team.

A computer program irretrievably fails when it makes an illegal write. The consequences of such an error can range from an incorrect data entry to the complete destruction of a data base and the complete loss of control of the computer. There are many well-established methods of preventing such an occurrence and writing an abnormal behavior report. Such reports can be used by the Provider to:

- Identify possible scenarios that may create the abnormal behavior.
- Prepare a stimulator / simulator test program for these scenarios.
- Apply this test program to the product and evaluate the results.

A corrective modification can usually be quickly developed once the engineering organization is able to reproduce the circumstances which created the abnormal behavior.

The “What If We” Programmable Monte-Carlo Test system (PMTS) was specifically developed to accomplish the required simulation. This program explores the Software Unit Under Test (SUUT), which for this effort is an executable or module (class, subroutine, etc). The PMTS subjects the SUUT to a random sequence of test conditions defined by a user-provided process and records the results. The use of a random generator to generate the test conditions insures that a comprehensive exploration of the test conditions will be used; not just the ones that are reasonable or expected.

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PROVIDER ANALYZE/ACT:

To improve the product and reduce the number of abnormal behavior events, the software development organization must analyze the results of their CHECK step to determine and implement the required software modifications

There are many well-established software engineering methods that improve the overall quality of the product. There are coding methods that:

- Detect errors early in the development process. This capability can be greatly enhanced by a properly defined set of software parts.
- Detect errors early in the check-out process.
- Detect and properly respond to errors throughout the life of the product.
- Prepare an activity log for critical applications.

By defining the library of software parts using these more effective methods, their use in the definition of product will be both facilitated and enforced. The PMTS can not only be used to insure that the goals of the upgrade are being met, but can also be used to evaluate the ability of a module or software part to resist improper use errors during the development / modification efforts.

CONCLUDING REMARKS:

The ISO-9001 requirement to continuously improve the process performance must also be applied to the standard methods used in the delivered "process-defining documents". Unlike many of the UML development environments, neither the PCG nor PMTS define or restrict the methods deployed by the responsible organization. All of the defining files can easily be created or modified by a simple text editor such as the Windows Notepad utility by members of the responsible organization.