Which Path to Quality

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In the last few years a number of methods have caught the fancy of American Management under the guise of quality or quality improvement. Some of these have little if anything to do with quality. However, because quality hacks have touted these fads and some firms have accepted them, they have become associated with the management style that obtains quality. Unfortunately, several of these methods have no direct relationship to quality so failed to help quality. These fads and all quality practitioners got a black eye from their use, or better, abuse of methods to achieve quality. In this paper, we examine some of the past and current fads as well as methods that do get results.

There are three classes of methods that appear and/or recur from time to time. These are

- Methods partially or not at all related to quality,
- Static methods, and
- Dynamic methods.

We will examine each method and discuss briefly why it is classified in one or another of the three classes.

Methods partially or not at all related to quality

There are a number of methods that some push as related to quality. Although some of these methods have value in other areas their relationship to quality usually is tenuous at best. Among these methods recently seen touted are

- Misuse of Quality Control Circles
- Shingo's Method of SMED
- Just in Time
- Balance Scorecard
- Benchmarking
- Re-engineering

These methods contribute little to the improvement of quality in the way they are often used and, in some cases, misused.

Misuse of Quality Control Circles

For example, if the quality control circles are used merely to reduce cost or improve productivity without reference to quality, these groups are really not a quality control circle at all but a manufacturing problem solving team. Ishikawa (Ishikawa, 1983), often called the father of quality control circles, wrote a book called "Guide to Quality Control" which is a basic guide to intro-

duce quality control circle members to the tools needed to act as an effective quality control circle.

Every example of Japanese quality control circles that this writer saw used one or more of the techniques that is basic to dynamic quality (treated below) and dealt with improvement of product and service for better quality. In contrast, most quality circles in the United States avoided these methods and looked to profit improvement using simplistic problem solving tools. It does not surprise the writer that these quality control circles burned out and that few are to be found today that lasted more than a year.

When used as originally intended, quality control circles are a dynamic way to achieve quality.

The Shingo Method of SMED

Another method that is often associated with achieving quality is the Shingo (1983) method of SMED, which stands for the Single Minute Exchange of Dies. SMED epitomizes Shigeo Shingo's contribution to production. Shingo, an industrial engineer found that much time is wasted in set-up.

He developed the concept of internal and external set-up. Internal set-up is performed when the system is not producing anything. External set-up can be prepared while the system is productive. Shingo found that when organizations do not distinguish between these two conditions, much time is wasted. The system is not as productive as it could be because all of the set-up was internal. Studying the process and using clever techniques minimizes the amount of internal set-up. As much as possible of the operation as is possible is converted to external set-up.

While this is very useful to reduce the cost of production, any quality gains are incidental.

Shingo (1986) also has a theory of quality that he calls Poka-yoke, a Japanese term for "Mistake proofing". Shingo's view of quality is that one needs to make processes as mistake proof as possible. Unfortunately he then looks at 100% inspection to achieve what he calls "Zero Quality Control". As a system, Shingo has some good points, the mistake proofing of processes, but goes to old fashioned 100% inspection all the time to achieve quality. This seems an unnecessary costly approach. While the SMED theory fits under the subheading of methods partially or not at all related to quality, the Poka-yoke system fits better under the dynamic methods because of the mistake proofing aspect.

Just in Time

Just In Time is a method closely related to Shingo's SMED system. Shingo's concept was that if the set-up cost were brought to near zero, it would be possible to economically make one item of a kind, almost to order as it were. Just In Time or JIT is a concept that provides the material needed to perform a service or make a product at the moment it is needed. That material and no more is the desired outcome.

The idea is to hold down the in-process cost often found when one operates on the Just In Case principle; stockpiling items just in case they are needed. At Toyota, the Kanban method of asking the prior operating unit for an item needed to produce an item is an example of this philosophy. The product is pulled through the production process rather than being pushed through, as is the case in most American Business today.

JIT was touted as a quality process because it requires outstanding quality to succeed. It also requires a delivery system that operates to perfection. Japanese suppliers accomplish this by having small plants, with a quality level perfect enough and close enough to the customer, to actually realize a JIT environment.

To say that JIT is a quality method is putting the cart before the horse. Flynn, Sakakibara, & Schroeder (1995) found that quality methods were needed to improve JIT performance. The sole contribution of JIT to quality is through "problem exposure and improved process feedback." The quality must be built-in both the product, service, and delivery system before JIT becomes viable. Those who try JIT without the necessary pre-conditions will find themselves in a heap of trouble and quickly revert to their comfortable Just In Case method.

Balance Scorecard

The Balanced Scorecard originally proposed by Kaplan & Norton (1996), uses four perspectives measures: a) Financial, b) Customer, c) Internal, and d) People, Innovation & Learning. The purpose of these measures is not so much to achieve quality as to provide measures that are not only monetary. However, as Dr. Deming often quoted Dr. Lloyd Nelson, "The most important numbers are unknown and unknowable." For example, the impact of both employee moral and customer perception of the organization can have a significant impact on their survival, yet cannot be measured directly.

While the attempt to consider the unknown and unknowable number is laudable, the fact is that only known and measurable number can be used in the balanced scorecard. This results in the difficulty of keeping the four perspectives in an appropriate balance. The measures are often subjective. Much of the measures related to people are how many were trained (without saying to what degree), how many show up for work, etc. The relationship of these numbers vis-à-vis the usual financial data is such that the financial data quickly dominate the measures. It does not appear to this writer that the balanced scorecard method has much to recommend it as a quality measure or improvement system.

Benchmarking

According to Camp (1989) a working definition is: "benchmarking is the search for industry best practices that lead to superior performance." It is unfortunate that this is most often interpreted as finding the best performer in an industry and then to copy the things that make that group the best performer. There are two issues with this concept. One is what is "best performer"? How is it judged? Will it be judged from the customer's view or from the financial view? What if there is a conflict?

The second issue is to copy without theory is inviting disaster. What is good for the "best in class" performer may not have any relevance to the market or operating conditions of the searcher firm. What needs to be done is to develop a theory of why the process works with all its ramifications and then see if that theory is transferable to ones own organization. For instance, the differences between Japanese work culture and its American counterpart were little understood when we introduced quality control circles into this country, refer to the work of Professor Cole (1981)

Reengineering

The inventors of reengineering state in their book, “Nor is reengineering the same as quality improvement, total quality management (TQM), or any other manifestation of the contemporary quality movement”(Hammer & Champy, 1993, p. 49). The authors go on to specifically state that quality improvement makes the existing process better. Reengineering discards the existing process and “starts over.” Why? They do it to become more competitive. I believe that the authors do not see the connection between quality and being competitive. Certainly, a program that makes no claim to be a quality improvement program cannot be regarded as a method for quality improvement. Others have thought reengineering to be a quality method.

Static Quality Methods

There are a number of methods of quality that are static. These methods rely on procedures and inspection of outcomes. They are basically the awards, procedural and inspection methods:

- Malcolm Baldrige National Quality Award
- European Quality Award
- ISO 9000 (and its subsets)

While these methods look at the issues associated with quality, they normally operate on the outcome of a process rather than on the process itself. In that sense, they accept the process and thus are static. Their purpose is to determine the state of art of an operation and to certify that the operators are following procedures with rigor. That is what I consider a static approach. The approach does not require that quality be *improved*, merely that it be *maintained*. The quality level can be obtained in such award systems and procedures by removing non-conforming items. While this may give an acceptable quality level, it is a costly way of doing business and does little if anything for the customer’s needs.

Malcolm Baldrige National Quality Award

There are those who consider the Malcolm Baldrige National Quality Award (MBNQA) as a quality tool. Many of those working in healthcare and education think of the Malcolm Baldrige National Quality Award as a quality program. The award however simply measures outcomes that result from an applied program. As a result, the Malcolm Baldrige National Quality Award is at best an instrument to tell managers their state of performance in producing quality. Even at that, the recent shift in emphasis away from quality has led experts in the field such as Dr. Richard Schonberger (2001) to ask the question, “is the Baldrige Award still about quality?”

Schonberger summarizes this point by saying that, “the Baldrige Award's original scoring breakdown mostly fits with [the] suggestion [of quality]. In the 1988 point-summary listing, the word "quality" was included 13 times. But what a difference 13 years makes: In the 2001 scoring summary, "quality" doesn't appear at all, though quality-related terms appear sporadically among the 17 pages of detailed criteria.”

The MBNQA might be used for assessment of the current state of an organization if it dealt more with quality and less with financial outcomes. If one believes in the importance of quality at all one would recognize that the financial outcomes are the result of achieving the quality that meets or exceeds the customer’s needs. There are a number of non-measurable aspects that lead to sales. If one concentrates only on the measurable aspects of an organization, these other aspects

(such as morale, customer service, reputation, etc.) are neglected to the ultimate detriment of the organization.

European Quality Award

The European Quality Award (EQA) is modeled on the Malcolm Baldrige National Quality Award. It has not just copied this award but added some touches of its own. This model looks at the enabling factors of leadership, examines the resultant processes and reviews the results together with feedback for continual improvement. The model includes People Results, Customer Results and Society Results. In the writer's opinion, it is more focused on quality than is the MBNQA. The MBNQA does not look at societal impact at all.

In spite of the advantages of the EQA the focus is so much on measurable outcomes that it does little to create continual improvement. Quality Awards are designed to measure outcomes and are more in the nature of a contest than a method for improvement. In contrast to both the MBNQA and the EQA, the Deming Prize established by the Union of Japanese Scientists & Engineers can only be won by a limited number of applicants to the Award.

The preparation for the MBNQA and the EQA is left up to individual business units who, when they feel that they are ready, submit a limited documentation of how their organization matches the criterion. This documentation is reviewed, scored and likely winners receive a relatively short audit to determine the truthfulness of the documentation. The Deming Prize administration starts with a survey of the operation and usually requires that a Master work with the company to achieve the levels of performance needed to win the award. The Deming Prize audit is very lengthy, detailed and thoroughly examines the whole operation. The differences are obvious if one reviews the procedure outlined at http://www.juse.or.jp/e/deming/pdf/05_tqmdiagnosis.pdf.

The problem with using an Award program as a diagnosis is that it is limited by the subjective view of the assessor. Self-assessment frequently gives unrealistic high scores. There is little knowledge available for improvement. Concentrating on areas that are not truly related to the customer's needs can bring up scores.

ISO 9000 (and its subsets)

There are a number of subsets for the automotive and communications industries. The various industries apparently need such subsets. ISO 9001: 2000 is a standard that tries to make the application of quality the same throughout the world. As Dr. Jeff Hooper, Project Leader for the Year 2000 Revisions of ISO 9001, explained to us, the word ISO is used as the Greek word root for equal although it is also the initials of the International Standards Organization.

In essence, the standard has series of requirements. Unlike the earlier, superceded version, the latest version puts a great deal more responsibility on management. In many ways it is a good system if one has no other knowledge for achieving quality. Many have complained about the cost of the system. However, that is because they are not aware of alternatives. It is somewhat like prepared food. It costs more to buy prepared food products than it does if one has the knowledge and skill to prepare it oneself.

The standard details what must be done and leaves it up to the firm to determine how to do the work. In essence it is a starter kit for those who wish or have to improve their methods to achieve quality but have nothing else. The drawback is a still heavy reliance on inspection although process control is featured more in this version of the program. A dangerous clause is 8.5.2 that deals

with the correction of non-conformities (defects). The impression of the standard is that all non-conformities are to be reviewed and corrected. If one does that, the same action will be taken for special causes of variation as is taken for common causes of variation. Such an act is tampering and can lead to making the process worse. The standard does not insist on using the only tool that will prevent this error, the process control chart.

The ISO standards help in that they establish a formal process of inspection and documentation involving management to an extent. It prevents some problems from going to the external customer. However, in spite of clause 8.5, it does not help a user in achieving continual improvement. Clause 8.5 recognizes the need for such an improvement but could also result in just the opposite since it does not give detailed methods for achieving the improvement. Some regard the administration of the standard as too costly for the return on the investment.

Dynamic Quality Models

There are three models that bear an interrelationship since each uses all or part of the other. They all rely more or less on Shewhart's work some 80 years ago. They all depend more or less on statistical thinking. Because most people do not know the difference between statistical thinking and statistics, they are afraid of what they see as an arcane method. Perhaps the fear is grounded in the notion that they may not have the same competence in this area as they have in management. In fact, any fear is groundless. The methods are based on managements principles derived from logic (hence statistical thinking) and proven problem-solving methods. The writer identifies the three models as:

- Continual Improvement
- Problem Solving
- Six-Sigma

Of these, the six-sigma model uses the most statistical tools.

Continual Improvement

This model is based on Dr. Deming's System of Profound Knowledge™. The concept is that there are four components that are all interrelated. These components are:

- Knowledge of Systems
- Knowledge of Variation
- The Theory of Knowledge
- Knowledge of Psychology

While each of these areas is a discipline in itself, it is the combination and interaction among the four components that leads to powerful improvement. As Deming (1994, p.93) stated, "One need not be in any part nor in all four parts in order to understand it and to apply it." The concepts are simple. Deming's 14 points listed in his *Out of the Crisis* (Deming, 1992) make the theory operable.

Knowledge of Systems

The basis of the knowledge of systems is to understand what is the system of a firm and what is the aim of the organization. All who deal with the organization must know its aim. It is vital to the survival of the organization. All parts of the organization must work towards the aim of the organization. Working to a different aim sub-optimizes the organization. This infers that contests and similar incentives work against the organization.

Knowledge of Variation

Every organization has variability to a greater or lesser degree. Sales vary from month to month. One needs to understand the theory of variability to distinguish between normal variation and an unusual cause. Most comparisons of reports fail to account for this variation so managers tend to treat every change as unusual. Sales managers are asked to explain every variation from the previous period's sales. One can speculate as to how much fiction is generated in this process.

The tool that enables one to distinguish between normal variation and an unusual event is the Process control Chart. Invented by Dr. Shewhart around 1924, it is a little known and greatly underutilized management tool.

The Theory of Knowledge

The theory of knowledge is a branch of philosophy that deals with reality. From a practical point, the concept of Operational Definition is important. In effect, there is no true number to any measurement. The number depends on what is measured, how it is measured and the interpretation put on the measurement. For example, the value of inventory depends on whether the accountant uses LIFO (Last In, First Out) or FIFO (First In, First Out) method of inventory valuation. Because the treatment of inventory can have a great impact on profit, the IRS does not permit change from one method to the other more than once in ten years. (The operational definition of a special cause of variation is the Process Control Chart.)

Knowledge of Psychology

The fourth component, knowledge of psychology, is pretty obvious. We operate through people and knowing what makes them function helps us get the best out of them. Unfortunately, the old fashioned behavioral school of B. F. Skinner is still dominant in management theory leading to the use of incentives (positive and negative). Modern methods of management find that these theories are not functional. For more on this refer to the books by Alfie Kohn (1993; 1986)

Management by Fact

An essential element of the System of Profound Knowledge is that it involves managing by facts. This in turn means that the management distinguishes between common causes and special causes of variation. The special causes of variation require management action to correct and to see if they could happen again. If the special causes could recur, management needs to take steps to minimize the damage they cause.

If the process has only common causes of variation, yet does not operate to management's (and the customer's) satisfaction, then another process is needed. This process is embodied in the Shewhart cycle of learning, or as it is widely known, the P-D-S-A (Plan, Do, Study, Act) cycle. See *Four Days with Dr. Deming* (Latzko & Saunders, 1995, p.65) for more on this tool.

Problem Solving Methods

Dr. Joseph M. Juran found years ago that there was a pattern in solving problems. He formulated the approach and called it Managerial Breakthrough (Juran, 1964). This method uses five steps as are shown here:

- Identification of a project
- Evaluation of a project
- Diagnosis of the cause
- Remedy the cause
- Hold the gains

Dr. Juran taught this method to the Japanese in 1953. At that time, Dr. Kaoru Ishikawa learned of the method and transformed it for use in Japan. Where Dr. Juran used cross-functional managers as a Steering Committee supported by a Diagnostic Team of fact finders. Dr. Ishikawa used the workers as both the Steering Committee and Diagnostic Team. Where Dr. Juran felt that most worthwhile projects are inter departmental in scope, Dr. Ishikawa focused on solving intra departmental problems occurring in the workers operation. One needs to keep in mind that Japanese workers have more control over what happens in their work place than do American workers. Dr Juran used brainstorming as a way to examine the problem. Dr. Ishikawa used the Cause and Effect (also known as the Ishikawa or Fishbone) diagram to develop the problem parameters.

Identification of a project

The first step is to identify a project. While much more on this is found in Dr. Juran's book, it amounts to essentially ranking major management problem areas by order of importance. Usually a dollar loss function is used to rank the problems. In effect, such a ranking is an application of what is called the Pareto Analysis. Dr. Juran invented this method early in his career and called it after Vilfredo Pareto, an Italian economist. Later, he tried to correct this name but it stuck (Juran, 1975). Dr. Juran recommends that once a project is picked that it be made part of the business plan. By making it part of the business plan the project gains legitimacy and supports the work needed to accomplish it.

Two groups are formed to accomplish the project: the Steering Committee and the Diagnostic Team. These two groups go on, what Dr. Juran calls, a voyage of discovery.

Evaluation of a project

The Steering Committee uses tools such as the Brainstorming, Check Sheets, and Pareto Analysis to focus in on the vital area of the problem. In short, they break the problem up into its component parts and find the potential causes. The Diagnostic Team gets the facts to support the hypothesis.

Diagnosis of the cause

The process continues with the Steering Committee formulating hypothesis, the Diagnostic Team finding facts, the Steering Committee revising their hypothesis on the basis of the facts, and so forth until a fundamental cause emerges. At this time, so much is known about the cause that the next step can be taken.

Remedy the cause

Dr. Juran contends that the remedy is usually obvious from the analysis performed up to this time. However, he cautions that before implementing the remedy, one looks at the organizational culture. The application of the remedy must fit that culture for it to succeed.

Hold the gains

The application of the remedy should result in a favorable special cause observed on the process control chart. If so, the process control chart should be recomputed to reflect the gains in quality and a decision needs to be made whether to continue the improvement on this project or if another project now needs the resources.

If there is no gain reflected by the process control chart, the team needs to re-examine its findings and continue working.

Six-Sigma

There are two parts to the so-called six-sigma concept. One is technical dealing with the nature of the process control chart and the other is a practical matter. In the writer's opinion, the technical aspect is in error while the practical application makes much sense. We are doing the right things (improving quality) for the wrong reason (flawed theory).

CEO's such as General Galvin and Jack Welsh believed what they were told about the technical, theoretical aspects and, on that basis, allowed their skilled employees the resources to do what they were supposed to do in the first place.

Technical Aspects

A sigma is a measure of variation. It measures how far each observation is from the average and squares that number. The average of the squares is called the variance of the population. Taking the square root (the reverse of squaring numbers) one gets the standard deviation. The symbol of the standard deviation is the Greek character "sigma". Hence six-sigma means 6 times the standard deviation.

A distribution is a curve that shows the frequency of occurrence for any point on the x-axis (abscissa). A distribution that is often encountered in nature is called the Normal (because the area under the curve equals unity) distribution. This distribution is also called the Bell Shaped or Gaussian (named after the mathematician) distribution. We know the Normal Distribution very well and tables have been constructed to show the area under the curve. The center of this distribution is at the mean (average if we use samples). The table below shows the parts per million that lies outside the point of the mean minus the number of sigmas shown in the table:

Sigma Shift	Parts per million
-6.0	0.0
-5.0	0.3
-4.5	3.4
-4.0	31.7
-3.0	1350.0
-2.0	22750.1
-1.0	158655.3

One often hears that six sigma means that only 3.4 non-conformances per million occur. Yet in the table that number is shown at 4.5 sigmas. The reason for this is that the originator of the notion, Mikel Harry, made an assumption that the mean of a process can shift 1.5 sigmas. In fact if the process mean shifts, the process is not stable and in need of repair. The Control Limits of the Process chart are based on a stable mean. More on this can be found in a paper by the writer (1998) on the Deming Electronic Network. Other papers that support the writers view are authored by Professor Tadikamalla (1994) and Dr. Bert Gunter (1989a; 1989b; 1989c; 1989d).

From this, the writer concludes that six-sigma is based on theory that misuses the Shewhart Process Control Chart concept and that meeting six-sigma standards is not necessarily the least cost solution. The continual improvement model and problem solving methods accomplish the same ends and do so even better.

The practical aspect of Six-Sigma

In spite of its flawed underpinnings, the six-sigma movement as practiced today is helping to achieve quality. The applications of six-sigma are in fact the continual improvement model done under the guise of another name. The purpose of the practical aspect is:

- to improve quality,
- to decrease cost, and
- to delight customers.

Since a statistical concept (sigma) is used, all statistical methodology has suddenly become an acceptable management method. Mr. Harry established Karate terminology that appears to please executives. Early results are spectacular. All of this is valuable for the quality movement. As long as the process does not place short-term gains ahead of long-term objectives of the organization the practical aspects of six-sigma will help achieve that which all of the dynamic models obtain, better quality, lower costs, delighted customers, jobs and more jobs.

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