Knowledge of "theory of variation" is one of the most powerful tools a company can develop in its quest for quality. It can improve manager's effectiveness and create opportunities for continuous improvement. It is part of the foundation of Deming's management philosophy, each of his 14 points is based partly on the desire to reduce variation.

Managing Quality Improvement

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W. Edwards Deming received his formal education in Mathematics and Physics, earning a Ph.D. from Yale in 1927. He was employed at U.S. Department of Agriculture as statistical expert. During that time Walter A. Shewhart, a statistician with Bell Telephone Laboratories, had created methods of statistically measuring variation in industrial processes, called control charts; Deming regularly met Shewhart, to study his methods.

During the World War II, Deming taught numerous courses in statistical quality control, using Shewhart's control charts, to improve the quality of American war production. Though successful during those years application statistical techniques faded in United States after war ended. American companies, which operated in a seller's market with virtually no competition, considered Deming's methods of statistical process control time consuming and unnecessary and by 1949 they were no longer part of corporate America.

Deming first brought his statistical quality control techniques and management philosophy to Japan in 1947. He trained Japanese eager students. By 1957, the Deming's prize, which recognised superlative achievement in quality, was established in Japan. In 1960, Deming became the first American to receive Japan's second order of the sacred treasure award because of his great impact upon Japanese industry.

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Although he was an industrial superstar in Japan Deming was not well known in the U.S. Japan was setting world quality standards for many manufactured goods. NBC broadcast a television show on June 24, 1980: "If Japan can why can't we?" The final quarter hour of the show focused on Deming's contribution to Japan as well as on business improvement documented at Nashua Corporate, a U.S. company following the Deming quality philosophy. W. Edwards Demings became famous in America. Since that time his services and seminars have been in great demand throughout the world.

**MANAGING QUALITY IMPROVEMENT**

Deming's message to managers was blunt: "Many companies can't perform well from longterm perspective because their managers do not know what to do". They had to orient themselves to continuous improvement of products and services to meet customers needs and stay ahead of competition. They had to innovate constantly and commit resources to support innovation and continuous quality improvement. Improvement of the process increases uniformity of products, reduces rework and mistakes, reduces waste of manpower, machine-time, and materials, and thus increases output with less efforts. Other benefits of improved quality are lower costs.,, happier people on the job, and more jobs, through better competitive position of the company.

In Deming's view, management is responsible for 85% of the quality problems (In fact, during the 1980s, Deming revised this to 94% !). In these cases management had to take the lead in changing the systems and process which created those problems. For example, consistent quality of incoming materials and components could not be expected when buyers were told to shop for price or were not given the tools for assessing a supplier's quality. Management had to develop long-term relationship with vendors, work with vendors to improve and maintain quality, train its own purchasing department in statistical process control, require statistical evidence of quality from vendors, and insist that specifications be complete. Once management had changed purchasing systems and procedures, buyers could then not only be expected but also able to do their job in a new way. When the top management is seriously committed to quality, lower-level personnel would be more likely to take action on problems for which they are responsible.

**THEORY OF VARIATION**

We live in a world full of variation. Variation always exists in any process, whether it involves automation or manual. We need to understand its sources and we need a scientific method for predicting it, for reducing it and for controlling it. Statistical thinking is an essential part of this scientific method. Application of statistical theory is the only way to deal with variation. Continuous improvement means continuously reducing the variation in products, services, processes and systems.

Understanding the theory of variation enables managers to recognise, interpret, and react
appropriately to variation in the data, figures, performance and outputs they deal with daily.

Deming points out that an effective way to reduce variation is to eliminate special-cause variation by bringing into a state of statistical control. Once the process is in control, it can be improved by reducing the common cause variation. Common causes include poor product design, incoming materials unsuited to their use, machines out of order, improper bills of materials, machinery that would not hold tolerances, poor physical conditions, and so on. On the other hand, special causes include lack of skill or knowledge, poor lot of incoming materials. If variation is due to special causes, the system is said to be unstable since it is not possible to predict when the next special cause will strike and, cannot predict the range of variation.

The strategy for special causes: get timely data. Investigate immediately when the data signals a special cause was present. Find out what was different or special about that point. Seek to prevent bad causes from recurring. Seek to keep good causes happening.

The strategy for improving a common cause system is more stable. In a common cause situation, all the data are relevant, not just the most recent or offending figure. In-depth knowledge of the process or systems being improved is absolutely essential when only common causes are present.

**DEMING'S FOURTEEN POINTS FOR MANAGEMENT**

Deming does not consider it as sufficient merely to solve quality problem. He seeks a major transformation in the current practices of Western style of management. The basis for this transformation is provided by his fourteen points. The fourteen points also provide the basis for a theory of management. The management commitment to a complete transformation of the current (bad) practices is absolutely necessary for survival and competitive success in this new economic age.

Knowledge of the above theory of variation is one of the most powerful tools a company can develop in its quest for quality. It can improve a manager's effectiveness and create opportunities for continuous improvement. It is part of the foundation of Deming's management philosophy; each of his 14 points is based, in part, on the desire to reduce variation (See the following Table for a summary of the fourteen points and how each point addresses variation).

| S. No | Deming's point | Description | Effect on Variation |
|-------|----------------|-------------|---------------------|
| 1.    | Create constancy of purpose for improvement of product and service. | Management must change from a preoccupation with the short term to building for the long term. This requires dedication to innovation in all areas to best meet the needs of customers. | It reduces variation because the employees will not have to constantly shift their priorities. |

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|   | MANAGING QUALITY IMPROVEMENT |
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| 2. | Adopt the new philosophy. |
|   | Shoddy materials, poor workmanship, defective products, and poor service must become unacceptable. Higher levels of quality at lower costs are possible if you learn to manage differently. |
|   | Tampering and over reacting to variation, which only increase variation must end. Learning to manage differently involves learning how to improve systems in presence of variation. |
| 3. | Cease dependence on mass inspection. |
|   | Inspection is equivalent to planning for defects; it comes too late and is ineffective and costly; instead, processes must be improved. |
|   | This forces you to identify the sources of variation in your processes and work toward reducing variation. |
| 4. | End the practice of awarding business on price tag alone. |
|   | Price has no meaning without a measure of quality being purchased. Companies must develop long term relationship and work with fewer suppliers. Both purchasing and vendors must understand specs, but they must also know how the material is to be used in production and by the final customer. |
|   | Working with a selected supplier on a long-term basis of loyalty and trust reduces variation in incoming material and hence in the finished product. Involving the supplier in the collaborative design of new products further improves quality and reduces variation. |
| 5. | Constantly and forever improve the system of production and service. |
|   | Waste must be reduced and quality improved in every activity. Improvement, however, does not come from studying the defects provided by a process that is in control but from studying the process itself. Most of the responsibility for process improvement rests with the management. |
|   | Improve products and services by understanding the causes of problems and seeking to reduce variation. Everyone in the company must participate in a disciplined way using the plan do-check-act cycle. |
| 6. | Institute modern methods of training on the job. |
|   | Training must be restructured and centered on clearly defined concepts, methods of acceptable work. Statistics must be used for deciding when training has been completed successfully. |
|   | There is variation in how people learn, and training programmes must accommodate it. How much training is needed should be addressed using common and special cause thinking. |
| 7. | Institute modern methods of supervising. |
|   | Supervisors must be empowered to inform upper management about conditions that need correction. Once informed, management must take action. Barriers that prevent hourly workers from doing their jobs with pride must be removed. |
|   | Managers who merely find fault with their employees or who punish longest ranking employee without the knowledge of the system increases the variability. On the other hand a leader enlightened with an understanding of variation, helps employees do their jobs better with less effort. |

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| 8. | Drive out fear. | Because of the tremendous economic losses by fear on the job, people must not be afraid to ask questions, to report problems, or to express ideas. |
|   |   | Fear creates an environment where accurate data are non-existent and where people are too protective of their jobs to accurately report on problems, failures, or defect. Fear paralyses the work force that could otherwise be actively engaged in reducing variation. |
| 9. | Break down business between departments. | Members of the research, design, procurement, sales and receiving departments must learn about problems with raw materials and specification in production and assembly. Each discipline must stop optimising its own work and instead work together as a team for the company as a whole. |
|   |   | Separate goals and objectives for different departments result in variation, and obstruction rather than co-operation. Reducing variation for the organisation as a whole requires co-operation across departmental boundaries. |
| 10. | Eliminate numerical goals for the work force. | Targets, slogans, pictures and posters urging people to increase productivity must be eliminated. Most of the necessary changes are out of worker's control, so such exhortations merely cause resentment. Although workers should not be given numerical goals, the company itself must have a goal: never ending improvement. |
|   |   | Improvement results only from changed processes and methods, management actions are required in most of the complex problems. The results of slogans and exhortations aimed at the work force only lead to demoralisation, tampering and increased variability rather than to effective change. |
| 11. | Eliminate work standards and numerical quotas. | Quotas focus on quantity not quality. Therefore, work standards practically guarantee poor quality and high costs. Work standards that state percentage defective or scrap goals normally reach those targets but never exceed them. Piece work is even worse, for reduced for defective units, that is if pays people for building defective units. But if someone's pay is reduced for defective units, that is unfair, for the worker did not create the defects. |
|   |   | Work standards lead to failure to measure and plan for variation, which in turn leads to missed deadlines, short shipments, and poor morale. Knowledge of the variation in a common cause system enables managers to forecast what can be realistically produced. A system that rewards people's efforts towards improvement would have greater value. |
| 12. | Remove barriers that hinder the hourly workers. | Any barrier that hinders pride in work must be removed, including not knowing what good work is, supervisors motivated by quotas, off gauge parts and materials and |
|   |   | Merit rating systems support behaviours that increase variation and destroy behaviours that reduce variation. Managers should not act as judges. |
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13. Institute a vigorous programme of education and training. Because quality and productivity improvements change the number of people needed in some areas and the jobs required, people must be continually trained and retrained. All training must include basic statistical techniques. Because quality and productivity improvements change the number of people needed in some areas and the jobs required, people must be continually trained and retrained. All training must include basic statistical techniques.

14. Take action to accomplish the transformation. Managers must show the work force that they are serious about adopting a systems view of their business. They must demonstrate their concern for worker interests, provide adequate training to measure system performance, and measures attempts to improve it. Co-ordinating the activities of everyone connected with the organisation contributes significantly to the reduction of variation and the optimisation of the entire system. Co-ordinating the activities of everyone connected with the organisation contributes significantly to the reduction of variation and the optimisation of the entire system.