# BOOK REVIEWS

## Defect Prevention: Use of Simple Statistical Tools

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**REFERENCE:** Kane, Victor E., *Defect Prevention: Use of Simple Statistical Tools (Quality and Reliability Series No. 17) + Solutions to Problems (Quality and Reliability Series No. 18),* Marcel Dekker, New York, 1989, $99.75 and $15 respectively.

Victor Kane has written this book for those with enough basic math to calculate mean, median, range, and standard deviation. His is a text on statistical thinking, not statistical theory, intended for managers, engineers, quality specialists, and students. Case studies and problems are given at the end of each chapter.

Kane's Appendix II gives the critical defect prevention tool of geometric dimensioning and tolerancing (GD&T) promoted by David P. St. Charles (*Quality Progress,* February 1990) for providing clear communications between design and manufacturing. Appendix I on Gage Evaluation provides a clear and necessary prerequisite for the measurement process relied upon heavily throughout the text. Appendix III gives tables of normal distribution probability values, *t*-distribution critical values, *f*-distribution values, and random numbers.

The following paragraphs give the contents of each chapter:

*Chapter 1*—The initial statements on defect prevention will capture the attention of any businessman. Though saying nothing new about our reaction-oriented business cycle, Kane emphasizes preventive actions rather than only reactions to defects (Kane's problem reaction wheel). The author's solution to our fire-fighting management style leads naturally into the common elements for a transition into modern process control and problem analysis techniques. Management and employee participation and the use of 10 simple statistical tools (SSTs) are essential for eventual defect prevention. Rather than "problem solving" Kane offers "system reforming." He points out major reasons why quality circles have failed as a "cure-all" for process problems. One reason is that employees were not trained in simple statistical tools. Kane blames poor communications for the continuation of unsolved problems. Data collection and simple analysis are offered as methods to assist in determining causes of problems. Kane blames training in statistical theory rather than in simple applications of statistical methods for our dilemma and states that simple statistical plots are often worth a thousand words.

*Chapter 2*—The author reviews basic process definitions and components. Kane's use of flow diagrams with sources of variability is very helpful in making the distinction between focusing on work process rather than work output. The author's emphasis on measurement and gaging are noteworthy and appropriate for the high quality data needed in today's competitive world. His references to measures of accuracy, repeatability, and reproducibility address the necessary specification considerations of manufacturing (Appendix I).

*Chapter 3*—Kane's comprehensive process parameter (men, methods, machines, materials, measurements, environment) surpasses the traditional triad (men, materials, methods). He emphasizes that measurement of the output does not address places within the process that result in uncontrolled variation. Controlled variation is the target. Kane begins his statistical development with basic location ($x$-bar) and standard deviation ($s$) estimates. His use of multiple examples is a proven teaching technique. The development of mean and range control charts is supported by many examples and discussions of interpretation and application. A strong distinction is made between control limits and specification limits. The use of case studies and cause-and-effect diagrams further enhances the concepts of control charting variations.

*Chapter 4*—Definitions of population, process, and sample direct the reader to process sampling methods that must be flexible with regard to manufacturing conditions. The author's explanation of the importance of selecting rational subgroups for sampling makes the development of control charts for startup and trouble-shooting less complex. The explanation of stratified control charts and the adoption of monitoring sampling plans are given in an easy-to-follow 10-step procedure. Kane warns us not to be misled by a stable process without adapting control charts to the process being monitored to identify special causes of variation. Variation and special causes diagrams are introduced as tools for predicting how control charts will react to process variations prior to data collection and sample plan selection. In addition, Kane discusses the cautions that accompany increased subgroup sampling during trouble-shooting of control problems. He also suggests remedies to sources of variability through physical changes in the process flow. Kane warns us that inadequate measurement sensitivity will result in incorrect out-of-control signals and charts that are not useful. The figures, methods, case studies, and examples are very educational. The problems are challenging and realistic. (Solutions to all problems are to be found in the companion volume.)

*Chapter 5*—Kane's procedures for plotting and interpreting standard and nonstandard (stem and leaf) plots are further examples of the high degree of practicality of his book. His perspective on how and where histograms are used is very comprehensive. Kane also suggests using histograms with control charts to detect multiple populations and measurement problems.

*Chapter 6*—In addition to traditional control chart warning signals, Kane gives examples where operators have made changes resulting in overcontrol patterns. He also introduces control chart simulation, where it is possible to make known changes to the process mean or variability at known times. The checklist for interpretation of control chart signals is very useful.

*Chapter 7*—Kane explains process capability indices. I like Kane's process capability continuous improvement flowchart because it incorporates the potential and performance process indicators developed in this chapter. He states that "the greater the capability, the lower the required sampling intensity needed to protect a given quality level." The procedures for calculating

process capability indices assist the reader in applying the text to practical real-world situations. The author echoes Dr. Deming's call to motivate continuous improvement and to evaluate the defect prevention system rather than perpetuate the uselessness of inspection-oriented quality audits. Kane also supports "benchmarking" for evaluating the prevention abilities of any system.

*Chapter 8*—Easy-to-use simplified check sheets for data collection, documentation, and problem analysis provide various techniques for practical applications, reinforcing the nontheoretical emphasis of Kane's text in contrast to "empty" theoretical treatises.

*Chapter 9*—Pareto diagram construction and analysis leads to an emphasis on the problems of maximizing improvement efforts. However, Kane warns the reader concerning Pareto analysis. His warnings on ignoring the "trivial many" problems are in line with those of other experts when applying this principle to the service sector of an economy.

*Chapter 10*—Kane's explanation of stratification by using geologic strata of mountains relates closely to my daily driving experiences in Denver. He describes how stratification of a drilled core relates to multiple-activity process interactions and stresses the importance of data collection and graphing. Rather than spending tedious hours on manual graphing, Kane recommends using computer software packages. The use of performance indicators is recommended to monitor quality and improve productivity.

*Chapter 11*—Kane's point that statistical significance does not imply practical significance is well taken. His introduction of ANOM (Analysis of Means) guides the reader carefully into the more sophisticated statistical tools that are the basis of his book.

*Chapter 12*—Kane's introduction of scatter plots with typical patterns depicts correlation relationships but without causation implications. He integrates the necessary activity of benchmarking into measurement equality plots. Using Kane's procedures, when significant correlations exist prediction lines can be displayed on a scatter plot. Scatter plots provide a useful tool for guiding the selection of characteristics that should be monitored using control charts. He reminds the reader of the importance of geometric tolerance positioning requirements of engineering specifications provided by CMMs (Coordinate Measuring Machines). Kane's case studies and problems instruct the reader in trouble-shooting techniques.

*Chapter 13*—Kane opens this chapter with a disclaimer that "the existence of 'tools' does not ensure implementation will be effective. What is needed is a system to organize and direct the application of the tools toward controlling processes and solving problems." Kane introduces cause-and-effect problem-solving techniques and diagrams including his aforementioned six-part process parameter. He discusses the investigation of potential causes, explains the benefits of developing comprehensive cause-and-effect diagrams, and provides a 10-step problem-solving system from team formation through corrective action to preventing problem recurrence.

*Chapter 14*—Kane links the 10 SSTs he has developed with management and employee participation with a 10-step (not to be confused with Deming's 14 points) DPS (Defect Prevention System) implementation strategy.

In summary, if your business is not following these simple statistical tools, Kane's 10-step defect prevention system, or some other continuous quality improvement process, you may not be in business by the end of the 1990s! The entire *Quality and Applied Statistics* series should be in the library of every quality assurance and quality control professional.