

# Multivariable Testing: Powerful Tool for Quality Managers



A few years ago, in order to improve the newsprint quality at its paper mill in De-Ridder, La., Boise Cascade plant managers purchased only fresh, premium-grade ground wood. They instructed employees to inspect and discard every piece of substandard wood and then cut the remaining wood to a specific length before processing.

But over time, while the cost of premium wood soared, the quality of newsprint produced at the paper mill did not improve. Then managers put together a team to experiment with a statistical quality process known as multivariable testing. MVT allows combinations of different input factors to be evaluated quickly and efficiently.

After running an MVT matrix of eight different wood factors, the team was amazed to discover that it didn't need to use premium wood and could stop sorting and precutting the wood—yet maintain and even improve the quality of the newsprint produced.

Boise Cascade ended up saving \$1.6 million in wood costs alone the first year. Total costs have been cut an average \$3 million annually, with no reduction in output quality.

MVT "is one of the most powerful tools ever created," says Charles Holland, a statistician and a leading practitioner of the technique. He is president of the consulting firm QualPro, Knoxville, Tenn. (423-927-0491). "It enables you to learn a fantastic amount of knowledge with relatively little work."

MVTs are essentially design-of-experiment, or DOE, programs, which have been on the market a little over a decade. The Minneapolis firm Stat-Ease (612-378-9449),

which produces computer software for DOEs, sells its product to a number of consulting firms around the country that specialize in multivariable testing.

"It's gratifying to find that DOE principles are being applied this widely, and that other companies are beginning to reap the benefits," says Pat Whitcomb, president of Stat-Ease.

MVT helps formulate quality improvements in the most efficient manner available. At American National Can Corp. (ANCC) near

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Chicago, chemical engineers trained in MVT juggle dozens of input variables to produce a variety of plastic packaging for food, meat, and dairy manufacturers.

"MVT is a wonderful tool to screen factors and to identify the vital few," says Mark McComb, quality director for ANCC's Flexible Packaging Group. The result: low-cost, high-quality packaging solutions.

**Up close and personal** Here's how a typical MVT process works: A group of workers is assembled representing various stages of a process flow in a company. These workers, who are most familiar with production problems, often have the best ideas for quality improvements.

Suggestions are collected. The ones that are infeasible or inefficient are discarded. The rest are

grouped as "factors," or variables for experimental design.

If, say, a dozen factors are under consideration, the "brute force" approach might mean running thousands of tests to evaluate the various combined effects of the independent factors.

Using MVT, however, experiments are reduced to a mere handful. While MVT cannot forecast the effect of every combination, it does remarkably well in predicting significant effects from combinations, as well as in highlighting major effects from any single variable.

**Buzzword with a pedigree** MVT could emerge as the latest new technique for quality process control, succeeding total quality management, or TQM, and "re-engineering."

But if MVT enters the quality-buzzword hall of fame, this will be something of an anachronism. MVT was developed by turn-of-the-century British mathematician Ronald Aylmer Fisher, who pioneered statistical sampling.

In the 1930s, Walter Shewhart, an American statistician working at Bell Telephone Laboratories, took Fisher's methods a step further and developed statistical control applications for industrial processes. More recently, Genechi Taguchi in Japan built upon this to develop statistical applications to experimental design. In the U.S., W. Edwards Deming and other gurus of the quality movement developed methodologies to incorporate statistical process control to improve manufacturing activities.

Thus, MVT is as much a predecessor to the modern quality movement as it is the latest progeny in its evolution.

*—Ted Agres*