

Putting Ideas to the Test

Combining the ideas and knowledge of a pulp and paper mill's workforce with powerful mathematical methods proves to be a cost-effective and fast approach in solving a wide variety of production problems.

By John O'Brien, Managing Editor



Most people are familiar with the feeling of having a good idea, but having nowhere to go with it or knowing it will fall on deaf ears. At the other end of the spectrum are the people who are at the receiving end and get bombarded with “good” ideas from colleagues, but can’t possibly filter through them all or even put a few to a test.

Knoxville, Tennessee-based QualPro is in the business of idea testing and has worked with a number of pulp and paper mills using ideas from each mill’s workforce to solve an array of production-related problems in areas such as paper machine runnability, machine production rates, paper characteristics, cost per ton of paper, and many other nagging issues that adversely affect profitability.

QualPro’s Multivariable Testing or MVT® process combines and tests dozens or even hundreds of ideas simultaneously. According to the company, MVT filters ideas into three categories: those that will make a positive difference,

those that will make no difference at all, and those that will actually make a harmful difference.

To learn more about the intriguing MVT process, *PaperAge* asked Art Hammer, Vice President of QualPro, to shed some light on the process itself and how it would be applied at a pulp and/or paper mill.

Is it fair to say that QualPro’s Multivariable Testing is basically idea testing?

MVT (Multivariable Testing) can be described as idea testing, but MVT takes rough, general ideas and refines their definitions to something that can be repeated on command. The MVT assures that the conclusions are correct specific to that idea and that idea’s interactions and synergies with other tested ideas. The MVT assures that the conclusions are broadly applicable in the operations and not unnecessarily sensitive. It focuses on ideas that are practical, fast, and cost free.

The MVT is also risk averse. There must be plant people who think the idea will improve the process performance.

Where do the ideas come from?

All the ideas come from the paper plant and its support organizations. The ideas can come from hourly workers, engineers, management, industry literature, vendors, and customers. The ideas can come from the wood yard, the chemical operations, the pulp mill, the paper machine, the lime kiln, environmental processes, boilers, power generation operations like turbines, maintenance, the lab, customer service... Heck, maybe even Sales.

Is there a limit or ideal number of ideas or variables you can combine and test?

From a mathematical basis, there is no limit to the number of ideas. However, when testing, the limit is due to the ability of the paper plant to be certain that all the test ideas are executed as defined and planned and data is recorded correctly.

What number of ideas, would you say, is getting up there in terms of too many?

Actually, much above thirty ideas in a single test will strain the organization. While test ideas commonly interact with each other, no idea in the test can be mutually exclusive of the other ideas in the same test.



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Could you give us an overall view on the QualPro Process?

First, we clarify the specific goals and objectives to be accomplished, which usually takes just a couple of hours at most. Then we agree on the key measures of success and their definitions. We brainstorm ideas for improving the key measure and refine the definitions of those ideas, and determine the values for the status quo and the suggested change. We then categorize the ideas as to their practical, fast, and cost-free attributes, and focus on those ideas that pass all



MVT was used to substantially improve performance and viability on PM 4, a vintage paper machine at the Lincoln Paper and Tissue mill in Lincoln, Maine.

three criteria. We also do any “homework” we feel is necessary for the execution of the test ideas.

Next, we begin a blind sampling program to challenge the measurement system of the key measure. We will continue this on through the testing and implementation.

We get proper control charts on the key measures and do detective work on the historical special causes of variation. Some may become additional ideas for testing to improve the key measure. Then we implement any “gimmies” and watch their performance on the key measure.

What's next?

At this point, QualPro prepares an MVT design and execution plan, including a strong monitoring program. The test starts along with the monitoring program, and we collect data as the test is executed.

An analysis of the MVT takes place next, and we select the five best ideas for improving the process. We then design a Refining MVT to confirm those five ideas and check for interactions. After an analysis of the Refining MVT, we make a determination of optimum process conditions.

Now we're ready to implement the best recipe and of course monitor the process closely.

What would a pulp and/or paper mill have to do in preparation to a visit from QualPro?

Very little. We need to make sure that historical data supports the value of improving the key measure and that the

project is not responding to just a short-term, quickly passing aberration. We would like to work on a chronic problem process where past efforts have not been sufficiently successful in improving competitive position.

It would help if there are process flowcharts available and if historical process and key measure data are available in Excel worksheets in time-sequential order.

What should a mill expect once QualPro personnel arrive on-site?

Once we arrive, we would like to meet first with plant top management to get the lay of the land, determine what the important issues and constraints and the pressing needs for improvement are.

Then we would like a physical tour of the plant given by someone who lives the internal workings every day. That could be a senior hourly employee, a first-line supervisor, or

maybe the operations manager. It would also be important to include the lab in this tour.

How do you approach the mill's workforce?

We have conversations separately with process engineers and hourly workers, followed by meetings with the immediate upstream process people. For example, if the focus is on the paper machines, we would like to meet with the pulp mill folks. We would also like to meet with lab people.

Do mill personnel have to go through any training about MVT?

In many engagements the training is limited to a few hours necessary to execute this specific MVT, monitor its execution, and collect data. From that minimum, training can be expanded.

Can you give us some specific examples of the type of ideas that would be tested, and how those ideas are input into the testing process?

The ideas depend on which part of the process is being tested. If the paper machine is the focus, imagine every process control mechanism, every input material, and their combinations as potential ideas for testing.

Machine speed is almost always an idea. In one case, after hundreds of ideas had been tested and successfully implemented, a mill manager commented that every MVT had paper machine speed included and every single time slowing the machine down did not improve the process. Conversely, speeding the paper machine up had, on several occasions, helped the process and paper quality.

Other ideas commonly tested are expensive chemical additions – amounts, location, and vendor. Still, other ideas include size press pressure, broke ratio, rush/drag, wire shake, wet end starch, refining amps, headbox level, horizontal slice, retention aid, machine chest consistency, table vacuum, etc.

In the bleach plant, common ideas might include defoamer usage, H-factor, free caustic residual, shower flow, temperature of steam mixer, spent acid, white liquor to reactor, and so on.

If, for example, twenty variables are input, how do you determine which variables (or combination of variables) are making the desired difference?

The key measure is recorded for each recipe (combination) of ideas tested. When all the recipes are executed and measured, the change in the key measure due to each factor and

MULTIVARIABLE TESTING

Results Driven - Prioritizes areas of highest impact for initial experimentation.

Economically Feasible - Primarily focuses on no cost or low cost "method changes" that are easy to implement and sustainable.

Innovations - The more ideas tested in a single MVT, the more powerful the test. Incremental cost of testing more variables is negligible. By testing more ideas, companies are more likely to test those which defy conventional wisdom.

Uncover Surprises - Often, the counter-intuitive ideas produce the most dramatic and positive results.

Question Conventional Wisdom - Very often, actions that have been long considered positive and perhaps even essential are found to be counterproductive. MVT can validate or refute conventional wisdom.





Here again, MVT was used to improve performance on PM 8, a tissue machine installed in 2006 at the Lincoln Paper and Tissue mill.

its interactions with other ideas is calculated. Then, using only the significant ideas, the optimum combinations are determined. Remember, a Refining MVT will be executed to confirm these.

When you say ideas are “tested” or “recipes” are created, and in this case let’s refer to a paper production process, are you referring to a software application producing probable scenarios from the input data, then leaving it up to the mill to run its own machine trials?

QualPro uses proprietary MVT designs and has proprietary software which assists in designing the MVTs. But the test is not a simulation exercise. A small sampling of possible combinations are actually executed in the plant and observed. For example, if there are thirty ideas which the plant wants to consider, there are over one billion possible combinations of those thirty ideas. There will be only about thirty-two of those ideas actually executed in the paper mill. Again, it comes down to a minute sample of the possible number of combinations.

Doesn’t MVT come at considerable risk or cost to the mill in regards to lost production during testing?

In the history of our 15,000 MVTs, we have never had an environmental, safety, quality, economic, or production “uh-oh” ever happen due to the MVT execution. We are appropriately very risk averse. Plants should expect to be able to sell and ship all the paper made during the MVT.

Do the prescribed MVT solutions always work in the actual production process? Or do refinements usually have to be made along the way?

Without our experience in running so many MVTs, one might expect some combinations to not run in the plant. Because we have run so many of these MVTs, we know what to look for in the MVT designing process to avoid these unpractical combinations.

Again, a Refining MVT will be executed as part of the plan to confirm the best combination of ideas to improve the process.

Does QualPro perform all MVT on-site?

Much of the MVT work is done on-site, but some of the work is off-site. After many years of doing MVTs, we have found that some of the work can be successfully done off-site, saving the paper company some travel costs.

Does QualPro always have to be involved with the MVT process or would you train mill personnel how to implement their own testing for future use?

In the early stages of MVT, QualPro does need to be personally involved. We bring hundreds of man-years to this technical project work, which is considered critical to improving the paper company’s competitive position. With the experience of running MVTs under our guidance, training, and coaching, we can prepare the paper company’s own people to become self-sufficient.

When QualPro is approached by a potential client, you must run into situations when that client’s expectations are unrealistic. Can you differentiate between a situation that MVT can or cannot work for?

After many years of helping a wide spectrum of paper companies improve their businesses, we are pretty good at assessing the potential for improving a particular process or product. If we don’t think MVT can bring a 5X improvement to the business over the cost of the MVT, we will not engage the work and will tell the potential client so. ■

For further information on QualPro’s MVT process, please contact Ken Holland Vice President of Customer Relations, at kholland@qualproinc.com.