

WHITE PAPER

Strategic and Tactical Benefits of Automated Sample Preparation



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Automation brings many images to mind, including large robots bolting car doors on in seconds and the mesmerizing packaging machinery most pharmaceutical companies employ. In the pharmaceutical laboratory, with its various types of automated instruments, some automated devices have become ubiquitous. For example, the auto-injector on a high-performance liquid chromatography system is a tool that most consider indispensable. Fully automated sample preparation and dissolution analysis are common, but their perceived benefits—the ones that justify their purchase—are primarily confined to labor savings. This article will explore additional ways in which laboratory automation can pay off in a big way.

The benefits of automating analytical methods used in the pharmaceutical industry commonly include reduced analytical labor. There are other benefits that may be less tangible, however, such as improved analytical quality. In this article, these benefits are presented in terms of whether they offer tactical value or strategic value. Tactical improvements are those that realize a localized benefit that, once implemented, is static. Strategic benefits are far-reaching and can help the organization meet corporate objectives.



*The Zymark® TPW3 (left) and SOTAX CTS (right)
for automated tablet assay are two automated analytical tools on the market.*

Traditional labor savings is a tactical approach in which automation eliminates the need for the analyst. Once the instrument is qualified, it can operate an attended method until it is finished, typically running for the better part of the day or even around the clock. This "walk-away time" is the most commonly perceived benefit of automating tablet assays or dissolution testing. One or two full-time equivalents may be gained in this manner. Benefits are calculated based on the salary and benefits' savings. Other savings can be obtained by improved inventory turns for product release.

Automation also generally reduces the probability of analytical errors or mix-ups. Because of the analytical detail it collects, the most commonly available secure auditable database simplifies writing out of specification (OOS) reports. Many companies estimate that each OOS report costs more than \$1,500 in lost time, and some companies have hundreds of such reports. This situation obviously creates an area of concern for the Food and Drug Administration.

Compounded Benefits

While the benefits just discussed are legitimate and can meet corporate hurdles for payback, they are static once they are implemented. Once labor has been reduced for a particular function, it starts to yield diminishing returns. You can only save that money once. The only way to continuously improve with a reduced labor model is to make additional investments to automate different tests.

A transitional approach toward a strategic version of this savings requires a longer payback time and the patience to realize more substantial benefits. Rather than using it to implement a staff reduction, the newly available resource can be applied to more significant tasks that can bring a greater return to the organization. This is generally referred to as an opportunity savings. The opportunity might make changes in the laboratory to introduce new products, implement electronic notebooks, or automate more products. This approach obviously complicates the justification of the initial project, but it is an ideal way to implement continuous improvement and achieve goals.

The benefits discussed so far can be realized in almost any analytical work-group within a pharmaceutical laboratory. Finding a willing workgroup, however, can be more difficult than you might think. Quality assurance (QA) people in the modern pharmaceutical facility earn their living, to a large extent, by minimizing risk, the risk of procedures not being followed or work being performed improperly. Implementing automation is a significant change that must be managed to reduce risk. Unfortunately, economic conditions within today's industry demand that we think outside the box to find better ways to get this done. We have to find ways to manage the risk that change can bring.

More profound benefits can be realized when various functions work together for interdepartmental savings, but this can be difficult for many reasons. Different groups have different objectives that may not consider the needs of the larger organization. They may also be reluctant to manage change. Most fundamentally, this approach requires the vision of an executive who sees the potential of making truly strategic improvements.

Less Work, Higher Quality

An analytical development group using an automated approach to develop method will also become more efficient in its primary function, because a typical method can be developed in less than half the time using an automated approach than a traditional approach. In addition, tools like experimental design can provide higher analytical quality. But how can the analytical development group's improvements help another group?

Once labor has been reduced for a particular function, it starts to yield diminishing returns. You can only save that money once. The only way to continuously improve with a reduced labor model is to make additional investments to automate different tests. Consider the case in which a laboratory has to expend resources to demonstrate that a method is equivalent to approved methods in terms of suitability.

If the analytical development group uses an automated approach, then its deliverable is an automated method. The downstream lab wants to automate its tasks and can now do so more easily. The barrier to implementing automation is lowered, making savings easier to obtain. Multiply that opportunity by the number of methods provided by analytical development to other labs, and real savings start to compound throughout the company. This is just a start, especially when we consider the number of steps involved in the development process and in transferring a product to manufacturing. The functional areas depicted in figure 1 can benefit when the analytical development group utilizes automated methods:

In each of these examples, labor or opportunity savings can be achieved using automated methods provided by an analytical development group. In most, if not all, of these areas, there are additional strategic benefits. Generally, these benefits are specific to the nature of the function.

Because automated methods usually work in a serial fashion, each sample has the same history of method steps, with identical time between steps. The overall effect is a tighter analysis quality, especially with respect to the time to injection. Automation assures that each sample is characterized by the exact same conditions, making it much easier to put the pieces of the impurity profile puzzle together when degradation components change as they go through transitional stages.

Benefits for Stability

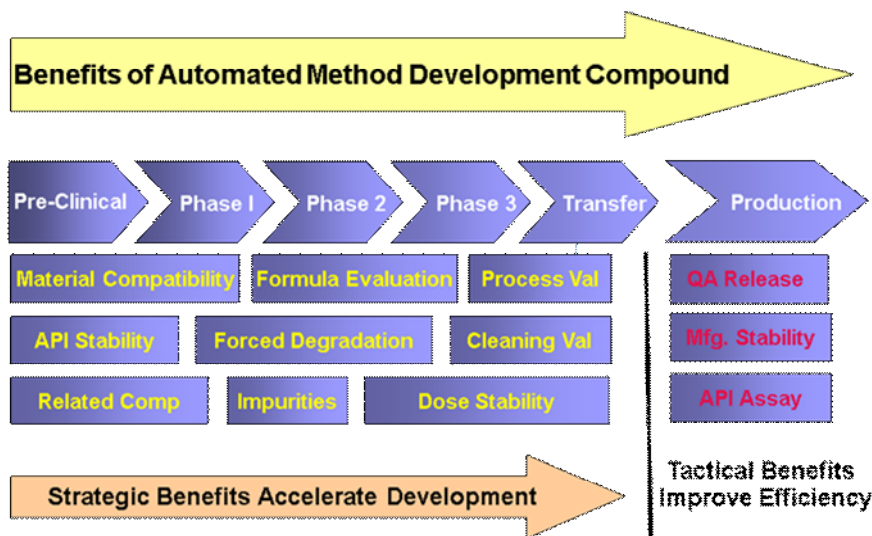
Product stability probably creates the largest workload in any stage of development and manufacturing processes. To ensure stability, it is critical to pull the sample and test it on schedule; if a sample is tested late, the data become less credible and exceptions must be reported.

In addition to tactical labor savings, automation allows samples to be scheduled to avoid missing their test window. If automation nearly eliminates the effect of the analyst's technique, stability properties of the sample will be more accurate. This improved analytical quality provides greater confidence when interpreting results to predict stability performance.

Coupled with the lower cost of analysis, testing more samples can improve the resolution of a stability effect. Testing more samples with better quality allows earlier detection of stability trends, ensuring more effective decision-making. Ultimately, this benefit can improve time to market. During process validation, testing can be completed quickly. Analytical turnaround time doesn't have to be rate limiting. When planned in advance, large validation runs can be tested faster than statisticians can evaluate them.

The Strategic View

All of these examples demonstrate the strategic view of automating analysis at various process steps in development. Evaluating formulas more quickly and verifying the process and the packaging components improve the process of bringing products to Market.



Implementing automation across functional groups provides a strategic benefit that can improve new product time to market and flexible testing approaches for manufacturing. When analytical development provides automated methods throughout the development organization and into manufacturing, the real potential of analytical automation can begin to be realized.

We see once again that removing analytical technique can significantly improve a process step. Analytical transfer is easier, because there is no technique to convey to the manufacturing facilities. As with the other functions discussed, a corporate database stores methods and analytical data, which are made available to the manufacturing organization by the same means. Approved methods are called from the database using the instrument's software and are run in order to prove the analytical suitability of the manufacturing facility's QA lab.

Much of the work done in the development process favors a vertical integration, moving from function to function. In manufacturing, the automated application integrates horizontally as manufacturing facilities around the world take advantage of automated methods that are already validated. Methods can be run in any part of the company with qualified equipment. The application of automation in the QA laboratory doesn't have to end here. Centralized methods in a corporate database facilitate outsourcing initiatives as well. Analytical qualification of the contract research organization can be straightforward if the same automated device is used.

Summary

These examples show that a basic benefit of automation, lower labor costs, is a tactical benefit that can also have strategic implications. Resources that have been transferred from repetitive analytical work can be used to make changes with more significant value to the company. Implementing automation across functional groups provides a strategic benefit that can improve new product time to market and flexible testing approaches for manufacturing. When analytical development provides automated methods throughout the development organization and into manufacturing, the real potential of analytical automation can begin to be realized.

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