There has been considerable and increasing interest in laboratory automation in recent years. Automation is sometimes viewed as a “silver bullet” that will ensure that laboratories are operating in the most efficient manner possible. An objective examination of the benefits of automation suggests that the gains are limited.

It is helpful to understand two very different approaches to improving processes and the resulting improvement in performance including turn-around-time, a key laboratory quality indicator.

The traditional approach of process improvement places the focus on the equipment and value added processes. The goal is to improve uptime, cycle tests faster and to replace staff with automation. There are benefits in this approach and there will be improvement in specific processes, but little impact overall on entire value stream.

A value stream includes all of the actions, both value creating, and non-value creating, required to bring a product (e.g. lab test) from order to delivery. When analyzing a value stream and identifying value added and non-value added steps, it is evident that value added steps account for a small percentage of the total time, often 10% or less of the time for a product (or lab specimen) to move through the entire value stream (as illustrated in Figure 1).

Lean Manufacturing principles are derived from the highly regarded Toyota Production System (TPS), which has become a widely adopted approach in many industries to achieve best practices and world-class performance. The Lean approach of process improvement recognizes that most of the benefits are derived from reducing or eliminating waste: the non-value added steps. Here the entire value stream is dramatically improved (e.g. lead times reduced) and value added processes are improved (because of lean process improvements).

Case Study
A recent study of operations at five medical centers looked at the merits of front-end automation on various measures: financial (return on investment), operations (lead time or turn-around-time improvements), safety, and quality.

Figure 1 shows the value stream and turn-around-times for morning draws under various scenarios.

- The current state (first bar-graph series) represents the current time required from collection to verification, about 115 minutes.
- The second series shows the improvement from implementation of front-end automation. A thorough examination of the process steps in the specimen processing area and improvements from automation indicates that lead times would improve by about 8 minutes. Automation links

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1 From the “Lean Lexicon,” Lean Enterprise Institute, 2003.
a series of process steps such as loading / unloading centrifuges and sorting, thereby eliminating any wait times between process steps. Much of the benefit from the front-end automation was derived from a shorter spin cycle in the centrifuge.

- Several facilities had a practice of delivering the entire batch of morning draws after the last patient draw. In some cases, it took up to 2 hours for a phlebotomist to return to the lab from their rounds. In lean, this storage on the phlebotomist’s tray represents waste. The third series shows the improvement from current state (without automation), with earlier deliveries to the lab, (three batches instead of one). This result (third series) includes the time needed for the phlebotomist to walk back to the lab with a smaller batch and return to the floors. Here, the average turn-around-time would be reduced by 39 minutes.
- The final series show potential for improvement from examination of the entire value stream and application of lean principles.

**Figure 1. Traditional Process Improvement vs. Lean Improvement:**
- Traditional (w Front End Automation): 8 minute improvement
- Lean (Phase 1): 39 minute improvement

In this example, the lean approach results in a five-fold increase in performance gain without a $400k capital investment. As this case illustrates, the most important performance improvement opportunities are to be found in the identification and elimination of waste using lean principles. A traditional focus on the value added processes fails to recognize or remove waste in the value stream.

Lean principles and the Toyota Production System do, in fact, support use of automation when appropriate, but only after thorough assessment of the value stream and elimination of waste.

“It is often better to use manual processes even when automation is available and would seem to justify the cost [by reducing staffing]. People are the most flexible resource you have. If you have not efficiently worked out the manual process, it will not be clear where you need automation to support the process.”

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