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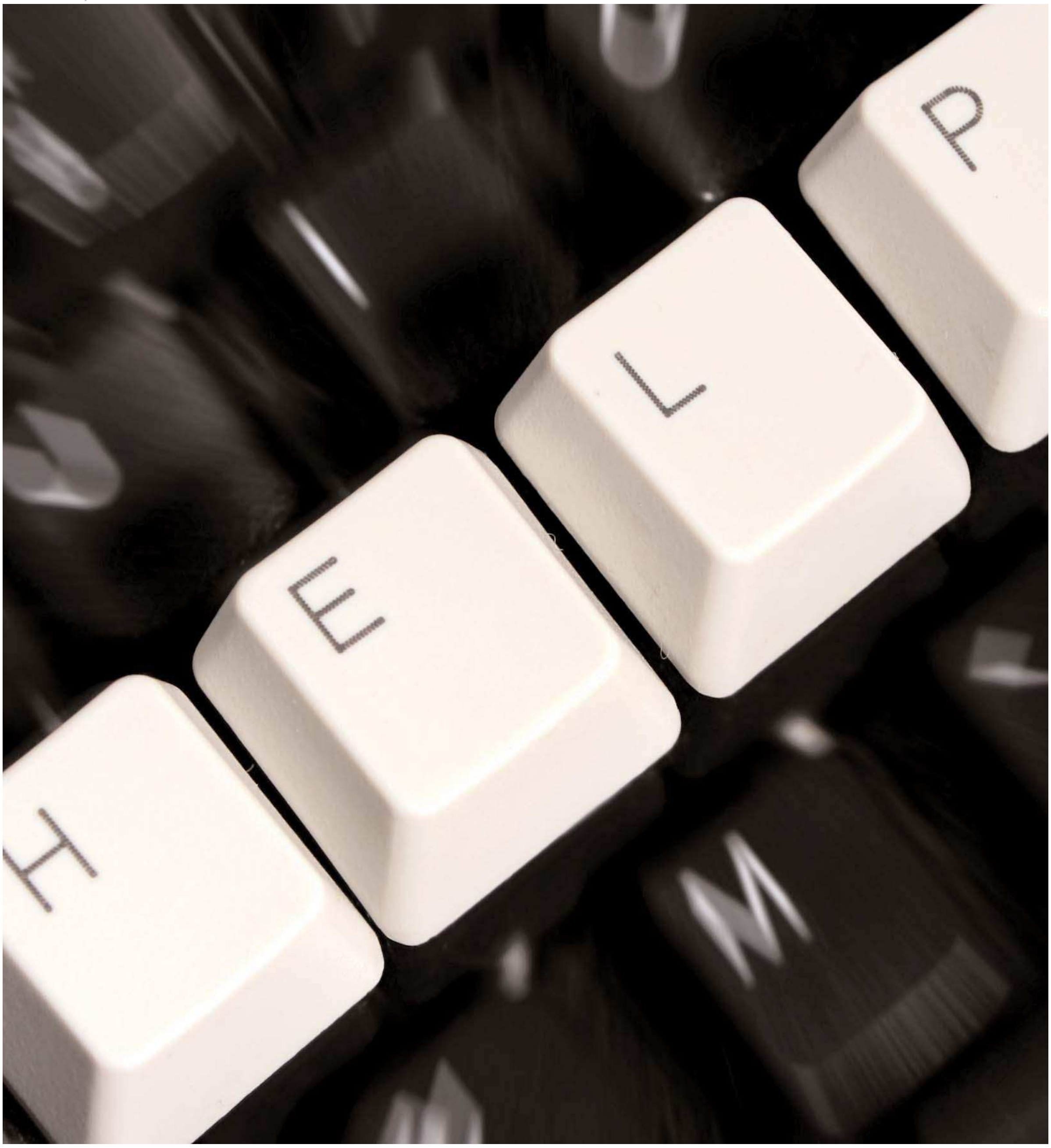

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Logjam, Bottleneck, Pinch-point:
The Efficiency Drain for the Modern Laboratory

IN RECENT YEARS, THE GROWING TREND TO RESOLVING WORKLOAD JAMS AND BOTTLENECKS WITHIN LABORATORIES HAS BEEN TO RELY ON AUTOMATION. BUT IS MACHINERY AND AUTOMATION REALLY THE ANSWER, OR IS THE PROBLEM MORE DEEPLY SEATED? COULD THE ISSUES INSTEAD BE RESOLVED BY LOOKING AT THE PROCESSES AND METHODS OF WORKING?

As the pressure on modern laboratories to improve efficiency and throughput grows, there has been a reluctance for scientists to borrow models from the manufacturing and engineering markets in order to overcome common bottlenecks and pinch-points in the laboratory process. Commercial payback comes from being able to get more robust processes to market quicker. Where does payback come from laboratory operations that are not measured, per se, using payback equations that relate to cost of goods or loss from inefficiency?

Laboratory managers are often faced with complex and fragile processes that last hours or days. However, their responsibility is to conduct the experiments and assays, and often not to address the efficiency of the laboratory. So, at what point does the manager decide it is necessary to change a laboratory workflow or process? The answer may lie in finding new or at least tailored metrics to make an assessment of routine laboratory operations as quantitative as the related production operations from which many of the guiding concepts of continuous improvement come.

CHANGING HABITS

Recognizing that a laboratory needs to change its practices is not easy, and finding solutions can be even more difficult. Short-term options are often taken to ease the immediate burden but long-term decisions, which take into account the organization's future plans, can be time consuming. The ownership of the problem can pass from one person to the next without the underlying issues ever being resolved. While universities and training teach scientists to work in a laboratory, staff are not often taught to look at management issues, such as workflow, efficiency, and productivity.

Although the advantages to automation are widely documented (greater accuracy of results and faster delivery times to name but a few), not every process is suitable for automation.

More often than not, change is instigated from the bottom-up, with pressure placed on a director inadvertently from the manager and staff. Some may resist the changes for fear of staff reductions or fear of stepping out of the established comfort zone. However, a change in processes does not necessarily lead to job cuts. It can improve the working environment for many while increasing throughput and the quality of results. Gone will be the mundane and tedious tasks and introduced will be the ability for highly trained staff to apply their skills in other areas. Where inefficiencies can be identified, one often sees areas of high staff turnover, where much of the staff will be in training at any one time, and natural wastage can occur.

In addition, laboratory processes often have high levels of variation, making the development of a robust and reliable process inherently difficult. Couple this with the high intrinsic value of the end product and a laboratory increasingly has to acknowledge and accommodate a degree of risk during its sample management, R&D, and processes. Mitigating this risk is becoming a common goal for more and more laboratories.

COMMON WORKFLOW BOTTLENECKS

No matter how well the space and laboratory apparatus were originally set-up (and this has usually

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been on an ad-hoc basis, driven by utilities and network issues rather than laboratory efficiency), as the workload and sample/specimen load increase, and common laboratory practices change and expand, it is necessary for the process to be critically reviewed in terms of workflow bottlenecks or logjams that affect the overall operation and productivity.

The first step usually taken is to look for instrumentation and software platforms that can automate a common process. But this is not always the best move. Although the advantages to automation are widely documented (greater accuracy of results and faster delivery times to name but a few), not every process is suitable for automation. For example, instruments rarely can multitask, which renders some actions more viable for humans to perform.

Automation may solve some of the efficiency issues in a modern laboratory; however, this will not overcome common logjams and bottlenecks in a process. Therefore, it is necessary to start modeling the process and assessing workflow needs in order to identify where the bottlenecks are, what processes are suitable for automation, and which workflows need to be rearranged or amended. This may include some physical alterations to the laboratory work space.

A general laboratory manager often does not have enough expertise and experience to start modelling the process. This is where process engineering companies can put the long-standing practices of productivity improvement and process automation to work for the laboratory industry. They can exploit available process models from the manufacturing environment (e.g., lean manufacturing or Kanban practices) in order to improve laboratory workflow.

DEVELOPING A ROADMAP

It may be possible for an organization to reassess its processes in-house. One way is to invite a manager from within a different department to spend time analyzing processes. He/she can bring an unbiased viewpoint. The downside is that to model the process, create a roadmap for the future, and implement it demands time that many in-house managers lack.

Outsourcing a process automation project is often seen as the first step in overcoming workflow issues. The first phases of the project — the development of specifications and user requirements — are paramount. Without the right leaders to drive the process, laboratories waste valuable time and money before this has even started. Laboratory managers can therefore leverage the specialist experience and knowledge of process engineers as an approach to solving the problem. Learning from other people's experiences provides faster, more efficient, and more cost-effective pathways to improving processes.

The following approach sets out a typical workflow evaluation project:

1. Map current processes in order to identify critical successful actions (CSAs) and redundant processes or bottlenecks in the process.
2. Identify sources and causes of the bottlenecks.
3. Identify the factors within the process that can be adjusted to improve and control the bottlenecks.
4. Assess and map the approaches that merit consideration. Factors to consider include use of capital, workflow optimization, space requirements, and planned future expansion options.
5. Determine a control strategy to ensure that the CSAs are optimized and that future additions to laboratory instrumentation can fit seamlessly and efficiently into the new process.

COMMON PINCH-POINTS

A typical high-throughput pharmaceutical laboratory will put all of its plate readers in one room and will program all of the readers to analyze the well plates overnight. This is a common bottleneck in a high-throughput laboratory, making it difficult for a team of scientists to obtain results all at the same time. Historically, it will have been set up in this way by IT and engineering for utilities, cabling, and network optimization. By examining issues such as the location of equipment, and organizing a staggered timetable for research, blockages, and pinch-points can be removed. The result can be better staff utilization, wait times for analyzers reduced or eliminated, and more assay results per unit time. All of this can be accomplished without significant investment in new equipment; it instead involves rationalizing the layout, workflow, and positioning of key assets in the laboratory.

CONCLUSION

Laboratories need to be aware that changing the processes may lead to cost savings. Staff may not need to be deployed to another area. Instead, consider that payback will come in the form of a decrease in turn-around time, decrease in waiting times for results, staff retention, and greater accuracy of results derived from greater efficiencies.

Everyone who experiences problems and workflow logjams should look at the current processes — are these troublesome now and would suggestions made now relieve problems in the future? Do not be afraid to speak up where you can see a way to help and improve the working environment. Achieving the ultimate efficiency is the responsibility of everyone in a laboratory.

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