

Driving Lab Efficiency and Performance Acceleration with LC/MS/MS

Introduction

The COVID-19 pandemic impacted industries, economies, and lives, and brought about the need for a new approach for contract testing laboratories working in different application fields. During the pandemic, labs suffered from supply chain shortages, logistics issues, and safety concerns for their staff, causing problems for daily operations and threatening economic viability. And after the pandemic, the testing labs industry has been facing additional hurdles, including increasing regulatory scrutiny and equipment productivity and operational efficiency issues.¹

For labs facing these and other pressures and opportunities, the time has come to rethink their operating model. A 2022 McKinsey study outlines some trends that can help labs sustain the new market demands for efficiency and productivity.²

- **High-throughput processes and physical automation.** Sample preparation is very often a time-consuming manual process. Automated high-throughput devices can help labs reduce sample preparation time and cost of analysis.
- **Data analytics.** According to McKinsey, labs need to integrate real-time data to enable more agile and accelerated data-based decision making.
- **Automated reporting and documentation.** When automation is implemented and connected via the digitalization process, reporting and documentation can be customized based on local requirements. Data integrity is enabled throughout the process.
- **Validated methods and analytical solutions streamlining accreditation.** ISO 17025 accreditation is demanding and complementary to other supplier certification: validated methods and instruments that streamline the accreditation process increase confidence and facilitate the implementation of methods.

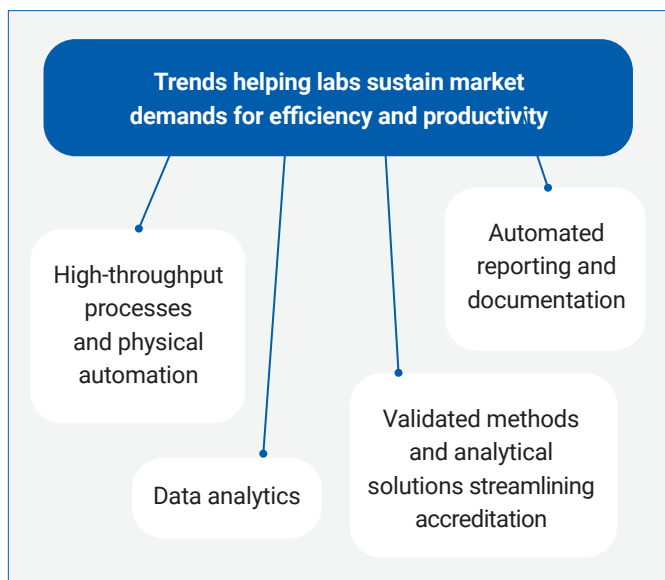


Figure 1: Trends helping labs sustain market demands for efficiency and productivity.

Considering the directions shaping the laboratory industry, this article revises trends that could be also applied in contract testing labs that are ISO 17025-accredited, using triple quadrupole liquid chromatography-mass spectrometry (LC/MS/MS), that can drive laboratory efficiency and performance. These trends put a greater focus on automation, extensive use of data in lab asset management, accreditation processes, digitalization to improve efficiency, and intensified strategic use of instrumentation.

Leveraging a Culture of Quality with Streamlined Lab Accreditation

Laboratories with a culture of quality and adherence to quality system requirements are managed to ensure compliance in day-to-day activities. Ultimately, they aim to deliver better outcomes to their customers.⁴

Being ISO 17025 accredited brings benefits for the lab and for their customers, such as a standardized approach for performance and competence, a professional working approach, and increased efficiency.

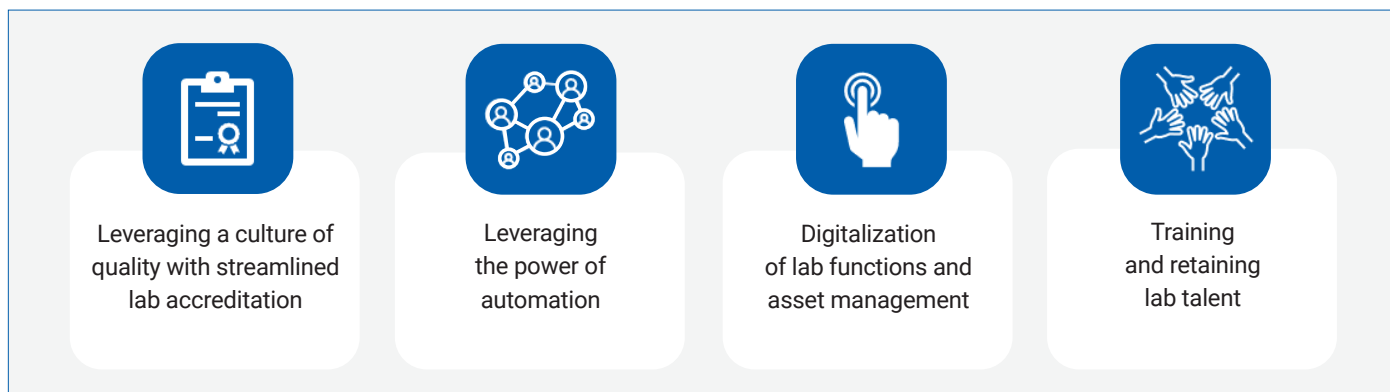


Figure 2: Trends Driving Lab Efficiency and Performance Acceleration With LC/MS/MS.

What Is ISO 17025 Laboratory Accreditation?

ISO 17025 accreditation is the most well-known lab accreditation: “ISO/IEC 17025 enables laboratories to demonstrate that they operate competently and generate valid results, thereby promoting confidence in their work both nationally and around the world. It also helps facilitate cooperation between laboratories and other bodies by generating wider acceptance of results between countries. Test reports and certificates can be accepted from one country to another without the need for further testing, which, in turn, improves international trade”.⁵



Figure 3: Benefits ISO 17025 Accredited Labs.

To be accredited to ISO 17025, testing labs must undergo a series of steps to demonstrate their capabilities and compliance – a process that involves considerable time and financial resources for labs.

Labs going through the accreditation process can benefit from analytical system offering features supporting the procedure. For example, the PerkinElmer QS-Works™ workflow provides an LC/MS/MS-connected platform that enables labs to achieve validated and verified, quality-assured methods for food, quickly and efficiently. The verified methods allow for an easy-to-implement analytical workflow that supports the validation step of the accreditation process.

The PerkinElmer QSight LC/MS/MS system also provides features that enable efficiencies for the accreditation process. For labs needing method development, its Dual Source technology helps shorten the time needed for method development by offering both electrospray ionization (ESI) and atmospheric pressure chemical ionization (APCI) modes on the same system. Combined with the StayClean™ technology, the system enables increased uptime, as the need for source cleaning is significantly reduced.

To support automation of the lab practice, PerkinElmer SimplicityLab™ lab execution system (LES) and PerkinElmer Simplicity 3Q™ software enable efficient instrument and workflow management. Compliance with CFR 21 Part 11, required for the accreditation process, is supported, resulting in more quality of lab operations and the easing of audit steps during and after the accreditation process.

Navigating the complexities of global regulatory entities and requirements can be difficult, and the penalties of noncompliance can slow down productivity in even the best-run laboratories. With a consultative approach, OneSource Compliance Services offers real expertise in qualification, requalification, risk management, and remediation. By consolidating with one provider and harmonizing lab protocols under a single Universal Operational Qualification framework, labs have a comprehensive, automated approach to testing, documentation, and compliance, streamlining processes across all major models of laboratory instrumentation.

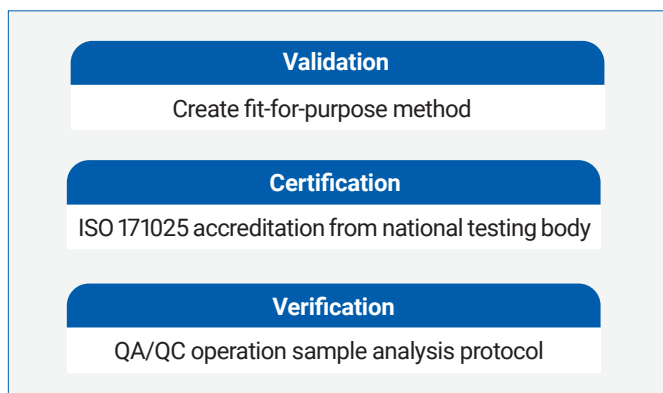


Figure 4: Process for getting ISO 17025 accreditation.

Choosing LC/MS/MS Solutions to Drive Efficiency and Productivity

When focusing on accelerating lab efficiency and performance, triple quadrupole LC/MS/MS adds a lot of analytical power. Lab staff spend most of their time streamlining methods and instruments with the goal of being more productive and efficient. By choosing an LC/MS/MS system, lab managers can benefit from a series of advantages:

Higher lab productivity

When dealing with complex matrices, labs often need to analyze the same sample with different analytical techniques or systems. Solutions that combine analytical capabilities can be of great help for lab efficiency and the bottom line. The QSight LC/MS/MS system features a unique Dual Source configuration that can be set in ESI or APCI modes, with fast, automated probe switching. The APCI/ESI source allows maximum flexibility and enables a wide breadth of compounds to be analyzed in a single run.

Minimizing maintenance

Regular cleaning and caring for lab equipment helps extend its lifetime and prevent it from adversely affecting analysis results. The QSight LC/MS/MS system's StayClean hot-surface-induced desolvation (HSID™) interface design enables users to analyze high numbers of samples from complex matrices with reduced need for cleaning.

Intuitive software platforms for improved productivity

Lab managers are always looking for ways to increase the productivity of their labs without sacrificing quality. Using the right analytical instrumentation is an important part, but software can help advance productivity further. PerkinElmer Simplicity 3Q software is designed modularly for intuitive, straightforward operation, with wizards guiding users through the workflow, from method development to results processing and reporting. Simplicity 3Q software was designed and built to deliver value and provide flexible scalability.

Leveraging the Power of Automation

Nonautomated processes can be time consuming, from labor-intensive sample preparation to manual results collection and transcription. Manual processes also require extensive employee training to minimize the risk of human error, impacting overall lab uptime and the bottom line. Automated technology can help labs increase efficiency, streamlining manual processes and freeing up lab staff time and schedules. In this way, lab technicians can focus on more specialized responsibilities. As such, investing in automated technology can help improve efficiency.

For example, nonautomated LC/MS/MS analysis of food samples required various steps before the actual analysis took place: grinding, weighing, extraction, centrifuging, diluting, filtering, and so on. Having automated systems that integrate the various manual steps improves data quality, increases sample throughput, and minimizes cross-contamination. With the PerkinElmer JANUS® G3 420 liquid handling workstation, multiple food sample preparation steps are incorporated into the QS-Works workflow, which is specifically configured to automate and integrate results in the SimplicityLab software

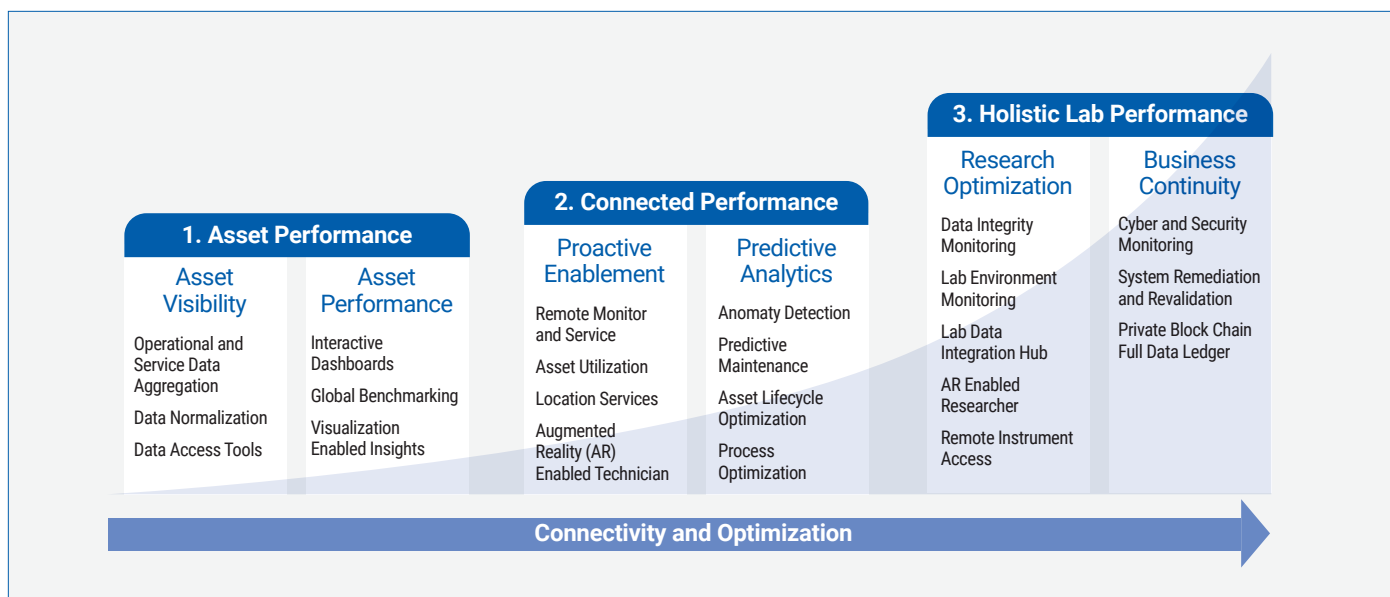


Figure 5: Example of the Lab Digital Journey Framework.

for cloud-based data management. With the integrated barcode scanner, efficiency of sample management increases, significantly reducing the risk of manual error. For mycotoxin analysis, the Meizheng ASPE 480 immunoaffinity and solid phase extraction system can be added into the workflow to perform both immunoaffinity chromatography and traditional solid phase extraction. The ASPE 480 is fully automated, with four extraction channels and the ability to prepare up to 48 samples continuously. Built-in syringe pumps can ensure an accurate flow rate and good reproducibility.

Digitalization of Lab Functions and Asset Management

In the future development of testing laboratories, digitalization can play a key role, helping improve productivity, increase collaboration, and ease asset and staff management. McKinsey has found that “an average chemical QC lab can reduce costs by 25 to 45 percent by reaching the digitally enabled lab horizon.”⁶

Laboratories that invest more time, effort, and money into digital capabilities such as sensors, analytics, software, and asset connectivity have a better ability to increase workflow efficiency, optimize asset performance, drive profitability, and improve customer satisfaction.

As connectivity with smart assets and environment sensing is spreading, labs can also leverage the opportunity to integrate and contextualize these new data streams with other existing operational and service data (repair history, asset age, qualification records, asset utilization, method use, and more). This can lead to significant insights and savings opportunities. Remote monitoring,

diagnostics, and service of critical equipment in high-throughput labs are enabled by enhanced connectivity: lab staff can program asset maintenance more efficiently, increasing the time available for more specialized tasks.⁷

At the individual instrument level, embedded sensors can gather and communicate data to enable visibility into asset usage and conditions. In this case, digitalization can take the form of a lab monitoring process, an excellent way to protect some of the most valuable assets of the lab, including instruments, equipment, and unique samples. Leveraging complete and up-to-date digital inventory with contextualized utilization data can help enable informed decision making on asset management, from maintenance to replacement.⁸

The PerkinElmer Asset Genius™ solution includes intelligent wireless sensors that automatically measure temperature, humidity levels, and more in a single comprehensive solution. For data analytics, the Asset Genius solution can also give essential information on equipment utilization, while integrated, easy-to-understand interactive dashboards allow for deeper insights and better decision making.⁹

What is “Big Data”?

Big data is a powerful tool for analysis and decision making in laboratories. By collecting and analyzing large datasets, lab staff can gain deeper insights into their analysis and make better decisions faster.

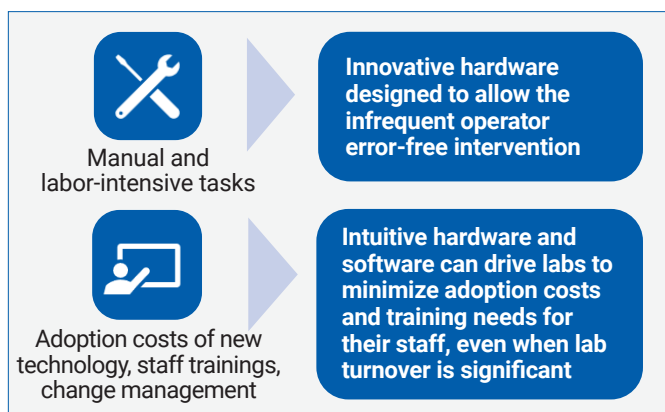


Figure 6: Costs of Lab Talent Management.

Training and Retaining Lab Talent

McKinsey conducted a study to understand what characterizes the best labs: talent management was found to be the most important driver of their productivity¹⁰.

In a high-throughput testing lab using LC/MS/MS systems, talent management takes the form of reducing the burden of manual and labor-intensive tasks, so that lab staff can focus on system and method optimization. The more that LC/MS/MS instruments help minimize operator intervention, the more time lab staff can focus on improvement and results. For example, the QSight LC/MS/MS system's innovative hardware was designed to enable infrequent, error-free operator intervention.

Adoption costs of new technology that impact lab talent management include training time and change management. Easy-to-use, intuitive hardware and software can minimize adoption costs and training needs for staff, even when lab turnover is significant. With the support of easy-to-learn software, the QSight LC/MS/MS system provides a simplified user experience. The intuitive software interface reduces adoption times and minimizes training needs, no matter the operator's expertise.

Conclusion

Increased pressure for productivity and reduction of operational costs and additional burdens caused by uncertainty in the macroeconomic scenario are leading contract testing laboratories using LC/MS/MS to rethink their approach for business viability and success. While digitalization and smart asset management are driving labs to increase automation and improve their talent management, LC/MS/MS solutions are key to productivity and efficiency, while supporting accreditation with integrated analytical workflow. The PerkinElmer QSight LC/MS/MS system combined with intuitive software and integrated workflow solutions can help labs accelerate performance and operational efficiency.

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Additional Resources

Learn how PerkinElmer Triple Quadrupole LC/MS/MS Portfolio help your lab meet their analytical goals. Discover the power of smart asset management with PerkinElmer Asset Genius
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