# Advanced Analytics in The Lab: How AI-Powered Analytics Transforms LIMS Data into Valuable, Action-Ready Insights

LabVantage Solutions, Inc

## The Digital Lab is Here

When modern LIMS software overtook traditional paper-based record-keeping in the lab, operations in every industry improved. Automated data collection drove efficiencies at the bench. Cloud solutions accelerated knowledge-sharing between partners. Built-in security and permission features enhanced data integrity. There's hardly a lab in operation right now that hasn't gained from this leap towards digital transformation.

That was then. Today, forward-thinking lab managers are taking the next big leap, this time from data collection to data science.

Until now, the lab operator's relationship to their data was usually prescribed by preset LIMS dashboards and reports. The data itself, often unstructured and siloed from other enterprise systems, was not always accessible, at least not without a skillful data modelling exercise. That's changing as artificial intelligence and machine learning move into the lab. Using data science algorithms, these advanced tools rapidly process all of that structured and unstructured LIMS data, integrating it with external enterprise data and serving lab managers and analysts with valuable insights and timely, meaningful recommendations.

In other words, historic LIMS data is no longer locked away; it's put to work for the benefit of the whole enterprise, helping to drive deeper statistical analysis, advanced insights, and dynamic business intelligence.

Using this advanced technology to transform LIMS data into action is already a feature of modern, fast-moving labs across all industries, and as you'll see in the analytics opportunities described in this paper, it's going to have an enormous impact. Is your lab ready?

## Advanced Analytics: The What, The How, The Why Now

Modern instrumentation, new models of public/private partnership, and evolving industry standards have made mass data collection both easy and indispensable. These advances have also created a scenario in which researchers and analysts must consider a huge (and growing) number of variables before making any decision.

As if all that data wasn't enough, add the challenge of ever-shrinking timelines. The pharmaceutical industry's race to develop a COVID-19 vaccine demonstrated what's possible when diverse partners collaborate to shrink the research lifecycle, and now that the world has tasted 'Warp Speed', there's no going back. Put simply, the companies that will survive the next five years are those that learn to use their data - new and historic, lab-specific and enterprise-wide - to move faster.

## Enter advanced analytics

A lab-specific, LIMS-ready advanced analytics solution solves both the data volume challenge and the speed challenge. It affords lab professionals a 360-degree view into their lab and their enterprise, helping to create meaning from data in order to identify the next best action. This visibility not only improves speed to market - it also drives down costs and supports smart decision-making, both inside the lab and across the company as a whole.

## Understanding Advanced Analytics

### Advanced - the Vehicle

A lab-specific advanced analytics solution is capable of digesting huge volumes of structured and unstructured data from multiple sources. Powered by advanced AI, the solution applies statistical and machine learning algorithms to make meaning from that data, identifying patterns, behaviours, risk factors, and untapped opportunities.

These advanced features are only useful if they're usable. The best advanced analytics solutions integrate with the existing LIMS environment as well as other data sources, inviting operators of all abilities to interact directly with the data. Using a familiar point-and-click interface, users can drill down to LIMS workflows and back up to big-picture visualisations, smoothly and easily. That's what 'advanced' looks like, wrapped in a user-friendly package.

### Analytics - the Destination

The data that fuels AI and machine learning in the lab comes from the LIMS (sample and environmental data, data from connected instruments, etc.) and from the enterprise (ERP and MEP systems, etc.).

The advanced analytics solution is designed to turn that data into business and statistical intelligence, providing operators with individualised and on-demand charts, graphs, reports, and dashboards to help them identify and optimise next steps.

This drives the science of just-in-time decision-making in the lab, using both historic and real-time data to predict outcomes, prevent failures, and liberate the secrets and solutions locked inside all of that valuable LIMS data.

## What does this add up to?

Advanced analytics in the lab is the key to:

**A broader scope of research and/or testing.** Use advanced analytics to mine historic LIMS data and collaborate with other relevant data sources, leading to meaningful, relevant insights.

**Improved speed to market.** A lab-specific analytics solution removes traditional barriers to LIMS data, accelerating research and enabling streamlined testing.

**A more profitable lab.** By teaching the advanced analytics solution to recognise untapped opportunities and flag risks, labs can optimise and accelerate their workflow.

## Advanced Analytics Opportunity: The Research Lab

### A Perfume Manufacturer's R&D Lab

**Their challenge:** Developing a single new scent means manually testing a dozen or more fragrance combinations, burning through valuable time and material resources with no guarantee of a successful outcome.

**Advanced analytics multiplies their options while shortening their innovation lifecycle**

Using criteria established at the bench, researchers teach their advanced analytics solution to identify potential candidates from years of sample data preserved in their LIMS.

**The result:** Research supported by data science: Researchers test only the four combinations recommended by their advanced analytics solution - and yet their scope of research extends down through tens of thousands of data points, far more than they'd ever generate in real time at the bench. This improves the outcome of every project.

An automated innovation lifecycle: With their advanced analytics solution igniting their progress from the start, researchers arrive at the winning scent in record time. Repeated across every research project, this translates to a notable increase in the lab's efficiency and, correspondingly, its profitability.

## Why choose lab-specific advanced analytics instead of an enterprise-level solution?

### Smooth two-way integration

With an analytics solution designed for the lab, users can toggle between higher-level visualisations and discrete LIMS data with ease. For example, if a user spots an anomaly in the analytics dashboard, she can dive into the data for a self-service query, then easily click back to the dashboard. It all happens smoothly, within a familiar interface.

### Analytics that knows the lab

The right lab-based analytics solution will feature hundreds or thousands of statistical and machine learning algorithms built for lab-specific use cases, giving operators the tools they need to find meaningful insights without IT support.

### Better security

A lab-based analytics solution can inherit the security, permissions and data integrity features already built into the LIMS, ensuring that access is appropriately controlled and that data remains compliant and secure.

## Advanced Analytics Opportunity: The Manufacturing Quality Lab

### A Quality Testing Lab at a Boutique Winery

**Their challenge:** While a batch of wine ferments, it ties up valuable cask capacity. This is a gamble for the vintner, who must wait an average of two years for each batch to complete its processing lifecycle before knowing, for sure, if that batch was worth the real estate it occupied.

**Advanced analytics turns a gamble into a sure bet**

Their LIMS software stores five years' worth of product data. The company uses their advanced analytics solution to look for patterns inside that data, isolating specific variables that impact product quality.

The solution's AI engine learns from those variables and predicts which current batches will meet the quality threshold.

**The result:** Optimised resource planning: Only the wines that are likeliest to deliver on quality, based on a statistical analysis of the LIMS data, are fermented to maturity. This ensures that valuable cask capacity is strategically allocated, improving the company's overall efficiency and throughput.

## Advanced Analytics Opportunity: The Contract Testing Lab

### A Contract Services Lab Specialising in Pharmaceutical Testing

**Their challenge:** Already operating at capacity, this lab struggles to perform routine maintenance without negatively impacting their testing schedule.

**Advanced analytics helps them to reduce downtime and predict surges in demand.**

With an advanced analytics solution at work inside their LIMS, this lab team can shift their strategy from 'routine maintenance' to 'prescriptive and preventive maintenance'.

The solution mines existing LIMS data (as well as instrument software, databases, and log files) to recommend specific maintenance tasks, prioritised by urgency. These tasks could be based on the instrument's historic performance, the number of samples scheduled, the operator using the instrument, the consumables involved, or other critical factors. The advanced analytics solution also uses LIMS data to predict demand and help lab managers schedule maintenance around incoming projects, further enabling a dynamic and proactive 'uptime strategy'.

**The result:** Improved operational readiness: Rather than remove an instrument from performance based on a static maintenance schedule, lab operators can focus their maintenance strategy only on areas that actually need attention. Not only does this help them to optimise the lab schedule, it also reduces unexpected downtime by alerting lab officials to potential performance issues before they arise.

## Conclusion

In order to move as fast as today's market demands, lab managers need a 360-degree view. They need to see into the past to mine insights from historic data. They need to use those insights to look into the future, identifying potential risks and locking in on new opportunities. They also need a clear view of the reality inside their lab and across the enterprise, each integrated with the other in an accurate and nuanced picture of whole business health.

That's what it means to have a 360-degree view. Past and future, lab-specific and enterprise-wide. To gain that view, labs need to put their LIMS data to work, powering an advanced analytics solution that's capable of delivering statistical and business analysis on demand. It's the next wave of transformation for the digital lab, and LabVantage is ready to help you ride that wave all the way to the top of your market.

LabVantage Analytics, our full-featured, self-service advanced analytics solution, is designed to integrate seamlessly with your LabVantage LIMS. It comes with more than 520 visualisation widgets and over 1,000 AI algorithms, giving lab users the flexibility they need to explore, analyse, and visualise their data in personalised and meaningful ways.

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