

MODERNIZE YOUR **QUALITY CONTROL** LABORATORY FOR THE SMART MANUFACTURING ERA

Learn how to digitize your QC laboratory to make it more efficient, reliable, and ready for Industry 4.0.

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Introduction

Quality Control and Industry 4.0

There's a lot of talk lately about Industry 4.0—but what is it and what does it mean for quality control laboratories?

Industry 4.0, also known as the fourth industrial revolution, represents a new way of manufacturing products. These industries will be connected to the Internet, equipped with sensors and software capable of collecting and interpreting vast amounts of data and information to mass-produce customized orders with greater efficiency and quality.

Currently, the vast majority of quality control processes in industries are neither digital nor automated, limiting the contribution of the quality control department and preventing it from assuming its role of actively supporting the improvement of operational efficiency, reducing costs, and addressing quality issues in the industry.

This whitepaper introduces Industry 4.0, outlines current challenges in quality control efficiency and reliability, and shares best practices to help quality control labs prepare for and benefit from this new era.

What is Industry 4.0?

Experts estimate that we are experiencing a new revolutionary period in manufacturing, with the conjunction of new digital technologies that are now reaching maturity, such as cloud computing, the Internet of Things, robotics, additive manufacturing, big data, among others.

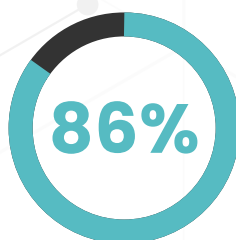
Also known as the fourth industrial revolution, Industry 4.0 is a concept born in 2011 in Germany. It originated from a government project asserting that technology is an excellent foundation for the necessary change and evolution in global industry, defined intelligent production systems, connecting machines, systems, and assets.

Industry 4.0 enables data collection and analysis between machines, creating faster, more flexible, and more efficient processes to produce higher-quality products at reduced costs. This reality is only possible due to increasing technological advances in information technology and engineering, encompassing sophisticated sensors, IoT (Internet of Things), advanced robotics, digital manufacturing (including 3D printing), artificial intelligence, cloud computing, data capture and analysis, software as a service and other marketing models, smartphones and other mobile devices, and more.

In 2015, PricewaterhouseCoopers (PwC) conducted an international survey, interviewing more than 2,000 companies in 26 countries about Industry 4.0. The survey spanned sectors as diverse as industrial manufacturing (including aerospace and defense), automotive, chemicals, electronics and forestry. A third of those interviewed said their company had already reached advanced levels of integration and digitalization, and 72% believed they would reach that point by 2020.

More importantly, 86% of respondents stated that, based on their experience so far, they expected to see both cost savings and revenue gains from their advanced digitalization efforts. Nearly a quarter estimated these improvements would exceed 20% over the next five years. Furthermore, around 55% of respondents expect to see a return on their investment within two years.

Another unprecedented survey, conducted by the CNI's Industry 2027 Project (The National Confederation of Industry) shows that 21.8% of industries plan to have their production processes fully digitized within the next 10 years.



Companies expect higher revenues and lower costs



1/3

of reached advanced levels of digitalization

Main technologies related to Quality Control in Industry 4.0



IoT - Internet of Things

In the area of the Internet of Things, more and more analytical equipment or instruments will be connected to the corporate network and the Internet to provide not only transcript-free results but also report status data, thus facilitating preventative maintenance.



Cloud Computing

Cloud computing offers a simple and practical alternative to using and paying for computing resources on demand, leaving the customer free to use automation and information technology services without worrying about the information and communications technology infrastructure.



Data Capture and Analysis

Capturing and storing data from a variety of sources, including equipment, raw analytical data, raw material analysis results, process points and finished products, contamination monitoring, and more, provides significant opportunities for analysis and information extraction to support management.



Software as a Service (SaaS)

An increasing number of quality control lab automation and management solutions are moving to the cloud, offering flexible, on-demand access through monthly subscriptions. This eliminates the need for costly upfront investments in licenses and IT infrastructure, significantly reducing risk for clients.



Smartphones and other Mobile Devices

The use of mobile devices provides a more practical and agile way to interact with information systems, allowing you to consult and disseminate information in real time, eliminating process downtime, as well as eliminating transcription and other repetitive manual activities, such as calculations of results, seeking greater reliability of the results delivered to production.

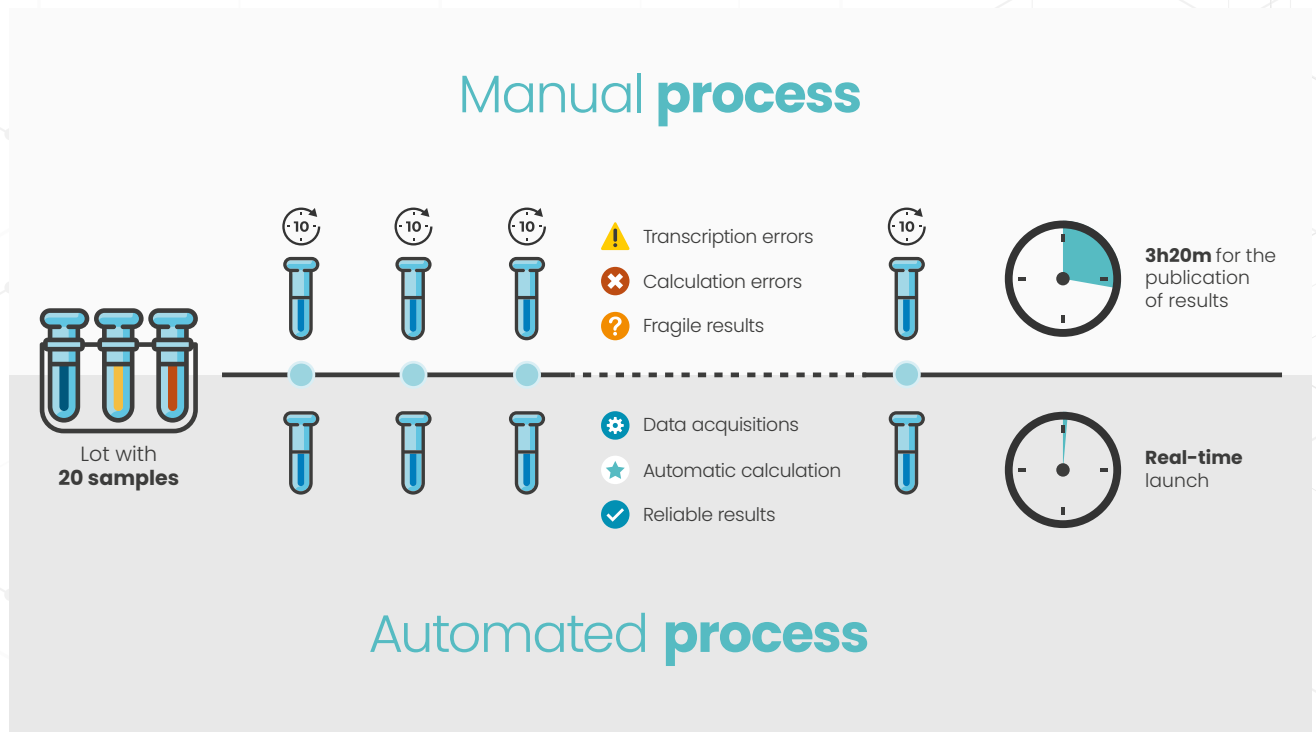
Quality Control in Industry Today

The state of quality control readiness for the digital age is not very good. Most quality control laboratories and other inspection processes still lag far behind the level of automation and computerization of production, which limits the delivery of fast and reliable results, resulting in late process corrections, wasted material and human resources, delays in lot releases and larger inventories, quality issues, and, in some cases, rework and impacts on the brand.

In many industries today, quality control still relies on outdated tools—spreadsheets, paper forms, or software that lacks true automation. This manual approach leads to costly downtime, transcription errors, and unreliable data, making it difficult for managers to track results and make informed, high-stakes decisions.

Practical Operational Example of Quality Control Testing

Imagine a very simple hypothetical scenario: A quality control analyst must analyze a batch of 20 samples from the production process. Analyzing and obtaining the results for each sample takes 10 minutes.



The analyst begins testing at 8 a.m., and since each test takes about 10 minutes, the sample batch test takes 3 hours and 20 minutes, so by 11:20 a.m. the analyst will have the results available to send to production. For sample 1, it took 10 minutes to obtain the result and 3 hours and 20 minutes to publish it to production.

If the workflow is still paper-based or spreadsheet-based, we will have significant down time in publishing results, as well as a fragile process in terms of the reliability of results based on data transcriptions or manual calculations.

If the workflow provides for automatic capture of analysis results, and the analyst uses a tablet or smartphone with an app to verify the results and their automatic appearance, they can publish each result as they receive it, thus eliminating downtime and errors associated with data transcription.

This example presents a simplified case where there is no record of the equipment or consumables used in the analysis or calculation and manual comparison of results, which would further compromise the time and fragility of the process.

In practice, quality control is not yet ready for Industry 4.0. Without a digital quality control process, operators and managers are making multi-million dollar decisions daily—often relying on outdated, unreliable information. It's time the industry recognized this risk.



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Quality Control Preparation for **Industry 4.0**

Preparing industrial quality control for Industry 4.0 involves automating and digitizing quality inspection and testing processes in the laboratory and in production, eliminating manual, repetitive, or error-prone activities and simplifying processes.

Quality control will become faster and more flexible to meet the evolving demands of testing and inspection. Driven by Industry 4.0 and the rise of mass customization, manufacturers will produce smaller, more diverse batches—requiring quality teams to analyze more samples with greater speed and precision.

A very important benefit of digitalization is rapid access to reliable historical data, enabling real-time indicators and alerts about trends or process deviations. Therefore, the use of AI (artificial intelligence) can be considered to better understand data behavior, extract insights, and predict future behaviors (predictive analytics).

Application examples include:

- Critical analysis of the sample analysis results, indicating that a particular analysis result does not agree with the others, thus minimizing review time;
- Estimation of the results of secondary analysis of the sample based on other results to minimize the time and inputs spent on non-critical analyses that can be assumed mathematically;
- Predict the results of analysis of a finished product based on analysis of their raw materials. This helps prevent the production of off-specification products or indicates batch composition corrections before production to consistently achieve the best results.

Therefore, it will be easier and faster to understand variability in raw materials, suppliers, shifts, etc., propose improvements, and proactively avoid quality issues, reprocessing, and costs, making the quality control area a key player in optimizing product reliability and business profitability.

Another possible application of new technologies would be to use IoT (Internet of Things) resources. For example:

- Control the status of laboratory equipment, understanding its use, availability, and condition calibration, etc.
- Allow detection of movement and location of samples in the laboratory (chain of automatic custody) through electronic tags.

While the full potential of these new technologies is still emerging, the first essential step in QC's digital transformation is process digitization. This delivers immediate benefits and creates a strong foundation for future advancements as technology continues to evolve.

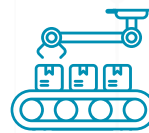
Benefits of LIMS Automation and IT in Quality Control

These are some of the immediate benefits of making quality control more digital through Laboratory Information Management System (LIMS) automation and IT. The benefits are realized in the quality control area and also in the production process, where the gains are enormous.



Quality Control

- Reduction in manual and repetitive work.
- Reduction in transcription and calculation errors.
- Increased production capacity with the same equipment and infrastructure.
- Reduced turnaround time.
- Easier compliance with regulatory and best practice requirements.



Production Process

- Reduction in process correction time.
- Reduction in process and product deviations.
- Reduction in energy and/or production input consumption.
- Reduction in quality issues and rework risks.
- Greater ease of compliance with standards and regulations.



Conclusion

The Fourth Industrial Revolution is here—and companies that fail to adapt risk falling behind. Without automation and specialized systems for quality control labs and production inspections, organizations miss critical opportunities to boost efficiency, reduce waste and process deviations, and cut the risk of costly quality issues and rework. Embracing innovation isn't optional—it's essential for staying competitive.

Step into the future of quality control with smart factories and Industry 4.0. Now is the time to modernize your processes and drive better business outcomes. With **Confience myLIMS**—a comprehensive, cloud-based lab information management system platform—you can fully digitize and automate your quality control and inspection workflows, boosting efficiency, accuracy, and reliability.



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