ThermoFisher SCIENTIFIC

The rhythm of innovation

Insights to accelerate science and drive productivity with an AI-enabled, automated digital lab

Your laboratory workflows shouldn't skip a beat.

Achieve next-level orchestration with integrated software and automation that keep your science in steady rhythm and ready to scale.

Find your lab's tempo.

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The pulse of progress

From digital vision to operational reality

Today, there is renewed energy and excitement about the future of the lab thanks to the promise of artificial intelligence, digitization and robotic automation. AI enablement, digital transformation and robotic automation are transforming how lab managers, R&D leaders, and IT professionals think about experience and scientific work in the lab. This transformation isn't just about adopting new tools—it's about reimagining how science gets done, and its potential to accelerate patient and business outcomes. What used to be manual and disconnected is becoming smart, streamlined, and deeply integrated.

While bold ambitions provide a great incentive for change, the reality is that the current pharmaceutical and life sciences environment actually demands it. Today's complex lab environment is shaped by a number of factors:

- Rising R&D costs that narrow lab margins and require agile and scalable solutions.
- Talent shortages and a growing skills gap that is forcing labs to reconsider their operations to do more with less.
- Supply chain disruptions causing organizations to rethink their sourcing and delivery models.
- More complex therapeutic modalities, such as cell and gene therapies and the growing demand for personalized medicines.

Faced with these challenges, the pharmaceutical landscape is hungry for disruption—maintaining the status quo is no longer an option.

According to a ZS report on pharmaceutical trends, 85% of biopharma executives say they will invest in data, digital and artificial intelligence (AI) for research and development (R&D) in 2025, seeking $1 billion-plus savings per top 10 companies in the industry.

Investment alone is not enough—realizing the potential of AI enabled, automated digital labs requires more than just new technologies, it requires teamwork and trusted partners who align their goals with yours and help guide your organization and scientists through a change journey.

Our purpose at Thermo Fisher Scientific is enabling our customers to make the world healthier, cleaner and safer, and this means helping scientists achieve their goals more effectively, moving beyond routine tasks to focus on what really matters: discovery, insight, and impact. Our cross functional experts work together with your team to guide organizations through goal setting, data integration, regulatory complexity, reskilling and other challenges and milestones throughout the digital automation journey.

The foundational components for exponential success have come together, and with a clear strategy and partner in place, lab leaders will be able to turn aspirations into reality, accelerating science and driving increased productivity with Automated Digital Labs, augmented with Artificial Intelligence.

My hope is that the following articles from changemakers in our organization provide some insight into key considerations around the digitalization journey, and shed light on how our digital science and lab automation solutions can scale to meet your needs and help you achieve your organization's goals.

Mark Fish

Vice President/General Manager, Digital Science & Automation Solutions, Thermo Fisher Scientific

Under pressure

Why pharma's lab infrastructure must evolve—now

Across the pharmaceutical value chain, a convergence of forces is reshaping how science gets done. Scientific complexity is rising, operational urgency is intensifying, and digital ambition is growing louder in every boardroom. But the systems that support the lab—the structural infrastructure that underpins discovery, development, and manufacturing—are struggling to keep up.

This isn't just a technology gap. **It's a foundational issue**. And it's showing up in every phase of the pipeline.

- **Discovery: science is moving faster than the systems supporting it**

Discovery science is evolving at breakneck speed. Biologics, multi-omics, and AI-driven research are pushing the boundaries of what's possible. But the tools supporting this work weren't built for this level of complexity. As a result, scientists are spending more time managing data than making discoveries. Disconnected instruments, legacy software, and manual data handling are slowing down the very breakthroughs they're meant to enable. The result? A growing disconnect between scientific ambition and operational reality.

- **Development: the race to file is being lost in the gaps**

Scientists in development are facing increased pressure to improve speed and scale. Teams are expected to move faster, with fewer resources, and across more geographies. But fragmented workflows and manual handoffs are creating friction at every turn. With preparation for clinical trials and chemistry, manufacturing and controls becoming a logistical maze of data silos delaying decisions, each inefficiency compounds the risk of missing critical timelines. This isn't just about productivity—it's about competitiveness. In a race to file, every delay is a lost opportunity.

- **Manufacturing: precision without integration is a risk**

New therapeutic modalities and ever more complex biologics demand traceability, real-time data, and automation. But many facilities are still running on disconnected instruments and paper-based processes. That makes it hard to scale, hard to optimize, and hard to trust the data. Without integrated systems, quality assurance becomes reactive instead of proactive. And in regulated environments, that's a risk no one can afford.

A need for urgency

Everyone agrees digital transformation is essential. But without a clear path forward, supported by a credible business case, organizations stall. And every delay makes it harder to catch up—especially as competitors modernize and regulators raise the bar.

As one pharma executive put it:

> *"We need to simplify our lab IT environment to accelerate science and drive productivity. Without a clear path, we risk wasting time, money, and momentum."*

Turning pressure into performance

The urgency is clear: the pressure is real, and it's rising. But it's also an opportunity. By modernizing lab infrastructure—through orchestration, automation, and intelligent data systems—pharma organizations can turn pressure into performance. **The future of science depends on it.**

Market insight

The digital lab imperative

Why the future of biopharma depends on automating every lab, not just some

In the race to deliver next-generation therapies, the laboratory has become both a pinch point and a performance lever. The pandemic proved that science can be accelerated, with lightspeed and warp speed heroic efforts, operating faster than ever before—but it also revealed the limits of fragmented, analog lab environments. The challenge now isn't just about digitizing individual labs. It's about building a connected, intelligent lab ecosystem that can scale sustainably across the enterprise.

According to a 2022 Accenture report, 91% of biopharma leaders are actively pursuing lab digitalization, with 69% already piloting or scaling initiatives. But progress is uneven, and pilot purgatory a common pitfall. Research, development, and QC/manufacturing labs each face distinct pressures—and without a unified strategy, digital investments risk becoming isolated efforts with limited long-term value.

only 17%
research labs currently digital

> *"Digital transformation, when executed at scale, can reduce the cost of bringing a new treatment to market by up to $1.7 billion."*
> *(Accenture)*

The upside is significant —according to the same Accenture report, digital transformation, when executed at scale, can reduce the cost of bringing a new treatment to market by up to $1.7 billion per drug. But this isn't just about cost—it's about agility, speed, and sustained change, enabling organizations to manage the complexity of modern science without heroic effort.

QC/manufacturing labs are leading the way, with **38% already digital** and **62% expected to transform within two years**. Their structured processes and largely standardized IT landscapes make them ideal candidates for transformation. Meanwhile, research labs—where **only 17% are currently digital**—face challenges around talent and data integration. Development labs, positioned between discovery and manufacturing, are under pressure to connect workflows and accelerate time to file, as digitalization in clinical sciences has left the development labs lagging.

What's clear is that digital transformation is no longer optional. It's a strategic imperative. And it's not just about technology—it's about people. Upskilling scientists, modernizing governance, and adopting cloud-native, agile practices are all essential to making transformation stick.

As the Accenture report states, labs are the lifeblood of a biopharma organization. To unlock their full potential, every lab must be treated as a strategic asset—and every scientist as a catalyst for digital innovation.

The three-legged stool supporting lab innovation

Framing the future of scientific labs through connectivity, robotics, and AI

By Hansjoerg Haas, PhD *– Senior Director and GM Laboratory Automation, Thermo Fisher Scientific*

Modern pharmaceutical labs are under increasing pressure to deliver faster, more reproducible results while managing growing complexity in data, instrumentation, and compliance. The question isn't whether to modernize—it's how to do so in a way that's scalable, interoperable, and aligned with scientific and regulatory goals.

We're focused on building practical, future-ready lab environments by embedding three foundational capabilities: connectivity, robotics, and AI. These aren't abstract concepts—they're operational levers that can reduce bottlenecks, improve data integrity, and free up scientists to focus on high-value work.

"The ultimate goal is automated science, where digital technologies and AI drive research and discovery, freeing up scientists to focus on high-value research."

Hansjoerg Haas, PhD
Senior Director, GM Laboratory Automation, Thermo Fisher Scientific

From manual to modular: A realistic evolution

Most labs today still operate in a hybrid state—part digital, part manual. Instruments may be automated, but workflows are often fragmented, with scientists spending up to 25% of their time on tasks that don't directly contribute to discovery. The shift toward fully integrated, end-to-end automation is underway, but it's uneven.

One of the most impactful developments is the use of autonomous mobile robots (AMRs) to bridge physical and digital gaps in workflows. These systems, combined with IoT and AI, enable labs to operate continuously and more predictably—without requiring a complete overhaul of existing infrastructure.

What's holding labs back?

Despite growing investment in digital transformation, many labs face persistent challenges:

- **Manual workload:** **Routine tasks still consume valuable scientific time.**
- **Vendor fragmentation:** **Disconnected systems make integration difficult and costly.**
- **Data latency:** **Delays in accessing and analyzing data slow decision-making.**
- **Inconsistent formats:** **Heterogeneous data structures complicate compliance and scale.**

These are not just technical issues—they're operational risks. Addressing them requires a coordinated approach that balances innovation with regulatory and business continuity needs.

Must-haves for the future lab

We see the lab of the future as built on three practical, interdependent pillars. To transform into the future-state lab, just like a three-legged stool you must have all three or you'll lose your balance:

1 Connectivity

A cloud-based infrastructure that links instruments, systems, and data across the enterprise. This enables centralized control, real-time visibility, and faster collaboration across teams and sites.

2 Robotics

Automation-ready instruments and mobile robotics that reduce manual handoffs, improve consistency, and increase throughput—without compromising traceability or compliance.

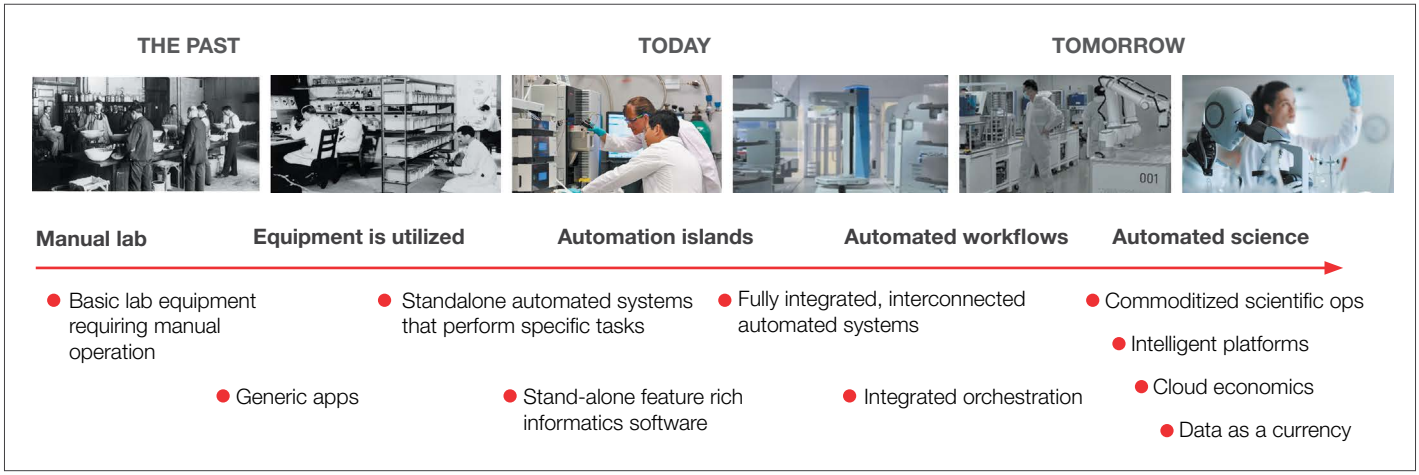
3 AI and Machine Learning

Embedded intelligence that turns raw data into actionable insights. From anomaly detection to predictive modeling, AI supports faster, more confident decision-making.

These pillars aren't theoretical—they're already being implemented in labs that need to scale operations, reduce variability, and accelerate discovery. The result is a lab environment that's not only more efficient, but also more resilient and better aligned with the pace of modern science.

Science in motion

Accelerating the race toward automated discovery



Science has always been a race—against time, against complexity, against the unknown. But today, that race is accelerating. What once took months now takes days. What once required teams of specialists can now be orchestrated by intelligent systems.

The lab is no longer a static space—it's a dynamic engine of discovery, evolving rapidly from manual processes to fully automated science.

From the manual lab of the past, where scientists relied on basic tools and generic software, we've moved through stages of increasing sophistication: standalone equipment, automation islands, and now, orchestrated workflows that connect instruments, data, and decisions in real time.

But the real inflection point lies just ahead: automated science. This is where the lab becomes a living system—powered by cloud economics, driven by data as a currency, and capable of scaling discovery like never before. It's not just about doing things faster, it's about doing things smarter, more reproducibly, and with greater impact.

The momentum is undeniable—according to a report from MarketsandMarkets[1], the global lab automation market is projected to grow from **$6.36 billion in 2025 to $9.01 billion by 2030, reflecting a robust 7.2% compound annual growth rate (CAGR)[1]** and indicating a surge in demand for intelligent, scalable, and integrated lab systems. This growth signals a fundamental shift in how science is conducted—and how quickly it can deliver results.

We're helping labs navigate this acceleration. Through our digital lab software and automation solutions, Thermo Fisher enables the transition from fragmented tools to integrated platforms, isolated tasks to intelligent workflows, and data collection to data-driven insight.

Because in this race, speed alone isn't enough. It's about direction, orchestration, and trust. And as labs push forward into this new era, Thermo Fisher is there—not just keeping pace, but setting the rhythm, a steady, intelligent beat that underpins every breakthrough and serving as the tempo of transformation.

*Click **here** to read the MarketsandMarkets - Lab Automation Market Forecast report*

The future-ready lab

A vision for smarter science

Imagine a lab where data flows freely, systems speak the same language, and science moves at the speed of insight. This is the future-ready lab—an intelligent, connected environment where digital laboratory software and automation solutions help unlock new levels of productivity, precision, and possibility.

At the center of this vision is operational intelligence—a dynamic, real-time view of lab performance that empowers teams to make faster, better-informed decisions. This isn't just about dashboards; it's about a digital nervous system that senses, learns, and adapts.

Lab automation and robotics take on the repetitive and the routine, enabling scientists to focus on discovery. Orchestrated workflows ensure that every step, from sample prep to analysis, is streamlined and synchronized. Data is no longer trapped in silos—it's aggregated, harmonized, and made actionable through a robust AI and ML strategy that surfaces insights and drives continuous improvement.

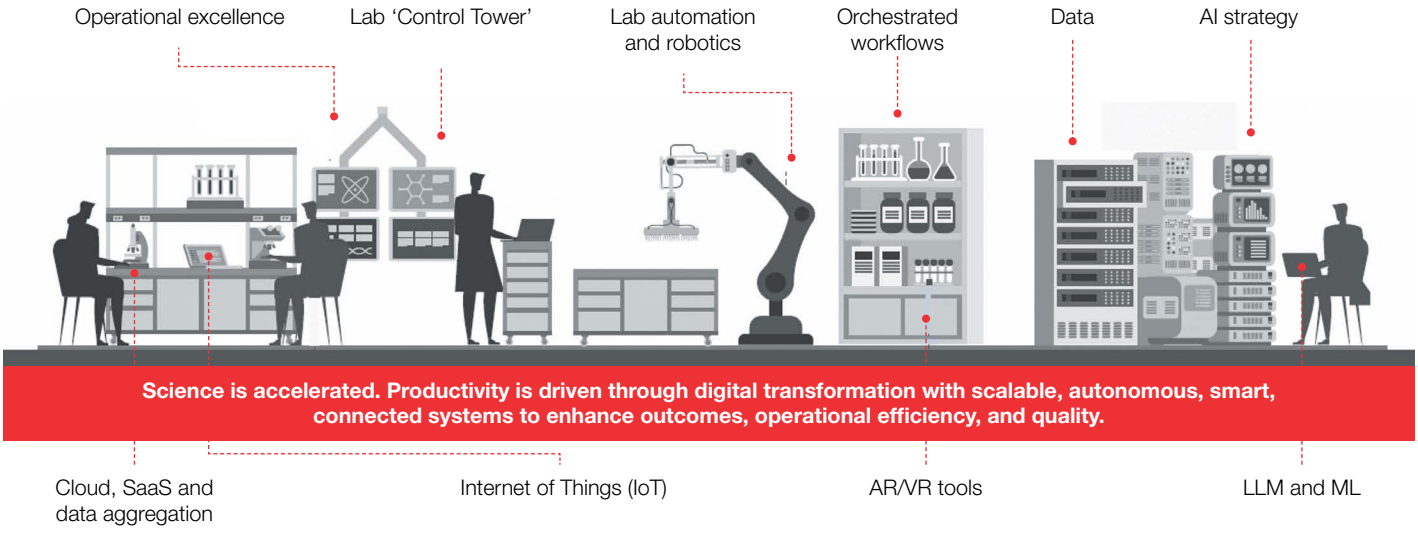
The lab of the future is cloud-powered, with SaaS platforms that scale effortlessly and ensure secure, compliant access to data from anywhere. IoT-connected instruments provide real-time monitoring and diagnostics, while augmented reality tools offer immersive support and training at the bench.

And as large language models begin to interpret complex datasets and assist in experimental design, the lab becomes not just automated—but intelligent.

This is a lab where science is accelerated.

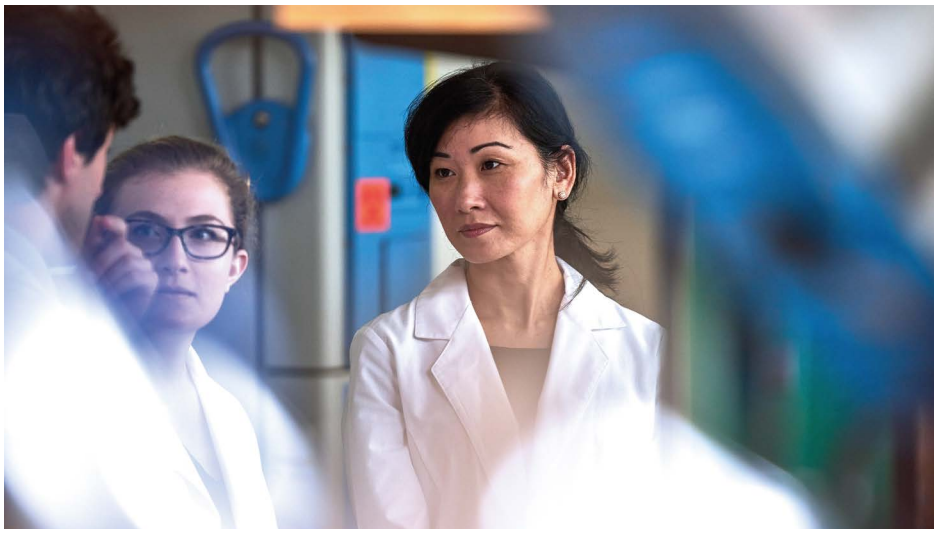
Where digital transformation drives productivity, quality, and patient outcomes. And while no single company delivers every piece of this ecosystem, Thermo Fisher is uniquely positioned to help labs navigate and realize this future—through trusted technology, deep domain expertise, and a commitment to enabling smarter science.

In this future-ready lab, Thermo Fisher sets the beat that drives your discoveries forward.



Blueprint for the modern lab leader

Strategy, data, and digital readiness



The modern laboratory is at a crossroads. As scientific complexity increases and the demand for speed intensifies, life sciences organizations are rethinking how their labs operate as part of a connected, enterprise-wide ecosystem. The shift to digital orchestration has become a present-day imperative for lab directors and digital leaders.

The remit of today's lab leaders includes finding ways to strategically accelerate discovery, streamline development, enable decentralized trials, and improve patient engagement. Thankfully, these goals can be more easily achieved thanks to advances in AI, machine learning, cloud infrastructure, and integrated data platforms. But the foundation for all of it is data—clean, structured, and interoperable.

The reality is that the biggest barrier to AI adoption isn't the algorithm—it's the data.

Without high-quality, accessible data, even the most advanced technologies fall short. That's why data readiness has become a critical focus area for digital transformation initiatives.

Naturally, leaders are increasing their investments in this space. The quest for FAIR data (Findable, Accessible, Interoperable, and Reusable) is now over a decade old, and yet still few scientific organizations will claim to have reached the end of the journey. In 2023, digital transformation budgets rose by an average of 4%, with top priorities including AI/ML, automation, cloud-native platforms, and integration technologies. New roles—such as digital transformation officers and lab informatics leads—are emerging to bridge the gap between scientific outcomes and technical execution.

A recent white paper titled "Accelerating Science, Driving Productivity," explores how digital laboratory orchestration is becoming a strategic lever to overcome these challenges. It emphasizes that success depends not only on adopting new technologies, but on ensuring data quality, system interoperability, and seamless integration across the lab landscape. Digital leaders must partner closely with their business partners and functional leaders to rapidly adopt technologies. Doing so will increase the positive business impact resulting from the investments in digital orchestration.

*Click **here** to read the white paper - Accelerating Science, Driving Productivity*

Is data the new oil?

How FAIR data principles are powering the next wave of AI in science

Scientific data is everywhere—but usable, AI-ready data? That's still rare. For many organizations, the problem isn't a lack of information—it's that the information is fragmented, inconsistent, and locked in formats no one wants to touch twice.

The FAIR data principles aren't new. But in the age of AI, they've become non-negotiable. Without them, even the most advanced models are flying blind.

> *"AI doesn't fail because the science is wrong. It fails because the data isn't ready."*
>
> ***Mark Fish,***
> *Vice President/General Manager, Digital Science & Automation Solutions, Thermo Fisher Scientific*

Every lab has it: legacy files, proprietary formats, missing metadata, and datasets that only one person knows how to interpret. Multiply that across global teams, and you've got a system that's not just inefficient—it's fragile:

- Data is often used once, then buried.
- Context is lost when researchers move on.
- Integration across platforms is a manual, error-prone process.

This isn't just a technical issue—it's a strategic risk. Without FAIR practices, organizations can't scale AI, can't reuse knowledge, and can't move fast when it matters most.

From FAIR to future-ready

Retrofitting FAIR principles is expensive. Instead, efficiencies are gained when scientists can make data FAIR from the moment it's created. That means embedding metadata, using open formats, and applying consistent vocabularies at the point of capture—not years later during a digital transformation project.

> *"Born-FAIR data doesn't just save time—it protects institutional knowledge."*
>
> *Senior Manager, Strategy & Consulting, Life Sciences, Accenture*

What FAIR looks like in practice:

- **Findable:** Unique IDs and searchable metadata.
- **Accessible:** Secure APIs, not buried folders.
- **Interoperable:** Standard formats that work across systems.
- **Reusable:** Clear context, licensing, and provenance.

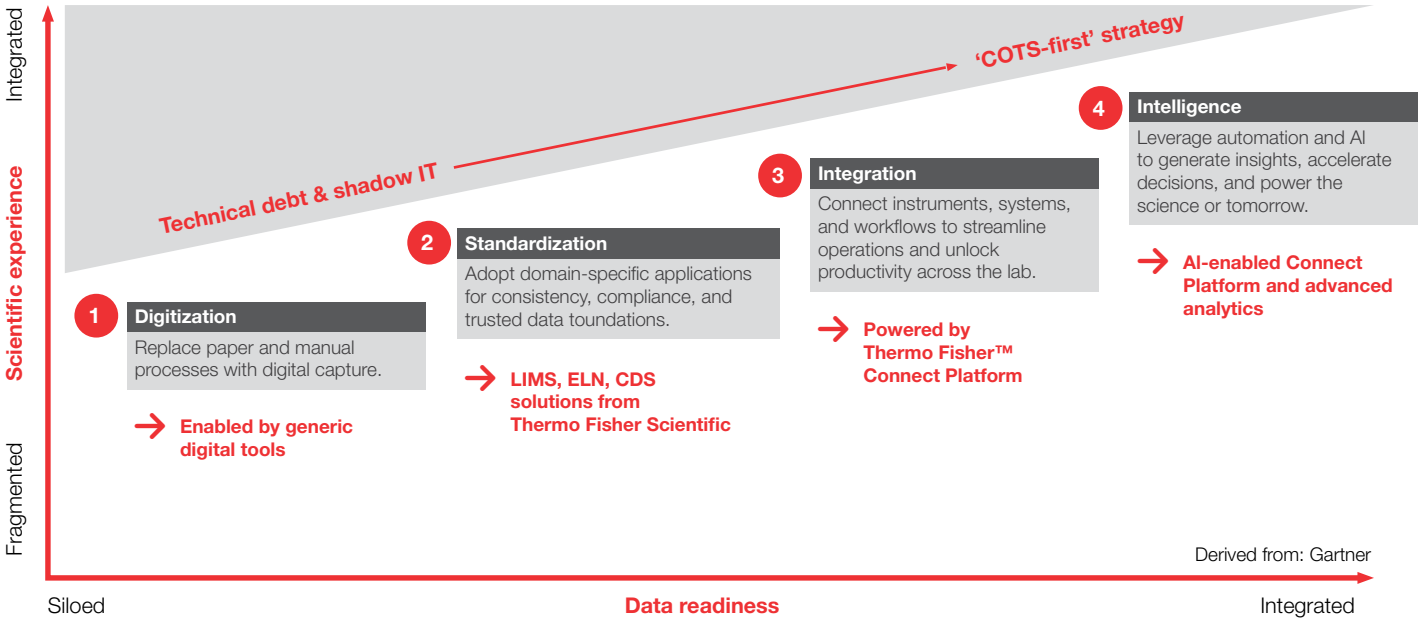
FAIR isn't just about compliance or IT hygiene, it's about building a lab that can scale, adapt, and collaborate—internally and externally. These practices will help ensure AI investments don't stall out because the data can't keep up.

> *"If data is the new oil, FAIR is the refinery."*
>
> *A Global Practice Lead in Scientific Informatics Services*

*Click **here** to read the white paper - Leveraging FAIR data for AI*

From digital ambition to automated intelligence

The lab's next leap



In pharma and life sciences, digital transformation is no longer a question of if—but how fast. Yet many labs remain stuck in a cycle of technical debt and shadow IT. They've *digitized*, yes—but they haven't truly *digitalized*. The result? A patchwork of tools, disconnected systems, and scientists spending more time managing data than making discoveries.

We take an agnostic view of the industry to help you bring new insights to action.

Across hundreds of labs, we see a clear, four-step evolution—one that moves from basic digitization to full orchestration and, ultimately, to intelligent automation. It's a journey toward what we call the **Automated Digital Lab**.

Here's how that journey unfolds.

1 Digitization—digitizing the manual

This is the starting point for most labs. Paper-based processes are replaced with digital forms, spreadsheets, and generic apps. It's a necessary first step—but it's also where technical debt begins to build. These tools weren't designed for science, and they don't scale. They live outside IT governance, creating risk and inefficiency. Still, this stage proves the value of digital documentation. It's the spark. But it's not the system.

2 Standardization—building a digital foundation

The next step is to move beyond generic tools and adopt systems purpose-built for science. This is where labs begin to implement domain-specific software—LIMS, ELNs, workflow scheduling, CDS, and eProcurement platforms.

These tools bring structure, compliance, and scientific specificity. They reduce manual handoffs, improve data integrity, and support regulated workflows. But they often remain siloed with limited integration. The burden of managing updates, hosting, and maintenance still falls on the lab.

That's why many organizations are shifting to a COTS-first strategy—commercial off-the-shelf software that's supported, scalable, and continuously improved by the vendor. They gain access to best practices, faster innovation cycles, and vendor-supported roadmaps. It's a strategic move that frees labs to focus on science, not software.

3 Integration—orchestrating the ecosystem

Once foundational systems are in place, the next challenge is integration. This is where most labs hit a wall: discrete systems don't talk to each other, data is duplicated, and scientists become the middleware. But there is hope for these pervasive issues—enter lab orchestration.

This stage is about creating a unified foundation—a platform that connects instruments, applications, and data streams. It's not just about APIs, it's about a baseboard that everything plugs into, reducing human intervention and enabling real-time coordination. Think of it as the lab's digital nervous system —making the whole greater than the sum of its parts to run a harmonious lab.

4 Intelligence—closing the loop with AI

At the peak of the digitally automated journey is the intelligent lab. Here, integration becomes intelligence. AI and machine learning are layered on top of orchestrated systems to create a self-learning loop.

This is where concepts like Lab in the Loop, DMTA (Design-Make-Test-Analyze), and DMTL (Design-Make-Test-Learn) come to life. AI models recommend experimental changes. Digital twins simulate outcomes. The system learns from every iteration—accelerating discovery and improving outcomes. It's not just automation, it's adaptation.

The Automated Digital Lab isn't a dream, it's a direction

Every lab is somewhere on this path. The key to success is to keep moving. The cost of standing still—technical debt, inefficiency, missed insights—is only growing.

The lab of the future starts with the scientist

We talk a lot about technology when we talk about the lab of the future—robotics, AI, orchestration, integration. But at the center of it all, remaining steady and persistent, is the scientist. The person at the bench and the team behind the data. Without the human insight that scientists provide, information would not turn into discovery.

Building a future-ready lab isn't just about digitizing workflows or automating instruments. It's about amplifying the **scientific experience**—removing friction, unlocking data, and giving scientists the space to do what they do best: think, test, learn, and discover.

A lab that works like scientists think

With the scientist's journey in mind, the future-state lab can't function as a collection of tools, it must be a unified ecosystem. One where instruments, software, and data systems are connected—not just technically, but intuitively. Where automation doesn't just speed things up, but makes the work feel more fluid, and AI doesn't replace decisions but enhances them.

This is what we mean by **agentic AI**—intelligence that works alongside and in service of scientists to execute discrete tasks, not above them. It recommends, learns, and adapts, and it does so in a way that respects the complexity of science and the creativity of the people doing the work.

From data silos to discovery engines

Of course, none of this works without data. But not just more data—better data: structured, secure, compliant, accessible. The kind of data that can move across systems, across teams, and across time without losing its meaning.

That's why orchestration matters. Not just as a technical layer, but as a strategic one. It's what turns a lab into a data-driven hub of discovery—where every experiment feeds the next, and every insight is built on a foundation of integrity and interoperability.

The real transformation is cultural

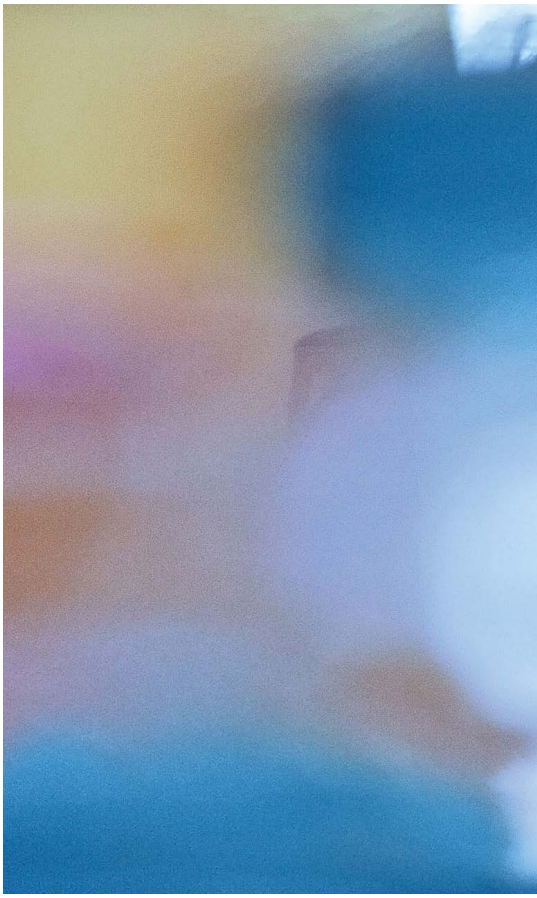
Technology can only take you so far; the real shift happens when scientists trust the systems they use. When they stop spending hours formatting data or troubleshooting integrations. When they feel empowered, not encumbered, by the digital tools around them.

That's the lab of the future—not just faster and smarter, but more human, focused, and free.

Because in the end, it's not about the tech. It's about your science, your people, and the breakthroughs they're here to make.

The lab OS

Rewriting the operating model for pharma R&D



By Richard Milne –
Vice President, Digital Customer Experience, Thermo Fisher Scientific

The molecule-to-medicine lab is at a breaking point

Across the pharma value chain, the lab is under strain. The shift from small molecules to biologics, RNA, and cell and gene therapies has introduced new complexity. Instruments are more specialized, data is more voluminous, and workflows are increasingly cross-functional and global.

Yet in many labs, scientists still manually extract data from instruments, reformat it in Excel, and upload it to siloed systems. One R&D leader described it plainly: "We're trying to do in-silico experimentation, but we're still struggling to get clean data out of our instruments."

This isn't just inefficient—it's a bottleneck to innovation. Without structured, contextualized data, AI models can't be trained. Without automation, workflows can't scale. And without orchestration, labs can't move at the speed of science.

Speed is the metric that matters

In every conversation we've had with pharma leaders, one priority rises above all others: speed to molecule. Not cost savings. Not headcount reduction. Speed.

Whether it's accelerating early discovery or compressing development timelines, the ability to move faster—without compromising quality—is the defining advantage. As one executive put it: "If we can bring a $1B drug to market one year earlier, that's huge value. Money is not the issue—vision is."

A Lab OS delivers that speed by

- Automating routine tasks to reduce manual handoffs and human error.
- Standardizing data capture across instruments, sites, and modalities.
- Integrating procurement and inventory to eliminate delays and stockouts.
- Providing real-time visibility into lab operations and experiment status.

It's not about replacing scientists. It's about giving them the tools to do more science, faster.

The wet lab is the logical starting point

While the Lab OS vision spans the full R&D lifecycle, the most immediate opportunity lies in the wet lab. This is where data is generated—and where most of the friction lives.

Instrument integration remains a persistent challenge. Labs often run dozens of instruments from multiple vendors, each with its own data format and interface. A Lab OS acts as a unifying layer, capturing data directly from instruments, contextualizing it, and making it ready for analysis—without manual intervention.

This is also where Thermo Fisher is uniquely positioned to lead. Our deep expertise in instruments, reagents, and procurement gives us a trusted foundation to build from. And our customers are telling us: start here.

Implementation must be modular, not monolithic

No pharma company is starting from zero. Every lab has existing systems, workflows, and investments. That's why a Lab OS must be flexible enough to work with what's already in place.

The most effective approach? Start with a pilot. Focus on a single site or workflow. Prove the value. Then scale.

This isn't just a technical strategy—it's an organizational one. Pilots reduce risk, accelerate buy-in, and create internal champions who can drive broader adoption. In fact, most pharma leaders we've spoken with estimate a pilot budget around $1M, with full-scale implementations ranging into the tens of millions over multiple years.

The Lab OS is an operating model for the future

The Lab OS is not a product, it's a new way of thinking about lab operations—as a coordinated, data-driven system rather than a collection of disconnected tools.

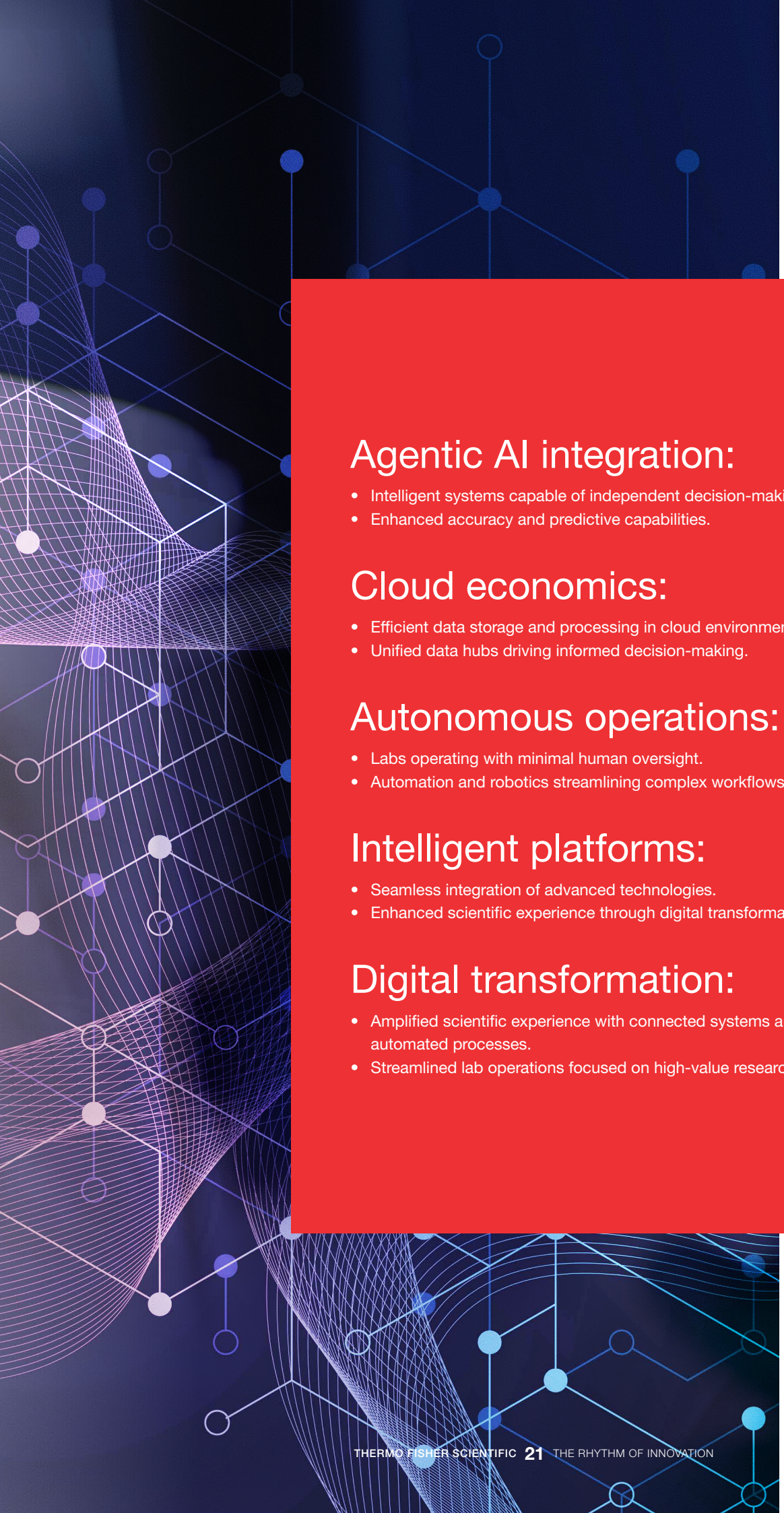
It's about enabling scientists to focus on discovery instead of data wrangling, turning lab data into a strategic asset, and building a lab that's not just digital—but intelligent, scalable, and resilient.

In a world where the first to file often wins, the Lab OS isn't a luxury. It's the infrastructure for competitive advantage.

Future forward

What’s next for the digital lab?

The future of laboratory science is shaped by intelligent platforms, autonomous operations, and cloud-native infrastructure. Thermo Fisher Scientific is investing in technologies that enable labs to operate with greater accuracy, scalability, and sustainability. Emerging capabilities like agentic AI and digital twins will further enhance scientific discovery and operational efficiency.



Agentic AI integration:

- Intelligent systems capable of independent decision-making.
- Enhanced accuracy and predictive capabilities.

Cloud economics:

- Efficient data storage and processing in cloud environments.
- Unified data hubs driving informed decision-making.

Autonomous operations:

- Labs operating with minimal human oversight.
- Automation and robotics streamlining complex workflows.

Intelligent platforms:

- Seamless integration of advanced technologies.
- Enhanced scientific experience through digital transformation.

Digital transformation:

- Amplified scientific experience with connected systems and automated processes.
- Streamlined lab operations focused on high-value research.

Innovation spotlight:

The complete lab transformation

Obstacles to digitalization

1 Integration

- High **variability** of instruments and systems across vendors, versions, technologies.
- Complex **network** infrastructure with different levels of security, policies and access.
- Growing net of **tightly coupled integrations** that accumulate technical debt.

2 Ingestion

- Lack of universal **ontology** that represents a diverse set of modalities.
- **Rigid** data models that quickly become obsolete and get mis-used.
- Embedded **custom code** that cause dependencies and inhibit upgradeability.

3 Storage

- Full context of the data can be across **multiple modalities** and formats.
- Data is not **findable or accessible** to consumers of the data (persons and systems).

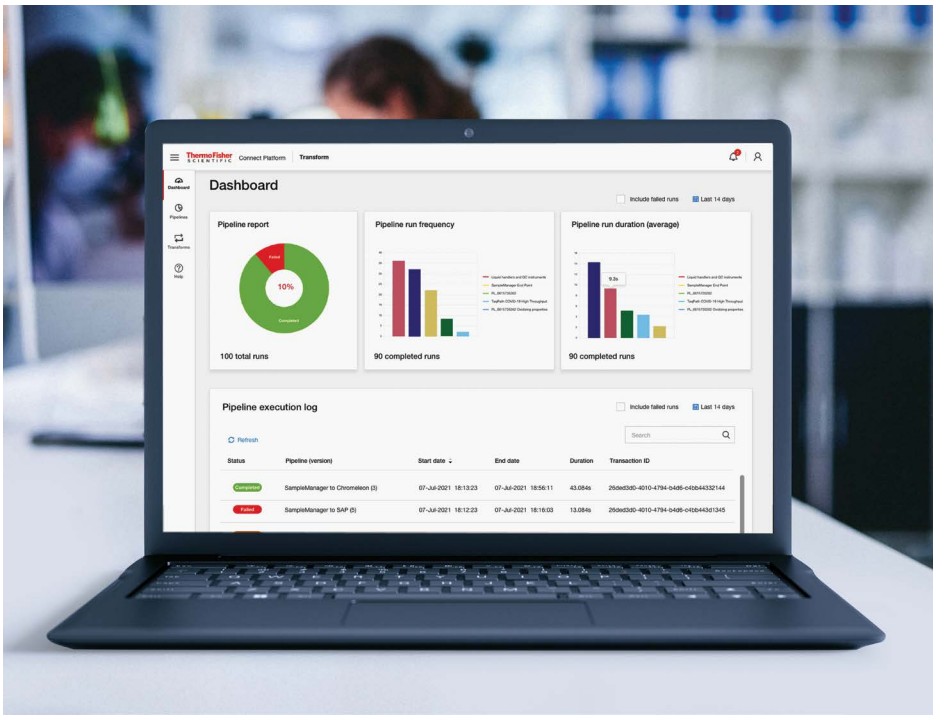
4 Logic

- Highly dependent on **human intervention** for repetitive and low-value activities.
- **Fragmented understanding** of the broader business processes, the big picture.

5 Interface

- **Highly variable experiences** result in constant context switching.
- Steep **training curves** result in product-aligned specialists and high onboarding and switching costs.
- Strong **functional divides** in system knowledge,

Thermo Fisher's strategic approach, expertise, and scale to effectively address needs for the Lab OS.



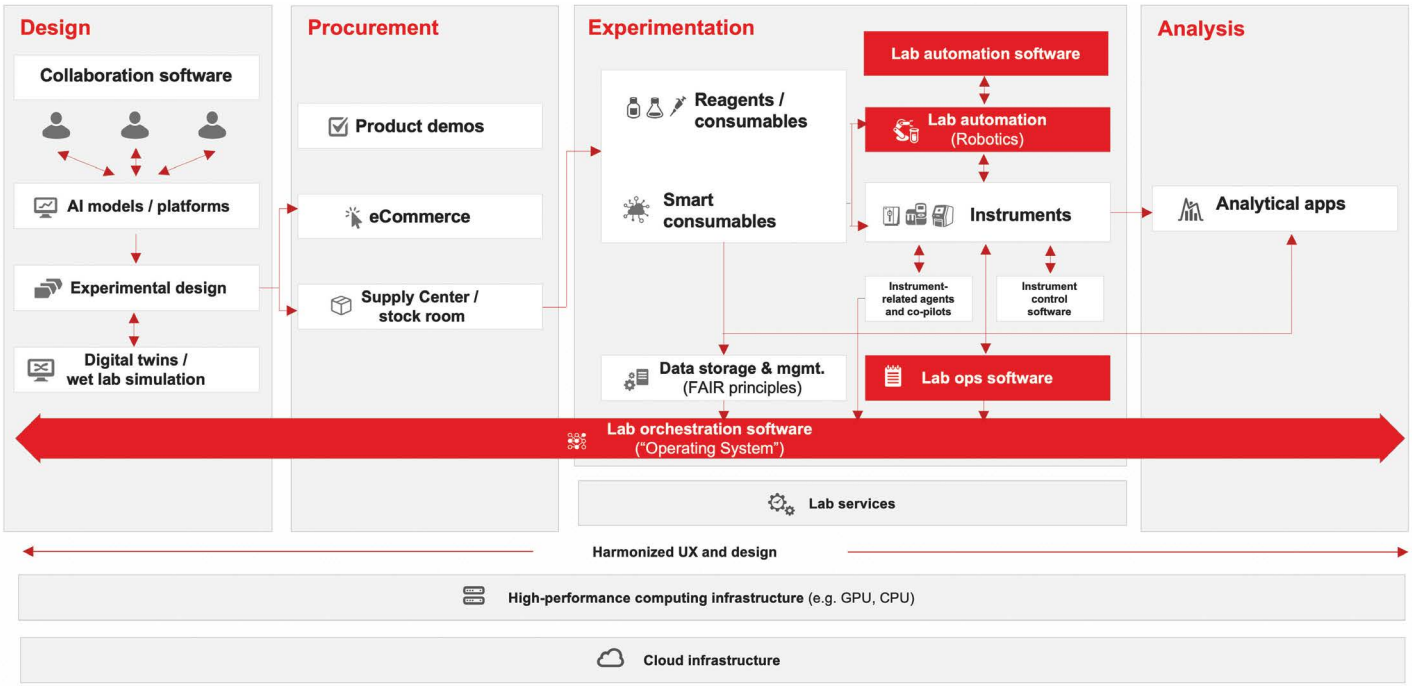
Scientific labs today are managing more complexity than ever—more data, more systems, and more pressure to deliver results faster. What's often missing isn't capability, but connectivity.

That's where the Connect Platform comes in.

Developed by Thermo Fisher Scientific's Digital Science and Automation Solutions team, Thermo Fisher™ Connect Platform, Enterprise Edition is a vendor-agnostic integration platform designed to bring structure to complexity. It connects instruments, systems, and data across the lab, creating a unified environment where workflows are streamlined, insights are accelerated, and operations scale with confidence.

At its core, the Connect Platform ingests and harmonizes data from across the lab ecosystem—normalizing formats, eliminating silos, and enabling real-time access and analysis. It's built to reduce friction, automate routine tasks, and ensure that information flows seamlessly from experiment to decision.

What sets it apart is its embedded intelligence. AI capabilities are integrated throughout the platform, supporting anomaly detection, resource optimization, digital twin simulations, and review-by-exception workflows. It's not just automation—it's intelligent automation, designed to adapt and evolve with the needs of modern science.



The Connect Platform supports the full drug discovery lifecycle, integrating dry-wet-dry lab workflows and connecting experimental design, lab automation, analytics, and procurement. With support for robotics, smart consumables, and FAIR-compliant data storage, it's built for labs that need to move fast without compromising quality or compliance.

For teams looking to modernize without disruption, Connect offers a practical, scalable path forward—one that turns digital complexity into operational clarity.

Case study

The lab of the future: seamless automation in scientific innovation

Exploring forward-thinking approaches as seen through a Thermo Fisher collaboration

A groundbreaking collaboration between Thermo Fisher Scientific and one of the top five largest pharmaceutical companies showcases the transformative power of modern lab automation. This pioneering project demonstrates how addressing critical industry challenges with innovative solutions can revolutionize the scientific landscape.

The company encountered significant obstacles during their vaccine trials, revealing several critical issues: handling an explosive 24-fold growth in sample volumes, synchronizing multiple systems, managing workload with limited staff, and overcoming inefficiencies caused by manual handling before automation could begin. These challenges called for a robust solution that could streamline operations and enhance productivity.

To optimize their laboratory processes, the company introduced the Thermo Fisher™ Connect Platform, an orchestrating, integrated lab solution. By incorporating high-throughput screening automation with advanced tools such as the Orbitor RS2 Microplate Mover, Spinnaker Microplate Robot, and Autonomous Mobile Robots (AMRs), the solution helped optimize and manage workflows more efficiently. The platform also featured a Control Center Interface, offering operational dashboards and real-time analytics for precise process management and timely intervention. Importantly, it ensured consistency and compliance within a Good Practice (GXP) environment, essential for regulated lab operations.

The collaboration led to several transformative outcomes for laboratory operations. Enhanced data scalability improved the management and processing of large data volumes, while significant reductions in manual interventions boosted efficiency. Moreover, the accelerated generation of actionable insights facilitated quicker decision-making, driving better research outcomes.

"Progress in automation has to be thoughtful, ensuring that manual tasks are not just automated but reimagined with an automation-first mindset," said a spokesperson for the company. "Utilizing data not as exhaust of our scientific assays but as the fuel that drives our progress, we envision a factory-like mindset where our product is data."

The transition from traditional laboratories to fully integrated digital ecosystems is already in motion. Thermo Fisher and the company's collaboration is a testament to how automation and digital integration can redefine scientific operations. The lab of the future is not just about faster processes; it's about creating smarter, more efficient systems that redefine the possibilities of scientific research.

The challenge:

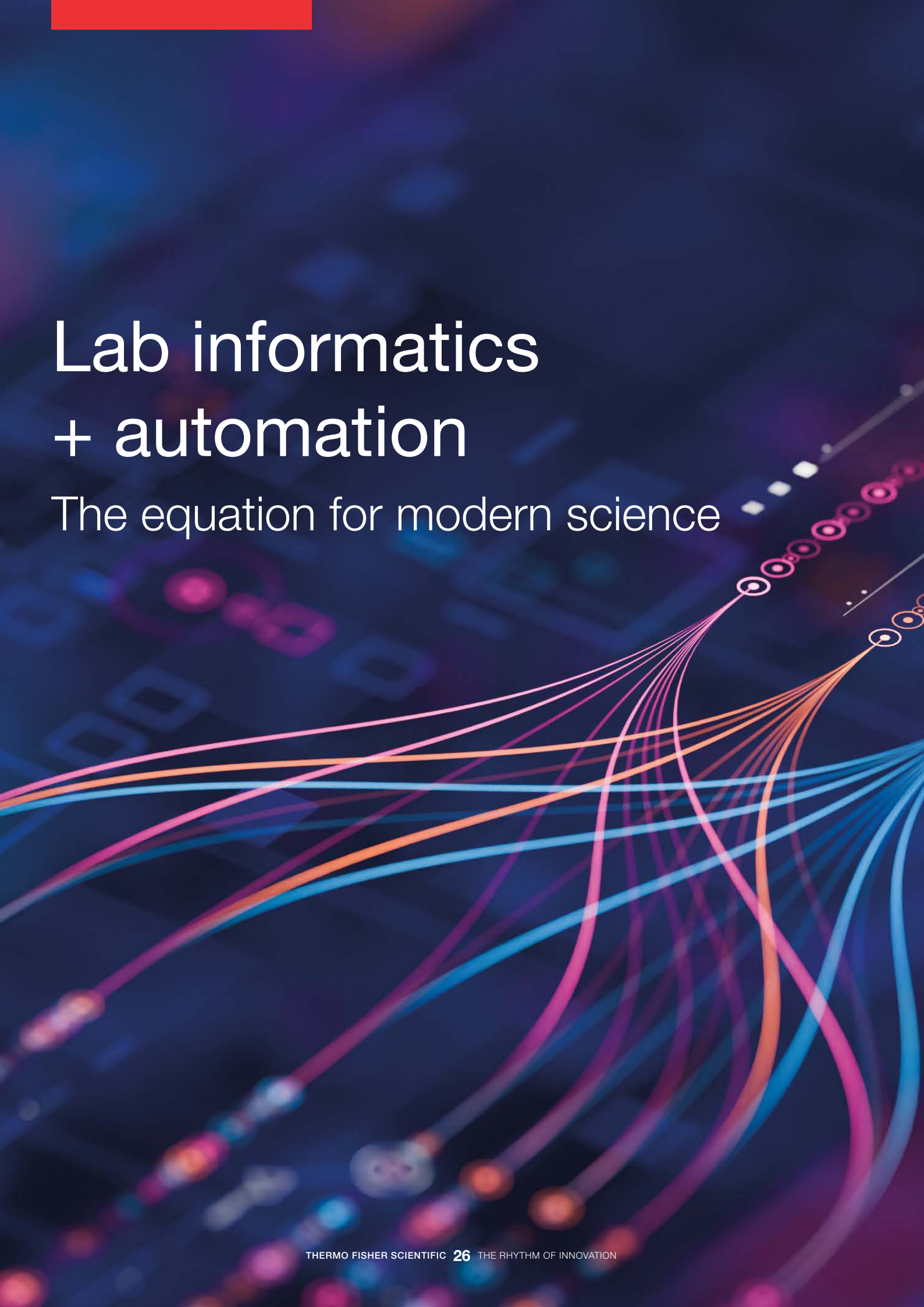
- **24x sample volume increase:** Handling unprecedented growth in sample volumes.
- **Complex logistics:** Synchronizing multiple systems and processes.
- **Limited staff capacity:** Managing increasing workloads with existing human resources.
- **Manual pre-work bottlenecks:** Inefficiencies before automation was implemented.

The solution:

- **Connect Platform:** Thermo Fisher's orchestration system for streamlined workflow management.
- **High-throughput screening automation:** Integration of advanced robotics and automated systems like Orbitor RS2 Microplate Mover and Spinnaker Microplate Robot.
- **Control center interface:** Real-time analytics and operational dashboards for effective process management.
- **End-to-end workflow automation:** Ensuring consistency and compliance in regulated (GXP) environments.

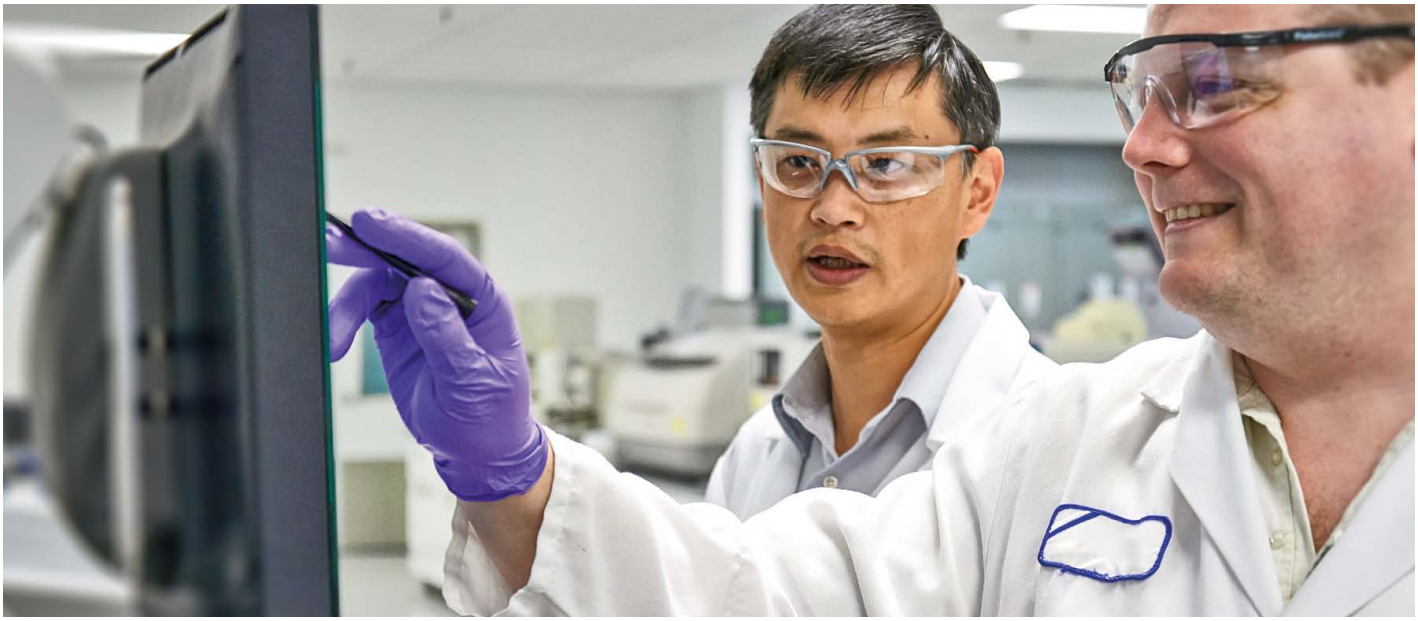
Key outcomes:

- **Enhanced data scalability:** Improved management and processing of large data volumes.
- **Reduced manual work:** Significant reduction in manual interventions, boosting efficiency.
- **Faster insights:** Accelerated generation of actionable insights, enhancing decision-making speed and quality.



Lab informatics + automation

The equation for modern science



In today's labs, the challenge isn't whether to modernize—it's how to do it in a way that actually accelerates science. That's where the convergence of Informatics and automation comes in. Not as buzzwords, but as a practical framework for building labs that are faster, smarter, and more resilient.

At its core, this isn't about replacing scientists. It's about removing the barriers that slow them down.

The case for convergence

Automation alone can move samples. Informatics alone can manage data. But when the two are integrated—when robotic systems, scheduling software, and data platforms work in concert—labs gain something more powerful: **momentum**.

That's the idea behind our approach. By combining decades of automation expertise with advanced Informatics, we help labs move from isolated tools to orchestrated systems. The result is a lab that doesn't just run—it learns, adapts, and scales.

What this looks like in practice:

- Robotic movers handle repetitive tasks with speed and consistency, freeing scientists to focus on analysis and design.
- Automated incubators ensure environmental precision and reproducibility across experiments.
- Lab orchestration platforms coordinate instruments, workflows, and data streams in real time.
- Informatics solutions—from LIMS and ELNs to workflow scheduling and chromatography data systems—ensure that data is captured, contextualized, and ready for decision-making.
- Collaborative platforms support multi-user, multi-experiment environments, enabling teams to work in parallel without conflict.
- Cloud-based tools provide scalability, remote access, and integration with AI and analytics platforms.

Together, these technologies form a connected ecosystem—one that reduces manual handoffs, improves data integrity, and accelerates the path from experiment to insight.

Why it matters now

As labs face increasing pressure to deliver results faster and more cost-effectively, the old model—fragmented systems, manual processes, siloed data—just doesn't hold up. Informatics + automation isn't a luxury. It's a requirement for labs that want to stay competitive, compliant, and capable of scaling innovation.

And with over 30 years of experience guiding digital transformation in regulated environments, Thermo Fisher Scientific brings more than just tools, we bring a roadmap.

Designing the digitally native lab

A strategic shift in pharma R&D

The modern pharmaceutical lab is under pressure—not from a lack of innovation, but from the complexity of managing it. As scientific workflows grow more intricate and data volumes expand, the traditional lab model—built around manual processes and siloed systems—struggles to keep pace. Integrated automation and digital solutions are not about replacing scientists; they're about redesigning the lab to work at the speed and scale of contemporary science.

Where manual meets its limits

Even in labs that have adopted digital tools, many processes remain tethered to manual execution. Sample handling, experiment scheduling, and data capture often rely on human input, introducing variability and limiting throughput. These constraints aren't just operational—they affect reproducibility, regulatory readiness, and ultimately, time to decision.

Automation systems address this by removing friction at the execution layer. Robotic platforms handle microplates, reagents, and incubation with precision and consistency. Autonomous mobile robots manage intra-lab logistics. These systems are modular and configurable, designed to adapt to the specific needs of each lab rather than impose a rigid structure.

Software that understands scientific workflows

Automation without orchestration is just machinery. What differentiates our approach is the integration of intelligent

Tools to accelerate science and drive productivity

software that understands the logic of scientific workflows. Tools like Thermo Scientifc™ Momentum™ Workflow Scheduling Software and Thermo Scientific™ SampleManager™ LIMS don't just digitize—they coordinate, like a steady base beat upon which your lab can rely and build from.

These platforms allow labs to define complex workflows, allocate resources dynamically, and monitor execution in real time. They support compliance with 21 CFR Part 11 and other regulatory frameworks, while also enabling seamless integration with instruments, data systems, and enterprise platforms. The result is not just efficiency—it's operational clarity.

Scaling science without scaling complexity

One of the most persistent challenges in pharma R&D is scaling operations without introducing new layers of complexity. Our automation and digital platforms are designed to scale horizontally—across teams, sites, and modalities—without fragmenting data or workflows.

This is particularly valuable in high-throughput environments, where the ability to run experiments continuously and reliably can compress timelines and reduce cost per data point. It also supports strategic initiatives like global harmonization, digital twin modeling, and AI-driven discovery.

Collaboration as infrastructure

Scientific collaboration is no longer a soft skill—it's a structural requirement. Advanced digital platforms are built to support distributed teams, shared data environments, and coordinated workflows. Thermo Fisher™ Connect Platform Enterprise Edition, for example, provides a secure, cloud-based backbone for integrating instruments, applications, and analytics across the R&D lifecycle.

This infrastructure enables real-time visibility into lab operations, supports data normalization across modalities, and provides a foundation for predictive analytics and machine learning. It's not just about sharing data—it's about aligning teams around a common operational model.

A platform for scientific precision and strategic agility

Our portfolio is not a collection of tools—it's a system architecture for the modern lab. By integrating automation, informatics, and orchestration, it enables labs to operate with greater precision, responsiveness, and insight.

For pharma leaders, the value is tangible: reduced variability, faster cycle times, improved compliance, and a lab environment that can evolve with the science. In an industry where every decision carries scientific, regulatory, and commercial weight, that kind of agility is not a luxury—it's a necessity.

The keys to future-proofing your lab

A trusted partner & thoughtful strategy

Pharmaceutical and life sciences organizations are optimistic about technology and automation's ability to accelerate scientific research and drive productivity. Manual, time-consuming processes are being replaced by smart, streamlined, and deeply integrated solutions.

Advancement of the laboratory IT environment has become essential, but without a clear path forward, labs suffer from wasted investment and missed opportunity. Scaling with purpose requires an enduring approach.

The right strategy and partner can ensure labs are setting measurable goals, integrating the right data, complying with regulatory frameworks and centering their scientists as they go—critical aspects of the digital transformation journey.

Our vision at Thermo Fisher Scientific is to co-create tailored solutions that empower scientists with a future-ready lab. One where digital transformation leads to scalable, autonomous, smart, connected systems to enhance patient outcomes, operational efficiency, and quality. To help actualize that goal, we offer deep expertise and a long-term commitment to deliver future-proof solutions—grounded in clear goals, shared accountability, and a focus on outcomes.

The Automated Digital Lab, built on seamlessly connected automation, intelligent software systems, and solutions that scale at the speed of your science, is closer than ever before, and new possibilities continue to emerge at a rapid pace. From mobilization through scale-up and production, now is the time to future-proof your organization for continuous innovation. Are you ready to set the rhythm of change, rather than simply keeping pace?

Reimagine your experience and discover how our digital science and lab automation solutions can provide a steady, intelligent beat that underpins future breakthroughs. It's time to unlock new possibilities in your research.

Transform your lab with digital science and lab automation solutions.

Be the scientist who redefines what's possible

2,500+ deployments | Global support | Innovation at scale

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