The Digital Chemical Lab

Top Performers Digitalizing Their Chemical Laboratories
Table of Contents

Executive Overview ................................................................. 3
Chemical Companies Face Multiple Business Challenges .......... 4
Operational Challenges in the Lab Make Improvement Hard ....... 5
Why Digitalize? The Status Quo Won't Scale .......................... 6
What's Driving Chemical Companies Digital? ......................... 7
Digitalization in the Lab – When, not If ................................ 8
Digitalization Falters beyond the Lab ................................. 9
Identifying the Top Performers .......................................... 10
Top Performers Have Better Capabilities for R&D and the Lab .. 11
Top Performers are More Digitalized .................................... 12
Prerequisites for the Digital Chemical Lab ............................. 14
Digital Chemical Lab Basics ............................................... 15
Digital Best Practices for the Chemical Lab ........................... 18
Enabling Technology for the Digital Chemical Lab ............... 20
Enabling the Digital Chemical Lab with a Solution Platform .... 22
Conclusion ........................................................................... 23
Recommendations ............................................................... 24
About the Author ................................................................. 24
About the Research ............................................................. 25
Executive Overview

Chemical companies rely on R&D and their laboratories to innovate so they can compete in increasingly crowded, global markets. In fact, innovation emerged as the most common problem in our recent chemical industry survey, with one-half of respondents citing it as their top business challenge (Figure 1). Of course, chemical companies face a host of shared challenges that they must address, including managing costs, capturing global markets, and driving sustainability.

Chemical companies also report related, operational challenges in the lab (Figure 2) that likely contribute to their business challenges and make change difficult. These challenges include research productivity, inability to find data, difficulty with new product development, traceability, and more.

Digitalization can help address these challenges by driving innovation, agility, customer-centricity, and quality. We surveyed over 170 chemical companies to understand their intent, status, and outcomes related to digitalizing the chemical laboratory. We used the survey to analyze digital best practices to see which correlate with higher performance and help companies meet their business objectives. Our key findings include:

- Most chemical companies have started to adopt digitalization
- Digital transformation is further along in the lab than beyond the lab
- Chemical companies report varied levels of digital maturity

The leaders exhibit higher digital maturity than other companies.

We identified the industry’s Top Performers, those with better revenue growth, margin expansion, innovation, and time-to-market performance, to understand their digital practices. We found that these leaders exhibit higher digital maturity than other companies, particularly in more advanced capabilities like chemical simulation and knowledge management. They also report much better operational capabilities in the lab. How do Top Performers reach these higher levels of performance? Top Performers:

- Are more digital in the chemical laboratory
- Have invested in more digital lab best practices
- Use more specialty scientific software
- Value a platform approach to integrate and support the digital enterprise

These findings help us understand what Top Performers do differently to achieve their higher levels of success. They also serve as a model for chemical companies looking to improve innovation and overcome challenges – and most importantly drive better business results. Let’s take a look at what we learned.
Chemical Companies Face Multiple Business Challenges

Survey responses show that the chemical industry faces a variety of business challenges. Chemical companies must continuously innovate and manage cost to differentiate and remain competitive. They compete on a global scale, while also having to meet the needs of very specific markets.

The chemical industry has to contend with complex corporate responsibility demands at the same time they struggle with innovation and cost. Surveyed companies indicate that they face increased demand for sustainable practices, the need to reduce energy consumption, and complex regulatory demands and reporting mandates.

The demand for innovation is reflected in many of the challenges reported by today’s chemical companies. Survey results indicate that they need to develop more customer-centric products, performance materials, and products for specialized applications. These all place demands on innovation capacity, as does the continuous pressure to reduce cost.

![Figure 1: Business Challenges Facing the Chemical Industry](image)

Certain chemical segments, including adhesives / sealants, bulk petrochemical, and specialty polymers, find innovation especially challenging. In those segments, over two-
thirds of respondents report innovation is a major challenge. Smaller companies, those making less than $250 million in revenue per year, compete on agility and were even more likely to struggle with innovation. But larger companies face their own challenges: companies making greater than $1 billion per year more frequently report cost and energy reduction pressures as their top challenges, and those making greater than $5 billion per year also tend to struggle with regional competition, sustainability, and talent acquisition / attrition. Let’s learn how chemical companies are addressing these challenges.

**Operational Challenges in the Lab Make Improvement Hard**

Chemical companies striving to overcome business challenges like innovation and cost control are hindered by operational challenges in the lab. In fact, these challenges likely are the source of these issues in the first place. The most commonly reported challenge in the lab is poor research productivity (Figure 2). It’s clear to see how poor research efficiency in the lab can hamper innovation and drive up cost.

*It’s hard to innovate and control costs when you can’t leverage past investments and experimentation because you can’t find and reuse results.*

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Productivity</td>
<td>42%</td>
</tr>
<tr>
<td>Searching for Data</td>
<td>40%</td>
</tr>
<tr>
<td>New Product Development</td>
<td>38%</td>
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<tr>
<td>Product Traceability</td>
<td>37%</td>
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<tr>
<td>Developing Operational Analytics</td>
<td>30%</td>
</tr>
<tr>
<td>Reusing Data</td>
<td>28%</td>
</tr>
<tr>
<td>Commercialization Speed</td>
<td>26%</td>
</tr>
<tr>
<td>Accessing Data Globally</td>
<td>24%</td>
</tr>
</tbody>
</table>

*Figure 2: Operational Challenges Facing the Chemical Industry*

Another challenge respondents identify is difficulty searching for data, which is one of the most significant contributors to non-value-added work we find across industries. Responding companies report that reuse is also a challenge. Again, there’s a clear connection with the business challenges: it’s hard to innovate and control costs when you
can’t leverage past investments and experimentation because you can’t find and reuse results.

Beyond innovation, chemical companies struggle with translating their research into profitable products, reporting challenges in both managing New Product Development (NPD) and time to commercialize products. In fact, companies greater than $1 billion have more trouble managing NPD than smaller companies and those greater than $5 billion report it as an even greater operational challenge, as reported by two-thirds of these largest companies.

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**Digitalization is well suited to alleviate these problems by accelerating the pace of innovation, increasing agility, and improving efficiency.**

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Chemical companies need to improve their operational capabilities to improve innovation, address cost, and contend with external pressures facing the business. As we’ll see, digitalization is well suited to alleviate these problems by accelerating the pace of innovation, increasing agility, and improving efficiency.

**Why Digitalize? The Status Quo Won’t Scale**

Digitalization is being adopted across industries in order to address the very issues chemical companies are suffering from. Our research shows that manufacturers adopting digitalization are gaining advantages in multiple dimensions, improving:

- Innovation
- Agility
- Speed
- Productivity
- Customer-centric Product Design
- Quality

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**Manufacturers adopting digitalization are gaining advantages in multiple dimensions.**

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These strategic benefits can dramatically change the competitive stature of a chemical company. Most companies, however, can justify their investment in digitalization based on productivity improvement alone. There’s simply too much inefficiency and burden on technical resources in the lab, as seen in other industries (Figure 3). But the real reason to digitalize is much more profound. We believe digitalization will change the market landscape across industries. We predict that those companies that adopt the digital
enterprise will gain a significant advantage and gain market share over competitors that fail to embrace digitalization.

![Figure 3: Non-Value-Added Work for Technical Resources]

Source: Reducing NVA in Engineering, Tech-Clarity

What’s Driving Chemical Companies Digital?

Given the range of potential advantages, what are the major factors leading chemical companies to pursue digitalization? There are a variety of drivers, many reported by about one-half of respondents (Figure 4).

The reasons chemical companies are seeking digitalization can be broken into several key themes:

- Improving efficiency and reducing direct costs
- Increasing sustainability
- Innovating faster and with more customer-centricity

Companies with revenue greater than $5 billion report a greater number of reasons they’re pursuing digitalization, with over three-quarters prioritizing efficiency and time to market and about two-thirds seeking to accelerate innovation and improve customer-centricity. Interestingly, the smallest and largest companies are the ones that most frequently report cost reduction as a driver.
Figure 4: Digitalization Drivers in the Chemical Industry

**Digitalization in the Lab – When, not If**

What steps are chemical companies taking to digitalize the chemical lab? Given the advantages, it’s not surprising to see that most have at least some digital processes (Figure 5). In fact, about one-third say they have “mostly” digital processes in the lab. Only a very small percentage report that they are fully digitalized, and an even smaller number say they don’t have plans to digitalize.

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**The digital transformation of the chemical laboratory has begun, although companies report a variety of stages of adoption.**

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The digital transformation of the chemical laboratory has begun, although companies report a variety of stages of adoption. We believe that digitalization will be the way chemical companies compete into the future, both within the laboratory and as overall businesses.

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**Digitalization will be the way chemical companies compete into the future.**
Digitalization Falters beyond the Lab

Digitalization is not limited to the laboratory. Companies are transitioning to digital enterprises because it can impact everything from customer relationships to plant productivity. This survey, however, shows that digitalization appears to diminish quickly when looking at how it carries beyond the lab (Figure 6).

**Digitalization appears to diminish quickly when looking at how it carries beyond the lab.**

Beyond the lab, no companies claim to be a "fully digital business" and only a relatively small number say they are “mostly” digital. It appears, however, that progress is underway. Over three-quarters of responding companies either have some digital processes or are developing plans to digitalize beyond the lab. This is critical given that while the challenges reported are influenced by the lab, companies must also integrate and collaborate with many others to truly overcome them.

**Chemical companies looking to improve innovation and control cost can start with the lab and build out to the rest of the enterprise.**

Digitalization in the lab can be a standalone improvement effort or a complementary project to a broader digital enterprise initiative. Chemical companies looking to improve innovation and control cost can start with the lab and build out to the rest of the enterprise through innovation and NPD. Alternatively, they can improve both simultaneously,
recognizing that improvements in the chemical lab can have a big impact on R&D, innovation performance, and the bottom line.

![Figure 6: Digitalization Within and Beyond the Chemical Lab](image)

**Identifying the Top Performers**

This study uses a benchmarking process to evaluate the benefits of digitalization in the chemical laboratory. In order to help understand what processes and technology are correlated with higher performance, we use a process we call “Performance Banding.”

Researchers collected business performance metrics that result from successful digital transformation. We evaluated four criteria that reflect chemical company success and profitability:

- Revenue growth (over the last 3 years)
- Margin growth (over the last 3 years)
- % Product <5 years old (to measure innovation)
- Time to Market

We identified the top 25% performing respondents as “Top Performers.”

We created an aggregate metric across these and identified the top 25% performing respondents as “Top Performers.” The rest with lower performance in these metrics were designated as “Others.” Then, we analyzed what the Top Performers do differently in order to make recommendations on which processes and technologies are associated with higher levels of performance.
Top Performers Have Better Capabilities for R&D and the Lab

Top Performers, those identified as having superior business performance, were analyzed to determine how operational performance in R&D and the lab relates to business performance. The survey finds that the Top Performers are consistently more likely to report they are "extremely effective" at operational capabilities in R&D and the lab (Figure 7). This leads us to conclude that better R&D / Laboratory performance leads to better business performance.

Better R&D / Laboratory performance leads to better business performance.

It’s interesting that the biggest difference between Top Performers and Others was their ability to respond to customers. Some of the key values of digitalization are the ability to identify customer needs and respond in an agile way to meet them.

Figure 7: Relative Operational Performance by Performance Class

* Managing / Reusing Chemical Knowledge performance is based on “very effective” performance in the chart as opposed to “extremely effective” like the others because many companies, including the Top Performers, report they are extremely effective at reusing chemical knowledge.
Top Performers are More Digitalized

What are Top Performers doing to achieve better operational capabilities and business performance? This survey shows that Top Performers are more digital in the chemical laboratory. Specifically, they are more than three times as likely to be “fully digital” in the Lab than Others (Figure 8). Although the majority of them are not yet fully digital, over one-half of Top Performers report they have at least "mostly" digital processes.

Top Performers are more than three times as likely to be “fully digital” in the Lab than Others.

Top Performers’ digital maturity isn’t limited to the laboratory. Top Performers are also twice as likely to have "Mostly Digital" processes beyond the lab than Others. But there is still room for improvement, even in the Top Performers. The remainder of this research analyzes the digital capabilities that companies leverage in the laboratory to gain a more detailed understanding of digitalization progress and provide actionable improvement opportunities.

Top Performers are also twice as likely to have "Mostly Digital" processes beyond the lab than Others.

![Figure 8: Digitalization Within and Beyond the Chemical Lab by Performance Class](image)

Figure 8: Digitalization Within and Beyond the Chemical Lab by Performance Class
Identifying Best Practices for the Digital Chemical Lab

What does it actually mean for a Top Performer to be more digitalized in the chemical lab? We analyzed digital practices for chemical labs to see which process and technology approaches the Top Performers have adopted more commonly than their lesser-performing competitors. The findings indicate that practices appear to fall into several levels of maturity (Figure 9).

We analyzed digital practices for chemical labs to see which process and technology approaches the Top Performers have adopted more commonly than their lesser-performing competitors.

The first collection of practices is relatively common to all companies. These are fundamental needs, which we labeled “prerequisites.” Many companies have implemented these. The next level of practices is the “basics.” These are capabilities that start to provide more value on their own. Top Performers are more likely to have adopted these, and they appear to create a foundation for their more advanced practices. Finally, we identified some “best practices” – digital processes that drive competitive advantages. These are more advanced practices that are significantly more prominent in the Top Performers than Others.

Figure 9: Digital Practice Maturity

You could potentially view these three levels of maturity as a maturity model and expect that Top Performers have extended from the prerequisites all the way through the best practices. That’s not necessarily the case. While the fundamentals are important and set the foundation for more value, in some cases the Best Practices can be implemented and
provide value on their own, although they are likely better with the underlying practices in place. We’ll explore practices in each of these levels further.

Prerequisites for the Digital Chemical Lab

Let’s start with the prerequisites of digitalization, the foundational capabilities that set the stage for greater value. They include data and process consistency. The first prerequisite is to have structured and standardized data storage. It’s important to have a logical data structure and have data consistency across the business. Only 16% of respondents say that their data storage is structured and standardized across steps, although over one-half say it is “mostly” managed this way (Figure 10). Like most of the prerequisites, we didn’t see much differentiation between the Performance Bands.

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Top Performers are 39% more likely to have consistent lab methods and processes across geographies.

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One of the keys to digitalization is acting uniformly to enable automation and then further digitalization. The second prerequisite we discovered is having standardized processes across the enterprise. Today, only 14% of chemical companies say they have consistent lab methods and processes across geographies. While very few indicate their processes vary by individual or lab, it appears that many chemical companies have work to do in standardization. This is one area where the Top Performers differentiate even at a foundational level: they are 39% more likely to have consistent lab methods and processes across geographies.

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Figure 10: Structured and Standardized Data
These prerequisites serve as the starting point for the digital lab. Others were at about par with Top Performers in having some of the fundamentals in place, meaning they are poised to move to the next step.

**Digital Chemical Lab Basics**

Let’s move on to the basics, the core fundamentals of the digital chemical lab. They include collecting, storing, accessing, and sharing data digitally and executing digital processes.

**Collecting Chemical Data**

The digital enterprise demands accurate, timely data. Creating an effective data plan for lab data is only the beginning of the challenge. Data must be effectively captured in the lab.

*The digital enterprise demands accurate, timely data.*

Chemical companies report that they collect lab data in a variety of methods ranging from paper to direct equipment integration. The status quo, which includes paper and manual data entry, doesn’t support the level of productivity, data accuracy, and quick access to data required for the digital world. Survey results show that Top Performers have more automated data collection. Specifically, they are 15% more likely to have direct equipment integration than Others.

*Top Performers have more automated data collection.*

**Managing Chemical Data**

Beyond collecting data, chemical companies must keep it secure and make it easily searchable and accessible to those who need it to do their jobs or want to reuse it. The most effective way to do that is with digital data, meaning the data is stored in a database as opposed to paper or electronic data. Electronic data, including scanned information, attached documents, and spreadsheets, are not easily accessible by others or directly interpreted for use in advanced features like analytics.

*Electronic data, including scanned information, attached documents, and spreadsheets, are not easily accessible by others or directly interpreted for use in advanced features like analytics.*
Currently, companies report that they manage data in multiple ways and use more of an electronic than digital approach (Figure 11). Although the shift from paper is underway, many chemical companies still work with paper-based processes and electronic documents, what some call “paper on glass.” These forms of data management make data access difficult and inhibit data reuse.

Encouragingly, almost two-thirds of companies are storing at least some of their lab data digitally. Top Performers are around 5% more likely to report managing lab data in a database.

**Data Access**

Or course collecting and storing data are really the means to an end. Data provides little value unless it can be readily retrieved when needed. Disappointingly, only about one-third of companies surveyed say that it’s “easy” to find chemical data, experiments, and formulations (Figure 12). Although another 40% say they can “usually find information in a reasonable time,” our research (and experience) shows that a significant amount of non-value-added time is spent recreating data that can’t be found. In this case, that means repeating experiments instead of using existing results, wasting time and money.
Top Performers are 57% more likely to be able to easily find chemical information than Others. Although Others report that they are close to on par with the Top Performers in collecting and managing data, they fall significantly behind when it comes to putting that information to use and gaining value from it. Although data access is considered a “basic,” it’s where it all starts to come together to differentiate the Top Performers and drive better performance.

An additional aspect of search is leveraging alternate search methods. Our research shares the value of providing multiple search methods to help people find the data they need. It’s enough of a challenge finding data that you know exists. In the chemical lab, chemists may want to find a chemical or formulation based on a certain need. About one-third of companies say they can find chemical data, experiments, and formulations by searching on performance characteristics or behavior – effectively “scientific search.” This is an opportunity for most companies to improve, even the Top Performers.

**Data Sharing**

Beyond finding data internally, chemical companies must share chemical information outside of the lab. Companies often rely on ad-hoc data communication methods such as email, network drives, or the modern equivalent – cloud storage solutions like Dropbox
or Google Drive. These less structured methods typically lead to using outdated and inaccurate information.

**Top Performers have more mature, digital data sharing practices.**

Digital data sharing helps provide more accurate information, ensures the value chain uses the most up-to-date information, and allows them to easily incorporate data into their own processes. Chemical companies report that they share data in a variety of ways, including 31% who say they transfer data digitally through integration and a smaller number that either use a shared system or offer guest access to their solution. Top Performers have more mature, digital data sharing practices. They are 37% more likely to share a common system and 17% more likely to provide guest access to their systems.

**Process automation**

The final “basic” capability analyzed is process automation. Digital workflows encourage repeatable processes that can be managed and improved over time, boosting quality and productivity. They also increase the velocity of processes, improving cycle times and time-to-market. The vast majority (75%) of chemical companies have at least somewhat automated their lab methods and processes, although only 11% say they are fully driven by workflows. This is again an area where Top Performers have more mature capabilities and are 15% more likely than Others to employ process automation.

**Top Performers are 15% more likely than Others to employ process automation.**

These basics are more common in Top Performers and form the foundation on which better practices can be built. Let’s move on to what these best practices can enable.

**Digital Best Practices for the Chemical Lab**

The survey starts to uncover more of the differences between Top Performers and Others when we look beyond the basics. These are best practices that build upon the basics and provide a competitive advantage. They include reusing chemical data, knowledge management, and simulation. Each of these practices is much more common in Top Performers.

**Reuse**

Reuse improves efficiency and outcomes of R&D by leveraging accessible, digital data collected and stored using basic digital practices. In the lab, reusing chemical data, experiments, and formulations not only saves time developing the data but also time in validating it, documenting it, and getting it approved.
About two-thirds of companies say they can reuse data, but approximately half of those say it’s “cumbersome” to do so. As mentioned earlier, when data is difficult to find it’s often recreated, wasting time and resources. Top Performers hold a significant advantage in their ability to reuse chemical data, as they are 61% more likely to be able to easily reuse it. We’re starting to see how the Top Performers gain their performance advantage from digitalization.

**Knowledge Management**

Chemical companies, like many other technical professions, typically lose undocumented expertise and intellectual property as experienced resources retire. Capturing and sharing this “tribal knowledge” can prevent reinventing the wheel and improve efficiency as well as outcomes. This is particularly important due to the retiring workforce in the chemical industry, a challenge frequently found in larger chemical companies. Only 21% of chemical companies indicate that they are fully capturing this intellectual property (IP) and making it search and reusable (Figure 13). Top Performers, however, are 42% more likely to have fully captured and reusable knowledge.

![Figure 13: Tribal Knowledge Captured, Searchable, Reusable](image)

**Top Performers are 42% more likely to have fully captured and reusable knowledge.**
Simulation

The only thing that improves efficiency and cycle time more than reusing an experiment is never conducting it in the physical world. Chemical companies can reduce physical experiments through simulation, modeling, and/or analytics to predict chemical behavior such as product performance and molecular properties. Simulation is an aspect of digitalization that offers significant dividends across industries and shows tremendous promise for the chemical industries.

*Top Performers are more than twice as likely as Others to use chemical simulation capabilities extensively.*

Although over one-half of survey companies say they “sometimes” use simulation, only 14% say they are doing it “extensively” (Figure 14). Simulation is another capability utilized much more frequently by Top Performers, and likely contributes significantly to their enhanced results. The survey shows that Top Performers are more than twice as likely as Others to use chemical simulation capabilities extensively.

![Figure 14: Use of Chemical Simulation / Modeling / Analytics](image)

Enabling Technology for the Digital Chemical Lab

How do digital chemical companies support their lab data and processes? And more importantly, what do Top Performers do differently to support their best practices and resulting performance advantage?
Chemical companies use a range of technologies to support the lab (Figure 15). The most common are Quality Management Systems (QMS), Analytics / Reporting, Project Management Systems, Spreadsheets, Text Documents, and Inventory Management. These are all used by at least one-third of participants of both performance classes.

The more interesting finding, perhaps, is what systems are more commonly used by Top Performing companies. The most common systems are likely useful, but the systems that have the most difference in usage by Top Performers are likely those that provide the biggest impact on performance (Figure 16).

**Top Performers are more likely to use specialized systems focused on R&D and the chemical lab.**

Top Performers are more likely to use specialized systems focused on R&D and the chemical lab. The most differentiating system use by Top Performers is Laboratory Information Management Systems (LIMS). This is followed by workflow / business process management and Artificial Intelligence / Machine Learning solutions. These are used more by Top Performers, although even they don’t commonly use them. Beyond those are some relatively general-purpose technologies that can add value for chemical labs, followed by Electronic Lab Notebooks (ELN) and Chemical Master Data Management Systems. These, and others including Laboratory Execution Systems, are specialized systems for the R&D / lab environment that can help improve performance.

![Figure 16: Ratio of Usage by Top Performers versus Others in the Lab](image-url)
Enabling the Digital Chemical Lab with a Solution Platform

Clearly Top Performers leverage more specialized solutions to manage their laboratories. Until recently, much of what’s been available on the market are point solutions and traditional LIMS solutions that lack integration across the diverse needs of R&D and the lab. Based on our experience in other manufacturing industries, however, we believe that chemical companies benefit even more from an integrated platform of solutions from the lab through production. For example, an integrated platform is a good way to streamline workflows and make sure that multiple researchers use the same, up-to-date information.

Chemical companies benefit even more from an integrated platform of solutions from the lab through production.

The survey solicited feedback from respondents on how an integrated platform of applications in the lab improves operational and business performance. Their responses are summarized in the word cloud (Figure 17), with the largest words representing the most common responses.

Figure 17: Value of an Integrated Chemical Lab Solution Platform
Participants also had the opportunity to share their views directly, indicating that a platform of chemical solutions:

- “... helps by improving collaboration between regions and functions along the entire Discovery / Development / Deployment value chain.”
- “... accelerates IP acquisition, minimizes rework, and reduces opportunities for user-created mistakes.”
- “… enables the lab to access insights in real-time by integrating with all of the other lab’s systems and creating a unified view into the data.”
- “… helps improve laboratory productivity and efficiency.”

Conclusion

Chemical companies are challenged to improve their innovation and product development performance while controlling cost. They face significant operational issues that make these business improvements hard to achieve. Digitalization holds significant promise to address these issues and improve performance because it’s proven to accelerate the pace of innovation, increase agility, and improve efficiency.

**Digitalization improves performance because it’s proven to accelerate the pace of innovation, increase agility, and improve efficiency.**

The transition to the digital chemical lab has begun. Today, however, most chemical companies have only partially digitalized. Top Performers, though, have greater digital maturity than their lesser-performing competitors. They’ve adopted more digital R&D and lab capabilities, particularly when you look beyond the basics to best practices.

Top Performers have implemented more specialized R&D and lab management systems to support their best practice processes. Based on the survey results, we believe that these capabilities help the Top Performers achieve better operational R&D and laboratory performance and drive better business performance. Our overall conclusion is that digital best practice processes and chemical laboratory management solutions provide a competitive advantage that helps chemical companies drive higher levels of innovation and profitable growth.

**Digital best practice processes and chemical laboratory management solutions provide a competitive advantage that helps chemical companies drive higher levels of innovation and profitable growth.**

Finally, we believe that digitalization will lead to significant market disruption across the chemical industries and result in a significant change in market leadership. Digital
transformation supported by best practices and a platform of integrated R&D and laboratory solutions will be a key differentiator to enable the future Top Performers that will lead the industry. The time to digitally transform the chemical laboratory is now.

**Recommendations**

Based on industry experience and research for this report, Tech-Clarity offers the following recommendations. Chemical companies should:

- Ensure the digital chemical lab prerequisites and basics are in place
- Pursue digital laboratory best practices including reuse, simulation, and knowledge management to differentiate and drive higher levels of innovation
- Leverage specialized laboratory and R&D software to drive better business performance
- Pursue a chemical laboratory systems platform strategy to further improve performance and gain a market advantage
- Leverage digitalization processes, tools, and techniques to take advantage of the current market disruption and gain market position

**About the Author**

Jim Brown is the President of Tech-Clarity, an independent research and consulting firm that analyzes the business value of software technology and services. Jim has over 25 years of experience in software for the manufacturing industries. He has a broad background including roles in industry, management consulting, the software industry, and research. His experience spans enterprise solutions including PLM, ERP, quality, service, manufacturing, supply chain management, and more. He is actively focused on researching new digital enterprise initiatives and technologies including cloud computing, digitalization, smart manufacturing, AR, VR, and the IoT. Jim is passionate about improving product innovation, product development, and engineering performance through digitalization and the use of software technology.

Jim is an experienced researcher, author, and public speaker and enjoys the opportunity to speak at conferences or anywhere he can engage with people with a passion to improve business performance through digitalization and software technology.

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About the Research

Tech-Clarity gathered and analyzed 171 responses to a web-based survey on operating chemical laboratories and the impact labs have on business performance. Survey responses were gathered by direct e-mail, social media, and online postings by Tech-Clarity, Dassault Systèmes BIOVIA, and a third party data collection partner.

The responding companies were a good representation of chemical industry segments, including Consumer Chemicals (36%), Agricultural Chemicals (33%), Life Sciences (30%), Bulk Petrochemicals (26%), Paints / Coatings (21%), Food & Beverages (20%), Commodity Polymers (18%), Specialty Polymers (17%), Pigments / Inks (14%), Industrial Gasses (13%), Catalysts (11%), and others including Semiconductors / Batteries, Adhesives / Sealants, Solvents, Textile Chemicals, Hardeners / Softeners, Construction Chemicals, Resin, Latex, Biodegradable Surfactants, Mining Chemicals, and Water Repellants. Note that the total is greater than 100% because companies were able to indicate that they serve multiple chemical markets.

The respondents were primarily from companies that develop and/or product chemicals (76%) but also include companies that deliver R&D / Lab / Engineering Services (24%).

The respondents reported doing business globally, with most companies doing business in the North America (41%), Western Europe (37%), Asia-Pacific Rim (36%), Eastern Europe (10%), and Latin America (9%). Again, the total is greater than 100% because companies were able to indicate that they serve multiple geographies.

The respondents represented a mix of company sizes, including 25% from smaller companies (less than $100 million), 20% between $100 million and $250 million, 25% between $250 million and $1 billion, 17% between $1 billion and $5 billion, and 13% greater than $5 billion. All company sizes were reported in US dollar equivalent.

The respondents were comprised of about 53% who are manager level, 24% director level, 14% VP or executive levels, and 9% who are individual contributor level.

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