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Report



Lab of Tomorrow

Lab Digitization Trends and Insights



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Executive Summary

Biotech and pharma labs stand at a crossroads. AI, machine learning, and data platforms are reshaping how they operate - faster, smarter, more collaborative. The potential is clear, but the path forward is anything but smooth.

Our report uncovers a paradox: labs recognize digitization's power, yet most are still in the early stages. AI leads with a 44% projected adoption rate, but tools like AR/VR remain niche.

And the real challenge? It's not just about technology - it's about people. Leadership sees itself as driving change. Teams often don't. That disconnect slows progress. Budget constraints, outdated systems, and limited expertise don't help.

But for those who embrace digital tools, the payoff is huge: less manual work, more innovation, better collaboration.



So, how can biotech and pharma companies turn ambition into action? Here are three areas to focus on:

Invest Smarter

Ensure your resources match your digital goals. Prioritize tools like AI and data management solutions that drive results.

Close the Skill Gap

Equip your teams with the knowledge they need to leverage new technologies effectively.

Start Collaborating

Align leadership and staff around a shared digital vision for smoother, faster transformation.

Labs are evolving - becoming more connected, predictive, and adaptive. The shift from isolated silos to cutting-edge ecosystems won't happen overnight, but with the right strategies and partnerships, it's closer than ever.

The future is digital... but only for those who close the gap.

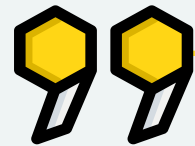


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Key Findings Overview



The Future of Labs is **Digital**: Innovate, Collaborate, Transform.

Digital tools are reshaping the biotech industry, driving efficiency, collaboration, and innovation. Organizations that embrace this shift will set the standard for the future.



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Main Findings

AI/ML and Data Platforms lead technology adoption, with significant growth expected

Main barriers include manual processes, lack of expertise, and budget constraints.

When it comes to the Digital Plant Maturity Model (DPMM), many labs are transitioning to connected digital systems, but higher maturity levels remain rare.

Collaboration gaps between executives and staff highlight the need for stronger alignment.

Conclusions and Recommendations:

01 Align Resources

Match digital ambitions with proper investments in tools and training.

02 Bridge Gaps

Foster collaboration between leadership and staff for smoother transformation.

03 Focus on Core Technologies

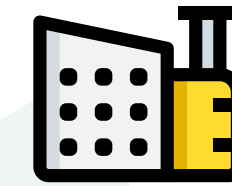
Prioritize high-impact solutions like AI/ML and data management solutions to drive progress.

Introduction

The biotech industry is experiencing rapid growth, driven by increased investment, innovation, and collaboration.

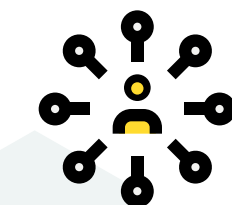
This survey offers a clear picture of the current state of laboratories as they explore, implement, and expand modernization efforts through digitization and data-driven approaches.

Objectives



Understand the Landscape

How biotech labs are modernizing through digitization?



Highlight Challenges

Uncover hurdles and advantages of adopting new technologies.



Analyze Investments

Identify key areas for lab technology investment.



Deliver Insights

Provide actionable recommendations and benchmarking opportunities.

Current vs. Future Technologies

Q1

What are the current technologies in use in your lab?

Q2

What technologies will your lab adopt in the next 2 years?

While no technologies are entirely absent from labs today, certain tools are set for significant growth. AI/ML and Data Platforms lead with adoption expected to rise by 45% and 29%, respectively, driven by the need for analytics and scalable infrastructure. Robotics/Automation and Scientific Data Management Solutions are also gaining traction as labs focus on efficiency and data integration.

By 2027, technologies like Data Platforms (92%), Electronic Laboratory Notebooks (77%), and AI/ML (77%) will become standard. Meanwhile, niche tools such as Lab Execution Systems, Digital Twin, and AR/VR will remain underutilized, with adoption rates below 20%. No technologies are expected to become obsolete, reflecting sustained value across the biotech ecosystem.

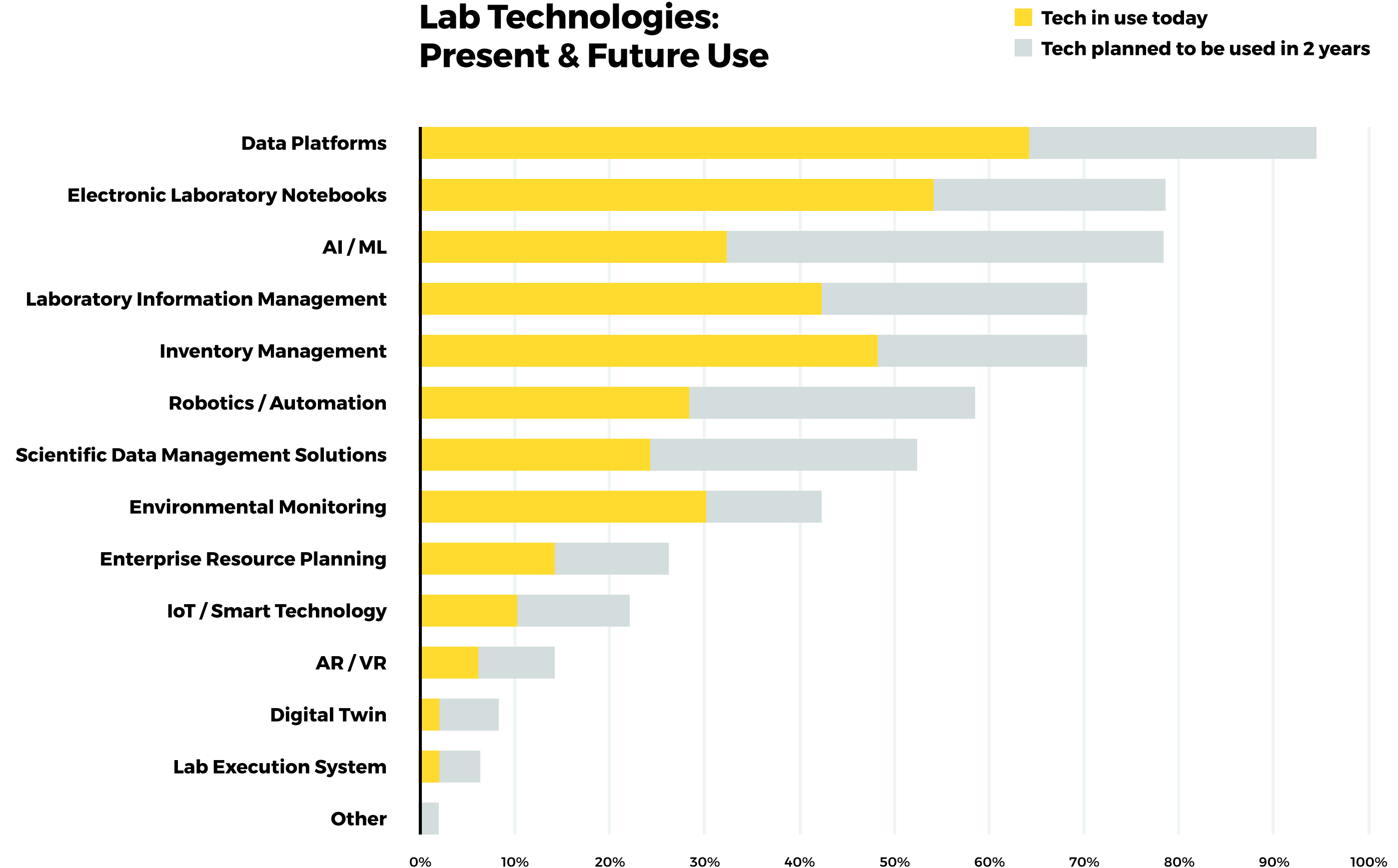
This trend highlights heavy investment in digitization and automation, with key technologies set to dominate the industry landscape.



Key Takeaway

Key technologies like AI, data platforms, and digital lab notebooks are becoming standard, while tools like AR, VR, and Digital Twin are still less common.

Lab Technologies: Present & Future Use



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Investment Priorities

Q3

What investment areas will your organization prioritize in the next 2 years?

The data highlights the key benefits driving modern lab technologies. Cost savings and efficiency (57%) lead as top priorities, reflecting a focus on operational optimization. Other major drivers include data-driven decision-making (43%), productivity (37%), and reducing time to market (33%), emphasizing speed and decision-making improvements.

Secondary benefits like data governance (25%), lab automation (24%), and compliance improvement (22%) highlight the need for better data management and regulatory adherence. Meanwhile, data integrity (18%), lab data aggregation (14%), and interoperability (10%) show interest in data integration and collaboration, though they are less immediate priorities.

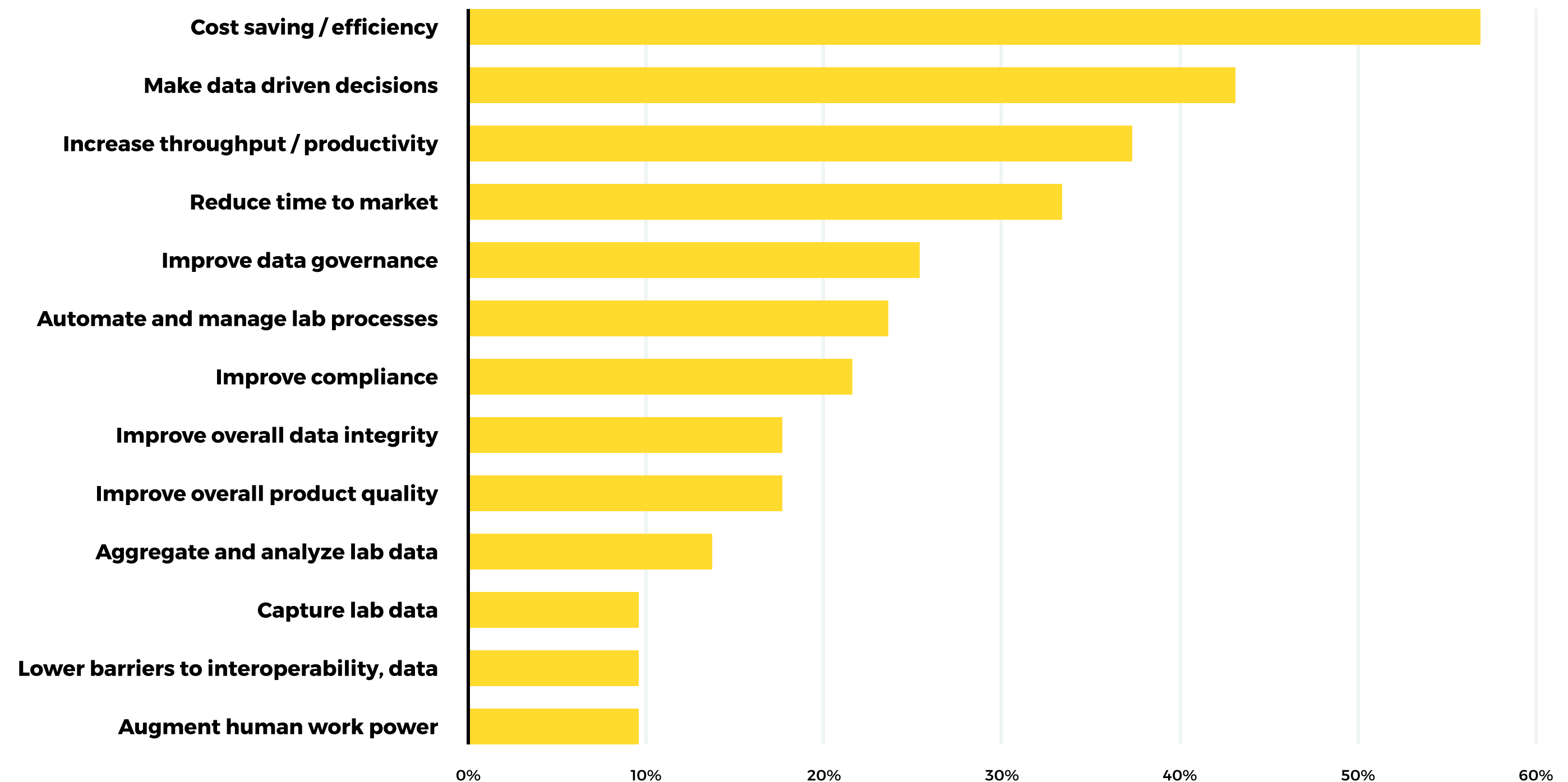
Emerging goals like augmenting human work power (10%) and capturing lab data (10%) suggest future opportunities but remain lower on the industry's current focus list. The industry focuses on efficiency now, with innovation opportunities emerging gradually.



Cost savings, efficiency, and data-driven decisions are the main drivers for adopting lab technologies, with data integration and collaboration as emerging priorities.

Investment Areas Priority in the next 2 years

State of Labs prioritizing given investment area



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Adoption Benefits

Q4

What do you believe are the most significant advantages of harnessing new technologies in labs for employees?

The most significant benefit, highlighted by 76% of respondents, is the reduction or elimination of manual processes, emphasizing the importance of automation in enhancing efficiency. Additionally, 57% noted that new technologies provide more time for innovation, demonstrating their ability to free employees from repetitive tasks and foster creativity.

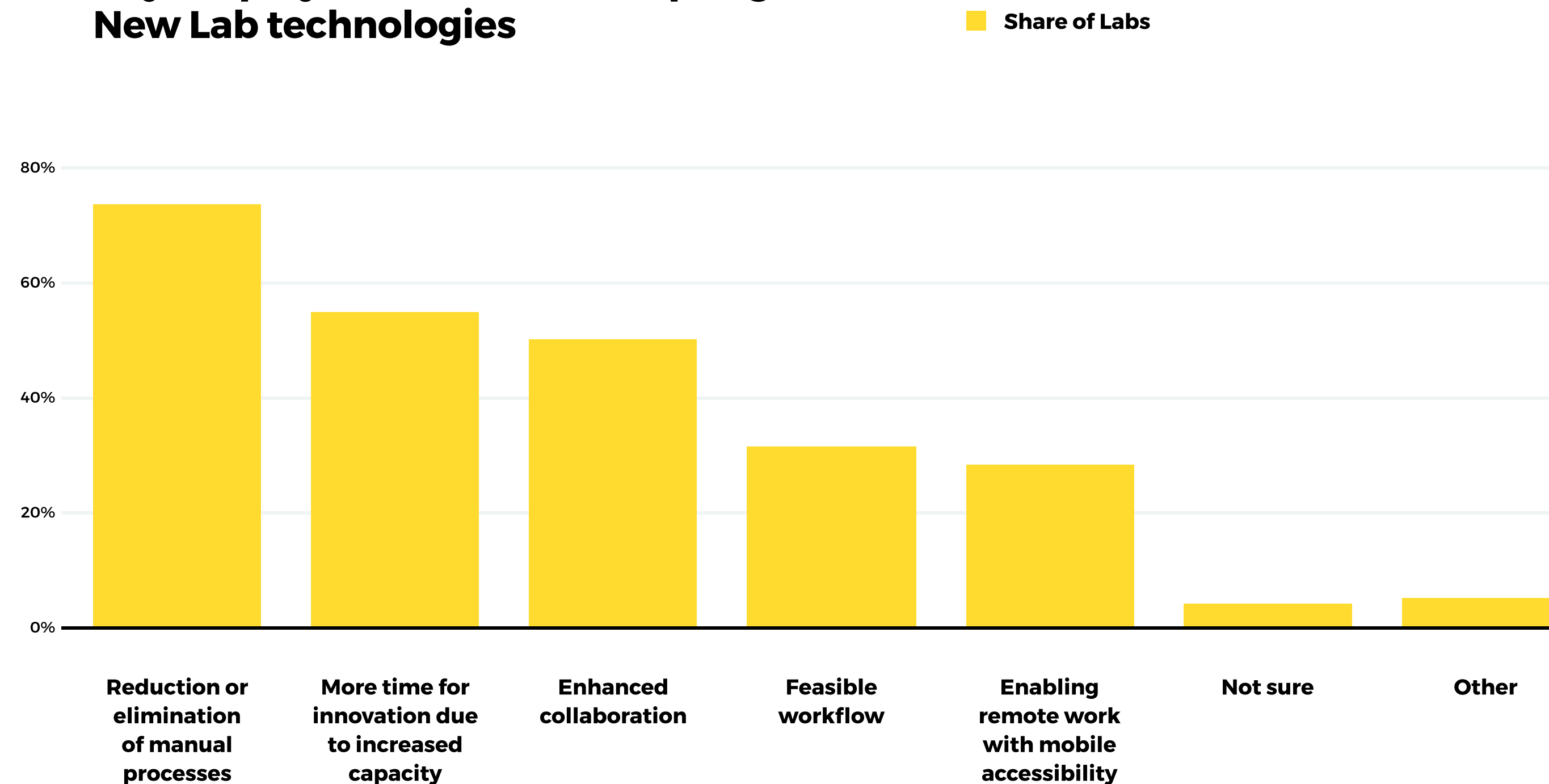
Other notable benefits include enhanced collaboration (51%) and the creation of more feasible workflows (33%), underscoring the technologies' role in improving communication and streamlining processes. While enabling remote work with mobile accessibility (29%) remains a secondary advantage, it reflects the growing demand for flexible and adaptable work environments.

A small portion of respondents (6%) mentioned "Other" benefits, while 4% remain uncertain, showing some variation in perceived value.



New lab technologies empower employees by reducing manual work, enabling innovation, and enhancing collaboration, while streamlining workflows.

Key Employee Benefits of Adopting New Lab technologies



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Transformation Challenges



The main barriers to lab digitization are hard-to-automate processes, lack of expertise, budget constraints, and issues with legacy systems and data governance

Q5

What do you believe are the most significant advantages of harnessing new technologies in labs for employees?

Adopting new technologies and driving digital transformation in labs presents several challenges. The top barrier, cited by 57% of respondents, is the lack of knowledge and expertise, reflecting the complexity of transitioning from legacy practices. Close behind, 55% pointed to difficulty of automating manual processes, highlighting the need for training in digital tools.

Budget constraints (51%), migrating legacy systems (33%), and data governance challenges (31%) further complicate integration efforts. Other barriers include uncertainty about where to start (31%), regulatory compliance (20%), and limited employee or management support (20% and 12%). Secondary issues like siloed data (10%), lack of connectivity (12%), and low implementation of the FAIR data approach (8%) remain relevant but less pressing.

Notably, 8% of respondents reported no significant barriers, suggesting that some organizations are well-prepared for digital transformation.

Main challenges in effectively leveraging digital transformation

Share of Labs prioritizing given investment area



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Receptiveness to Digitization

Q6

How receptive are executive leaders to digitization?

Q7

How receptive is lab staff to digitization?

For executives, the average rating is 3.60, and the median is 4, indicating that the majority perceive executives as moderately to highly receptive to digital transformation. For lab staff, the average rating is 3.58, with a median of 3, reflecting a perception of moderate openness, with slightly lower overall ratings compared to executives. This suggests that, on average, respondents view both groups as generally receptive to digitization, but lab staff are perceived as slightly less enthusiastic, with fewer top-tier ratings.

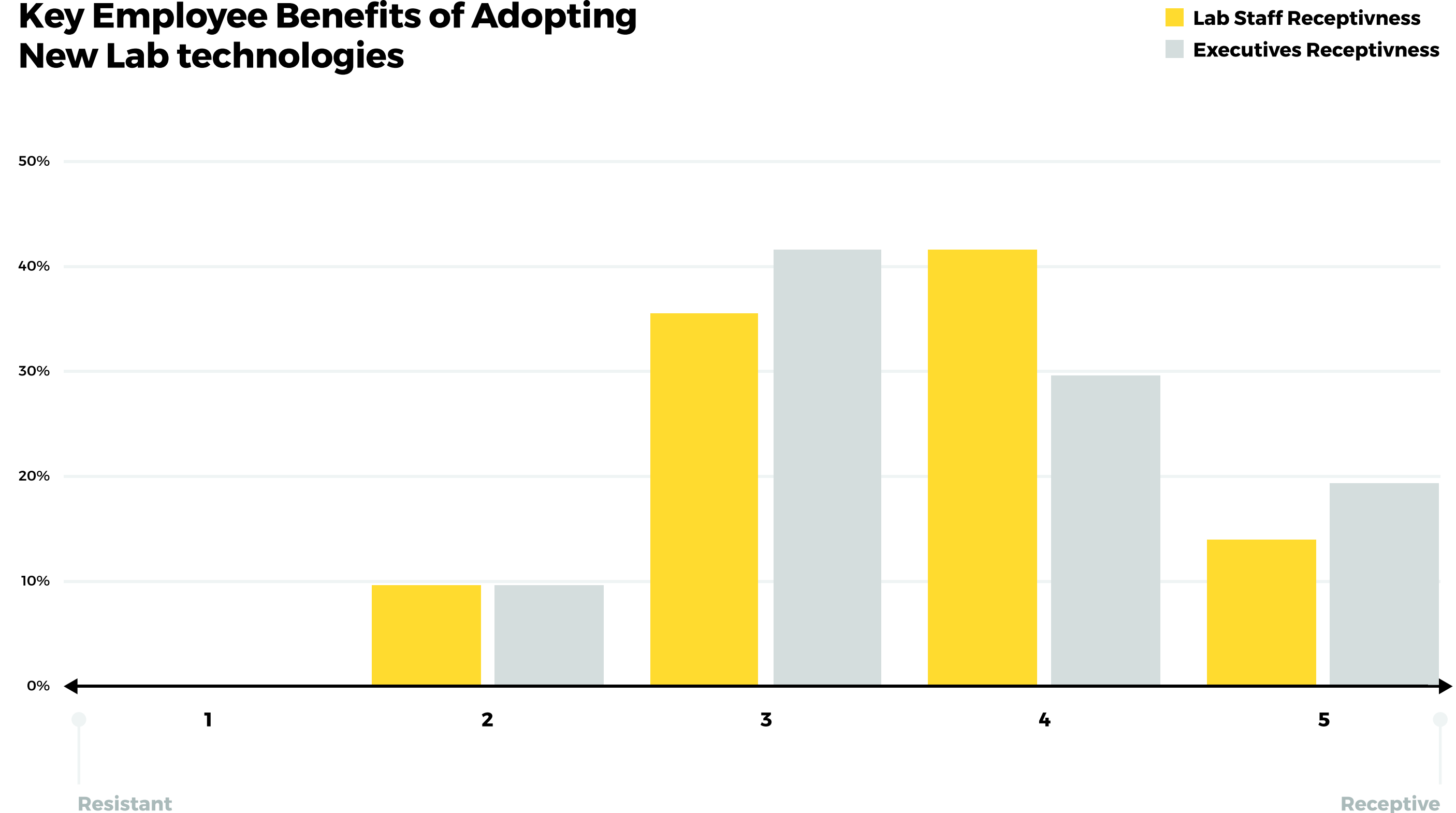
Differences in Self-Perception: Executives rate themselves more favorably than others rate them, with an average self assessment of 4.00, suggesting strong confidence in their role as digital transformation leaders. Lab staff, on the other hand, rate executives lower than the general average (3.37 among lab staff), indicating a perception gap. Interestingly, lab staff's self-assessment aligns with the general data, showing consistency in how their receptiveness is perceived.



Key Takeaway

Executives see themselves as highly receptive to digitization, but lab staff are less convinced of this, while consistently viewing their own openness as aligned with the overall perspective.

Key Employee Benefits of Adopting New Lab technologies



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Investment Enthusiasm



Key Takeaway

Many organizations remain in the planning phase for digital transformation, with only a small number fully committing resources, particularly for external support.

Q8

How much has the organization invested, either with internal staff or through external services, to plan and implement digital & data transformation?

The data reveals varying levels of investment and planning for digital and data transformation within organizations:

29% of organizations have allocated no specific resources, indicating a significant portion is still in the early stages of engagement.

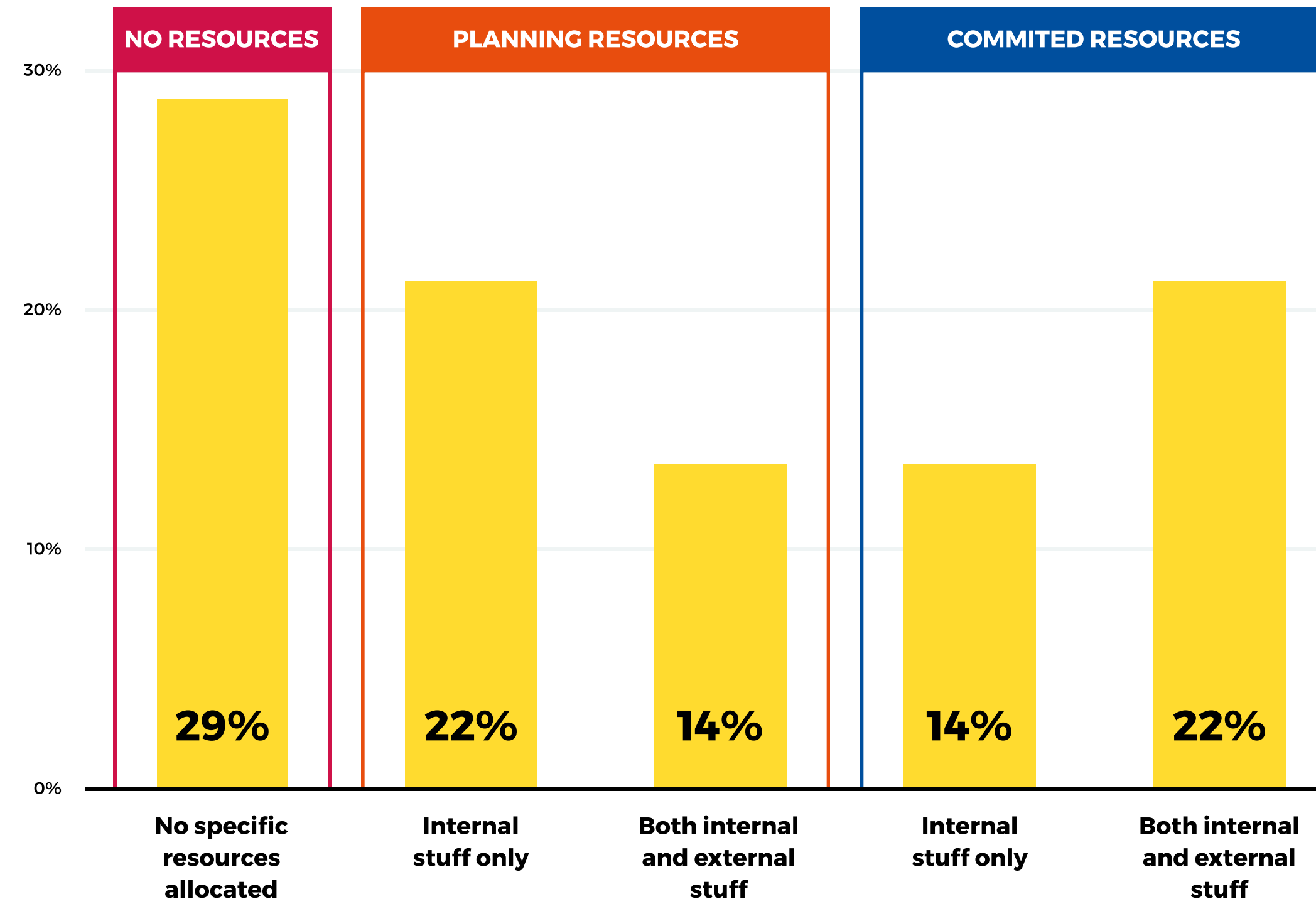
22% organizations are planning the scope of resources for internal staff only, while 14% organizations are planning for both internal and external staff.

A smaller number have committed resources: 14% organizations for internal staff only, and 22% organizations for both internal and external staff, reflecting a clear division between planning and execution stages.

This indicates a mix of readiness levels, with a significant portion still in the planning phase, while others have begun committing resources to drive transformation.

Investment in Digital & Data Transformation

Share of respondents selecting this answer



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Digitization Improvement Plans

Q9
What does your current Lab digitization level look like?

Q10
What level do you expect to achieve in 18 months?

The data highlights the current state and future aspirations for lab digitization. Most labs are in the "Digital Silos" (23 respondents) or "Connected" (15 respondents) stages, with an average level of 2.22, expected to rise to 2.98 in 18 months, reflecting progress toward higher digitization. Many labs plan to move to "Connected" (25 respondents) or "Predictive" (7 respondents) stages, emphasizing efforts to break silos and adopt predictive capabilities.

56% (28 respondents) expect a 1-level increase, while 33% (17 respondents) anticipate no change. Only 4 respondents and 1 respondent foresee 2- or 3-level jumps, showcasing the gradual nature of digitization progress. Advanced levels like "Adaptive" (2 respondents) remain a long-term goal for most.

The respective five areas correspond to the Digital Plan Maturity Model, providing a structured framework for assessing and enhancing digital planning capabilities.

Pre-digital

Manual, paper-based processes, stand-alone lab instruments, and lengthy information collection times delay batch release and inter-site transfers.

Digital Silos

Quality and lab management systems with networked instruments, but limited integration and manual, labor-intensive analytics.

Connected

Centrally managed, networked lab instruments with semi-automated batch reviews, standardized data usage, automated data integrity controls, and centralized descriptive analytics.

Predictive

Integrated lab systems offer near real-time, end-to-end visibility of quality management, with a unified data view, at-line testing, automated batch release, exception-based review, and embedded predictive analytics.

Adaptive

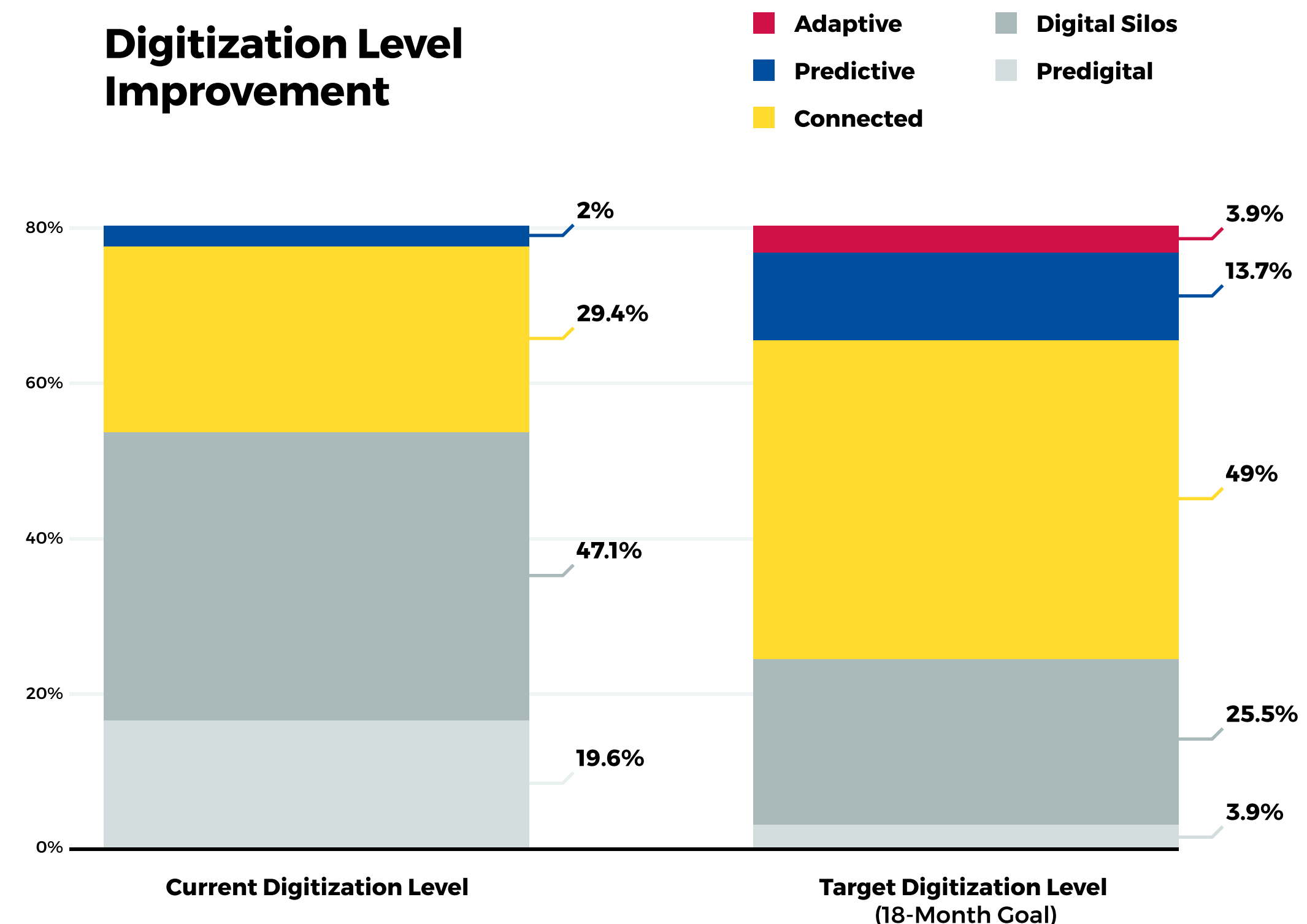
Integration with external stakeholders enables seamless access to field-generated quality data, with self-configuring instruments in modular units supporting in-line, real-time process monitoring and AI-driven adjustments.



Key Takeaway

Labs are advancing in digitization, with an average jump of 0.73 levels, focusing on moving from Digital Silos to Connected, while Adaptive remains a long-term goal.

Digitization Level Improvement



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Investment, Receptiveness, Digitization

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Cross-question analysis

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Digitization Receptiveness Across Roles

Lab staff often rate executive receptiveness lower (3.37) compared to their own (3.67), showing frustration with insufficient attention & resources from leadership. Executives do the same: they rate themselves higher (4.0) than they rate lab staff (3.42).

Mixed responses in the middle investment range (2-4) show receptiveness around general averages, indicating moderate engagement.

In organizations where resources are committed to internal and external teams, receptiveness tends to align with higher-than-average ratings (4.06), suggesting shared enthusiasm for digitization initiatives.

Investment Enthusiasm vs. Digitization Goals

Organizations aiming to advance 1 level in digitization show moderate enthusiasm for investment, averaging 3.32 in Q8, reflecting realistic alignment between goals and resources.

Those targeting 2+ levels of advancement average significantly lower (2.0) in investment, highlighting a misalignment between ambition and resource allocation.

Organizations planning no digitization progress average 2.06, indicating limited investment enthusiasm and low strategic focus on transformation.

Key Takeaways



01
Lab staff perceive executives as less receptive, reflecting potential resource frustrations.

02
Organizations aiming for big digitization leaps often lack sufficient investment, risking failure.

03
Balanced investment and collaboration across roles are essential for digitization progress.

04
Companies with aligned goals, investments, and enthusiasm are better positioned for success.

Digitization Level & Technologies Alignment

This analysis highlights trends in the adoption of lab technologies across varying levels of digitization:

- Data Platforms and Electronic Laboratory Notebooks are consistently needed and applied regardless of digitization level, demonstrating their fundamental role in lab operations.
- The average adoption increase across all technologies between digitization levels is 8%, rising to 14% when focusing on technologies planned for implementation by at least half of respondents at levels 4-5. Generally, organisations at levels 4-5 have ~80% more technologies implemented compared to those at levels 1-2.

- Robotic & Automation exhibits the largest increase in adoption, with a 29 percentage point rise between the lowest and highest digitization levels, underscoring its growing importance in advanced digital environments. Robotics / Automation is right behind AI/ML, with 47 percentage point rise.
- Technologies like ERP, IoT/Smart Technology, Digital Twin, and Lab Execution Systems show consistent but low adoption rates across all levels, unlike others that experience noticeable growth with higher digitization.

Planned Technology Adoption Across Digitization Tiers - Aspirations

Digitization Level in 18 months	Data Platforms	Robotics / Automation	Laboratory Information Management	Scientific Data Management Solutions	Inventory Management	Enterprise Resource Planning	AI / ML	Environmental Monitoring	Electronic Laboratory Notebooks	IoT / Smart Technology	Lab Execution System	Digital Twin	AR / VR
Predigital - Digital Silos	44%	31%	44%	63%	56%	19%	31%	50%	19%	19%	0%	13%	6%
Connected	60%	60%	64%	76%	64%	44%	40%	24%	28%	16%	12%	8%	4%
Predictive - Adaptive	90%	90%	80%	70%	70%	70%	60%	40%	30%	20%	30%	10%	10%

Regional Comparison

QX

How do these differences vary across different countries?

Current Technology Adoption

Poland and the rest of Europe are at similar levels of average tech adoption, but USA leads by on average 50%, reflecting significantly higher adoption rates today.

Electronic Laboratory Notebooks (ELN): Adoption varies widely, with Poland currently at 28%, Europe at 57%, and the USA leading at 78%.

Data Platforms: Poland and the USA share high adoption rates (86%), while Europe lags behind at 43%.

Robotics/Automation: The USA shows dramatically higher adoption, with rates 267% higher than Europe.

Future Technology Adoption & Benefits Outlook

Europe and Poland have ambitious plans to adopt new technologies, aiming to narrow the gap with the USA, which would lead by only 17% in average adoption in 2 years.

In terms of employee benefits, European and Polish organizations prioritize enhanced collaboration and feasible workflows more, aligning closely with their digitization goals.

Plans to advance digitization levels are similar for Europe and Poland, surpassing the USA's ambitions in this area.

Key Takeaways



The USA leads in current technology adoption, but Europe and Poland are poised to close the gap significantly over the next 2 years.

Poland and Europe share similar priorities and plans, focusing on collaborative workflows and ambitious digitization advancements to match global leaders.

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Cross-question analysis

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Organization Size & Type

QY

How do these differences vary based on organizational type and size?

Technology Adoption Rates

Start-ups and SMEs lag 25% behind enterprises in tech adoption, with universities 139% behind.

Data Platforms are equally popular across all organizations, but start-ups are twice as likely to have adopted AI/ML compared to enterprises.

Start-ups and enterprises have the most ambitious plans for tech adoption over the next 2 years, while universities and SMEs lag behind.

Digitization and Receptiveness

Universities stand out as the only group where executives are rated 1 point lower in receptiveness than lab staff.

Ambitions for advancing digitization levels are led by large companies (500+ employees), aiming for at least 1 full level increase. Mid-sized companies (51-150 employees) are the least ambitious.

Focus and Priorities

All organizations prioritize AI/ML, with nearly 100% of start-ups planning to implement it within 2 years.

Larger companies prioritize increasing throughput/productivity and data-driven decision-making, reflecting their focus on efficiency.

Digital transformation challenges increase with company size, as larger organizations more often face resistance from employees.



Start-ups and enterprises are leading the charge in AI/ML adoption and ambitious plans, while universities and SMEs lag significantly.

Larger organizations are more focused on productivity and data-driven decisions but face more challenges with employee resistance during digital transformation.

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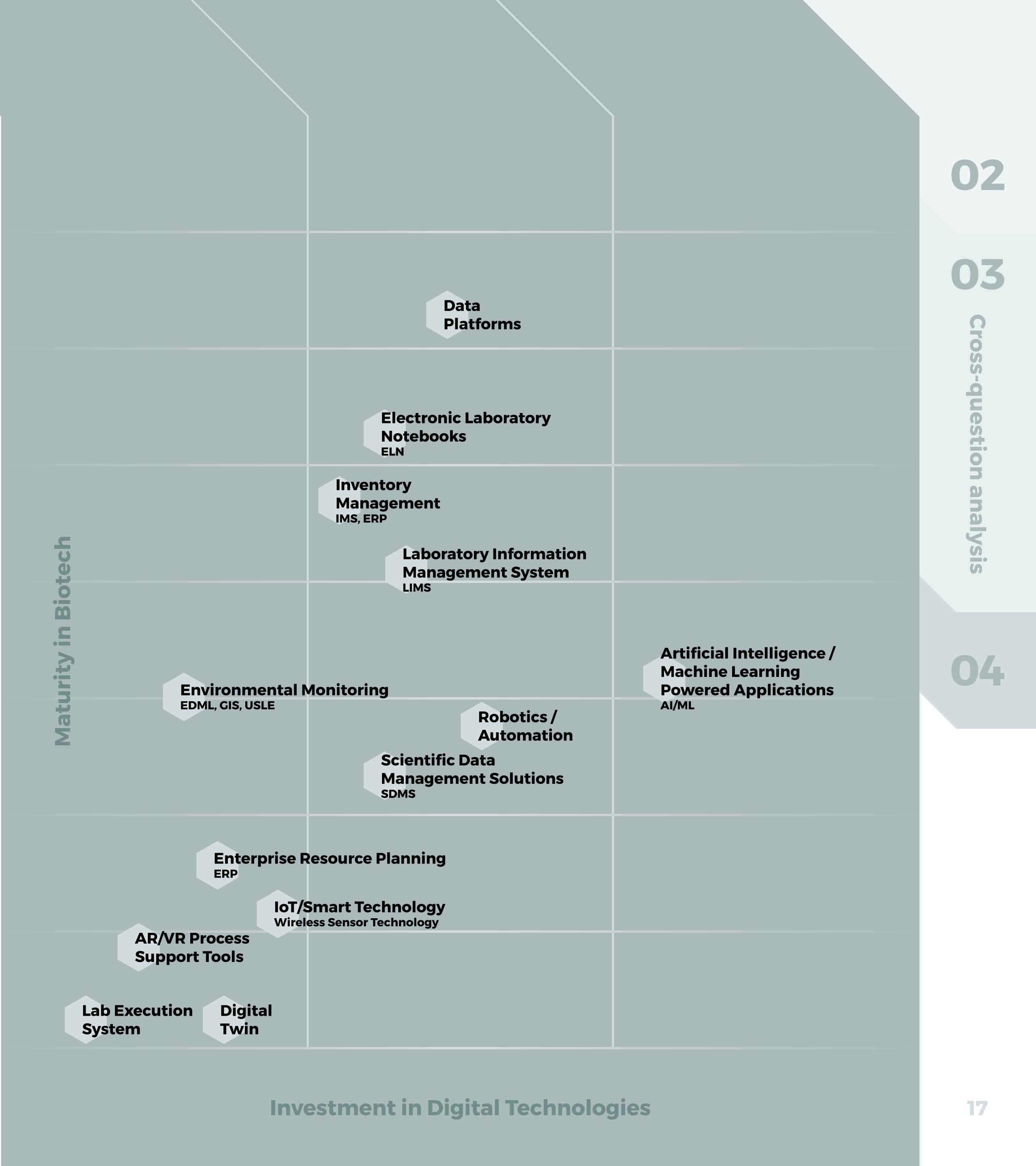
Cross-question analysis

04

Technology Maturity

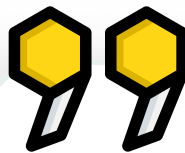
Certain digital technologies like Cloud, AI, Data House, 3D printing, and AR/VR solutions are widely adopted and implemented in biotech and manufacturing operations.

They make improvements in plant operations, quality control, and supply management as well. Those new technologies will define the sector’s pioneers. We’ve already seen many companies embody at least some of them, with many more beginning the journey to do so.



Digital Transformation Roadmap for the Lab of Tomorrow

	46% responders point	30% responders point	30% responders point
	AI / ML as a NEW technology to harness in the next 2 years.	Data Platform as a NEW technology to harness in the next 2 years.	Robotics / Automation as a NEW technology to harness in the next 2 years.
Business	GOAL: Accelerate time to discovery for new drug candidates. ACTION: Identify bottlenecks in the process. implement AI/ML models for real-time data analysis, predictive modeling, and automated hypothesis testing.	GOAL: Centralize and standardize all lab data. ACTION: Consolidate fragmented data sources into a unified, validated data platform with real-time accessibility.	GOAL: Increase lab productivity & throughput, reduce human errors. ACTION: Automate repetitive lab tasks such as sample handling, pipetting, and data logging.
Technology	GOAL: Enable scalable and efficient AI-driven workflows. ACTION: Provide standardized AI/ML infrastructure with secure deployment pipelines and real-time data integration.	GOAL: Ensure seamless data interoperability and analytics. ACTION: Create one central and validated data store with various data tools and secure access.	GOAL: Build an adaptive and autonomous lab infrastructure. ACTION: Introduce closed loop control solutions and automate data acquisition from equipment
Organization	GOAL: Become data driven organization. ACTION: Enable lab staff with AI tools and knowledge around in-silico experimentation.	GOAL: Provide new data-centric tools for lab staff and scientists. ACTION: Implement new tools and train personnel in new ways of interacting and using the data.	GOAL: Train future-ready lab workforce. ACTION: Train and enable lab staff with using new technologies and tools.



Where do you start? Start where the impact is undeniable. Start where momentum is easiest to build. Maybe that's a quick win. Maybe it's tackling the low-hanging fruit. Or maybe it's something bigger, something foundational.

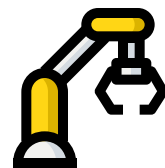
Every organization has a different entry point. But wherever you start, remember this - technology is not the goal. It's a tool. A means to drive business performance, to sharpen efficiency, to make the complex simple.

And when setbacks occur—as they often do—pathways to support are opening up more than ever.



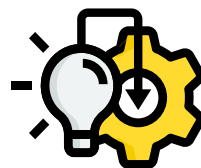
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Conclusion



Rise of Core & Emerging Technologies

The biotech industry is embracing digital tools, with technologies like AI/ML and Data Platforms leading the way. Core solutions are becoming essential, while niche tools remain on the sidelines. This transformation reflects the sector's push for efficiency and innovation in shaping the labs of tomorrow.



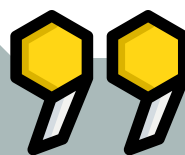
Ambition Meets Action

Many organizations aspire to advance digitization, but progress is uneven. Some commit resources to achieve their goals, while others remain in planning or allocate none at all. Closing the gap between ambition and action is crucial for meaningful transformation.



Navigating the Digitization Journey

Digital transformation brings both challenges and opportunities. Barriers like limited expertise and budget constraints slow progress, but growing collaboration and adoption of advanced tools are paving the way for a more connected, predictive future.



Lab of Tomorrow will rely on the inter-connectivity and data-focused technologies impacting data-driven decisions from key business stakeholders.

A strong focus on the results-driven collaboration across both people and technology dimensions will help to accelerate the journey towards the lab of tomorrow's vision.



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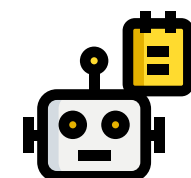
Survey methodology



The survey was conducted entirely online using a Typeform solution.

Participants were selected through existing professional connections and outreach via LinkedIn and cold emails, with no specific targeting beyond ensuring eligibility for the sample criteria.

A total of 51 companies participated anonymously, representing a diverse yet limited dataset.



Potential question limitations included ambiguity in interpreting broad terms like AI/ML, where respondents might have varying definitions or expectations of adoption.



While the sample size is adequate for basic analysis, it constrains deeper exploration, such as cross-referencing multiple data points.

Additionally, one-third of respondents were Polish organizations, which, while similar to European counterparts, might have introduced regional weighting in responses.

Key Limitations

Sample Size and Composition

Small sample size (51 companies) limits detailed cross-analysis.

Regional Bias

Overrepresentation of Polish organizations might skew results slightly.

Question Clarity

Ambiguities in defining technologies (e.g., AI/ML) may lead to varied interpretations.

Time Frame

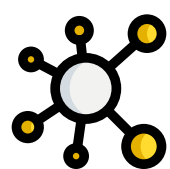
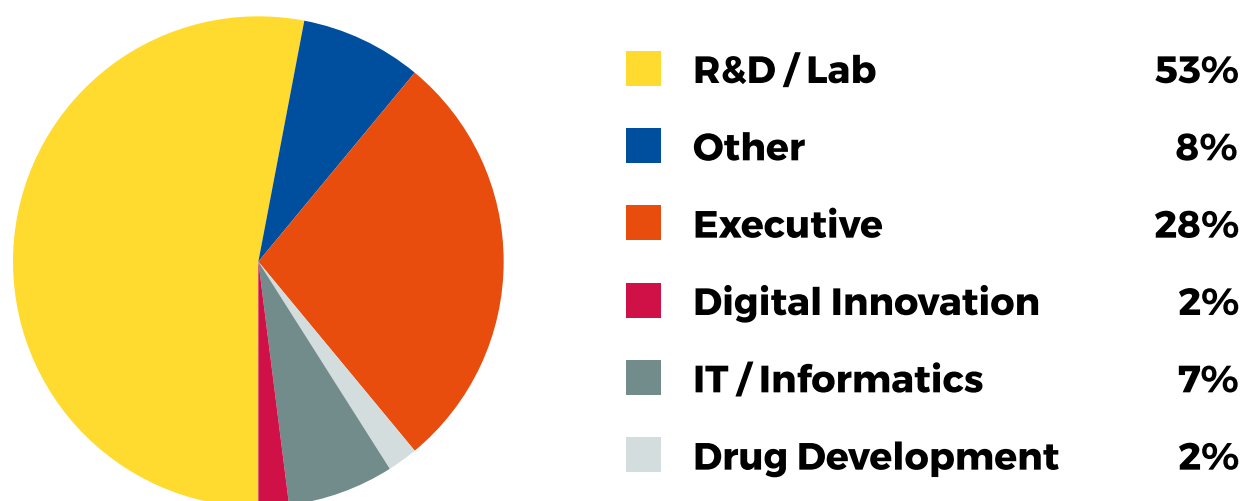
Responses collected over a short period might impact diversity of participation.

This methodology highlights the value of the survey while acknowledging the constraints that shape the insights derived.

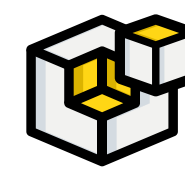
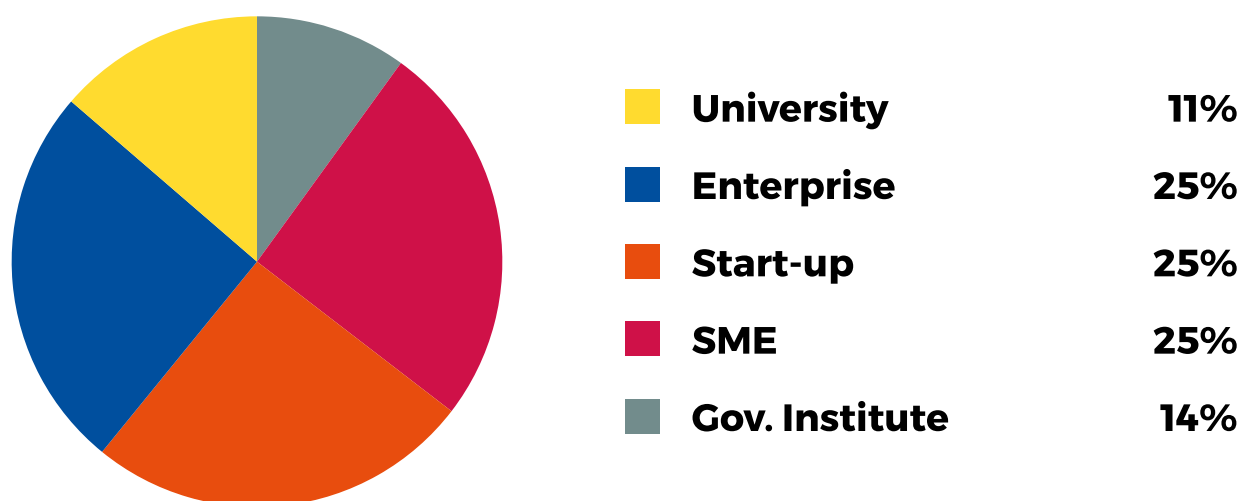
Participants Profile



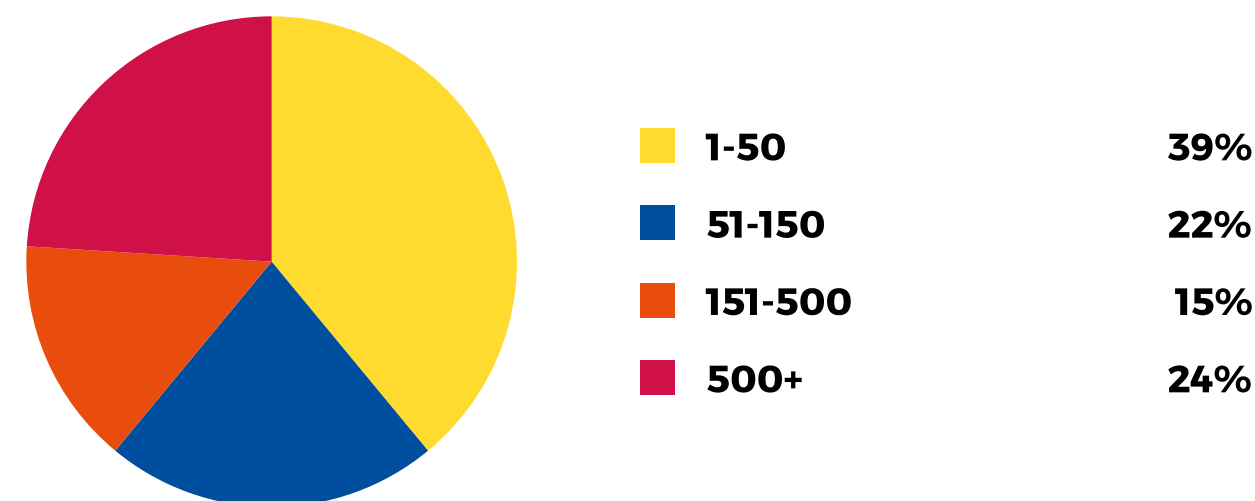
Roles



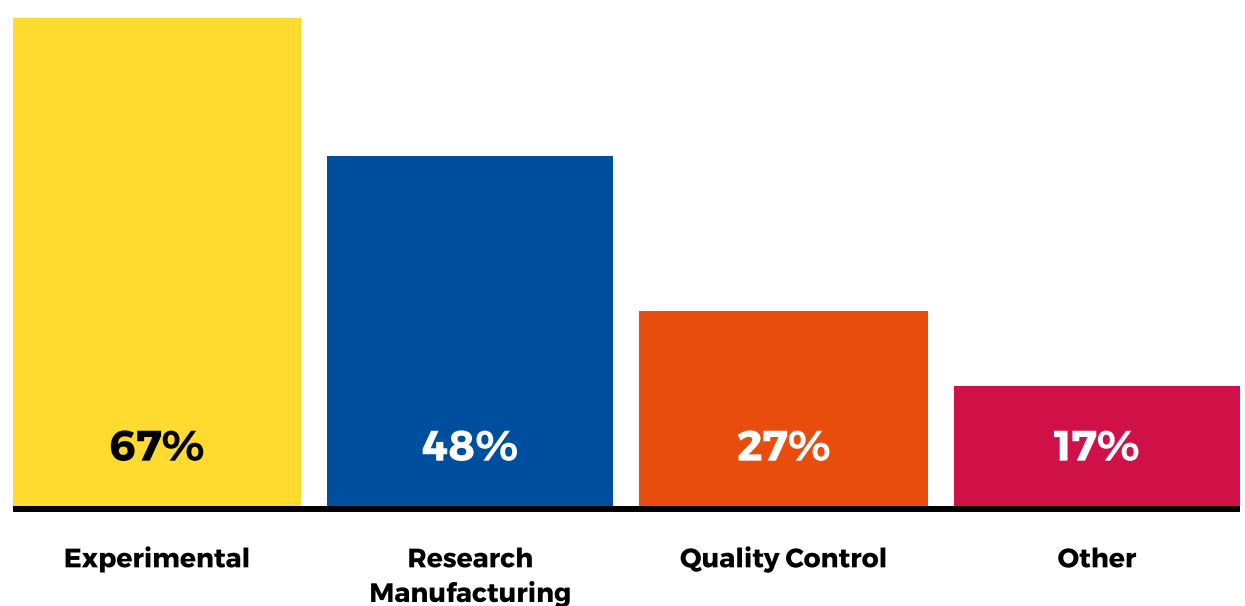
Type of Entity



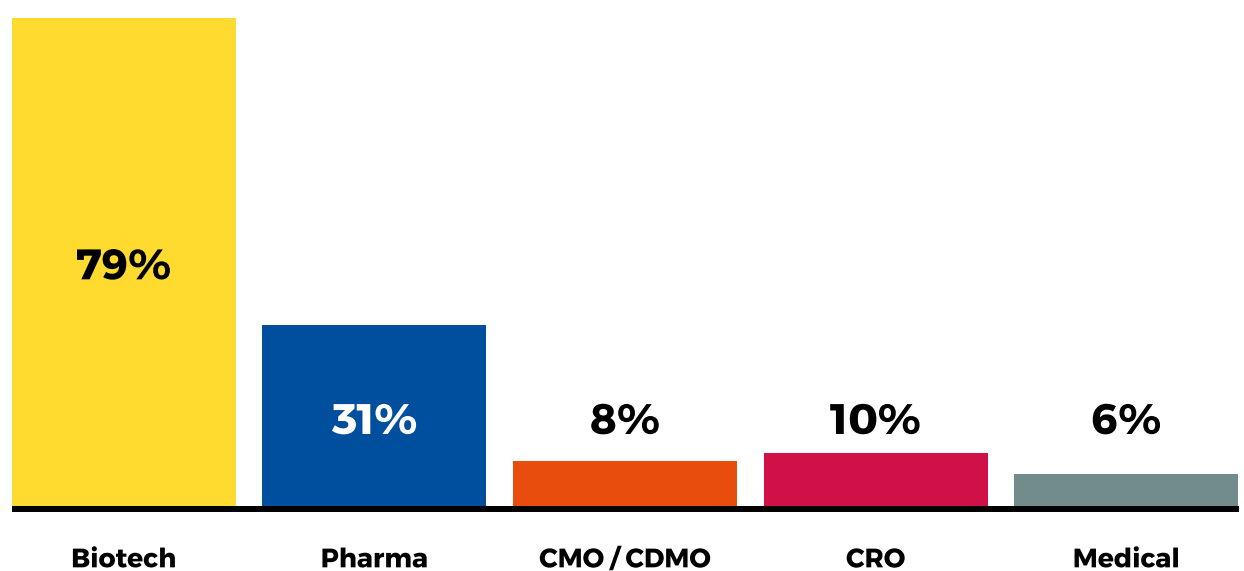
Organization Size



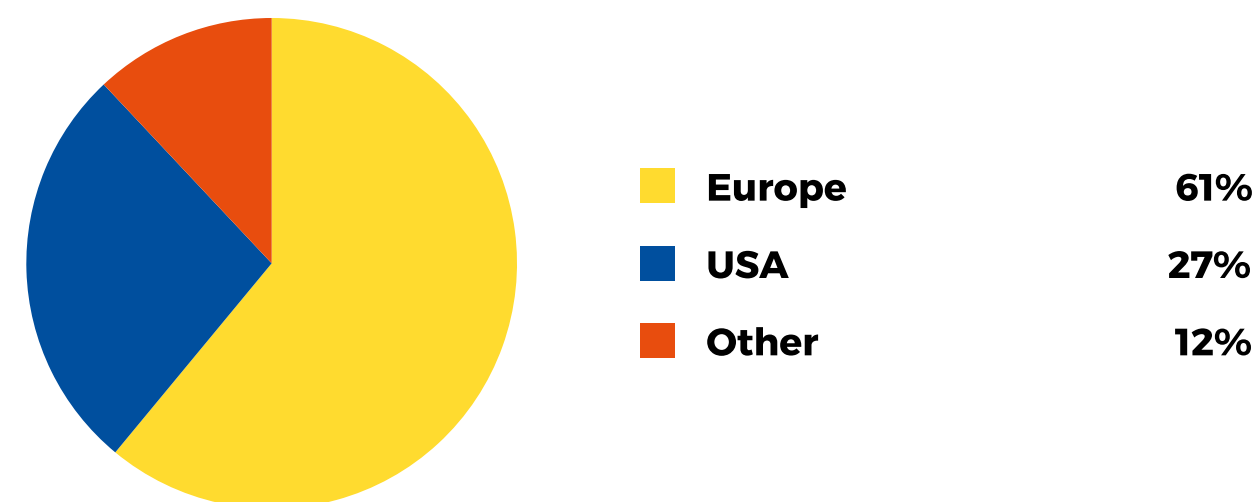
Type of Lab



Industries



Regions



*The total exceeds 100% because participants' organizations may operate in multiple industries, allowing them to be categorized under more than one sector.

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A4BEE is a technology company deeply committed to support biotech, pharma, and manufacturing sectors.

We work closely with global players to shape winning strategies, implement new digital solutions and harness the power of connectivity, flexibility, and modularity. We support them at every stage of their digital transformation journey while solving real-world problems.

\$25m

worth of projects for our clients

120+

projects in last 3 years

6

years on the market

110+

talents working with us

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Digital & Data Advisory

Digitization & Data Strategy
Data Analytics, ML & AI
Biotech Labs & Mfg Digitization



Digital Solutions Engineering

Cloud & Data Platforms
Digital Twins
AI, ML & Analytics



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Control Engineering Services
IIoT, Robotics & Retrofitting
Digital Manufacturing



R&D & Hardware Development

Industrial Products & Prototypes
Biotech Smart Devices
Products & R&D Acceleration

