Intelligent life sciences

A blueprint for creating value through AI-driven transformation

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Foreword

AI in life sciences: Closing the ROI gap

Life sciences organizations have established themselves as leaders in artificial intelligence (AI) adoption, with a clear vision, business-led implementation, and robust data and technology foundations. Despite this progress, generating a high return on their AI investments is proving challenging.

While AI is delivering operational improvements and strategic advantages, new research by KPMG International shows many organizations are reporting only moderate, low, break-even or no return on their AI investments. Looking ahead, many expect ROI to remain flat in the coming years, raising a critical question: How can life sciences organizations better bridge the gap from no to low or moderate returns to consistently high ROI?

Our research finds organizations that utilize hybrid operating models, an optimized mix of functional and agile, significantly increase their chances of high ROI. This finding highlights the importance of adaptability in driving AI-enabled value creation. If the operating model is the primary determinant of ROI success, then life sciences organizations should prioritize structural transformation to become more adaptable, flexible, and AI-ready.

The challenge is no longer whether AI can deliver value, but how companies can reshape their organizations to fully realize its potential.

In this report, we explore how leading life sciences firms are making this transition — adapting their operating models, breaking down silos, and fostering AI-driven agility. We also share actionable insights into how organizations can take a value-based approach to AI that helps to accelerate innovation, unlock new growth opportunities, and maximize the impact of their AI investments.

Liz Claydon
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Global Head of Deal Advisory
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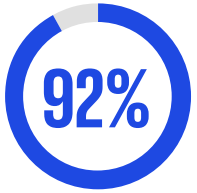
At a glance

AI is a critical differentiator

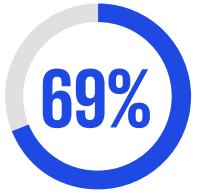
86% believe that organizations in their industry that embrace AI will develop a competitive edge over those that do not

The role of AI is clear



state their organization is clear on which AI technologies and capabilities it should invest in

and



have a clear strategic vision of the role AI will play over the next five years

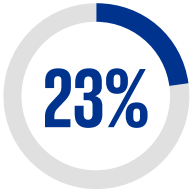
Initial implementations are encouraging

97% have achieved operational improvements through the adoption of AI

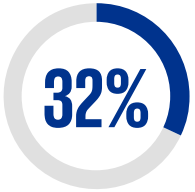
with

73% achieving improvements in efficiency

For many high ROI is proving elusive



of life sciences organizations report achieving high or very high ROI

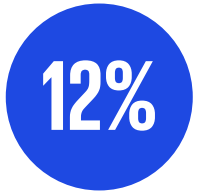


expect ROI to remain flat in the coming years

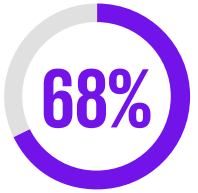
However, an adaptive structure drives higher ROI

Those who use a combination of functional and agile models are twice as likely to achieve high ROI

compared to those with traditional functional or matrix-based structures



Data has proven to be the key challenge



state that data has proven to be one of the most significant implementation challenges, issues include data silos, inconsistent formats and quality as well as security and privacy concerns.

Industry is preparing for an agentic future

89% feel comfortable with AI making end-to-end autonomous decisions for specific processes

and

85% have significant or growing use of autonomous agentic systems

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Introduction

AI in life sciences is about more than just technology adoption — it's about transforming the way life sciences organizations innovate, operate, and create value. From accelerating R&D, innovating across product portfolios, optimizing clinical trials to streamlining supply chains, AI can invigorate across multiple facets of the industry.

AI in life sciences is rapidly evolving — from traditional data analytics to generative AI and now toward agentic AI, capable of autonomous action within defined parameters. Generative AI (Gen AI) is already transforming R&D by accelerating drug development, generating novel compounds, and streamlining regulatory documentation.

The next leap — agentic AI — promises even greater impact, enabling systems that not only analyze data but proactively design experiments, manage trial workflows, and adapt in real time to new findings. This evolution is reshaping how life sciences organizations operate, collaborate, and deliver value — moving from static workflows to dynamic, AI-augmented ecosystems that accelerate innovation, reduce time-to-market, and personalize medicine at scale.

AI is already reshaping both scientific innovation and business operations. On the R&D front, AI is shortening drug discovery timelines and innovating the product portfolio with 'around the pill' and 'around the device' AI-enabled offerings. It's changing precision medicine and digital therapeutics with personalized dosing and digital biomarkers and improving clinical trial design through real-time data analysis and predictive modeling. AI-driven automation is even expediting regulatory submissions, ensuring compliance, and optimizing drug manufacturing processes.

Commercial and operational functions are also reaping significant benefits. AI is revolutionizing supply chain management, improving demand forecasting, and personalizing patient and healthcare provider engagement. AI agents are transforming customers, sales and field service teams by augmenting and automating engagement processes. AI-powered analytics are also enhancing market access strategies and salesforce intelligence, optimizing pricing models, and identifying new opportunities for revenue growth.

This report is supported by exclusive KPMG research, providing findings from a survey of 183 senior life sciences AI leaders. It is designed to provide C-suite executives, technology leaders, and decision-makers across the life sciences industry with actionable insights and strategic guidance to help them navigate the complexities of AI

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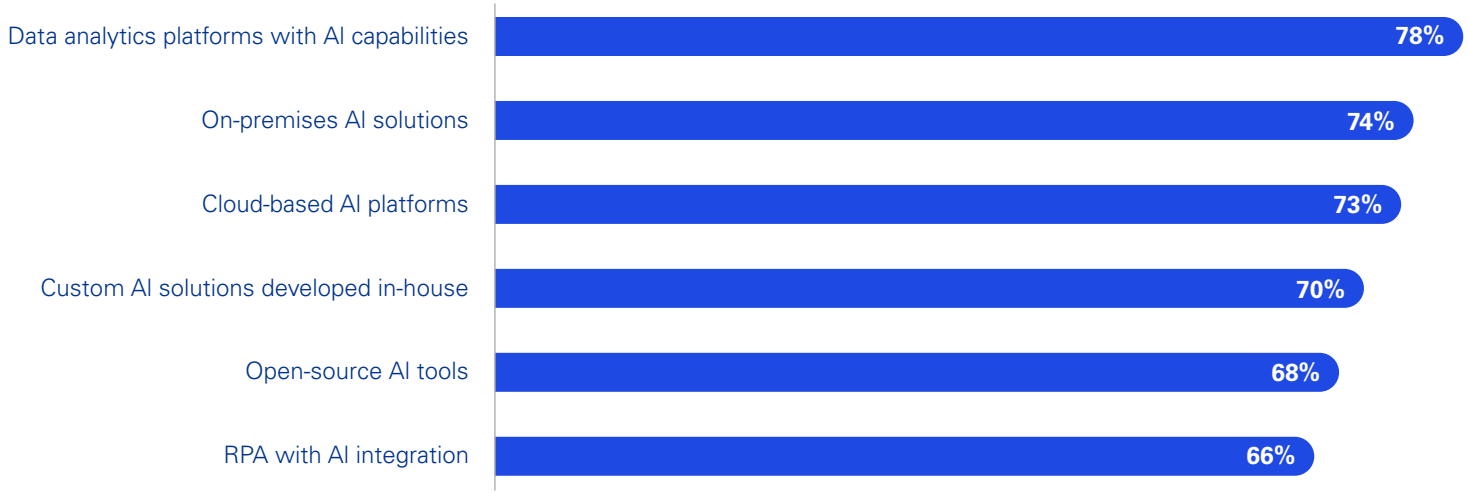
adoption.

In this report, we:

- Identify the attributes of high-performing organizations as well as the critical enablers of AI adoption, including data infrastructure, workforce readiness, and governance.
- Define AI-driven value creation in life sciences, focusing on the ways AI enhances R&D productivity and operations (while also addressing ROI challenges).
- Present an AI maturity framework to help organizations progress through three key stages:
    1. Enabling workforces and building AI foundations — Establishing the data, governance, and skills necessary for responsible AI adoption.
    2. Embedding AI across enterprises — Scaling AI solutions across clinical decision support, operational efficiency, and patient engagement to help deliver greater value.
    3. Evolving operating models and ecosystems — Shifting toward AI-powered, adaptive healthcare models that foster collaboration across commercial, R&D, healthcare ecosystems, research institutions, and regulatory bodies.

Figure 1: Significant or extensive use of AI in life sciences



To what extent (if at all) does your organization use the following artificial intelligence (AI) platforms and solutions? n=183

Source: Intelligent life sciences: A blueprint for creating value through AI-driven transformation, KPMG International, 2025

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AI in life sciences

Research findings

About the research

To study the current state of AI adoption and technology-related issues, KPMG International commissioned a quantitative survey of 1,390 decision-makers in eight industries (life sciences, healthcare, insurance, technology, banking, retail, industrial manufacturing and energy), across eight countries (Australia, Canada, China, France, Germany, Japan, the United Kingdom, and the United States). Included in this multi-sector study are 183 senior life sciences leaders (51 percent of whom held C-suite titles) representing large diagnostics firms and mid-sized pharmaceutical, biotech, medical device and pharma industry services companies.

Current state

A sector out in front

Among all industries exploring the potential of AI, our research shows that life sciences is one of the most advanced. Unlike sectors still experimenting or struggling to scale, life sciences organizations have embedded AI deeply into their operations — from R&D and clinical trials to supply chains and commercial functions. For many, AI is not just a tool, but a core part of how they work.

This leadership stems from early investment. Most of the surveyed life sciences organizations have been using AI for over three years, and nearly all have a clear understanding of the AI projects they should invest in and why. Strategic thinking is strong, with two-thirds of companies having a well-defined AI roadmap for the next five years. And perhaps most significantly, AI initiatives are usually business-led, not IT-led — ensuring alignment with core goals like speed to market, scientific innovation, and regulatory compliance.

Making AI work across the enterprise

AI is now embedded in day-to-day functions for many life sciences firms, not just in pockets. More than half of organizations are using AI across entire departments or value streams. Whether it's speeding up clinical trial design, identifying promising compounds, or improving patient support, AI is being applied with clear purpose.

This enterprise-wide adoption is made possible by thoughtful organizational design. High-performing firms use hybrid structures — blending functional expertise with agile teams — to drive both innovation and operational excellence. This balance enables teams to move fast when needed but stay grounded in the regulatory and scientific rigor the sector demands.

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AI also requires the right technology backbone

Most life sciences firms have invested in enterprise data platforms, analytics engines, and cloud-based infrastructure. These capabilities allow data to flow across teams, enabling better insights, automation, and decision-making. And critically, many organizations are training their people to understand data and AI — building a culture that's ready for what's next.

AI as a strategic and sustainable investment

Beyond immediate operational gains, life sciences firms are embedding AI into the core of their offerings. Sixty-five percent of companies are systematically integrating AI into their products and services, and 69 percent are investing in AI experimentation without immediate output expectations — a strong indicator of long-term commitment.

Despite AI's strategic importance, sustainability remains a top priority. Seventy-eight percent of life sciences organizations view meeting sustainability goals as an even greater strategic imperative than AI implementation, and 83 percent have concrete plans to mitigate the increased energy demands of AI.

Looking ahead: Toward autonomous intelligence

AI in life sciences is rapidly moving beyond traditional analytics. Generative AI is already being used for tasks like drafting clinical documents or modeling molecules, and many organizations are beginning to explore agentic AI — systems that can act autonomously within defined parameters.

These developments raise exciting possibilities. Eighty-nine percent of organizations are comfortable with AI making end-to-end autonomous decisions for specific processes, and 85 percent report significant or growing use of autonomous agentic systems. In the near future, intelligent agents could design lab experiments, monitor clinical trials in real time, or manage supply chain disruptions automatically without human oversight. Many leaders are ready for this shift, with high levels of comfort around AI making decisions in specific use cases.

The sector's forward momentum is also evident in its mindset. Many organizations are investing in AI not just for immediate gains, but to help future-proof their operations. A majority are experimenting without expecting short-term payback — showing a deep commitment to innovation.

of organizations are comfortable with AI making end-to-end autonomous decisions for specific processes

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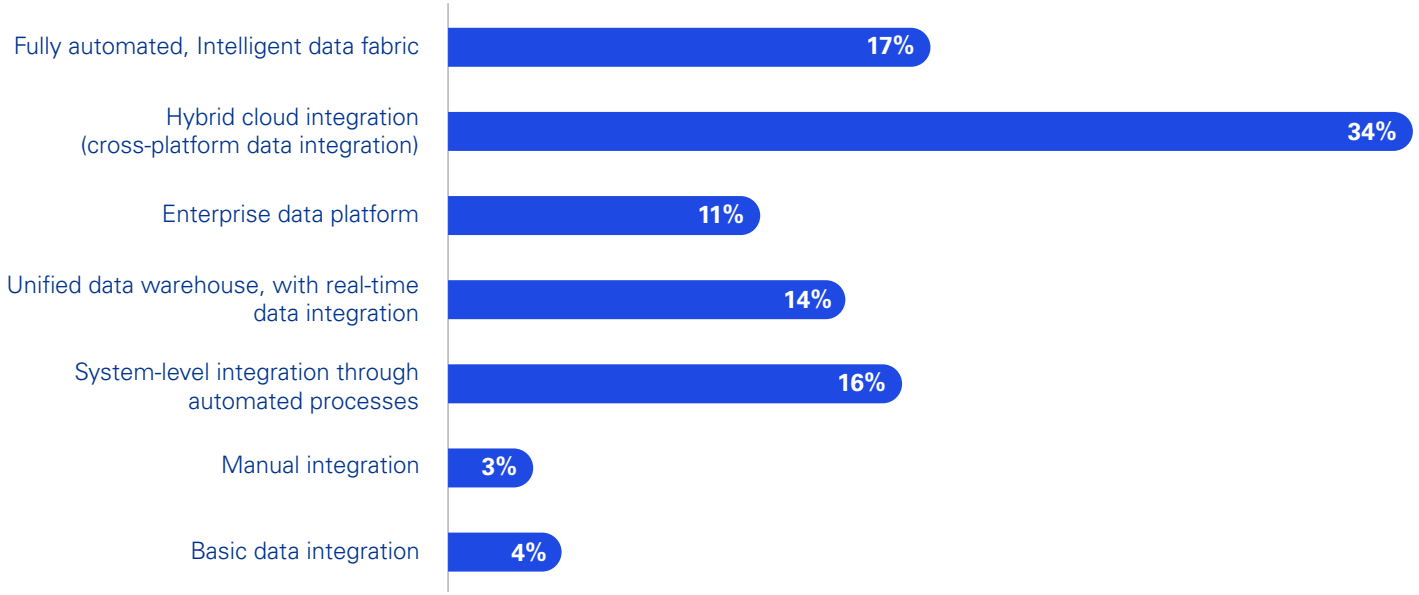
Figure 2: Data foundations in life sciences



How would you describe the current level of data integration in your organization? n=183

Source: Intelligent life sciences: A blueprint for creating value through AI-driven transformation, KPMG International, 2025

Barriers to progress

The data dilemma

Despite having strong digital foundations, data challenges remain a key barrier. Sixty-eight percent cite issues like siloed data, inconsistent quality, and privacy concerns. Whether it's patient information, clinical data, or regulatory content, accessing and integrating data across teams is still difficult.

These challenges create friction across the AI lifecycle — from training algorithms to generating actionable insights. And although confidence in AI-generated outputs is relatively high, these barriers can slow adoption, limit scale, and increase the risk of bias or error.

> "At the end of the day, you will need to get the data from humans. It will be humans generating the data and I see that it could go both ways. Humans can really understand the potential of AI and take this seriously, or they can get defensive and keep the data. If we cannot feed the AI with good data, then AI will be basically nothing."

Director, Life sciences firm — Germany

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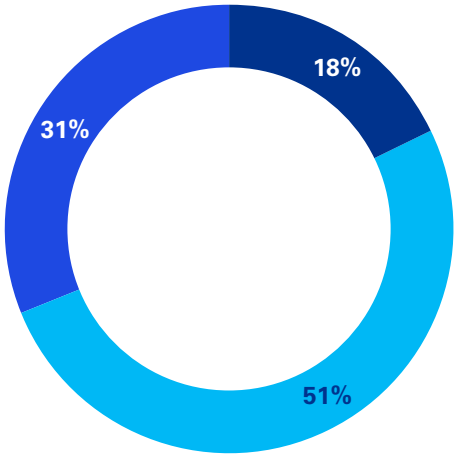
Figure 3: Estimated ROI in initiatives in life sciences



What has been the estimated return on investment (ROI) from your organization's AI initiative so far? (Responses for those whose organizations measure ROI, n=133)

Source: Intelligent life sciences: A blueprint for creating value through AI-driven transformation, KPMG International, 2025

Proving value remains elusive

Life sciences respondents rank measuring ROI as their third biggest AI adoption challenge. While most life sciences organizations believe in AI's potential, quantifying its impact remains difficult. Many leaders report pressure from shareholders to demonstrate fast returns on AI investments — but less than a quarter of firms are currently seeing strong ROI. Around 38 percent are seeing moderate gains, and one-third do not expect major improvements in the near term.

This disconnect is understandable. Many AI use cases are long-term plays — especially in R&D, where payback may take years. Nonetheless, the inability to consistently measure value remains a credibility issue, particularly in capital-intensive environments.

Skills shortages inhibit progress

Many life sciences organizations are constrained by a growing AI skills gap. While 74 percent of companies have begun training their workforce in AI, the demand for specialist skills — such as machine learning, data engineering, and AI governance — continues to outpace supply. This shortage is particularly acute in areas where scientific expertise and AI capabilities must intersect, such as drug development, clinical informatics, and regulatory tech. Without sufficient internal talent, organizations often face delays in scaling initiatives, increased reliance on external vendors, and challenges in ensuring AI solutions are both scientifically sound and compliant.

Operating model maturity makes the difference

Our research shows that operating model design is a major success factor. Organizations using hybrid structures — mixing functional expertise with agile squads — are twice as likely to achieve strong ROI from AI. These models enable faster innovation without sacrificing compliance or coordination.

In contrast, firms that remain locked in traditional, functionally siloed models tend to struggle with collaboration, responsiveness, and speed. The takeaway is clear: to get the most from AI, life sciences organizations should rethink how teams are structured and how work flows across the enterprise.

Unlocking AI's full potential

Life sciences firms have moved beyond AI experimentation into real-world impact. They are building the culture, technology, and operating models needed to scale AI with confidence. The sector's leadership position is not just about being early — it's about being strategic, aligned, and forward-thinking.

Still, to unlock AI's full potential and increase ROI, firms must continue breaking down data silos, improve how they measure success, and build agile organizations capable of navigating a rapidly evolving technology environment.

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Agentic AI

Unlike traditional AI that requires human oversight, agentic AI can independently make complex decisions, adapt to changing environments and manage multi-step processes autonomously. This innovation is set to transform R&D, clinical trials and operational efficiency. Based on KPMG professionals' technology and industry experience working with life sciences organizations around the world, we anticipate that agentic AI will impact every area of life sciences.

In pharmaceuticals and biotechnology AI will:

- Autonomously design experiments, optimize trial protocols, and adapt in real time to emerging data — Accelerating product development
- Independently manage regulatory documentation, align submissions with evolving guidelines across jurisdictions, and adapt strategies in real time based on feedback from agencies — Accelerating approval timelines and reducing compliance risks
- Continuously analyze real-world data and patient outcomes, tailor treatment protocols, suggest dose adjustments and flag adverse reactions in specific subpopulations — Enhancing therapeutic efficacy and safety post-launch

In MedTech AI will:

- Enable intelligent devices to self-calibrate, coordinate care workflows — Proactively guiding clinicians and patients based on continuous learning
- Connect devices to autonomously detect anomalies, escalate urgent findings and initiate next steps in care — Transforming chronic disease management and post-operative monitoring
- Forecast component wear, schedule preventive servicing in smart equipment, and adjust device settings — Maximizing uptime, reducing costs, and ensuring uninterrupted clinical performance

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Key actions to help support AI success

To help maximize long-term value creation, life sciences organizations should focus on four critical areas:

Develop an AI strategy focused on value realization

Life sciences organizations should develop a focused and diversified AI strategy that aligns with commercial goals, stakeholder needs, patient outcomes and that balances opportunities with risk.

Build trust into the AI-enabled innovation ecosystem

Trust is a cornerstone of AI adoption in life sciences. Organizations should aim to implement explainable AI (XAI) models, ethical AI governance frameworks and strict regulatory compliance to ensure transparency in decision-making.

Create a scalable technology and data infrastructure

AI's potential in life sciences depends on high-quality, integrated data and modernized technology infrastructure. Organizations should invest in enterprise data platforms, AI-driven analytics, and cloud-based infrastructures to enable seamless data integration and real-time AI applications.

Foster a culture of AI-augmented operations

It is said that AI won't replace humans. But humans with AI will likely replace humans without AI, so life sciences organizations should cultivate a culture that embraces continuous learning, empowers cross-functional collaboration, and equips their workforce to confidently harness AI as a strategic partner in driving scientific, clinical, and operational breakthroughs.

Integration is the biggest challenge. We want to scale, and we want the efficiency savings. But we're not getting those efficiency savings, because every instance of integration has to be managed individually.”

Vice President, Life sciences firm — UK

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Building the intelligent life sciences organization

Next-generation AI capabilities require companies to balance innovation with compliance, helping ensure that AI advancements create value and instill trust. This requires a structured, multi-layered approach that builds capability across foundational, functional and enterprise levels.

Enterprise

In our research, 68 percent of life sciences respondents report significant stakeholder pressure to prove the ROI of AI, making value capture essential. This layer plots AI transformation initiatives on a roadmap and, with help from a transformation office, adjusts priorities dynamically to maximize economic impact. It orchestrates enterprise-wide change, starting with how AI can adjust strategies, operational models and key objectives. It also defines operating model shifts, workforce evolution, and risks and controls.

Functions

Data silos are among respondents' biggest challenges when it comes to AI implementation, but to maximize value, organizations must allow data to flow freely between departments. This layer drives AI-enabled transformation across business functions, prioritizing customer-facing value streams and end-to-end enabling processes and workflows. AI applications, agents and robotics are embedded in workflows, and functional operating model changes are implemented to further realize benefits.

Foundations

This layer establishes the AI-first technology stack, including infrastructure, cloud and choices on chips. High-quality enterprise data needs to be curated, and diverse models are likely to be deployed to handle domain-specific AI. An increased focus on cybersecurity for AI is needed as well as a plan for other emerging technology, such as agentic AI. Here, our respondents are mostly prepared. The majority are using cloud or hybrid cloud infrastructure, a positive sign of AI readiness.

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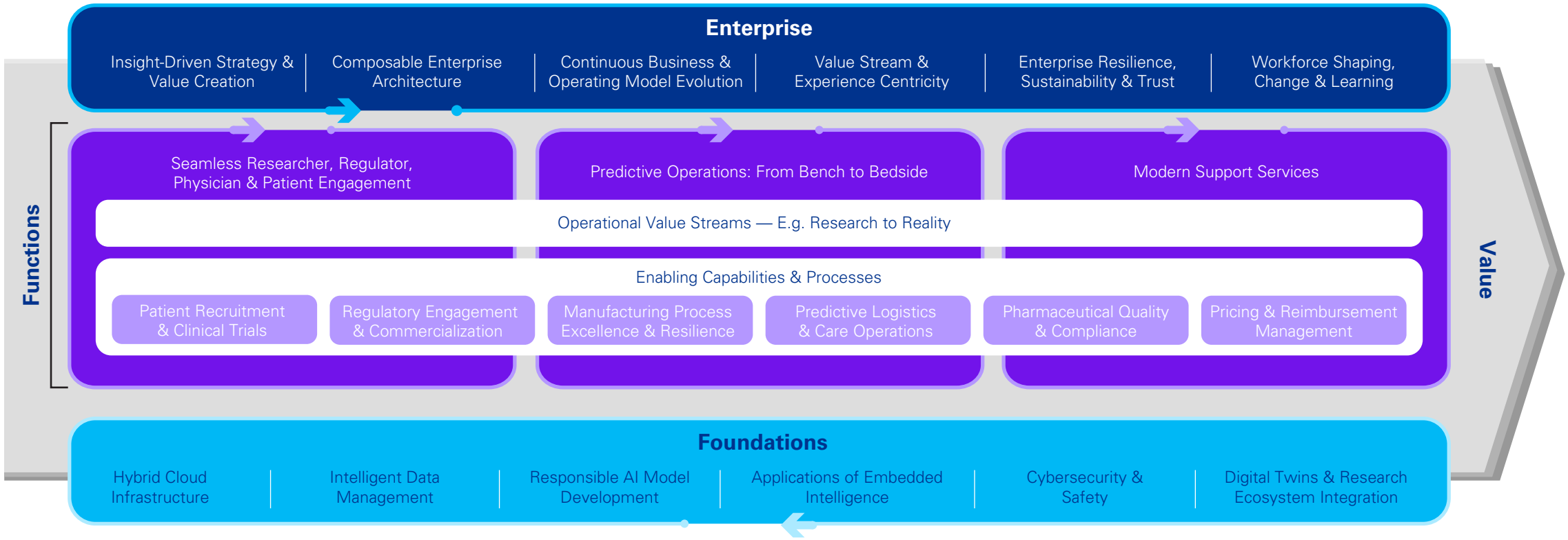
Blueprint for intelligent life sciences organizations

This illustrative blueprint outlines key, high-level capabilities for AI-powered, customer-centric life sciences organizations. Intelligent life sciences organizations leverage advanced technologies, personalized experiences, data-driven insights and automated operations to enhance efficiency, innovation and resilience. Focused on embedding intelligence across value streams and processes, it helps to ensure seamless customer, researcher and patient interactions, robust risk management, intelligent research, product manufacturing and future-ready adaptability.



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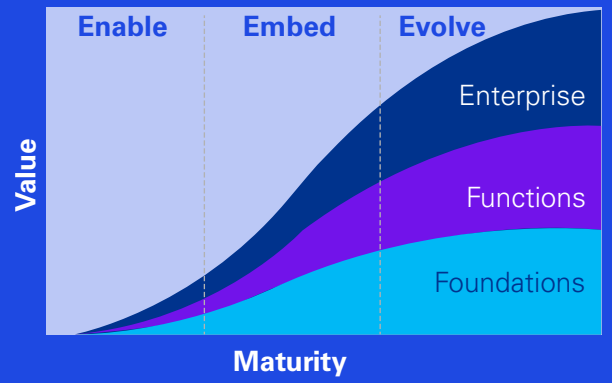
The three-phase journey to become an intelligent life sciences organization

By examining leading practice, KPMG has identified that organizations can increase capability and value across three phases of AI transformation. This structured yet flexible framework helps organizations navigate the complexities of AI adoption. It balances the need for short-term efficiency gains with the imperative to innovate and remain agile in the face of future disruption.



Enable

The Enable phase builds AI foundations. Organizations appoint a responsible executive, create an AI strategy, identify high-value use cases, boost AI literacy, align with regulations and establish ethical guardrails. AI pilots are launched across functions, while cloud platforms and pre-trained models are leveraged with minimal customization.

Embed

The Embed phase integrates AI into workflows, products, services, value streams, robotics and wearables, helping to deliver greater value. Senior leaders drive enterprise-wide workforce redesign, reskilling and change, embedding AI into operating models with a focus on ethics, trust and security. AI agents and diverse models are deployed, supported by cloud and legacy tech modernization, while enterprise-wide data enhances operations.

Evolve

The Evolve phase elevates business models and ecosystems, using AI and frontier technologies like agentic and blockchain to solve sector-wide challenges. AI orchestrates seamless value creation across enterprises and partners. Emphasizing ethics and trust with real-time security, this phase uplifts human potential. AI is embedded in the culture of the organization. The workforce, upskilled with deep training, fosters a creative, innovative and value-driven future.

Organizations are likely to have a portfolio of initiatives aimed at any level of operating models within each phase and effort and investment will vary as organizations mature. Initially, most resources will focus on Enable, with a small effort to explore enterprise-wide transformation. Over time, as foundational efficiencies are realized, more effort is invested in Embed. Later, with an eye on the future, long-term investments in Evolve lay the groundwork for transformative innovation.

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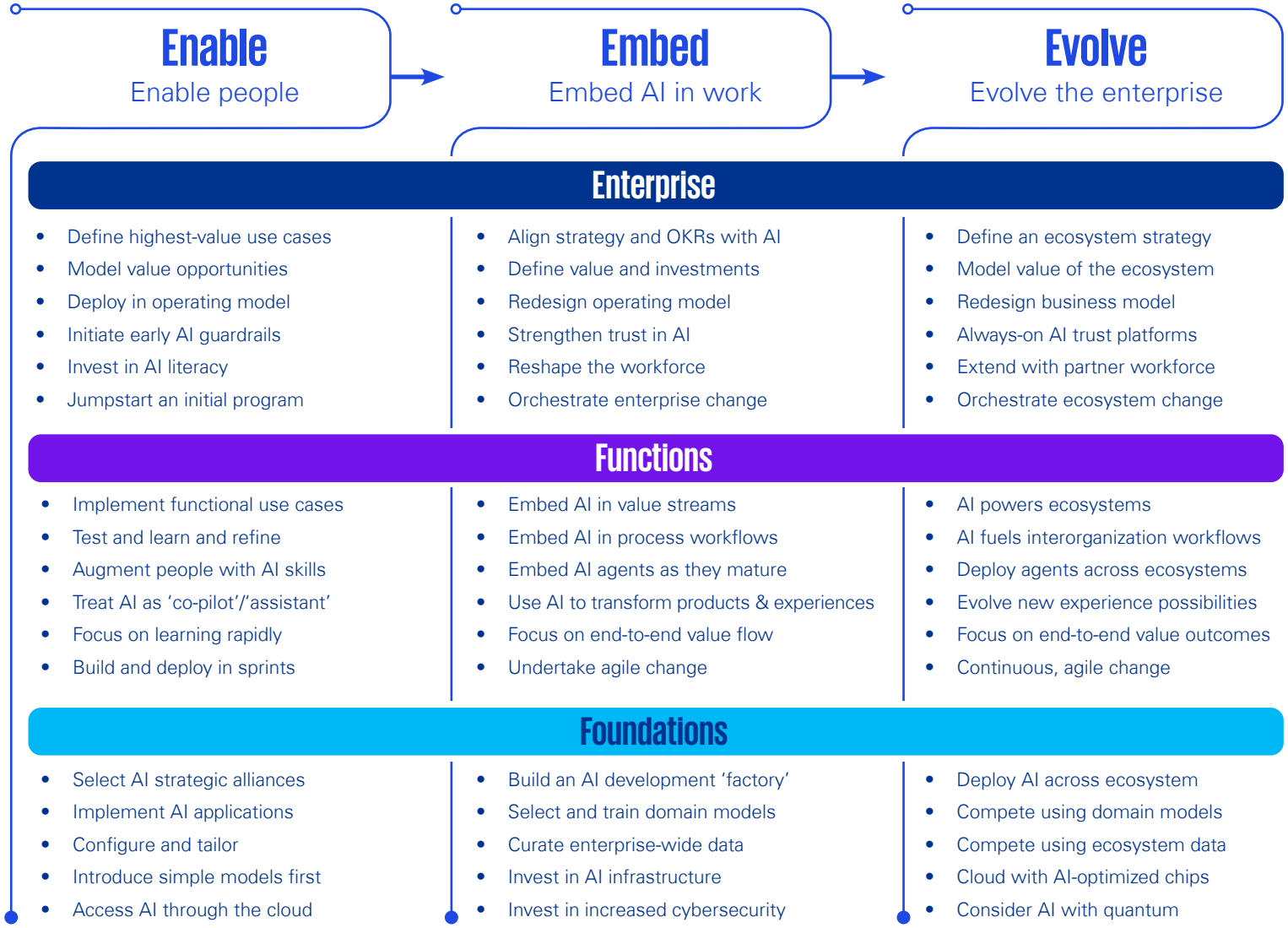
Phases of the AI journey

Focusing on maturity across Enable, Embed and Evolve is critical for sustained value creation. At the enterprise layer, increased AI maturity involves orchestrating AI across functions to enable enterprise-wide innovation and strategic alignment. Without a balanced focus on all three layers, organizations risk missing opportunities for transformation. At the functions layer, AI should be embedded into key value streams, optimizing specific processes and creating improved outcomes, such as more compelling products and services, and more engaging end-to-end employee and customer experiences. At the foundations layer, organizations should build up new AI-first technology stacks. Infrastructure, data, models and applications can all become optimized for delivery of AI.

Life sciences organization maturity against the three phases

Our research found that the path to AI value is uneven across life sciences organizations, with some areas progressing faster than others. Different functions may be at different stages of AI adoption, with some focusing on foundational efficiencies (Enable), others scaling AI for growth (Embed), and a few exploring transformative opportunities (Evolve).



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The first phase:

Enabling life sciences teams with AI

The Enable phase allows researchers, scientists, regulatory teams and commercial leaders to integrate AI into their flows of work. The initial focus identifies areas where AI can deliver quick, measurable improvements by automating routine tasks, streamlining workflows, accelerating decision-making and building longer-term capabilities.

Here, the sector demonstrates progress: nearly three in four respondents (73 percent) say their organizations have achieved efficiency improvements with AI, with 39 percent citing financial improvements.

At the enterprise level, this includes appointing senior AI leadership, developing a clear AI strategy, and aligning AI initiatives with R&D, operational, and regulatory priorities. Organizations should also invest in AI literacy programs, ensuring that professionals across research, manufacturing, and commercialization understand AI's capabilities, limitations, and ethical considerations. They must also comply with jurisdictional regulatory requirements and data privacy and protection legislation, and conform to AI standards such as IS 42001, EU AI Act, SOC 2 and the NIST Risk Management Framework.

Other KPMG insights on responsible and ethical AI use in life sciences

The road to responsible AI adoption in life sciences
(KPMG in the US)

Medical Devices and the EU AI Act: How to achieve a comprehensive compliance strategy
(KPMG in Germany)

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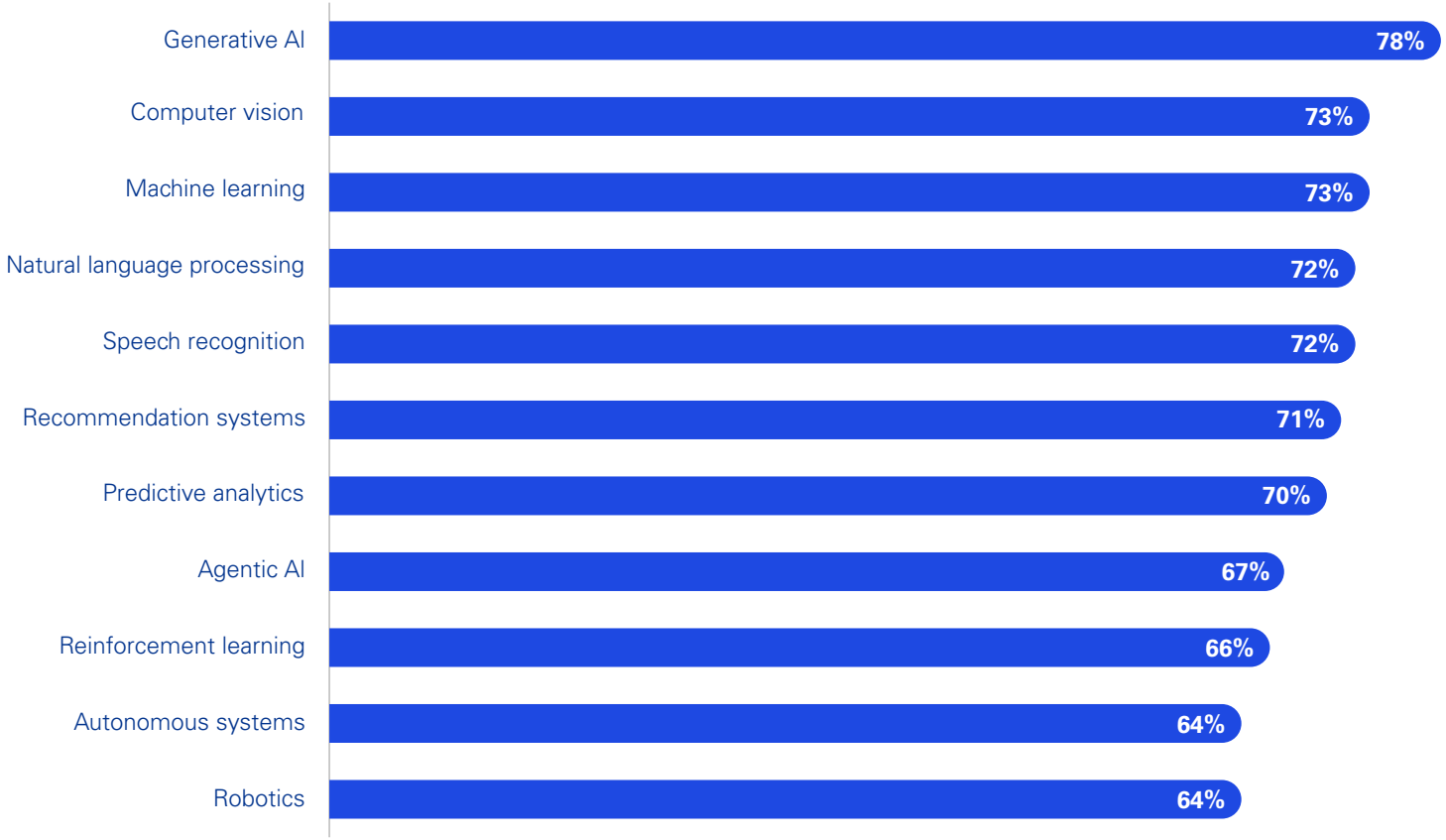
At the functional level, life sciences companies can test AI solutions in areas such as protocol design, multi-omic sample analysis, digital pathology, clinical trial optimization, regulatory compliance automation and supply chain management. These pilots help organizations build AI expertise, identify early wins, and refine implementation strategies before scaling. Pilots also deliver real-world evidence that AI can provide immediate efficiency gains, reduce complexity and help ensure compliance.

Cloud-based AI platforms, pre-trained scientific AI models, and federated learning techniques help researchers integrate AI into drug development, biomanufacturing, and commercialization. In MedTech, AI improves R&D, including faster identification of biomaterials or unmet needs, for example. This early experimentation doesn't require significant customization or infrastructure overhauls, helping to ensure that AI adoption is practical, scalable and aligned with business goals.

The goal of early AI adoption is to augment human expertise. In this way, life sciences organizations can help ensure that AI adoption is strategic, scalable, and primed for long-term success.

Figure 4: Significant or extensive use of AI applications in life sciences



Does your organization use any of the following artificial intelligence (AI) applications? n=183

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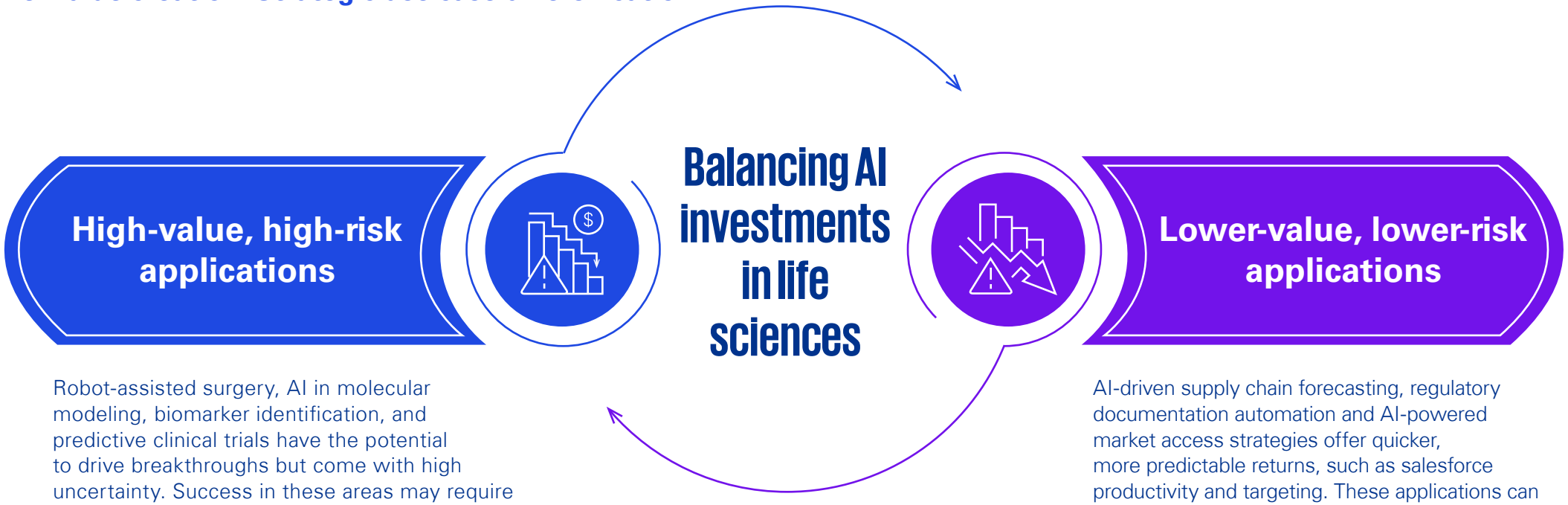
Value creation in life sciences

In the first phase of AI adoption, life sciences organizations build foundational capabilities while delivering measurable value. This approach prevents AI from becoming an isolated technology investment and instead helps to ensure that AI adoption is strategic, scalable and tied to tangible business outcomes. Our research highlights that the most effective organizations follow a dual-track approach, balancing parallel value creation and realization. While high-value applications may take longer to mature, lower-risk operational AI solutions can deliver immediate efficiency gains, sustaining investment and securing stakeholder buy-in.

Parallel value creation: Strategic use case diversification



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To guide clients' AI strategy and investments, KPMG in the US analyzed vast amounts of data to quantify the Gen AI opportunity. The analysis calculated the potential value at stake from fully deploying and adopting Gen AI across all potential uses within companies.

Over

17 million companies globally assessed.

After looking in depth at

7,000 companies employing

72 million people and pressure-testing results with

500 clients,

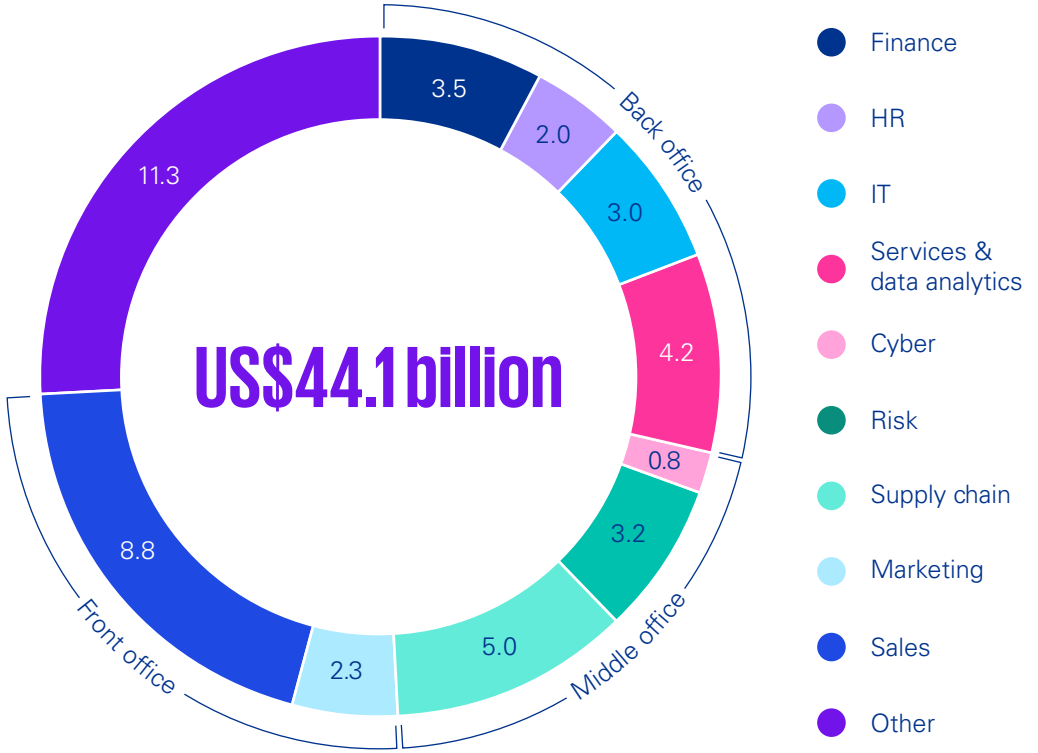
the results equate to

4 — 18% EBITDA* improvement in labor productivity alone.

Our calculations and methodologies show the potential value opportunity within the life sciences sector in the chart to the right.

*EBITDA = Earnings before interest, taxes, depreciation and amortization

Figure 5a: Gen AI opportunity, task complexity breakdown: Life sciences (Value in US$ billions)



Source: Quantifying the GenAI opportunity, KPMG in the US, February 2025

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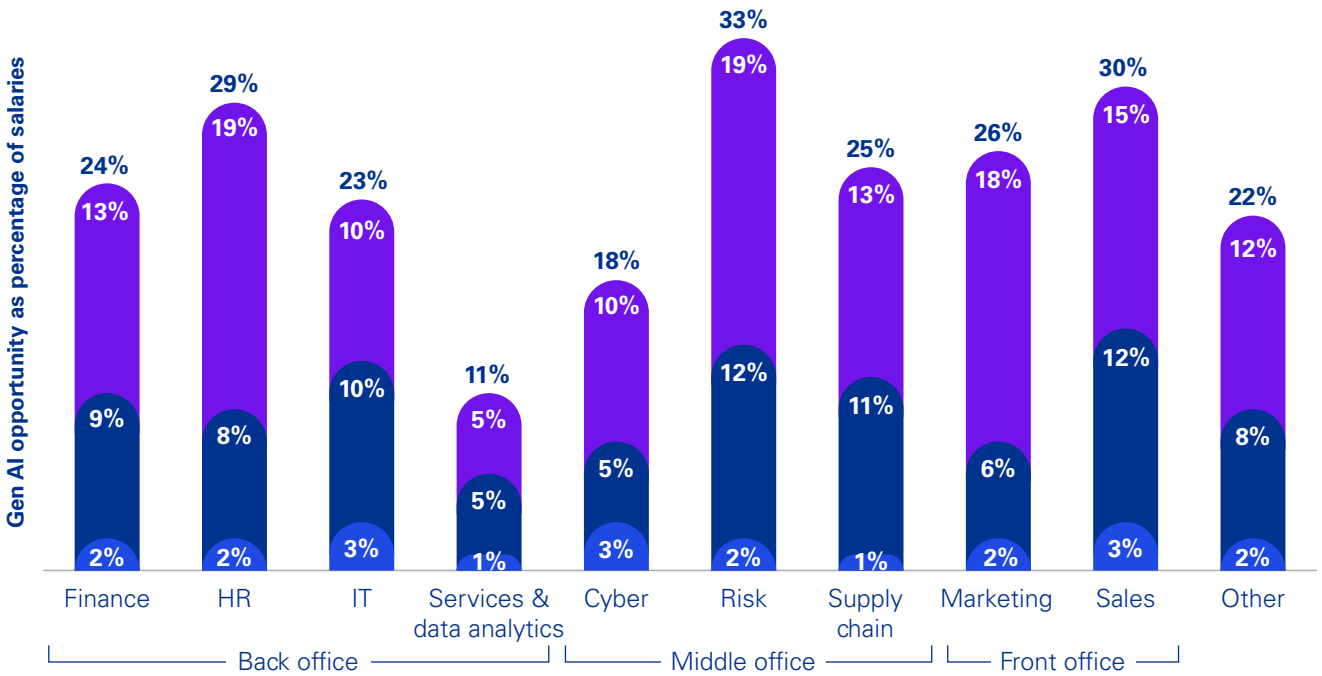
Figure 5b: Gen AI opportunity, task complexity breakdown: Life sciences



Low complexity

Based on tasks that are relatively simple and can be effectively augmented using readily available Gen AI tools such as Copilot, ChatGPT and other out-of-the-box technologies.

Medium complexity

Based on tasks that have potential for Gen AI augmentation but may necessitate the development of more integrated and customized solutions.

High complexity

Based on tasks that have potential for Gen AI augmentation but will likely require the creation of integrated and sophisticated solutions, as well as comprehensive governance and change management to enable adoption.

Note: Figure 5b shows the Gen AI opportunity as a share of total salary cost by degree of complexity within each function for all life sciences organizations in the sample. The axis represents share of the Gen AI opportunity as a proportion of the total salary cost by degree of complexity within the function. Percentages in the graph were rounded to the nearest whole number.

Source: Quantifying the GenAI opportunity, KPMG in the US, February 2025

Top 10 areas of opportunity: Life sciences

01 Customer relationship management

02 Regulatory compliance and reporting

03 Operations execution

04 Medical research

05 Performance optimization

06 In-store analytics

07 Regulatory compliance

08 Supply chain resource allocation

09 Treatment protocol summary

10 Clinical data analysis

Source: Quantifying the GenAI opportunity, KPMG in the US, February 2025

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Parallel value realization: Building AI capability while delivering ROI

Regardless of sector, successfully embedding and integrating AI requires human talent, advanced infrastructure and the right operating model. However, rather than front-loading AI investments in capability development, the most effective organizations build AI skills and infrastructure iteratively and align them with ROI milestones. This helps to ensure that AI is an enabler of value. Early AI investments should focus on foundational enablers, such as AI-ready platforms, data and data lakes, alongside workforce literacy programs. As capabilities mature and AI use case sophistication increases, organizations can later scale AI in other areas, such as drug design and clinical trials.

Sub sector-specific use cases

Pharmaceuticals and biotechnology

Generative AI for drug discovery: Using AI models to generate novel molecular structures with optimized properties for drug development.

AI-enabled biomarker discovery: Enhancing early-stage research by identifying promising biological targets and biomarkers for disease detection and treatment; advanced imaging analysis; digital pathology; spatial transcriptomics.

AI-driven epidemiology: Analyzing large-scale health records, patient-reported data, and wearables for post-market surveillance and precision medicine insights.

Predictive pharmacokinetics and drug repurposing: AI modeling to simulate how drugs interact in the human body, reducing failure rates and identifying alternative applications for existing drugs.

MedTech

AI-assisted medical imaging and diagnostics: Using computer vision and deep learning to improve accuracy in imaging.

AI-powered robotics for surgery: Enhancing robotic-assisted surgery with real-time AI-driven guidance and predictive analytics.

Smart medical devices and AI-integrated wearables: AI-driven sensors providing real-time health monitoring and predictive alerts for chronic disease management, facilitating 'hospital in the home' and outpatient models.

AI-driven device manufacturing: Automating MedTech production processes with AI-enhanced quality assurance and predictive defect detection.

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Case studies

Optimizing supply chain and inventory management

Supply chain management in the life sciences sector is fraught with challenges that require careful navigation. Companies must prioritize regulatory compliance, manage product complexity and demand forecasting, and anticipate potential disruptions.

A multi-billion-dollar global life sciences company had multiple systems and disparate processes. As a result, they were unable to track inventory, resulting in over-purchasing that tied up a significant percentage of the company's working capital.

The company has engaged KPMG in the US to help them create a more centralized approach. This process involves reimagining the current state of the company's inventory management processes, then implementing and using AI to automate key processes with the goal of improved demand forecasting, inventory optimization and a reduction in working capital.

Responding to evolving medical device regulatory requirements

Around the world, medical device regulators are requiring manufacturers to provide them with up-to-date information at the product code level. Given that Unique Device Identification (UDI) attributes are dispersed across vast amounts of unstructured data, this is a complex undertaking. A global medical device manufacturer had historically used a heavily manual process to collect, extract and validate this information from unstructured data sources. This process was time-consuming, error-prone, and could only be significantly scaled with temporary workers, and costed the organization hundreds of millions of dollars a year.

To address these challenges, the manufacturer turned to KPMG in the US who created an AI-enabled Automated UDI Attribute Extraction solution. Generative AI models, equipped with natural language processing (NLP) capabilities and Graph Database technology are used by the solution to sort through unstructured data to identify, categorize, and extract relevant information with high precision and speed to support more efficient human validation. The solution enables the organization to meet urgent regulatory deadlines and maintain market access, while reducing costs and supporting scalable operational excellence.

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The second phase:

Embedding AI in the flow of work

> AI adoption is occurring across the entire business model, across the value chain of manufacturing, marketing, customer engagement, research and development, and most of the end-to-end value chain functions.

Marketing Head, Pharmaceutical company — Japan

The Embed phase marks the shift from AI experimentation to full-scale integration across life sciences — from drug discovery and clinical trials to manufacturing, regulatory compliance and commercial operations.

To help to ensure strategic alignment, senior leadership should oversee AI-driven transformation at the enterprise level, embedding AI into operating models, to drive systemic improvements. The Embed phase also prioritizes ethics, security, compliance and trust, aligning AI applications with industry regulations. This also reinforces transparency in clinical validation, real-world evidence generation and regulatory decision-making.

AI models and intelligent agents become deeply embedded into drug discovery pipelines, real-world evidence platforms, regulatory workflows and supply chain networks. The effectiveness of AI is further strengthened by multimodal data integration, pulling from clinical trials, imaging, genomics, real-world data and patient-reported outcomes. Life sciences infrastructure evolves toward a hybrid AI model, combining cloud-based AI capabilities with on-premises high-performance computing resources to help to ensure scalability, compliance and security.

While some R&D and commercial functions may still be in early adoption phases, organizations can now expand AI's role beyond cost savings to broader value creation. AI drives business growth by accelerating drug pipelines, improving regulatory approvals, optimizing workforce efficiency and quality as well as enabling new revenue streams through AI-driven insights. Life sciences operating models will shift from rigid departmental structures to integrated, value-stream-driven models, spanning drug development, regulatory processes and market access strategies.

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AI-driven value streams in life sciences

In life sciences, value creation depends on optimizing R&D efficiency, regulatory compliance, operational excellence and market competitiveness. The value of the prize is enormous and achieving high levels of efficiency is equally important.

Over US$276B[1]
in global life sciences R&D investment

Clinical trial related impacts[2]

US$500,000
Approximate cost of loss of a single day of delay in unrealized or lost prescription drug sales

US$40,000
Approximate mean direct cost to conduct a clinical trial per day

Product innovation to patient outcome

MedTech's value stream spans processes from R&D to manufacturing to post-marketing support. It requires rigorous safety and compliance standards.

Drug development and preclinical research

AI accelerates drug discovery by designing and optimizing molecules while predicting efficacy and toxicity. AI speeds up biomarker discovery, automates high-throughput screening, and enhances preclinical studies through simulations — reducing animal testing and improving success rates.

Clinical trials and regulatory compliance

AI improves trial efficiency via optimized patient recruitment and protocol design, increasing the likelihood for success while enabling automated regulatory submissions. It enhances compliance through AI-driven pharmacovigilance, quickly identifying safety signals and ensuring adherence to evolving regulatory standards.

Supply chain optimization

AI enables real-time defect detection, smarter forecasting, and streamlined logistics to prevent shortages. Automated batch release and compliance audits reduce delays, while AI-enabled cold chain monitoring protects sensitive products throughout distribution.

Market access, commercialization, and post-marketing surveillance

AI informs pricing strategies and supports faster market access by analyzing payer data and real-world evidence. It enhances provider engagement and therapy adoption through personalized outreach and ensures ongoing safety via continuous post-marketing monitoring.

[1] Amitah Chandra et al., "Comprehensive Measurement of Biopharmaceutical R&D Investment," Nature Reviews Drug Discovery (August 2024), DOI: https://doi.org/10.1038/d41573-024-00131-2
[2] Getz, K. (2024 June 6). How Much Does a Day of Delay in a Clinical Trial Really Cost?, Applied Clinical Trials, Volume 33, Issue 6, https://www.appliedclinicaltrialsonline.com/view/how-much-does-a-day-of-delay-in-a-clinical-trial-really-cost-

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The third phase:

Evolving the life sciences ecosystem

The Evolve phase represents the full-scale transformation of life sciences organizations into AI-powered, ecosystem-driven enterprises, capable of adapting to market shifts, forming new business models, and solving industry-wide challenges.

In this phase, AI extends beyond internal operations to orchestrate collaborative ecosystems with biotech firms, regulatory bodies, healthcare systems, insurers and technology partners, delivering seamless, cross-industry value.

In this phase, AI converges with frontier technologies like advanced visualization, driving breakthroughs in life sciences innovation. These advancements require closer collaboration between biopharma, MedTech, digital health and research institutions, helping ensure AI-driven discoveries are translated into real-world applications faster than ever before. Ethical considerations, data security and regulatory compliance remain central, with real-time monitoring, continuous auditing and AI governance frameworks delivering transparency and trust.

The focus shifts to seamless interoperability, enabling AI systems to operate across platforms, data sources, and institutions. Multi-agent AI environments will enhance collaboration between different AI models, optimizing complex decision-making in drug development, diagnostics, and patient care. Advanced simulations and synthetic trials will revolutionize clinical research by reducing reliance on traditional patient recruitment, accelerating testing, and improving predictive accuracy. These innovations may significantly shorten discovery timelines, allowing life sciences organizations to bring new treatments to market faster while reducing costs and improving patient outcomes.

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The life sciences sector is already experiencing cross-sector convergence as boundaries blur between telecom, retail, and technology industries. Telecom providers are leveraging their infrastructure, IoT networks, and access to health data to enable connected health solutions, while tech and retail giants are embedding AI into consumer-facing health devices and cloud-based platforms. This fusion is creating a new category of 'AI-enabled healthcare', where diagnostics, monitoring, and wellness are increasingly delivered through intelligent, data-driven ecosystems that challenge traditional MedTech and pharma business models.

"As AI enables costs to come down, some markets will grow, some decline, and new ones emerge. Invest in areas of price elasticity — things we can do more of with AI as costs decline. Your competitors may focus more on what is disappearing and risk being replaced."

Erik Brynjolfsson — Professor and Senior Fellow at the Stanford Institute for Human-Centered AI (HAI), Director of the Stanford Digital Economy Lab

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Ecosystem-driven opportunities in the Evolve phase

As life sciences organizations become orchestrators of AI-driven ecosystems, they will likely develop high-value, collaborative AI applications that go beyond traditional industry boundaries. In the Evolve phase, AI can enable seamless interoperability across biopharmaceuticals, MedTech, diagnostics, digital health, and regulatory ecosystems, fostering a more personalized, predictive, and scalable life sciences industry.

AI-powered personalized and preventative medicine

AI can shift life sciences from a reactive to a proactive industry by integrating biopharmaceutical companies, healthcare providers, insurers, and wellness platforms to create tailored treatment plans and risk-based prevention strategies. AI models continuously analyze genomic data, real-time biometrics from wearables, and environmental and social determinants of health to predict disease onset before symptoms appear.

By combining predictive AI with pharmaceutical R&D and insurance risk assessments, organizations can deliver targeted early interventions, lifestyle-based treatments, and AI-optimized medication regimens, reducing long-term healthcare costs while improving patient outcomes.

Pharma and biotech firms are also leveraging AI-driven digital health platforms to track drug efficacy in real time, ensuring adaptive and personalized treatments that evolve based on continuous patient monitoring.

AI-enhanced remote and AI-driven smart labs

AI is enabling a transition from centralized R&D and hospital-based treatment to AI-powered remote research and decentralized care models. AI-driven lab automation and virtual R&D environments allow pharmaceutical and MedTech companies to run simulations and synthetic trials, optimizing the drug discovery-to-market cycle.

AI-powered virtual scientists and lab assistants conduct hypothesis testing, data analysis, and experiment optimization, reducing human error and accelerating discovery timelines. AI-powered digital twins and remote monitoring tools provide real-time patient monitoring and disease progression tracking, enabling early interventions for chronic diseases and post-surgical recovery.

Autonomous AI-driven monitoring systems can continuously analyze patient vitals, flagging early signs of complications and automating intervention protocols to reduce the burden on clinicians and enhance patient outcomes.

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AI-integrated clinical trials and drug development

AI can redefine the clinical trial process by transforming how life sciences organizations collaborate with hospitals, contract research organizations and regulatory agencies. AI-driven real-world data integration enables life sciences companies to identify ideal patient candidates for trials, helping ensure greater diversity and real-world applicability in drug development. AI-powered federated learning and digital twin simulations predict drug effects on virtual patient populations, significantly reducing the time and costs associated with traditional clinical trials.

AI accelerates regulatory approval timelines by automating documentation, risk analysis, and compliance monitoring, ensuring faster market access for new therapies. Adaptive trial designs powered by AI allow companies to dynamically modify trial parameters based on real-time efficacy and safety data, increasing trial success rates and improving patient safety.

AI-driven value-based life sciences ecosystems

AI is enabling life sciences companies to transition from transactional to outcome-driven business models, fostering value-based ecosystems with payers, regulatory bodies, and healthcare providers. AI can continuously track patient outcomes, adherence to treatment plans, and long-term health improvements, ensuring that reimbursement models are tied to actual health benefits rather than traditional volume-based pricing. Predictive AI in healthcare financing can help optimize risk-sharing agreements between pharmaceutical companies and insurers, ensuring that pricing reflects real-world treatment efficacy.

AI-driven global supply chain orchestration helps minimize cost fluctuations, prevent drug shortages, and enhance supply chain resilience, ensuring stable market access for life-saving therapies. AI-enabled biopharma-manufacturer collaboration is streamlining precision medicine development, helping ensure that patients receive the right treatment at the right time, backed by AI-driven insights that personalize care and improve overall therapeutic effectiveness.

AI-driven

real-world data integration enables life sciences companies to identify ideal patient candidates for trials, ensuring greater diversity and real-world applicability in drug development.

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Key recommendations

The research reveals that those organizations that are realizing the most value from their AI investments have focused on four strategic actions:

1 Design an AI strategy that aligns with core competencies

Life sciences organizations should develop an AI strategy that aligns with their commercial strengths. AI initiatives should be value-driven and deliver scalability, interoperability and measurable impact across the organization.

> In our annual company objectives there's a part related to artificial intelligence where everyone has to say how they will adopt more artificial intelligence. ”

Director, Life sciences firm — France

Key actions

- **Prioritize high-impact AI use cases:**

  Focus on AI applications that deliver immediate value in areas such as molecular modeling, biomarker discovery, real-world evidence analytics, regulatory automation and supply chain optimization.

- **Develop an AI governance and leadership framework:**

  Establish a cross-functional AI steering committee that includes scientists, regulatory experts, IT leaders, data scientists and commercial stakeholders to oversee strategy, ethics and implementation.

- **Ensure AI scalability and interoperability:**

  Design AI solutions that seamlessly integrate with existing research platforms, clinical trial management systems, databases and biomanufacturing workflows, helping to ensure enterprise-wide scalability.

- **Define clear AI metrics and ROI measurement:**

  Establish quantifiable goals such as faster drug development timelines, reduced R&D costs, improved regulatory approval rates and optimized supply chain efficiency, helping to ensure AI delivers tangible business value.

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2 Build trust into the AI transformation roadmap

Trust is essential for AI adoption in life sciences. Engaging stakeholders early in AI development will help to ensure widespread adoption and long-term trust.

> Regulatory issues are another unique challenge in our industry because it directly concerns human health and safety. This leads to stringent oversight when handling personal health information. Strict compliance with regulations such as GDPR is essential to ensure patient privacy is not compromised.

Chief Marketing Officer, Life sciences firm — China

Key actions

- **Implement explainable AI and bias audits:**

  Help ensure AI models provide interpretable decision-making processes for scientists, regulators and clinicians by conducting bias detection and fairness audits, particularly in areas such as genomics, clinical trials and drug efficacy predictions.

- **Engage researchers, regulators and industry stakeholders in AI development:**

  Involve scientists, pharmaceutical leaders, regulatory agencies and patient advocacy groups in AI model training and validation. Use continuous feedback loops to improve transparency and adoption.

- **Establish AI ethics and compliance oversight:**

  Develop AI governance frameworks aligned with regulations, helping ensure privacy, security and accountability in drug development and patient-centric applications.

- **Showcase proven AI success stories:**

  Share real-world case studies demonstrating AI's impact on reducing R&D costs, accelerating clinical trial approvals and improving biomanufacturing efficiency.

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3 Create a sustainable technology and data infrastructure for AI adoption

High-ROI AI depends on scalable, interoperable and secure technology infrastructure. Organizations should modernize legacy systems, integrate fragmented research data sources and enable real-time AI applications across functions.

> The biggest challenge is trash in, trash out. You need to really make sure the data that you're training your AI on is quality.

Director, Life sciences firm — Germany

Key actions

- **Modernize legacy IT and research infrastructure for AI readiness:**

  Transition to cloud-based, AI-native architectures that support real-time analytics and automation in drug development, compliance and supply chains.

- **Unify and standardize data across platforms:**

  Implement interoperable data standards (FHIR, HL7, OMOP, and CDISC) to integrate structured and unstructured life sciences data. Give AI models access to comprehensive datasets across research, clinical trials and post-market surveillance.

- **Invest in secure AI-driven data governance:**

  Deploy AI-powered data management tools to automate de-identification of patient data, help ensure regulatory compliance and strengthen cybersecurity against IP theft and data breaches.

- **Adopt federated learning for collaborative AI training:**

  Enable privacy-preserving AI model training across life science companies, hospitals and research institutions so AI models can learn from diverse patient populations without compromising data privacy.

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4 Build a culture that uses AI to elevate scientific and operational potential

AI should enhance human expertise, not replace it. Life sciences organizations should foster a culture where AI augments researchers, regulatory teams and commercial functions. Reskill the workforce, integrating AI into scientific education and reinforcing AI's role in improving efficiency and innovation.

> I think their fear [employees] is that AI can replace them, and they're worried about job safety.

Director, Life sciences firm — Australia

Key actions

- **Integrate AI training into life sciences education and professional development:**

  Embed AI literacy into biomedical research programs, clinical trial training, regulatory affairs courses and supply chain management certifications.

- **Upskill life sciences professionals:**

  Provide AI competency training for scientists, regulatory teams and commercial leaders.

- **Position AI as an enabler, not a replacement:**

  Clearly communicate AI's role in accelerating research, improving decision-making and automating routine tasks. Create tangible goals for the usage of AI — for example, "free up more time on X process, so we can spend more time on research" means it is less likely people will feel that they will be replaced.

- **Encourage cross-disciplinary collaboration:**

  Foster partnerships between biologists, chemists, data scientists and regulatory experts to co-develop AI solutions that align with real-world research and business needs.

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Conclusion

The adoption of AI across the life sciences sector marks a transformative shift in how organizations innovate, operate, and deliver value. From accelerating drug development and optimizing clinical trials to enabling precision medicine and enhancing supply chain agility, AI has become a present-day imperative. This report has highlighted how leading life sciences organizations are moving through three waves of AI maturity: enabling individual productivity, embedding AI across core operations for efficiency, reengineering processes for scaled value, and reimagining the entire ecosystem for sustainable growth and impact.

Yet, as the sector advances, new challenges emerge. Governance, interoperability and trust remain critical hurdles. Organizations must not only invest in AI technologies but also in the operating models, data strategies, regulatory alignment, and workforce skills needed to embed AI responsibly and at scale.

The future of AI in life sciences is agentic, multimodal, and deeply human-centric. Digital agents can automate complex workflows, generative AI can assist scientists in creative problem-solving, and predictive models can support physicians in delivering proactive, personalized care. To realize this potential, life sciences companies must act — establishing AI transformation roadmaps, modernizing legacy systems, and fostering cross-functional collaboration.

AI is a strategic enabler — not just a technological upgrade and will be key to innovation and market leadership.

The future of AI in life sciences
is agentic, multimodal, and deeply human-centric.

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Methodology

To gain a broad understanding of how leaders are navigating the opportunities and challenges of implementing AI, KPMG International conducted a robust research program involving multiple methodologies. This included in-depth interviews with eight AI experts spanning technology, government regulation and industry, as well as discussions with sector-specific KPMG specialists. Qualitative research was conducted to uncover nuanced, industry-specific challenges and opportunities, including insights from several industry experts, including Erik Brynjolfsson of Stanford University, a renowned authority on AI and digital transformation.

The research was further strengthened by a quantitative survey of 1,390 decision-makers in eight industries (life sciences, healthcare, insurance, technology, banking, retail, industrial manufacturing and energy) across eight countries (Australia, Canada, China, France, Germany, Japan, the United Kingdom, and the United States). These leaders shared their experiences and perspectives on overcoming barriers to AI adoption, from dismantling legacy systems to addressing organizational inertia.

In parallel, an 18-month research project evaluated the realistic value at stake for fully deploying and adopting generative AI. Together, these inputs offer a clear roadmap for organizations to unlock AI's potential and drive meaningful, enterprise-wide change.

About the life sciences respondents

- 183 senior life sciences executives
- 51 percent of respondents held C-suite titles

Organization operating/revenue size	Percentage of respondents
Under US$1B	20%
US$1B to less than US$5B	60%
US$5B to less than US$10B	12%
US$10B to less than US$20B	2%
More than US$20B	6%

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KPMG: Guiding your AI transformation with experience and trust

We are a global network of professional services firms whose consultants provide support to the world's top 30 largest biotechnology and pharmaceutical companies ranked by revenue.[3]

With over 150 years of experience in data, industry insights, technology and regulatory expertise, KPMG is uniquely positioned to help you uncover AI opportunities, work through critical business challenges and unlock new revenue streams. From strategy to implementation, we guide you in taking small, impactful steps to tackle even the most complex problems — all underpinned by trust. We've invested in an AI-enabled platform for organizational change. It brings together the best of our thinking, frameworks, strategies and tools. So, you can change smarter and move faster — eliminating inefficiencies and building trust and confidence, at every step.

[3] Source: KPMG firm client lists reconciled against list of biomedical companies by revenue. (2025 February 14). In Wikipedia. Retrieved February 21, 2025, from https://en.wikipedia.org/wiki/List_of_largest_biomedical_companies_by_revenue

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Wherever you are on your AI journey, KPMG can help:

Develop a transformational AI strategy

Define your AI goals, identify opportunities and risks, and create a tailored strategy and execution plan. Build a business case with clear metrics to secure investments and help to ensure measurable success by scaling AI for enterprise-wide impact and building lasting capabilities.

Ensure AI trust and compliance

Scaling AI introduces complexities and risks. KPMG Trusted AI teams can help ensure your AI solutions are ethical, secure and compliant. Our Trusted AI Framework, built on 10 ethical pillars, empowers organizations to boldly deploy AI responsibly, transparently and with confidence.

Empower your workforce with AI

KPMG AI-enabled Workforce solutions deliver personalized adoption and upskilling experiences, helping your team embrace generative AI and infuse it into everyday work.

Building a sustainable AI technology infrastructure

Leverage KPMG professionals' experience to integrate AI frameworks, platforms and accelerators, helping you to ensure your technology infrastructure is ready to scale AI initiatives.

We help clients harness the power and potential of AI. From strategy to implementation. Small steps to solving seemingly impenetrable problems. Underpinned by trust.

You can discover endless opportunities with AI. You can with KPMG.

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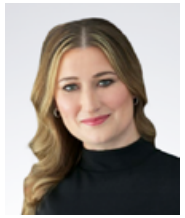

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