



EXECUTIVE INSIGHTS

The Power of Prediction: How Generative AI Can Drive Biopharma Strategy

Use of AI in biopharma

The current use of artificial intelligence (AI) in biopharmaceutical organizations is highly siloed in individual R&D, operational, and sales and marketing processes.

AI applications within R&D span the value chain. Key examples include tools that focus on improving the quality of drug candidates, optimizing clinical trial design, and reducing both the costs of clinical trials and their timelines (e.g., with virtual trial arms). AI has also seen adoption within supply chain management, with applications in demand forecasting and inventory/logistics as well as in manufacturing for robotic process automation and quality control (QC). Within biopharma sales and marketing functions, AI is used to enhance promotional strategies, improve patient support and optimize omnichannel marketing deployment. For more on existing applications of AI in biopharma, see *Artificial Intelligence in Life Sciences: The Formula for Pharma Success Across the Drug Lifecycle*.¹

Despite the adoption of AI in function-specific processes, its use in defining company strategy is nascent, due in part to the following:

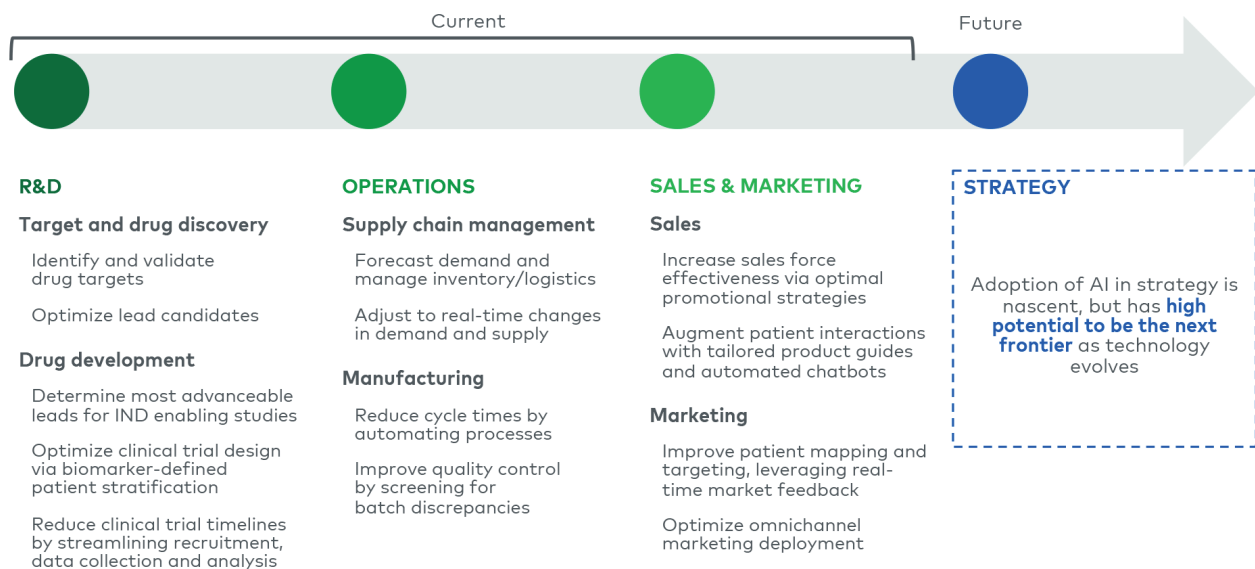
- The highly interdependent nature of strategy, spanning organizational layers, functions and inputs
- A focus on long-term company goals instead of near-term objectives
- Previous limitations on data availability and quality to train predictive models

However, recent technological advancements present a promising opportunity for overcoming these challenges and incorporating AI more effectively into strategic decision making. Generative AI technology has rapidly improved across all applications, including text-based (e.g., natural language processing and generation), quantitative (e.g., time series forecasting, predictive modeling), image/video/audio-based, and code-based AI. Text-based and quantitative generative AI are best suited to support biopharma strategy, given the ability to train these AI models with inputs from diverse sources and quantify multidimensional scenarios.

While the world is still trying to comprehend the true power of text-based generative AI since the November 2022 public launch of ChatGPT (GPT-3.5, and subsequently GPT-4), machine learning and predictive modeling are likely to enable critically valuable quantitative insights as the technology continues to improve (as noted in a recent L.E.K. Consulting special report, ‘Generative Artificial Intelligence (AI): Who (or What) Wrote This?’).²

As AI adoption and technical capabilities continue to expand, biopharma executives should view these tools as an opportunity for differentiation and define their vision to integrate AI into strategic processes across all layers of their organization (see Figure 1).

Figure 1
Current and future use of AI in biopharma



Note: AI=artificial intelligence; IND=investigational new drug application
Source: L.E.K. research and analysis

Components of biopharma strategy

Strategy within biopharma organizations is generally defined at three levels – corporate, therapeutic area and asset – with narrowing focus and specificity across each. Strategy at each subsequent level considers, reinforces and creates a feedback loop to strategic priorities defined at previous levels in the hierarchy, helping harmonize strategy across the organization (see Figure 2).

Figure 2
Biopharma strategy hierarchy and strategic inputs applicable to generative AI (non-exhaustive)

STRATEGY HIERARCHY	External landscape	Financial objectives	Growth priorities	Business development opportunities
Corporate	Macro-industry context and trends	Long-term financial planning and corporate productivity	Optimal pipeline scope and balance (e.g., geography, TA, modality)	BD requirements, external options and trade-offs
Therapeutic area	Key trends affecting TA evolution (e.g., new MoA, modalities)	TA growth aspirations	TA priorities (e.g., indications, modalities, capabilities)	External opportunities and trade-offs
Asset	Product market context (e.g., SoC evolution, patient journey)	Commercial opportunity assessment	Asset positioning (e.g., priority segments, unmet needs)	Opportunity cost (internal vs. external)

Note: AI=artificial intelligence; BD=business development; MoA=mechanism of action; SoC=standard of care; TA=therapeutic area
Source: L.E.K. research and analysis

The strategic inputs (i.e., information needed for management to make strategic decisions) across levels that are most applicable to generative AI include:

- **External landscape** – External forces and trends (e.g., macroeconomic, competitive, technological, epidemiological, regulatory) affecting decision making.
- **Financial objectives** – Long-term revenue and cost forecasting, reflecting an evolving external landscape and legislative changes (e.g., U.S. Inflation Reduction Act).
- **Growth priorities** – Relative attractiveness and feasibility of different approaches to generate growth. Priorities can be defined at the corporate level for geography (e.g., U.S. versus ex-U.S.), therapeutic area (TA) (e.g., oncology versus other TAs) and modality (e.g., biologics versus cell therapy); within the therapeutic area for disease indications, modalities and capabilities; and at the asset level for priority patient segments and unmet needs.
- **Business development opportunities** – Identification of pipeline/capability gaps relative to strategic priorities, and evaluation of external opportunities (e.g., assets, companies) and trade-offs versus internal programs.

Generative AI will likely have the most significant impact on strategic inputs that require aggregation and analysis of large data sets from heterogeneous sources across industries, organizations and functions. External data sources aggregate information from outside the organization (e.g., industry trends, TA and asset landscapes/trends, competitor performance/pipelines, regulatory changes, macroeconomic indicators), while internal data sources provide a detailed view of the company’s past performance and current situation (e.g., financials, pipeline, capabilities, resources). The most valuable insights may come from AI models trained on both external and internal data sets, enabling AI-generated predictions that reflect a comprehensive view of the company’s position and options.

Generative AI in biopharma strategy

As AI capabilities continue to evolve in the coming years, strategic applications or ‘use cases’ will continue to expand, presenting tremendous opportunities for innovative organizations to generate differentiated strategies. As companies accumulate more data and refine their models, generative AI systems become increasingly proficient at identifying patterns and providing valuable insights. Implementing AI in strategic processes today will lay the foundation for continuous improvement as models learn and adapt with more training, use, and iteration.

Figure 3 below is an example of an AI-generated response that evaluated a hypothetical pharmaceutical company’s strengths, weaknesses, opportunities and threats, or SWOT (see appendix for prompt details).

Figure 3
Example AI-generated SWOT analysis for a hypothetical biopharma company

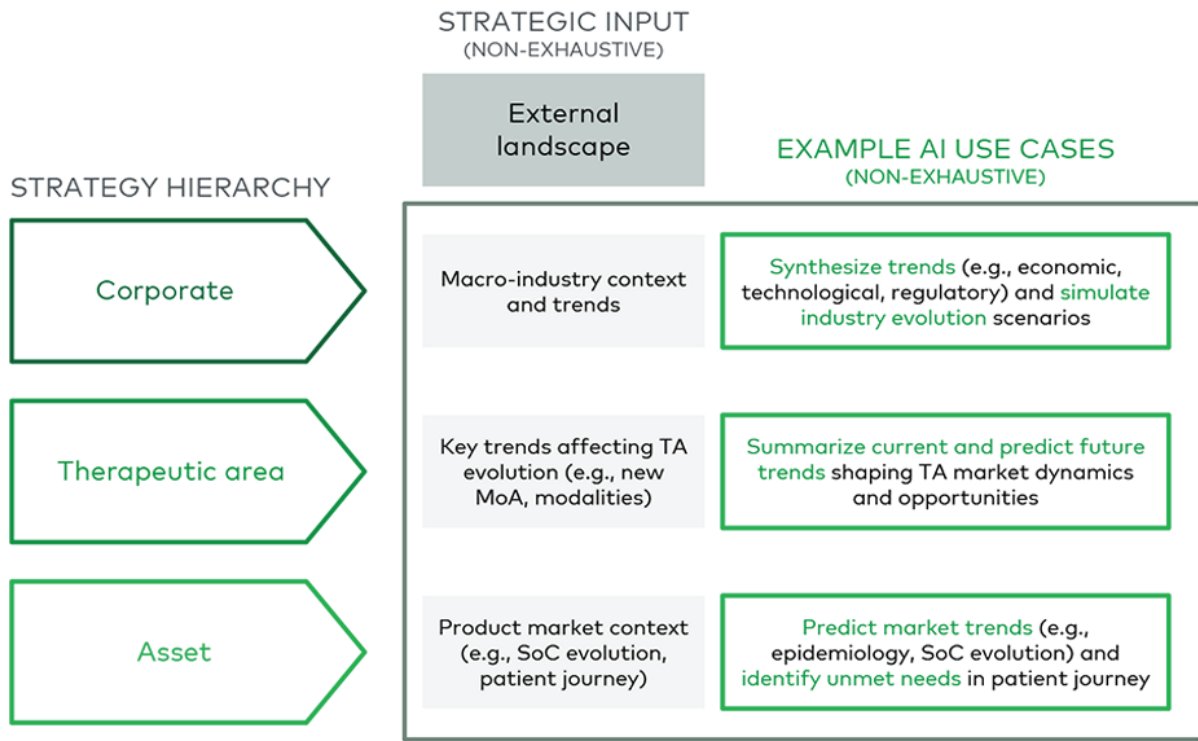
STRENGTHS	WEAKNESSES
Specialization in high-demand therapeutic areas: infectious disease, oncology and neurology	Heavy reliance on two leading products for revenue, which face loss of exclusivity by the end of the decade
Proven R&D capabilities with two top 10 revenue-generating drugs developed in-house	Predominantly early-stage clinical pipeline, posing uncertainty about future drug candidates’ success
Strong revenue generation, with over \$5 billion in sales from leading products last year	Limited diversification across therapeutic areas, potentially increasing vulnerability to market fluctuations
OPPORTUNITIES	THREATS
Strengthen the clinical pipeline through research collaborations, in-licensing deals or acquisitions	Intense competition from established pharmaceutical companies and emerging biotech startups
Accelerate R&D to identify and develop new drug candidates to compensate for revenue loss due to expiring patents	Regulatory challenges and rising costs associated with drug development and approval processes
Expand into complementary therapeutic areas or explore new indications for existing drugs to diversify revenue streams	Market penetration by generics and biosimilars following the loss of exclusivity, leading to reduced market share and pricing pressure

Note: AI=artificial intelligence; SWOT=strengths, weaknesses, opportunities, threats
Source: ChatGPT (GPT-4)

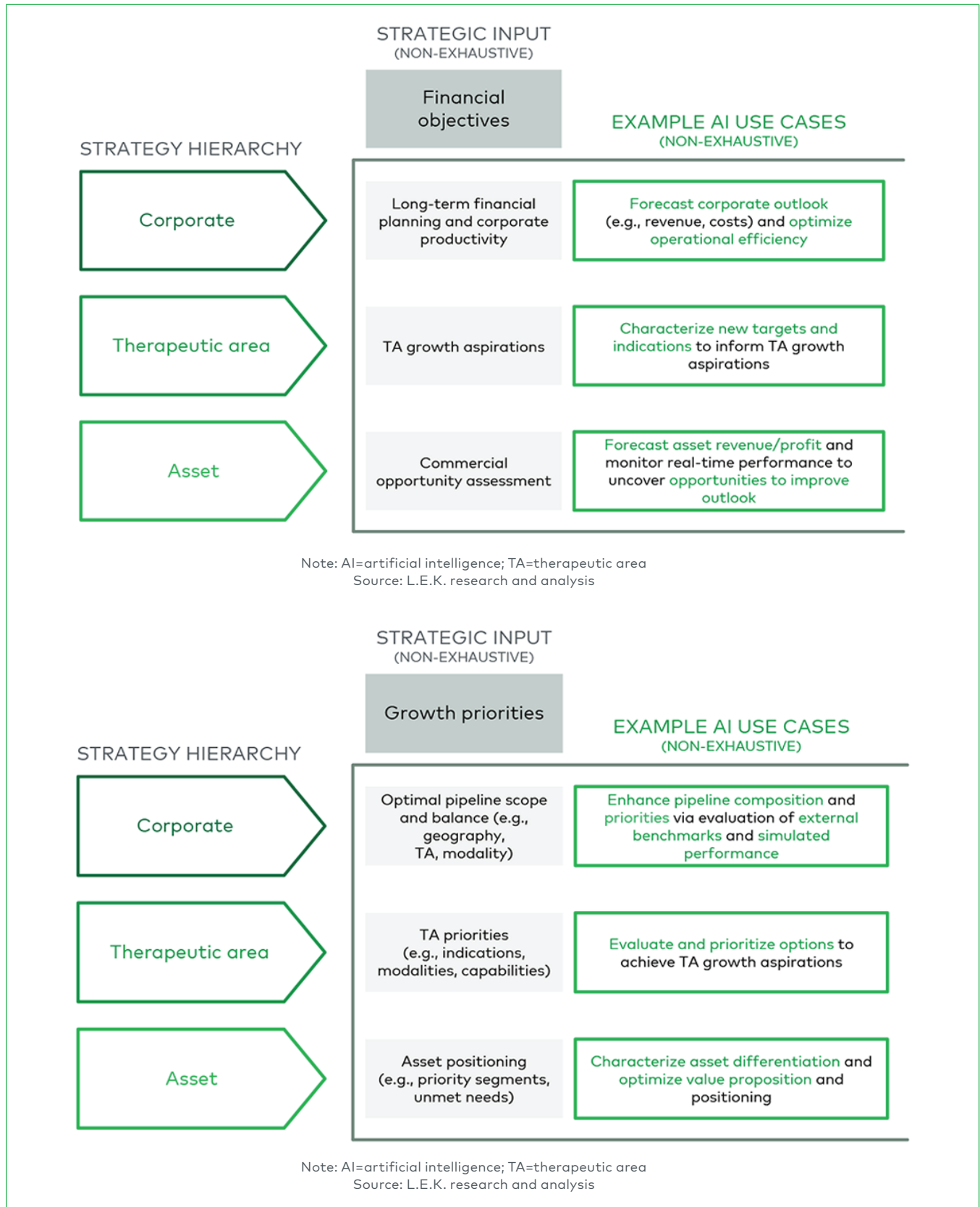
Generative AI, like the model that provided the SWOT analysis (ChatGPT/GPT-4), currently excels at processing and analyzing large amounts of information, synthesizing complex concepts and providing structured insights based on the given context. There are, however, some limitations to the current technology, including its dependence on the quality and scope of training data, which may lead to outdated or less accurate responses (such as occasional "hallucinations," or reasonable-sounding but incorrect answers).

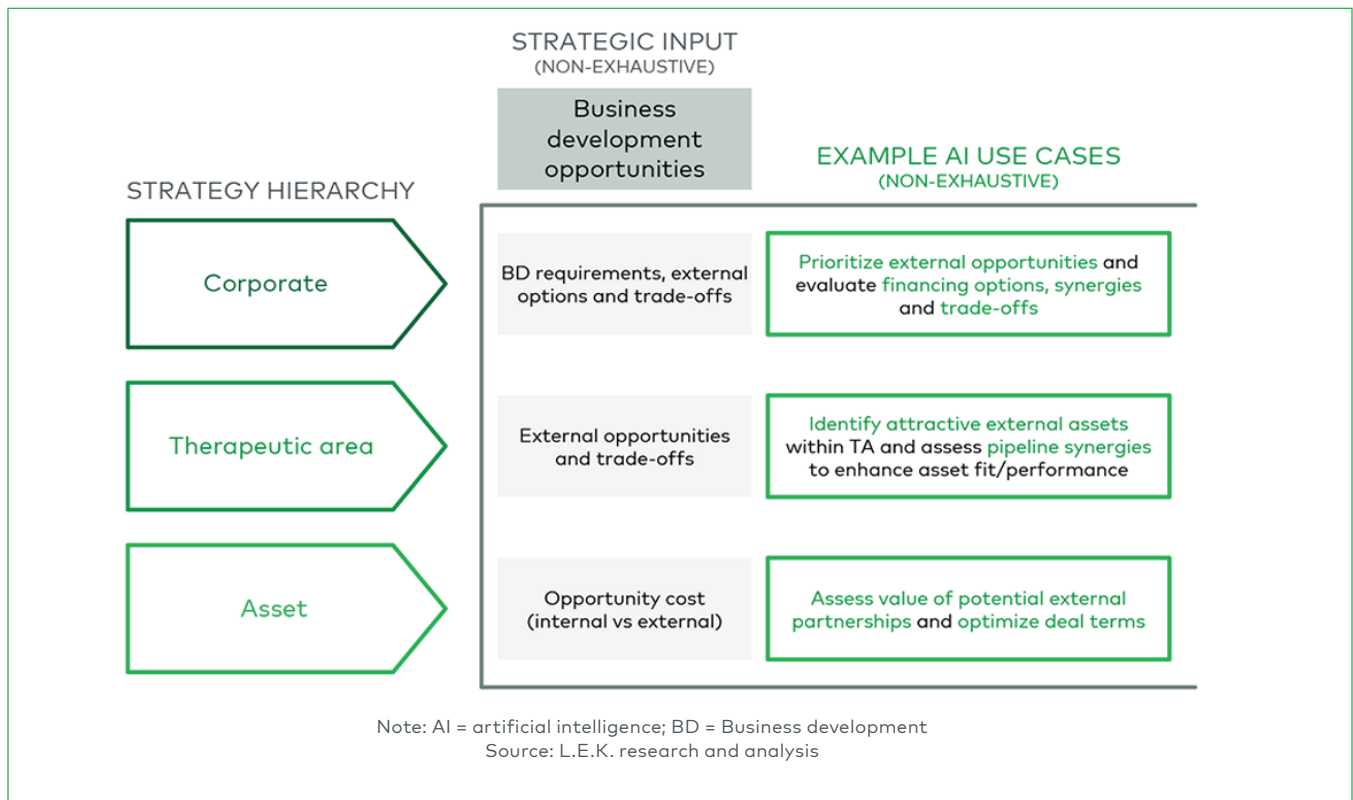
As generative AI models continue to evolve and improve, their responses to similar questions will become more accurate, context-aware and relevant. In the near-term, applications will focus on synthesis of external trends, evaluation of external benchmarks, and forecasting of financial performance. In the medium term and longer term, advancements in machine learning and quantitative predictive modeling are anticipated to enable AI to generate more impactful strategic insights, such as identification of new market and product opportunities, predicted future trends and AI-suggested adaptation of strategic priorities based on the assessment of real-time performance.

Figures 4-7:
Example generative AI use cases in biopharma strategy



Note: AI=artificial intelligence; MoA=mechanism of action; SoC=standard of care; TA=therapeutic area
Source: L.E.K. research and analysis





Despite its transformative potential, embedding generative AI in strategy is not without risks and challenges. Executives must assess the distinctive characteristics of their organization and its exposure to inherent risks. Figure 8 highlights some of the crucial factors to consider when defining the vision and governance for generative AI in biopharma strategy.

Figure 8
Key risks and challenges of generative AI in strategy

data accuracy and bias	Models trained on incomplete or inaccurate data can produce biased or unfair outputs, leading to suboptimal decision making
interpretability and explainability	Challenges with interpreting or explaining more complex GenAI models (e.g., deep learning) can be problematic, as stakeholders may be hesitant to trust or act on AI-generated insights without a clear understanding of the rationale and/or sources supporting them
overreliance on GenAI	Overconfidence in AI-generated insights can lead to poor decision making if human/organizational expertise and intuition are neglected
misalignment with objectives	If the objectives of the GenAI model do not align with overall company goals, ethics and values, the AI system may produce output that conflicts with desired strategic direction
data privacy and legal issues	Improperly managing data sources and/or sharing intellectual property with external AI vendors can expose companies to IP theft, competitive risks and legal/regulatory issues

Note: AI=artificial intelligence; GenAI=generative artificial intelligence; IP=intellectual property
Source: L.E.K. research and analysis

Next steps for management

For executives seeking to maximize the strategic potential of generative AI throughout their organization, a thoughtful and structured approach will be essential and includes the following:

- Defining the vision and governance for AI integration in strategic decision making aligned with company goals
- Identifying and prioritizing AI tools (e.g., ChatGPT, Bard or customized models) and use cases to maximize utility, leveraging external partners if needed
- Creating proof of concept to validate feasibility, identify potential issues and gather feedback before deployment
- Developing an operationalization roadmap, and deploying AI models to enhance decision making, integrating with existing strategic processes
- Aligning change and risk management for implementation, compliance, and continuous improvement, helping to foster a culture of innovation and to address any privacy, legal and ethical concerns

Generative AI holds immense promise for enhancing biopharma strategy, and embracing its transformative potential will be crucial for maintaining a competitive edge. A thorough understanding of the challenges and a clear strategic vision are crucial for successful implementation. At L.E.K., we are committed to collaborating with biopharma executives and other industry leaders to explore these opportunities and navigate the challenges. We welcome the opportunity for a thoughtful dialogue on how generative AI can revolutionize your strategic decision making process.

Glossary

Artificial intelligence (AI): Artificial intelligence refers to the development of computer systems and algorithms that can perform tasks that typically require human intelligence. These tasks include learning, reasoning, problem-solving, understanding natural language, perception and decision making.

Generative AI (GenAI): Generative AI is a subset of AI that focuses on creating new data samples or content based on the patterns and features learned from existing data. These AI models are designed to generate novel and realistic outputs, such as images, text, music or even video, by understanding and mimicking the underlying structure and characteristics of the training data.

ChatGPT: ChatGPT (GPT-4) defines itself as “an advanced AI language model created by OpenAI, based on GPT-4 architecture. It generates humanlike text by predicting and completing sentences, assisting users in tasks like answering questions, creating content, or offering suggestions. ChatGPT learns from a vast data set and improves its responses through fine-tuning.”

Appendix

ChatGPT (GPT-4) prompt for SWOT analysis for a hypothetical biopharma company:

Perform a SWOT analysis for a hypothetical pharmaceutical company that could resemble real-life scenarios faced by pharmaceutical CEOs, demonstrating the power of text-based generative AI to provide insights informing strategic decision making. The hypothetical company specializes in infectious disease, oncology and neurology. It has two leading products, both developed in-house, that rank among the top 10 revenue-generating drugs in two of these TAs. These products generated over \$5 billion in sales last year, but will face loss of exclusivity by the end of the decade. The company has a broad clinical pipeline focusing on the three TAs, but most of the assets are in the early stages of development. Please analyze the company’s strengths, weaknesses, opportunities and threats, considering factors such as competition, the upcoming loss of exclusivity for the two leading products and the current status of the clinical pipeline.

For more information, please contact lifesciences@lek.com.

Endnotes

¹ Lek.com, “Artificial Intelligence in Life Sciences: The Formula for Pharma Success Across the Drug Lifecycle.” <https://www.lek.com/sites/default/files/insights/pdf-attachments/2060-AI-in-Life-Sciences.pdf>

² Lek.com, “Generative Artificial Intelligence (AI): Who (or What) Wrote This?” <https://www.lek.com/sites/default/files/PDFs/healthcare-generative-ai.pdf>

About the Authors



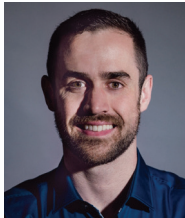
Ricardo Brau

Ricardo Brau is a Managing Director and Partner in L.E.K. Consulting's Boston office. He leads the firm's Life Sciences Biopharma sub-sector and has experience across most therapeutic areas and industry segments, in both large and emerging biopharma companies. Ricardo joined the firm in 2008 as a Life Sciences Specialist and advises clients on a range of critical issues, including corporate and business unit strategy, innovation, R&D portfolio management and commercial planning.



Matt Mancuso

Matt Mancuso is a Managing Director and Partner in L.E.K. Consulting's Boston office and a member of the Life Sciences practice. Matt is experienced in oncology and non-oncology opportunity assessment and target identification, including leveraging commercial, scientific and advanced bio- and chemo-informatic analysis. He combines scientific, clinical and financial analyses to inform corporate strategy, business development and commercial and R&D decisions to create shareholder value.



Spencer Robertson

Spencer Robertson is an Engagement Manager in L.E.K. Consulting's New York office and a member of the firm's Biopharma and Life Sciences practice. Spencer is helping to lead the firm's efforts in generative artificial intelligence (AI) and has extensive experience advising biopharma executives on a wide range of critical topics, including portfolio optimization, therapeutic area strategic planning and business development strategy/commercial due diligence.



Nick Barker

Nick Barker is based in L.E.K. Consulting's Boston office and is the Director of Data & Analytics at L.E.K. for the North America region. During his time at the firm, Nick's focus has been on helping clients leverage data to make better decisions, forecast business outcomes and build smarter enterprises. He has led multiple engagements leveraging Big Data, predictive modeling algorithms, state-of-the-art segmentation, geospatial analysis and data visualization techniques.

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