WHITE PAPER

How top pharma companies are calculating ROI for AI in pharma R&D

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Impact where it matters.

Artificial intelligence (AI) has rapidly transformed from a nascent technology into a strategic imperative within pharmaceutical R&D. Industry leaders are making substantial platform investments to accelerate drug discovery and development. These investments have already yielded impressive results such as faster target identification, accelerated market research insights, improved clinical trial recruitment rates and significant cost savings.

Despite these clear successes and strong executive sponsorship across the industry, consistently articulating the tangible return on investment (ROI) from AI initiatives remains a significant challenge. Current ROI metrics often focus on isolated operational outputs like time or cost savings. R&D leaders themselves admit these are often "finger-in-the-air estimates," rather than rigorous, enterprisewide value quantification.

How a standardized framework can align AI investment strategies with pharma R&D objectives

For years, fragmented systems and manual processes have constrained the promise of seamless, standards driven data flow across R&D. With modern AI platforms, that vision is now achievable—turning real time, harmonized data into a foundation for faster decisions, scalable gen AI use cases and measurable productivity gains in clinical development.

There's a clear need to move beyond anecdotal success stories. We need a standardized, comprehensive framework that aligns scientific progress with commercial imperatives.

We propose a multidimensional ROI framework tailored specifically for pharma R&D. It combines quantitative metrics across scientific, operational and commercial dimensions, directly linking AI investments to strategic goals.

By adopting a disciplined and integrated approach, pharma R&D organizations can make AI more than a speculative investment. They can turn it into a transparent and powerful value engine, ultimately delivering more innovative cures to patients faster and more efficiently.

As AI becomes more deeply embedded in R&D decision-making, explainability and ethical accountability must be foundational, not optional. Transparent AI models enable scientists and regulators to trust and validate insights, especially in high-stakes domains like drug safety or patient stratification.

Ethical considerations—such as data privacy, algorithmic bias and equitable access—must be integrated into AI governance from the outset. Only by embedding explainability and ethics into the platform strategy can organizations ensure that AI-driven value is both sustainable and socially responsible.

How pharmaceutical companies measure ROI from AI in R&D now

Major pharmaceutical companies are aggressively investing in AI platforms and strategic partnerships across the entire R&D pipeline. This surge reflects AI's recognized potential to accelerate drug discovery and development.

How companies are currently investing

We explain both ideas in more detail below:

- **Sanofi** has deployed its enterprise AI platform, "plai," to aggregate and analyze internal data, accelerating mRNA research and improving clinical trial site selection. They report outcomes such as 20%-30% faster target identification and large cost savings.
- **AstraZeneca's** rare disease unit, Alexion, is funding an AI collaboration with Verge Genomics for target identification.
- **Pfizer** adopted Google Cloud's AI "Target and Lead Identification Suite" and used AI to expedite Paxlovid development.
- **Novartis** is a significant AI investor, codeveloping generative chemistry tools with Isomorphic Labs and Generate Biomedicines. It also invests in clinical document automation with Yseop and uses enterprise AI tools like Microsoft Azure and Dataiku. Novartis also reports significant AI-driven gains, including 90% faster market-research insight, 3.4x higher trial recruitment and a 20% uplift in sales productivity.
- Other leading companies such as **Roche/Genentech, Amgen** and **GlaxoSmithKline** also report substantial AI spending and internal initiatives. **GlaxoSmithKline**, for instance, is using "data tech, including AI and platform technologies" at every R&D stage to be "faster, more effective and more predictive." Amgen states AI helps it "move from molecule to medicine with speed and efficiency."
- An industry survey indicates that 85% of pharma executives are increasing AI funding. It also shows that 70% are treating it as an immediate priority. Technology partnerships with providers like AWS, NVIDIA and Oracle Life Sciences are now mainstream, reflecting a hybrid build/buy model.

How value is currently measured and articulated

In practice, AI ROI metrics are still evolving. Many companies rely on operational key performance indicators (KPIs) such as time saved (e.g., days or months shaved off timelines), cost reductions (e.g., avoided headcount) and throughput gains (e.g., targets found, experiments run).

For example, Sanofi attributes $300 million in supply chain savings to AI-driven predictive analytics. Novartis tracks clinical and commercial metrics like a 3.4x patient recruitment rate and a 20% sales productivity gain from AI tools.

Internally, R&D groups also cite model results as value proxies. For example, an internal machine learning model's "area under the curve" (AUC) rose from 0.78 to 0.88. Shorter process times can also be value proxies, as when Novartis reduced interview data analysis from 21 to two days.

These "success metrics" are often aggregated into ROI stories for board meetings.

Are current ROI articulation efforts optimal?

Despite the impressive efficiency statistics, value articulation largely remains qualitative or piecemeal. Many R&D leaders admit that current ROI claims are approximate. As one vice president noted:

"AI's impact is often described by comparing scenarios (e.g., 'if AI helps these three of 20 tasks, maybe we cut six months off development'), but these are considered 'finger in the air' estimates."

Formal ROI frameworks that tie AI projects directly to profit and loss or portfolio valuation are still rare outside of initial tech pilots.

In essence, companies collect compelling efficiency statistics. But there's no industry standard for translating AI outputs into tangible R&D value, such as an increased probability of drug approval or net economic gain. This immaturity in measurement practices means that current efforts, while promising and often localized, are not yet optimal for enterprise capital allocation.

Pharma R&D ROI is inherently uncertain, and aligning AI metrics to ultimate value (e.g., new drugs, revenue) remains a work in progress. As AI scales, there will be an increasing demand for "hard metrics" to justify further investments.

What we learned from sponsor interviews

We interviewed R&D leaders and AI sponsors to understand how they think about the value of AI. We discovered key themes regarding investment focuses, adoption patterns and value articulation practices.

Investment focuses and adoption patterns:

Interviewees emphasize that life sciences R&D differs significantly from general tech development. Biological systems are complex and "don't always follow the algorithm." AI is viewed as a powerful aid, but its adoption requires a cautious, "training wheels" approach, involving controlled pilots and rigorous validation to ensure scientific reproducibility and patient safety. This phased adoption builds confidence among regulators and scientists before scaling.

Practical adoption often begins in areas with clear data, such as genomics and imaging, or for repetitive tasks like data management and trial operations, where AI can be tested against known benchmarks.

Executive engagement:

High-level sponsorship of AI is prevalent, with investment decisions often involving R&D leadership directly. Executives reported high influence on AI platform decisions and funding allocation. There's continuous communication about AI's strategic importance, with CEOs setting bold AI goals and executives attending tech summits. However, despite strong enterprise commitment, on-the-ground adoption still grapples with cultural and skill gaps.

How ROI is captured and impact articulated:

All interviewees agreed that measuring AI ROI is difficult. One executive described the approach of breaking down projects into "core measurable units." The team then identifies where AI can help and then aggregates these gains to estimate the overall impact, such as bringing a candidate to the clinic "six months faster." This executive, like others, acknowledged these estimates are still "finger in the air."

There are currently no robust ROI calculators. The absence of clear baselines (what would happen without AI) and the long timelines inherent in drug development make accurate attribution challenging.

Stakeholders mainly track "leading indicators" like the percentage of time saved on a task or improvements in model accuracy. Actual business outcomes, such as revenue uplift, are considered remote. The consensus is that while companies can "hype it up by 4x or 5x faster," rigorous follow-up on the numbers is essential to sustain the narrative. Therefore, ROI is more often assessed qualitatively (e.g., trial metrics, reduced workload) rather than as hard financial returns.

Value articulation currently relies heavily on case studies and pilot results. Companies cite examples of productivity gains or trial diversity improvements to justify ongoing funding. Some suggested using AI itself (e.g., using a large language model to summarize results) to impress management. However, there's a clear desire for a more systematic narrative, moving from isolated anecdotes to standardized dashboards.

The interviews reveal keen interest and executive engagement in AI, along with compelling use cases. Yet companies universally struggle to quantify AI's value in concrete business terms. This highlights the critical need for a structured framework and organizational support for robust metrics and governance.

"Our research reinforces a need for a digital, AI-powered model: AI delivers its full value only when it is embedded in a data first, connected operating model that links scientific insight, clinical execution and measurable business outcomes. ZS is working with top sponsors to help digitally transform their R&D organizations, moving from siloed pilots to scalable enterprisewide solutions."

– Arup Das, Principal, ZS

Move from evidence to value with an ROI framework

To transition from anecdotal evidence to quantifiable value, we propose a multidimensional ROI framework specifically designed for pharma R&D. This framework integrates quantitative metrics across scientific, operational and commercial dimensions, ensuring alignment with strategic objectives

Guiding principles of the framework

The framework is built upon several core principles:

- **Link to R&D goals:** Metrics must directly connect to both scientific objectives (e.g., novel targets, predictive accuracy) and broader business outcomes (e.g., lower costs, faster approvals). For example, tracking how AI shortens key cycle times or improves success probabilities ties technology directly to the core mission of R&D.
- **Baseline comparisons:** It is crucial to benchmark AI-enabled workflows against standard, non-AI practices to establish the incremental gains attributable to AI. This could involve measuring trial enrollment rates with and without AI site selection.
- **Balanced portfolio:** The framework incorporates both short-term efficiency metrics (often "quick wins") and long-term impact indicators. A mature AI program will demonstrate both immediate gains, such as cost savings and process speed-ups, and contribute to high-risk breakthroughs like new drug candidates or paradigm shifts in discovery.
- **Ownership and accountability:** Clear owners for each metric (e.g., project leads, business heads) must be assigned, and these metrics should be integrated into governance dashboards. Transparency in results is key to driving follow-through and ensuring accountability.
- **Iterative refinement:** Metrics should be continuously revisited and refined as projects mature. Early indicators may evolve, and building in learning loops allows for recalibration of goals based on new insights.

FIGURE 1:

Key metric categories and examples

The framework uses various metric categories to provide a holistic view of AI's impact:

Value dimension	Key metric	Example/impact
R&D productivity	Targets or candidates discovered (per year)	Sanofi: Seven novel drug targets discovered in one year via AI engines
R&D efficiency	Cycle time reduction (days or % faster)	Novartis: Insight generation down from 21 to two days (−90%)
Clinical trial quality	Recruitment rate multiplier	Novartis: AI-selected sites recruit 3.4x more patients versus median
Clinical trial diversity	Enrollment of underrepresented patients	AI-enabled site selection yields 2.7x more Black or African-American enrollees
Cost savings	$ saved (absolute or %)	Sanofi: $300M saved via AI-driven supply-chain optimization
Commercial impact	Sales productivity or revenue uplift (%)	Novartis: 20% increase in sales productivity from AI-driven territory planning
Model performance	Predictive accuracy (AUC, etc.)	Novartis: In-house model AUC improved from 0.78 to 0.88
Adoption/process	User adoption (# users, usage rate)	Sanofi: "plai" is used daily by ~15-20k employees, with 95% of top managers
Time to market	Months to investigational new drug/new drug application (remaining)	Projected (hypothetical) time saved per program via AI refinements

These metrics should be continuously tracked against pre-AI baselines or control groups. If AI-enabled trial design consistently enrolls patients significantly faster, as Novartis found with a 2x-3x acceleration), it saves months and helps avoid extra costs. Similarly, if AI improves molecule triaging accuracy to more than 80% in silico, we can measure fewer lab cycles and assign value to that reduction. Over multiple projects, such gains aggregate into substantial portfolio-level productivity improvements.

The proposed framework offers several advantages:

- **A clearer demonstration of bottom-line impact:** It enables a more transparent and compelling demonstration of AI's direct impact on business outcomes.
- **More informed investment decisions:** By providing rigorous, data-driven insights, it facilitates more informed investment decisions and strategic capital allocation for AI initiatives.
- **Motivation to scale successful pilots:** It provides the quantitative evidence needed to justify scaling successful pilot projects into broader enterprisewide deployments.
- **Alignment with corporate strategy:** By defining value in the same language as corporate strategy (e.g., "pipeline internal rate of return" or "expected value of success"), R&D can effectively communicate AI's contributions to finance and leadership.
- **Accountability:** This approach requires projects to establish clear value hypotheses up front (e.g., "our AI tool will reduce trial costs by X% or find Y more leads") and holds them accountable for delivering on these projections.

This framework mirrors comprehensive ROI equations used in consulting, adapted to specifically address the nuances and complexities of AI projects in R&D.

How can pharma implement the framework in real time?

To operationalize this multidimensional ROI framework within a large pharma R&D organization, it's essential to adjust existing governance structures, processes and cultural norms.

Key recommendations for framework adoption

Establish AI governance and accountability

- **Action:** Form an AI steering committee or empower an existing innovation board with executive oversight (e.g., chief data officer, executive vice president of R&D). Use this group to track AI ROI metrics. This committee should mandate that all AI projects define success metrics up front and report on KPIs and learnings through regular reviews.
- **Impact:** This ensures transparency and rigor, aligning with the industry trend where approximately 80% of companies now have formal AI governance structures.

Integrate into the project life cycle

- **Action:** Embed value tracking into the standard project stage-gate process. For every AI initiative, require a "value theory" that clearly links technical KPIs to anticipated business outcomes. Pilot phases should be used to test and refine these metrics and ROI targets must be included in go/no-go decisions when scaling.
- **Impact:** This ensures that AI investments are evaluated for their business impact from inception, moving beyond mere technological novelty.

Build cross-functional teams

- **Action:** Foster truly cross-functional collaboration by aligning data scientists, biologists, clinical operations specialists and business managers within integrated teams. This multidisciplinary approach ensures that metrics are both scientifically valid and commercially relevant. Consider encouraging "citizen data scientist" programs, empowering domain experts to contribute directly to value definitions.
- **Impact:** For example, pairing modelers with clinical operations teams can significantly improve the adoption and impact of AI in areas like site selection for trials.

Upgrade infrastructure for measurement

- **Action:** Invest in robust data pipelines and sophisticated dashboarding tools capable of automatically capturing usage and outcome data. A centralized data lake of trial results, for instance, can feed real-time reporting comparing AI-enabled cohorts against non-AI control groups. Use scalable cloud platforms to ensure adequate compute and analytics capabilities.
- **Impact:** This foundational infrastructure provides the necessary data backbone for accurate and continuous ROI measurement.

Cultivate an AI-value culture

- **Action:** Shift the organizational focus from merely adopting "cool tech" to delivering measurable ROI. Incentivize teams to deliver demonstrable gains, potentially by tying bonus metrics to efficiency improvements. Provide comprehensive training for leaders to effectively interpret AI-driven metrics. Crucially, communicate success stories internally with concrete numbers (e.g., "we cut time to proof-of-concept by 30%" instead of vague statements like "AI helps a lot").
- **Impact:** This cultural shift ensures that AI investments are viewed through a lens of business value, fostering widespread adoption and accountability.

Iterate and share learnings

- **Action:** Treat the ROI framework as a living tool that evolves with organizational learning. Use early projects as pilots to calibrate metrics and identify which ones truly signal value. Share templates and benchmarks across the organization to prevent knowledge silos.
- **Impact**: Lessons learned from one disease area, such as oncology recruitment metrics, can inform and improve methods in another, like neuroscience, leading to compounded benefits across the portfolio.

Embed explainability into model development and deployment

- **Action:** Require that all AI models used in decision-making—especially those impacting patient outcomes, trial design or regulatory filings—include explainability features. Encourage the use of interpretable models where feasible or layer post-hoc explanation tools (e.g., SHAP, LIME) over complex models. Establish documentation standards that explain model logic in plain language for end users and reviewers.
- **Impact:** Enhancing model transparency builds trust among scientists, clinicians and regulators, improving adoption while aligning with growing regulatory scrutiny around AI-driven decisions.

Operationalize AI ethics across the development life cycle

- **Action:** Integrate ethical review checkpoints into the AI project life cycle—from data sourcing and labeling to deployment and monitoring. Create an AI ethics review board or incorporate ethics assessments into existing compliance structures. Prioritize issues like patient privacy, consent, algorithmic bias and fairness, especially in datasets involving underrepresented populations.
- **Impact:** Embedding ethics into governance ensures that AI initiatives align not only with business goals, but also with societal and regulatory expectations, mitigating risk and enhancing long-term value delivery.

By putting these recommendations into practice, pharma companies can transition AI from isolated experiments to an embedded, enterprisewide capability. Clear governance and accountability will tie investments to outcomes. Teams will become culturally aligned around data-driven value, rather than merely technological innovation.

Moving toward a unified language to determine ROI for AI in pharma

The pharmaceutical R&D landscape is undergoing a profound change in basic assumptions driven by AI, which promises to significantly accelerate scientific endeavors.

While companies are aggressively innovating with new AI platforms, partnerships and internal teams and have collected compelling anecdotal evidence of success, a critical gap remains. They still need rigorous definition and measurement of AI's true impact. Senior leaders require a standardized approach to ROI articulation to justify substantial future investments and strategically allocate resources toward projects that generate the most value.

Our analysis highlights that leading pharma companies are beginning to report concrete efficiency gains. Novartis's clinical trial performance metrics and Sanofi's multimillion-dollar cost savings are two examples. However, the industry still lacks a unified language for AI ROI.

As AI moves beyond isolated wins, the value conversation shifts from individual use cases to how AI platforms reshape decision-making at scale. In an era of agentic AI, advantage comes from redesigning high-leverage R&D decisions to be AI native—so intelligence is embedded directly into how work flows, not layered on after the fact.

"As AI moves beyond pilots, a value framework helps R&D leaders clearly articulate and measure where platform investments create real, scalable value, turning isolated AI wins into a credible, enterprise level ROI story."

– Shuja Mohammed, Director, Business Planning and Operations, AstraZeneca

A framework to align AI with R&D transformational goals

Our multidimensional framework offers a clear roadmap. Measure what truly matters: time, quality, productivity and cost. Align these metrics with strategic objectives and embed them within robust governance structures.

Through disciplined implementation, pharma R&D organizations can transform AI initiatives from speculative investments into a transparent and potent value engine. Clear ownership, reliable data infrastructure and strong leadership support make this possible.

By rigorously quantifying AI's contributions at every stage of R&D, companies can ensure that "AI at scale" delivers on its ultimate promise: bringing more life-changing cures to patients faster and more efficiently, while boosting corporate growth and shareholder value.

About ZS

ZS is a management consulting and technology firm that partners with companies to improve life and how we live it. We transform ideas into impact by bringing together data, science, technology and human ingenuity to deliver better outcomes for all. Founded in 1983, ZS has more than 15,000 employees in over 40 offices worldwide.

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