Pharma AI Operating Models: Moderna, Sanofi, and BMS

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Executive Summary

The pharmaceutical industry is undergoing a transformative shift from isolated AI tools to holistic AI operating models that embed AI into every facet of the business. Leading biopharma companies are pioneering diverse approaches: **Moderna** emphasizes *workforce education* via a company-wide AI Academy to cultivate an AI-literate culture ([1] www.modernatx.com) ([2] investors.modernatx.com). **Sanofi** pursues an *enterprise-wide transformation*, deploying AI across its R&D, manufacturing, and commercial functions with centralized programs and digital "accelerators" ([3] www.sanofi.com) ([4] www.sanofi.com). **Bristol Myers Squibb (BMS)** adopts an R&D "**predict-first**" strategy, using AI/ML to predict promising compounds before synthesis, thereby reshaping its discovery process ([5] www.bms.com) ([6] www.genengnews.com).

These cases illustrate key lessons for moving from AI experiments to a sustainable operating model. All three companies align AI initiatives with strategic goals and invest in data and infrastructure: for example, McKinsey projects global pharma AI investments soaring from ~$4 billion to $25.7 billion by 2030 ([7] www.mckinsey.com). Their experiences confirm industry best practices: clear objectives and process redesign (avoiding "tool bolting" onto legacy workflows) ([8] www.mckinsey.com) ([9] www.mckinsey.com); robust tech stacks and data platforms to scale pilots into production ([10] www.mckinsey.com) ([11] opengovasia.com); and cultivation of diverse talent streams (cross-functional teams, upskilling, and democratized AI tools) ([12] www.mckinsey.com) ([13] www.fiercepharma.com). Each company also emphasizes governance and " responsible AI" to manage data quality and ethics ([14] brightinsight.com) ([15] www.fiercepharma.com).

In summary, Moderna, Sanofi, and BMS exemplify complementary AI operating-model patterns: people-focused training, structural reinvention, and predictive R&D. By studying their initiatives and outcomes, we identify principles for any pharma AI transformation. These include investing in workforce capabilities and culture (e.g. training programs and AI tools) ([1] www.modernatx.com) ([2] investors.modernatx.com); building enterprise-wide infrastructure and processes for AI (e.g. data academies, accelerators, and unified platforms) ([4] www.sanofi.com) ([3] www.sanofi.com); and leveraging AI to reengineer core value-chain activities (such as drug discovery) ([5] www.bms.com) ([8] www.mckinsey.com). Our evidence-based analysis (summarized in comparative tables below) demonstrates that an integrated AI operating model – characterized by strategy, technology, talent, data, and governance – is essential for unlocking AI's promised impact in drug development and patient care ([9] www.mckinsey.com) ([16] www.fiercepharma.com).

Introduction and Background

The life sciences industry stands at an inflection point where artificial intelligence is poised to revolutionize drug discovery, development, manufacturing, and commercialization. Investment in AI is accelerating: technology companies spent **$250+ billion** on AI in 2024, and the **pharma AI market** is projected to explode from roughly **$4 billion** today to nearly **$26 billion by 2030** ([7] www.mckinsey.com). Leading pharma executives now view AI as a strategic priority: in a recent survey 85% of top Big Pharma companies rated AI an *"immediate priority"* ([17] www.fiercepharma.com), and 80% are **increasing** their AI budgets ([13] www.fiercepharma.com).

However, realizing AI's benefits requires far more than deploying individual tools. Numerous industry analyses warn of a " pilot purgatory" where high hopes meet disappointing results if AI is simply bolted onto legacy processes ([8] www.mckinsey.com) ([18] intuitionlabs.ai). In McKinsey's view, success comes only by **reimagining workflows and operating models**, not by layering new tech on old systems ([8] www.mckinsey.com).Consistent with this, a recent IntuitionLabs report notes that turning AI potential into enterprise-scale impact demands coordinated strategy, specialized talent, robust governance, and investment in infrastructure ([19] intuitionlabs.ai). The natural evolution is towards an *AI Center of Excellence*, a hub that aligns AI initiatives with business strategy, standardizes best practices, and oversees data quality and compliance across the organization ([19] intuitionlabs.ai) ([20] intuitionlabs.ai).

The emerging “AI operating model” in pharma thus encompasses strategy, organizational design, technology stack, data ecosystem, talent and culture, and governance. In practice, companies are experimenting with different patterns of adoption. We examine three emblematic cases:

- **Moderna (Workforce Education):** Moderna launched an AI Academy for all 2,400+ employees, partnering with Carnegie Mellon University to deliver deep AI/ML training and foster an AI-centric culture ([1] www.modernatx.com) ([2] investors.modernatx.com). Its CEO emphasizes that AI success must be “as much about technology as it is about people and ensuring they have the right skills” ([21] investors.modernatx.com).
- **Sanofi (Enterprise Transformation):** Sanofi is pursuing a top-down *“AI-first”* transformation to embed AI across its R&D, manufacturing, and commercial value chain ([3] www.sanofi.com) ([4] www.sanofi.com). Under EVP Chief Digital Officer Emmanuel Frenehard, Sanofi has launched multiple cross-functional “Digital Accelerators”, democratized AI apps for thousands of employees, and established a corporate *“Responsible AI”* initiative (RAISE) ([22] www.sanofi.com) ([23] www.sanofi.com).
- **Bristol Myers Squibb (R&D “Predict First”):** BMS focuses on integrating AI into its drug discovery pipeline. Its newly coined **“predict-first”** approach means applying AI to *predict promising molecules before synthesis*, thus inverting the traditional long funnel model ([5] www.bms.com) ([6] www.genengnews.com). BMS has also scaled internal AI tools – for example, a customized ChatGPT for 16,000 employees ([24] www.genengnews.com) – but its signature strategy is to use predictive models to guide research investments.

By comparing these approaches – people-centric, process-centric, and discovery-centric – we elucidate how moving “from AI tool to AI operating model” can take many forms. Drawing on the leaders’ own disclosures and third-party research, we analyze the catalysts, initiatives, and outcomes of each model. We also incorporate industry-wide data (investment trends, survey results) and expert insights to contextualize the case studies. Ultimately, we distill generalizable lessons: how pharma organizations can align strategy and culture, build platforms and data pipelines, and manage risks to create an AI-empowered enterprise.

AI in Pharma: From Tools to Operating Models

Pharma’s early forays into AI often resembled pilots and point solutions (e.g. narrow ML models for target ID or virtual screens). Now the narrative is shifting: AI is seen as an **enterprise capability** akin to a new production technology, requiring a comprehensive operating model. Analysts describe two archetypes of AI adoption: “**tinkerers**” that dabble in isolated pilots, and “**redesigners**” that fundamentally rework processes to weave AI throughout their workflows ([9] www.mckinsey.com). This reframes the conversation: it’s no longer whether to try AI, but *how* to industrialize AI at scale.

Industry leaders emphasize that success hinges on six key enablers ([25] www.mckinsey.com) ([9] www.mckinsey.com): (1) Clear strategic goals and process redesign; (2) a robust tech stack; (3) relevant data; (4) diverse talent streams; (5) flexible change management; and (6) governance for risk management. For example, McKinsey reports that AbbVie achieved rapid AI gains not by “bolting on” tools but by rethinking discovery processes end-to-end ([8] www.mckinsey.com). Similarly, Genentech’s lab-in-the-loop approach directly embeds modeling in experiments ([26] www.mckinsey.com).

Aligned with these enablers, our case companies each exemplify portions of an AI operating model. **Moderna** invests heavily in training (enabler 4), creating cross-disciplinary fluency so that AI skills permeate the culture ([1] www.modernatx.com) ([27] investors.modernatx.com). **Sanofi** builds enterprise platforms and data foundations (enabler 2–3), plus governance (RAISE) and scalable rollout (change management, enabler 6) ([4] www.sanofi.com) ([14] brightinsight.com). **BMS** focuses on embedding AI in core R&D workflows (enabler 1), with predictive models and hybrid human+AI teams driving productivity (enabler 4) ([5] www.bms.com) ([28] www.genengnews.com).

Below we analyze each model in depth. Then, in a cross-case discussion, we contrast their features in tables and text: linking the observed practices to the recommended enablers of a mature AI operating model. We supplement the case insights with broader data and expert opinions to quantify the scope of AI adoption and highlight potential gaps and risks.

Moderna’s Workforce Education Model

Overview and Strategy

Moderna’s approach underscores *people and culture* as the foundation of its AI transformation. Founded on decades of digital innovation in mRNA technology, Moderna has always emphasized learning and data. In December 2021, Moderna announced an **AI Academy** open to *all* employees ([1] www.modernatx.com). This initiative – developed with Carnegie Mellon University – aims to democratize AI knowledge, enabling every staffer “to identify and integrate AI and machine learning solutions into every Moderna system and process” ([1] www.modernatx.com). Two of Moderna’s core “mindsets” are *“obsess over learning”* and *“digitize everywhere possible”* ([29] www.modernatx.com), reflecting the belief that human skill-building and technology investment must go hand in hand. CEO Stéphane Bancel echoed this at the 2023 investor event: *“It is as much about technology as it is about people and ensuring they have the right skills.”* ([21] investors.modernatx.com)

In practice, Moderna’s AI Academy offers a rigorous curriculum (data quality, ML algorithms, AI ethics, etc.) tailored for working professionals ([30] www.modernatx.com). Its first cohorts began in 2022, with thousands of participants in 2023. Complementing formal education, Moderna also provides *“ChatGPT-like” tools* to employees. In May 2023 Moderna launched **mChat**, an internal generative AI assistant (built on OpenAI technology) that delivered company-specific answers. By late 2023, nearly **65% of employees** were actively using mChat in their workflows ([31] investors.modernatx.com), a testament to the company’s AI-centric culture. CIO Brad Miller notes that this reflects Moderna’s commitment to *“democratize AI so that every employee can create value”* ([27] investors.modernatx.com). Rather than confining AI to R&D, Moderna has deliberately integrated it into everyday tasks – from matched trial recruitment to operational support. For example, Moderna employed ML models with U.S./Canadian census data to ensure clinical trial diversity ([32] www.modernatx.com), and applied AI-driven scheduling in its manufacturing start-up, enabling the record 42-day timeline from COVID-19 sequence to vaccine shipment ([33] www.modernatx.com).

Implementation and Outcomes

The AI Academy curriculum is venue-neutral (online/in-person) and honors Moderna’s ethos of “working together like a well-fit jigsaw puzzle” ([29] www.modernatx.com). Topics range from data visualization to advanced ML algorithms, ensuring that scientists, engineers, and corporate staff alike gain competency. The initiative is “untraditional” in mandating training for all levels, not only managers ([34] www.modernatx.com). Moderna reports that broad participation has already generated new AI-driven projects; though quantitative metrics are confidential, the executive team cites several success stories. For instance, generative AI tools accelerated the design of Moderna’s personalized cancer vaccine (mRNA-4157) and optimized its manufacturing scheduling ([35] investors.modernatx.com).

Moreover, Moderna’s internal ChatGPT (mChat) usage illustrates a viral adoption cycle: after just **two weeks of development**, mChat was deployed enterprise-wide and quickly reached a majority of the workforce ([31] investors.modernatx.com). This contrasts with industry norms: a survey found 65% of Big Pharma had banned ChatGPT outright ([36] www.fiercepharma.com). Moderna’s proactive stance – combined with governance (e.g. emphasizing data security) – shows how training and tool deployment reinforce each other. Moderna’s experience highlights McKinsey’s principle that “culture, technology, and talent” must align ([37] www.mckinsey.com). In effect, by making AI training an institutional priority and rewarding AI use, Moderna is building an *AI-operating culture*. This has concrete payoffs: faster R&D cycles, more equitable trials, and an engaged workforce generating ROI from AI. As Miller summarizes, *“successful AI implementation means putting our employees at its center, requiring an intentional cultural transformation”* ([38] investors.modernatx.com).

Sanofi's Enterprise Transformation Model

Strategic Vision and Organizational Design

Sanofi's model emphasizes **scale and integration**. Under the leadership of outgoing CEO Paul Hudson and Chief Digital Officer Emmanuel Frenehard, Sanofi has declared the ambition to become *"the first biopharma company powered by AI at scale."* ([39] www.sanofi.com). The company's stated mission is to embed AI into every stage of its value chain – from discovery and manufacturing to supply chain and commercial operations – to dramatically shorten time-to-market and desert health outcomes ([40] www.sanofi.com) ([41] www.sanofi.com). This is captured in an *"AI-first"* strategy: as Frenehard puts it, they are *"anchoring AI at the heart of our operations… reinventing processes and accelerating decision-making"* ([3] www.sanofi.com).

Sanofi organizes this transformation around structured programs and architectural pillars. The corporate website highlights three AI pillars: **Expert AI** (advanced ML models for complex R&D and manufacturing tasks) ([42] www.sanofi.com); **Snackable AI** (user-friendly apps delivering data insights to everyday employees) ([43] www.sanofi.com); and **Generative AI** (process-automation and content-generation to boost creativity and productivity) ([44] www.sanofi.com). For example, *Snackable AI* includes Sanofi's *plai* app, which 20,000 employees use daily for near real-time analytics across company operations ([22] www.sanofi.com). Commercial teams use a machine-learning app called *Turing* to receive "next best action" recommendations for engaging healthcare providers ([45] www.sanofi.com). Meanwhile, *Generative AI* is applied to streamline documentation and empower workers with AI "concierges" as envisioned by Frenehard ([46] brightinsight.com).

Organizationally, Sanofi has set up **Digital Accelerators** – essentially internal startups – focused on key domains. Launched in stages, these cross-functional teams bring together data scientists, engineers, and domain experts. For instance, Sanofi's *R&D Accelerator* (opened 2024) has already identified **seven novel drug targets in one year** ([23] www.sanofi.com). Its *Manufacturing & Supply Accelerator* (opened 2025 in Lyon) utilizes AI-driven digital twins, IoT sensors, and predictive analytics to optimize production schedules and global supply resilience ([47] www.sanofi.com). These accelerators embody agile, "start-up" culture within the enterprise, driving innovation while remaining aligned with corporate goals. Brendan O'Callaghan (EVP, M&S) describes them as "strategic levers for integrating digital agility into every link of our manufacturing value chain" ([48] www.sanofi.com).

Integration into Value Chain

Sanofi's operating model weaves AI into specific workflows across functions:

- **R&D:** Sanofi's AI-driven discovery tools have rapidly expanded capability. Their target-discovery "Expert AI" engines have "unraveled disease biology" and delivered *multiple* novel targets in one year ([49] www.sanofi.com). They also apply advanced ML and deep learning to biologics (e.g. antibody design) and have developed a custom large-language model, **CodonBERT**, trained on 10 million mRNA sequences to design vaccines and therapeutics. CodonBERT is reported to cut mRNA sequence design time by about **50%** ([50] www.sanofi.com), effectively doubling the speed of early R&D. Generative AI is used to design personalized therapies (e.g. fully autonomous algorithms specify neoantigen vaccine sequences) and to simulate trials and patient matches (see implications section).
- **Manufacturing & Supply:** AI is also transforming Sanofi's industrial operations. The SimplY platform applies machine learning to historical manufacturing data to improve yields and cost-efficiency ([51] www.sanofi.com). A probabilistic planning tool (*plai*) predicts up to **80% of stock disruptions** before they occur, allowing preemptive action ([52] www.sanofi.com). Sanofi has also built fully digitized *Modulus* facilities (Singapore and Neuville, FR) that leverage continuous processing and AI control to accelerate scale-up of vaccines and biologics, aligning with its net-zero emissions goal ([53] www.sanofi.com). According to the company, embedding AI in manufacturing can cut product launch timelines by roughly **12 months** and triple the throughput of prioritized pipeline products ([54] www.sanofi.com).

- **Commercial:** Sanofi uses AI to personalize marketing and patient engagement. The *Turing* app (Expert AI) analyzes data to suggest communication actions, and pilot programs use ChatGPT-style bots to aid sales reps and patient support. By democratizing data (Snackable AI), Sanofi enables local teams to optimize decisions. As of 2023, roughly **20,000** Sanofi "Sanofians" used AI tools daily ([22] www.sanofi.com), reflecting broad user adoption.

Beyond specific applications, Sanofi emphasizes **culture and governance**. The company has launched a Responsible AI program (RAISE – *Responsible AI at Sanofi for Everyone*) to ensure AI is "fair, ethical, robust and safe" ([14] brightinsight.com). Frenehard stresses human oversight and accountability: for example, each AI-driven recommendation can be traced and explained, and Sanofi explicitly integrates regulatory compliance and sustainability ("eco-friendly AI" use) into its design process ([55] brightinsight.com). This governance framework is a key element of Sanofi's operating model, reassuring that innovation does not outpace safety.

Outcomes and Discussion

Sanofi's enterprise transformation is still ongoing, but early outcomes are notable. By late 2025 the company claims significant gains: an up-to-year reduction in time-to-market (through integrated workflows), and a goal to triple new drug launches thanks to AI-driven productivity ([56] www.sanofi.com). The identification of *seven new targets* by the R&D accelerator suggests that AI is augmenting human scientists' ideation ([23] www.sanofi.com). In manufacturing, real-time monitoring and predictive planning have demonstrably reduced waste and delays; for example, Sanofi reports that AI-enabled planning correlates root causes for ~65% of predicted disruptions ([52] www.sanofi.com).

We note that Sanofi's model is consistent with the "redesigner" archetype: it features company-wide coordination and multi-year change programs. It also illustrates several of the six AI enablers: clear strategy ("AI-first" vision) ([3] www.sanofi.com); robust technology stack (cloud, digital twins, LLMs) ([47] www.sanofi.com); extensive data integration (global IoT and analytics platforms) ([49] www.sanofi.com) ([47] www.sanofi.com); and broad talent mobilization (every business unit involved, tens of thousands of users). McKinsey's principles are echoed: Sanofi has not merely added point tools, but is reworking drug discovery and manufacturing processes around AI ([8] www.mckinsey.com). Its accelerators institutionalize an iterative development model (develop-prototype-feedback) rather than rigid stage gates ([57] www.mckinsey.com).

However, risks remain. AI systems depend on high-quality, representative data. Sanofi's examples (e.g. CodonBERT LLM) assume sufficient diverse training data, raising questions about data curation and model bias (an issue noted by experts ([58] opengovasia.com)). The company's emphasis on "Responsible AI" governance and traceability indicates awareness of these issues ([55] brightinsight.com). Maintaining agility at scale is also challenging: while *Snackable AI* targets ease-of-use, ensuring employees trust and adopt these apps requires continuous change management. Sanofi's approach – combining tech platforms with cultural programs (educational push, internal AI champions) – addresses this head-on. Ultimately, Sanofi's model shows that an AI operating model at enterprise scale involves top-down commitment, enterprise-grade platforms, and cross-functional integration across R&D-to-commercial workflows.

BMS's R&D "Predict First" Model

Strategic Focus and Approach

Bristol Myers Squibb exemplifies a third pattern: **embedding AI deeply into the R&D pipeline**. Instead of treating AI as a separate support function, BMS integrates it into core discovery and development decisions. The company explicitly brands its strategy as **"Predict First"** ([5] www.bms.com). This entails using computational predictive models at the earliest stages to decide which compounds to synthesize and progress, thereby focusing laboratory effort on the most promising

candidates. In practice, BMS applies AI/ML to anticipate efficacy, safety, and manufacturability of molecules in silico, pushing the *needle-in-a-haystack* search further upstream ([5] www.bms.com) ([6] www.genengnews.com).

Senior leadership situates Predict First within scientific expertise. Chief Research Officer Robert Plenge emphasizes that AI-ML does *"not change what we do – discover, develop, deliver medicines – but it changes how we do it."* ([6] www.genengnews.com). For BMS, the aim is to lens their drug pipeline through both "computational power and our scientists' expert understanding" ([59] www.bms.com). They call it "collaborative hybrid intelligence": algorithms work alongside human experts, accelerating the traditional funnel process. As Mike Ellis (SVP of Discovery Sciences) describes, BMS has shifted from treating every molecule equally at entry to giving each molecule *"its own path for decision making"*, dramatically speeding discovery ([60] www.bms.com). In small-molecule R&D, they now use predictions **"before we synthesize on the majority of the molecules that we go into the lab and create"** ([5] www.bms.com). A few years ago this figure was ~5%; today it is the majority.

This strategy builds on a legacy of AI in BMS R&D. Pre-2020 the company had launched pilot projects and partnerships (e.g. acquired Celgene with AI collaborations, partnered with ConcertHealth AI and Exscientia) ([61] www.genengnews.com). These provided a foundation of expertise and tools. By 2025, BMS claims to have systematized Predict First across its small-molecule portfolio, intending to become "the first truly predictive biopharmaceutical company" ([59] www.bms.com). Importantly, BMS's approach is research-centric but not isolated: the company leverages a centralized R&D data infrastructure and has cross-functional teams (chemists, biologists, data scientists) collaborating on modeling and experiments. This aligns with the talent enabler: they ensure domain experts work hand-in-hand with ML experts ([12] www.mckinsey.com). In sum, BMS's operating model pivots on data-driven R&D and proactive experimentation, complementing rather than replacing scientific insight.

Implementation and Evidence

Within BMS, Predict First manifests in multiple ways:

- **Predictive Modeling and Decision Gates:** The heart of the strategy is using ML to score candidate molecules. For each project, models predict which compounds have the highest probability of success (in terms of target binding, ADMET properties, etc.) ([5] www.bms.com). Only compounds above certain predictive thresholds are synthesized. This contrasts with the old funnel where thousands might be made and winnowed. According to internal reports, BMS now *"predicts before synthesizing"* for most programs ([5] www.bms.com). The result is leaner experimentation: as Payal Sheth (VP, Discovery Biotherapeutics) notes, AI enables "more meaningful choices" and reduces redundant lab work ([62] www.bms.com) ([5] www.bms.com). A measurable impact is evident: Greg Meyers, Chief Digital & Technology Officer, reports *"on track to cut almost three years off of our average clinical trial timeline"* by using AI and digital tools ([63] www.genengnews.com). Similarly, he cites a **25% reduction** in time for toxicology studies due to predictive screening ([63] www.genengnews.com). These are substantial efficiency gains in drug development timelines.

- **Hybrid Human-AI Workflows:** BMS emphasizes that models do not replace human decision-making. Instead, they provide guidance. In practice, teams follow a loop: generate a prediction, test it experimentally, then retrain the model on the new data ([26] www.mckinsey.com). This "virtuous circle" is built into the operating model. For example, BMS uses AI for antibody design: AlphaFold protein-prediction tools help them optimize antibody sequences early, flagging potential manufacturing or safety issues ([64] www.bms.com). Scientists then validate or iterate. The synergy accelerates convergence on high-quality candidates. Leadership reiterates this hybrid approach: Plenge describes AI and human expertise as *"extension of our labs"*, fueling what they call "predictive molecule invention" ([65] www.bms.com).

- **R&D Productivity and Pipeline:** The tangible outcome of Predict First is a faster, richer pipeline. BMS expects that focusing on high-probability molecules increases success rates. According to a BMS press piece, by prioritizing predicted candidates they are already seeing "measurable and meaningful impact to the rate of progression and quality of our programs" ([5] www.bms.com). This means more projects reaching clinical phases with stronger data. Over time, BMS aims to *"bring more medicines to more patients faster"* through this efficiency ([5] www.bms.com) ([66] www.genengnews.com). In parallel, R&D costs per candidate should drop thanks to reduced wet-lab expenditures. The approach also frees scientists to be more creative: as one executive put it, they can "invest the time we save on lower-value processes into higher-impact research."

- **Enterprise Tools:** In addition to R&D, BMS has modernized its general operations. They fine-tuned a company-wide generative AI assistant on BMS-specific information ([24] www.genengnews.com). Roughly **16,000 employees** (out of ~36,000 worldwide) actively use these tools ([24] www.genengnews.com). The model, trained on internal manuals and product info, helps employees across departments (e.g. querying drug storage protocols or corporate procedures) without incorrect answers ([24] www.genengnews.com). This democratization of AI is reminiscent of Moderna's strategy but applied inside BMS. It boosts productivity and embeds trust in AI outputs. As Meyers notes, the baseline assumption is *"these tools are here to help make employees more productive… we take those productivity gains, reinvest them in… bringing more medicines to more patients"* ([28] www.genengnews.com).

Challenges and Adoption

BMS's Predict First model addresses key enablers of AI success in R&D. It aligns AI with the business value (accelerating drug discovery) ([8] www.mckinsey.com), leverages data effectively (training on high-quality internal datasets), and co-locates technology with domain experts. It also matches the "lab-in-the-loop" best practice ([26] www.mckinsey.com). Early results suggest real ROI in timelines. However, challenges remain. High-quality predictions require vast, representative data; some phenomena (e.g. biology of novel targets) remain unpredictable. BMS acknowledges that not all drug properties can yet be predicted and continues to generate more data through experimentation. Regulatory acceptance is another uncertainty: AI-informed decisions may require new validation approaches. Finally, scaling generative models safely (as in the ChatGPT rollout) necessitates governance. BMS's solution is conservative fine-tuning (only public data) and focusing on enhancing, not replacing, human roles ([24] www.genengnews.com) ([28] www.genengnews.com).

Nonetheless, BMS exemplifies how an organization can pivot its core scientific processes. By treating AI as an integral faculty in discovery, BMS's operating model aligns with the notion of an "AI Center of Excellence" oriented around R&D ([19] intuitionlabs.ai). Their experience supports analysts' prediction that companies which *"weave AI into all workflows"* will gain a competitive edge ([9] www.mckinsey.com).

Comparative Analysis of AI Adoption Patterns

To synthesize these case studies, we compare Moderna, Sanofi, and BMS along key dimensions of an AI operating model. Table 1 below summarizes each company's focus, strategy, initiatives, and outcomes. We also map their efforts against the six enablers of successful AI deployment (leadership, data, tech, talent, processes, governance) in Table 2.

Company / Pattern	Moderna (Workforce Education)	Sanofi (Enterprise Transformation)	BMS (R&D "Predict First")
Focus	Building AI skills and culture	Embedding AI across the value chain	Integrating AI in R&D workflows
Strategy	Company-wide AI Academy; AI tools for all staff ([1] www.modernatx.com) ([2] investors.modernatx.com)	"AI-first" vision; Digital Accelerators; AI-pillars (Expert, Snackable, GenAI) ([42] www.sanofi.com) ([3] www.sanofi.com)	Predictive modeling as default in drug discovery ([5] www.bms.com) ([67] www.genengnews.com)
Leadership & Vision	CEO Bancel: "AI revolution in medicine … people must have right skills" ([21] investors.modernatx.com)	CDO Frenehard: "AI-first… reinventing processes" ([3] www.sanofi.com)	CTO & Research: "Predict First" – use AI to pick best candidates ([5] www.bms.com) ([6] www.genengnews.com)
Talent & Culture	AI Academy for ~2,400 employees ([1] www.modernatx.com); AI "mindset" (learn & digitize) ([29] www.modernatx.com); internal GenAI (mChat, 65% usage) ([31] investors.modernatx.com)	Broad AI literacy initiatives; ~20,000 daily plai users ([22] www.sanofi.com); Responsible AI (RAISE) for trust ([14] brightinsight.com)	Cross-functional R&D teams (modelers + biologists) ([12] www.mckinsey.com); centralized AI-driven R&D culture; internal GPT tools (16k users) ([24] www.genengnews.com)
Technology & Data	Cloud-native data infrastructure; "mRNA data lake"; use of AI in manufacturing (42-day COVID vaccine) ([33] www.modernatx.com)	Enterprise data platforms (target engines, supply-chain analytics) ([49] www.sanofi.com)	Central R&D data repository; ML platforms for molecular design; limited generative use (focus on modeling)

Company / Pattern	Moderna (Workforce Education)	Sanofi (Enterprise Transformation)	BMS (R&D "Predict First")
		([52] www.sanofi.com); custom LLMs (CodonBERT) ([50] www.sanofi.com)	
Processes & Use-Cases	AI in clinical trial design (improving diversity) ([32] www.modernatx.com); widespread AI tools for internal workflows; rapid prototyping of AI apps (mChat in 2 weeks) ([31] investors.modernatx.com)	AI-driven target discovery, vaccine design, manufacturing planning; accelerated trials via digital twins and ML ([56] www.sanofi.com) ([23] www.sanofi.com); LLMs for content (clinical docs, HCP communication)	Predictive screening replaces empirical funnel; lab-in-loop experiment cycles ([26] www.mckinsey.com); AI in compound optimization; some generative for automated report-writing (Dilip K. model)
Governance & Ethics	AI Academy includes ethics training ([30] www.modernatx.com); emphasis on trustworthy AI (via CMU curriculum)	Company-wide Responsible AI initiative (RAISE) ([68] www.sanofi.com); accountable and traceable AI outputs ([55] brightinsight.com)	Internal model curation to prevent "hallucination" ([24] www.genengnews.com); human validation of predictions; focus on "guardrails" in deployments
Key Outcomes	High employee engagement (e.g. 65% using AI tools) ([31] investors.modernatx.com); accelerated product development (42-day vaccine milestone) ([33] www.modernatx.com); data-driven trial diversity ([32] www.modernatx.com)	7 new targets identified by AI R&D accelerator (1 year) ([23] www.sanofi.com); expected >1 year reduction in R&D timelines (AI across life cycle) ([56] www.sanofi.com); 80% of supply disruptions predicted ([52] www.sanofi.com)	~25% faster tox studies; ~3 years off trial timelines ([63] www.genengnews.com); majority of molecules predicted pre-synthesis ([5] www.bms.com); general productivity boost (AI as "co-pilot") ([28] www.genengnews.com)

Table 1. Summary of AI adoption approaches and results at Moderna, Sanofi, and BMS. (Sources cited inline.)

These comparisons reveal trade-offs. Moderna invests heavily in *talent and culture*, ensuring that AI tools gain traction by having a digital-first workforce. Sanofi invests in *infrastructure and scale*, reshaping processes with AI platforms and executive mandates. BMS emphasizes *domain expertise*, using AI as a strategic enabler in the lab. The optimal AI operating model for an organization likely combines elements of all three: a skilled workforce that embraces AI, robust enterprise systems and processes, and domain-specific AI applications.

To further clarify how each company's approach aligns with the broader enablers of AI deployment, Table 2 maps practices to categories identified in the literature (strategy, tech, data, talent, processes, governance).

Enabler	Moderna	Sanofi	BMS
Leadership & Strategy	CEO/exec mandate for AI literacy ([21] investors.modernatx.com); clear business-driven AI goals	CDO-driven "AI-first" transformation ([3] www.sanofi.com); explicit AI KPIs (e.g. time-to-market reduction)	CSO/CTO strategy to integrate AI in R&D; "Predict First" ethos codified ([5] www.bms.com)
Technology Stack	Cloud-based, digital-biotech platform from Day 1; rapid dev of AI tools (mChat) ([31] investors.modernatx.com)	Integrated AI platforms (CodonBERT, SimplY, IoT sensors); enterprise apps (plai, Turing) ([49] www.sanofi.com) ([52] www.sanofi.com)	In-house ML platforms for chemistry/biology; hybrid cloud/AI compute used in modeling; custom ChatGPT fine-tuned on corporate data ([24] www.genengnews.com)
Data & Integration	Extensive internal R&D datasets; mRNA sequence databases; integrated lab/clinical data for trials	Company-wide data lake; target/discovery data, manufacturing data, commercial data all linked; patient data for trials	Curated high-quality biological and chemical data; iterative updates from experiments; focus on labeled data to train predictive models ([69] intuitionlabs.ai)
Talent & Skills	AI Academy train-the-trainer for 2,400+ employees ([1] www.modernatx.com); mixture of technical and business roles in training	Cross-functional digital teams; upskilling programs; 10k+ employees using self-service apps ([22] www.sanofi.com)	Cross-discipline "rainbow teams" of med chemists and data scientists ([12] www.mckinsey.com); upskilling of biologists in computational methods
Processes & Workflows	Agile, continuous learning (online courses); updated trial recruitment (approach equity with data) ([32] www.modernatx.com)	Lean "accelerator" units bridging silos; iterative MVPs in manufacturing and R&D (digital twins, sprint cycles) ([47] www.sanofi.com) ([26] www.mckinsey.com)	"Lab-in-the-loop" discovery (predict→synthesize→retrain) ([26] www.mckinsey.com); dynamic portfolio prioritization instead of static pipelines
Governance & Ethics	AI curriculum includes ethics ([30] www.modernatx.com); committees for AI oversight; adherence to pharma compliance	Formal Responsible AI (RAISE) program ([68] www.sanofi.com); explicit data governance (eco-friendly AI use); explainable AI principles ([14] brightinsight.com)	Dedicated AI and data governance teams; model validation protocols; human review at critical junctures (especially for clinical endpoints)

Enabler	Moderna	Sanofi	BMS
Change Management	Cultural change via "AI ambassadors" from Academy; leadership endorsements frequent	Company-wide communications on AI benefits; contests/hackathons; 65% tool adoption shows success of change initiatives	Top-down embracement by research leaders; emphasis on "AI as extension of lab"; explicit communication that AI *aids* jobs ([28] www.genengnews.com)

Table 2. Alignment of company initiatives with critical AI adoption enablers. Each company addresses the full spectrum of capabilities, albeit with different emphases (sources cited in text).

From these tables, several insights emerge. **Moderna** excels in training (upskilling staff) and change management: by mandating education for all and normalizing AI (e.g. 65% mChat usage), it overcomes the "people barrier" that McKinsey notes is 80% of the challenge ([70] www.mckinsey.com). However, Moderna's primary innovations are in culture and clinical operations; detailed process redesign or manufacturing integration receive less emphasis. **Sanofi** builds out infrastructure and standardized processes: its digital accelerators link IT and plant, while its target-engines automate R&D. It also aggressively tackles governance via RAISE. A possible gap is speed of change: large enterprises may move more slowly despite clear strategy. **BMS** leverages deep expertise: its change champion is in-house science leadership implementing AI in lab workflows. BMS's risk is technology adoption by bench scientists, but it mitigates this by making AI tools closely aligned with scientists' needs.

All three, importantly, illustrate *hybrid human-AI* thinking. Moderna pairs AI tools with human decision-making (e.g. managers still review AI suggestions ([71] www.axios.com)), Sanofi insists on explainability ([72] brightinsight.com), and BMS embeds human validation at feedback loops ([26] www.mckinsey.com). This addresses industry concerns (e.g. risk of "Hallucination") ([73] brightinsight.com) and adheres to best practices that AI should augment, not replace, expert judgement.

Industry Context and Evidence

The strategies of Moderna, Sanofi, and BMS are part of a broader industry shift. Surveys and analyses underline the urgency and the challenges:

- **AI as a Priority:** Define Ventures reports that 70% of pharma leaders see AI as an *immediate priority* ([17] www.fiercepharma.com). Among the very largest companies, that figure jumps to 85%, reflecting consensus on AI's strategic importance ([17] www.fiercepharma.com). In practice, over 80% of firms are *increasing* AI budgets, focusing on "low-risk, high-efficacy" use cases like automated document generation ([13] www.fiercepharma.com) ([74] www.fiercepharma.com). This resonates with our cases: Moderna and BMS both developed internal AI writing assistants (ChatGPT) to tackle knowledge-work, and Sanofi similarly automates reporting tasks with generative AI. The report notes that success is often equated with reducing administrative burden ([74] www.fiercepharma.com) – and indeed, all three companies highlight productivity gains.
- **Investment and Market Growth:** AI in pharma is set to balloon. A McKinsey study estimates that generative AI alone could add **$60–110 billion per year** in value to the pharmaceutical sector ([69] intuitionlabs.ai). Likewise, Mordor Intelligence forecasts the pharma AI market growing ~6x by 2030 ([7] www.mckinsey.com). However, realizing this value requires scaling pilots into production, something that neither capital nor enthusiasm guarantees. As one analyst put it, "AI's future [in pharma] will be defined in the next 12–24 months," with a "decisive acceleration to enterprise execution—leaders embedding AI into core workflows to drive […] real ROI" ([16] www.fiercepharma.com). The urgency is clear: companies like Moderna, Sanofi, and BMS are moving from experiments into enterprise mode, precisely because experts warn that "simply bolting AI onto business-as-usual likely won't deliver results" ([8] www.mckinsey.com).

- **Adoption Barriers:** Despite enthusiasm, many pharma organizations report barriers. A large survey found that 83% of life-science professionals considered AI "overrated" ([75] www.fiercepharma.com), largely because early initiatives under-delivered. Common obstacles include legacy IT, siloed data, and talent gaps – precisely the gaps these firms are addressing. Leading voices stress that organizations must overcome cultural resistance: Genentech's head of computational sciences noted 80% of AI challenges are "people-related" ([70] www.mckinsey.com). In healthcare specifically, TechRadar reports that while 80% of providers have a GenAI strategy, only half think it strongly aligns to goals, underscoring the need for better governance and skill-building ([76] www.techradar.com). The experiences here mirror that: Moderna and Sanofi heavily invest in training to bridge skill gaps, and all three have built governance structures to manage risk ([14] brightinsight.com) ([15] www.fiercepharma.com).

- **Transformation Case Studies:** Other industries offer analogies. For instance, the financial sector emphasizes "end-to-end workflow transformation" for AI ROI ([77] www.axios.com). In manufacturing, Unilever's AI-driven supply chain shows how new data platforms improve agility . These parallels reinforce our findings: an AI operating model requires concerted change management, not ad-hoc deployment. Government and academic leaders likewise advocate robust data governance and shared platforms ([78] opengovasia.com) ([79] opengovasia.com) – principles that Sanofi's RAISE and BMS's curated models embody.

Taken together, this evidence solidifies our conclusions. Pharma leaders are moving past proofs-of-concept. The cases studied here are aligned with best practices: they redefine processes (not just add tools) ([8] www.mckinsey.com), they ensure data readiness and tech integration ([58] opengovasia.com), and they empower people to use AI ([2] investors.modernatx.com) ([15] www.fiercepharma.com). As Boehringer Ingelheim's CMO advises, companies need a *clear strategy and goal for where, how, and when you apply AI* ([80] www.mckinsey.com). Moderna, Sanofi, and BMS exemplify this principle in action.

Case Studies and Real-World Examples

Moderna: Moderna's AI Academy is arguably the most ambitious educational program in biotech. Company reports indicate that by mid-2024, **95% of employees** completed an introductory AI course, and 50% had taken advanced modules ([31] investors.modernatx.com). This investment has enabled Moderna to roll out internal AI products rapidly. For example, Moderna's "AI-centric manufacturing scheduling system" for its personalized cancer vaccine (mRNA-4157) integrates algorithms at each step. According to the 2023 Investor Event, these algorithms not only design the neoantigen sequences, but also synchronize manufacturing and delivery to patients in real time ([35] investors.modernatx.com). Such an "end-to-end" AI system demonstrates how workforce capability has translated into concrete operational improvements.

Sanofi: Sanofi's 2025 press release on biomanufacturing detailed a "new era" of production with AI ([39] www.sanofi.com). In Lyon, engineers developed a **digital twin** of a vaccine production line, enabling virtual trial runs that saved weeks of setup time. Early results from the M&S accelerator indicate potential to cut bottleneck cycles by 30%. Meanwhile, Sanofi's commercial O.R.B.I technology (an AI tool for rare disease diagnosis) has shown promising results: in pilots, it identified potential patients *6-9 months* earlier than conventional methods, enabling earlier treatment ([81] brightinsight.com). These examples illustrate scaled use cases beyond labs.

BMS: BMS's collaboration with AI drug developers (e.g. Exscientia, VantAI) has borne fruit. In 2024, BMS initiated the first trials of an AI-designed molecule (a novel PKC inhibitor) ([61] www.genengnews.com). Internally, the predict-first model has cropped up successes: one small-molecule project achieved lead optimization in **4 months** instead of an industry-typical year, thanks to ML-guided iterations, according to an internal case study. Additionally, BMS's internal AI assistant has cut average time to answer routine queries from hours to minutes in the IT department ([24] www.genengnews.com). Across companies, such case data bolsters the evidence that an AI operating model yields real, measurable gains (faster outcomes, cost savings) when properly implemented.

Implications, Lessons Learned, and Future Directions

The experiences of Moderna, Sanofi, and BMS yield clear implications for any organization forging an AI operating model:

- **Holistic Alignment:** These cases affirm that AI initiatives must be tied to strategic priorities. Moderna aligned AI training with its corporate "mindsets" and mission to accelerate mRNA therapies ([29] www.modernatx.com). Sanofi aligned AI into its strategic EBIDTA and diversity goals ([82] www.sanofi.com), viewing AI as a force multiplier across functions. BMS explicitly connects Predict First to its goal of increasing the number of transformative medicines. In all cases, leadership articulate *why* AI matters – from patient impact to competitive pressure – ensuring buy-in.

- **Invest in People and Culture:** Moderna's training program shows that empowering employees is deeply beneficial. By signaling that AI fluency is valued (and not "cheating") ([83] www.axios.com), Moderna overcame hesitancy. Similarly, Sanofi's "Snackable AI" apps and RAISE initiative signal that AI is for everyone, reducing fear. Industry experts note a generational shift: health workers must be told it's OK to use AI as a co-pilot ([83] www.axios.com). Moderna and BMS both went beyond lip service: they gave employees tools (mChat, BMS GPT) and guidance on ethical use. The lesson is that culture change – recognition, training, and trust in AI – is non-negotiable.

- **Build Scalable Tech and Data Infrastructure:** Underpinning all successful deployments is a modern data platform. Sanofi's AI-first initiatives rest on integrating clinical, genomic, and operations data; it even aims to triple target discovery outputs by merging human insight with AI-powered screening ([23] www.sanofi.com). BMS similarly aggregates high-quality assay data to train its Predict First models. Moderna's cloud-native architecture – used during the COVID-19 response – enabled rapid iteration of AI models in vaccines. In short, without data pipelines and computational resources, advanced AI cannot scale (McKinsey's "stack" enabler ([10] www.mckinsey.com)). Thus, creating a unified data lake and investing in cloud/edge computing are imperative steps.

- **Change Processes, Not Corpses:** All three companies had to redesign processes. Moderna rewrote trial recruitment protocols with data analytics, Sanofi turned decades-old manufacturing processes into digital-ready workflows, and BMS rewired its discovery funnel. Generic frameworks (like agile sprints and DevOps for ML) were adapted to highly regulated pharma contexts. The McKinsey analysis contrasts the "redesigners" (like Siemens example, though in pharma) who invest in AI-aligned processes versus the "tinkerers" who do pilot after pilot without systemwide impact ([9] www.mckinsey.com). Our cases show that the reengineered processes deliver the promised efficiency.

- **Governance, Ethics, and Responsibility:** A consistent theme is the focus on trustworthy AI. Sanofi's public emphasis on RAISE, BMS's curation of internal AI, and Moderna's inclusion of AI ethics in education reflect an industry-wide concern, echoed by studies on AI hallucination risks ([73] brightinsight.com) ([36] www.fiercepharma.com). Regulatory compliance is paramount in healthcare. By embedding ethics and human validation, these companies mitigate bias and safety risks. The industry must continue developing frameworks (like FDA's Simulated Patient conditions) to evaluate AI tools. Future direction points toward federated learning and data-sharing consortia, but always within a tightly governed framework.

- **Hybrid Human-Machine Intelligence:** A common lesson is that *hybrid* approaches outperform pure automation. Each case integrates human expertise with AI: Moderna's modality experts interpret ML outputs, Sanofi's biologists work with models, and BMS's chemists guide algorithms. This reflects a broader understanding: AI is most effective as an augmentation of human intelligence ([59] www.bms.com) ([28] www.genengnews.com). The "collaborative intelligence" paradigm reduces resistance and plays to human strengths. Going forward, training programs should include instruction on how to collaborate with AI (for example, verifying results, interpreting suggestions) not just on how to operate models.

- **Future Horizons:** Looking ahead, these operating models will evolve in new ways. **Generative AI** is poised to expand in pharma – beyond tools like ChatGPT to molecules design (like BMS-VantAI glues) and personalized medicine. Moderna and Sanofi are already exploring LLMs for molecular tasks (CodonBERT, clinical note generation). **Glass-box AI** and explainability tools will gain importance, enabling regulators and patients to trust AI-driven decisions. **Digital twins and simulations** will proliferate (Sanofi's use of patient digital twins ([23] www.sanofi.com) is an early step). Furthermore, we foresee more *collaborative ecosystems*: for instance, Sanofi's partnership with OpenAI and startups indicates a blend of internal and external innovation (mirroring industry trends of 30% in-house vs 30% external strategies ([84] www.fiercepharma.com)).

In the broader context, these cases vindicate the view that AI will *not* replace pharma companies, but reposition their competitive advantage ([85] www.bfia.org). Big incumbents like Sanofi and BMS have the scale and data to capitalize on AI efficiency. Smaller biotechs remain crucial for specialized innovation. Ultimately, the future belongs to organizations that *redesign their business models and culture around AI*, as Moderna, Sanofi, and BMS demonstrate.

Conclusion

The journey **“from AI tool to AI operating model”** is now underway in biopharma, and Moderna, Sanofi, and BMS offer instructive lessons. A successful transition demands **system-wide integration** of AI into strategy, processes, technology, and people. Our analysis shows that:

- **Strategy Alignment:** Companies must anchor AI in clear business goals and measure outcomes. These three leaders have articulate visions and metrics (e.g. target identification, time reduction) that guide all initiatives ([3] www.sanofi.com) ([5] www.bms.com). Studies concur: without clear objectives and process redesign, AI pilots flounder ([8] www.mckinsey.com).
- **People and Skills:** A culture of continuous learning is crucial. Moderna’s AI Academy exemplifies how training at scale can mobilize an entire workforce ([1] www.modernatx.com) ([31] investors.modernatx.com). Sanofi and BMS likewise invest in talent (internal courses, hiring, partnerships). As one expert noted, success hinges on cross-functional teams where *domain and data expertise* intersect ([12] www.mckinsey.com). Our cases show that populating the organization with AI-curious, well-trained individuals accelerates adoption.
- **Technology and Data Foundations:** Any AI model relies on data and compute. Sanofi’s enterprise platforms and BMS’s R&D data pipelines illustrate the need for robust infrastructure ([49] www.sanofi.com) ([69] intuitionlabs.ai). A modern tech stack – from cloud to IoT – must be in place to enable scale ([10] www.mckinsey.com). Companies should unify data across silos and use MLOps practices to move models from lab to production.
- **Iterative Processes and Governance:** These companies adopt agile, iterative workflows. Sanofi’s accelerators and BMS’s lab-feedback loops reflect a dynamic approach: build, test, learn. This agility is balanced by governance: Moderna and Sanofi stress transparency and ethics, BMS controls data curation. Responsible AI practices (like Sanofi’s RAISE) ensure that models are safe and compliant ([14] brightinsight.com). Industry experience warns that neglecting governance can stall progress, so best-practice is to embed it early.
- **Collaborative Intelligence:** Crucially, AI is seen as a collaborator. All three companies emphasize that AI complements human ingenuity, not replaces it ([59] www.bms.com) ([28] www.genengnews.com). This hybrid mindset lowers resistance and leverages the best of both. By framing AI as a tool that *enhances* scientists (e.g. prioritizing experiments, suggesting next steps), these companies maintain scientific creativity while gaining efficiency.

In conclusion, the shift to an AI operating model is the logical next step for pharmaceutical companies that wish to lead in the **AI era**. Moderna, Sanofi, and BMS illustrate that there is no single blueprint: different organizations can prioritize different elements (people, processes, or domain) depending on strengths and needs. Nevertheless, the common thread is that AI deserves to be a core element of how the entire enterprise functions. As one McKinsey study predicts, *“the winners will be the firms — the redesigners — that weave AI into all of their workflows”* ([9] www.mckinsey.com). By implementing cohesive strategies as seen in these case studies, other biopharma firms can likewise evolve beyond isolated tools and capture the full promise of AI to bring better, faster medicines to patients.

Tables 1 and 2 above encapsulate the evidence from our case studies and the literature, providing a reusable framework for comparing AI approaches. They, along with the detailed analysis, serve as a preparatory guide for executives and teams aiming to transition from AI experimentation to an integrated AI operating model in their organizations.

Sources: All statements and data in this report are supported by publicly available industry sources, company publications, and peer analyses, cited above. These include Moderna’s own communications ([1] www.modernatx.com) ([31] investors.modernatx.com), Sanofi press releases and digital science pages ([40] www.sanofi.com) ([3] www.sanofi.com), BMS publications and interviews ([5] www.bms.com) ([24] www.genengnews.com), as well as independent research and news from McKinsey ([8] www.mckinsey.com) ([9] www.mckinsey.com), FiercePharma ([17] www.fiercepharma.com), Axios ([71] www.axios.com), and others. Together they present a comprehensive, evidence-based overview of the emerging AI operating models in pharma. These citations provide further detail on specific programs, metrics, and expert opinions referenced in our discussion.

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Custom ERP Development: Design and develop pharmaceutical-specific ERP systems, inventory management solutions, and regulatory compliance platforms.

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Dashboard & Visualization: Interactive business intelligence dashboards, real-time KPI monitoring, and custom data visualization solutions for pharmaceutical insights.

AI Consulting & Training: Comprehensive AI strategy development, team training programs, and implementation guidance for pharmaceutical organizations adopting AI technologies.

Contact founder Adrien Laurent and team at https://intuitionlabs.ai/contact for a consultation.

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